Source: Landcare Research

Keywords: poisons/non-target species/fluoroacetamide/livestock

Ref Type: Pamphlet
Keywords: sodium fluoroacetate/fluoroacetate/1080

Keywords: fluoroacetate/sodium fluoroacetate/diagnosis/treatment/acute toxicity

Ref Type: Report
Keywords: poisoning/1080/anlaysis/muscle/liver/livestock/witholding period
Abstract: 1080 poisoning was in the public eye in Canterbury when sheep died after they were returned to a block pronounced "safe" after poisoning operations. About 160 ewes died out of 800, and 1080 poisoning was confirmed. It is reported that errors were made in the analysis of bait tested to determine if it was safe to stock. Recently a workshop on 1080 analysis was held at Invermay AHL. These are the recommendations for sampling: 1) Take the samples from the animals which are first to die in the outbreak even though they may be more autolysed. 2) The best specimens in order of preference are muscle, stomach contents then liver

Ref Type: Report
Keywords: 1080/poisoning/birds/persistence in animals/non-target species/secondary poisoning/humans
Abstract: Recently, Canada geese around Lake Benmore were poisoned by oats impregnated with 1080

Ref Type: Report
Keywords: 1080/poisoning/dogs/diagnosis
Abstract: A dog may die of 1080 poisoning but have tissue 1080 levels too low to detect.

Keywords: diagnosis/sodium fluoroacetate/treatment/poisoning

Keywords: field efficacy/ground control/welfare/1080

Keywords: fluoroacetate/poisoning/treatment/poisons

Keywords: occupational exposure/regulatory toxicology/metabolism/sodium fluoroacetate/fluoroacetate/humans/developmental toxicity/reproductive effects
Keywords: occupational exposure/regulatory toxicology/sodium fluoroacetate/fluoroacetate/humans

Ref Type: Report
Keywords: persistence in water/possums/aerial control/1080/fluoride/poisoning/persistence in invertebrates
Abstract: Public concerns about stage 1 of the joint Department of Conservation/Taranaki Regional Council possum control operation on Mount Taranaki/Egmont included issues relating to potential effects of the use of 1080 poison on water quality and water usage, in particular domestic water supplies from catchments draining areas within the aerial poison application zone. Taranaki Regional Council undertook a comprehensive water quality monitoring programme in recognition of these concerns, despite the existence of documented water quality monitoring information for two earlier aerila control operations (Waipoua Forest and Rangitoto Island) which indicated that no contamination of natural water by 1080 resulted from these large scale operations. This programme included natural surface waters within and outside (controls) the operational zone, major water supplies (raw and treated) and groundwaters. Monitoring concentrated on 1080 and fluoride (the principal breakdown product) concentrations in the waters. Sampling commenced in advance of the first aerial application of 1080 and extended throughout the operational period with one site sampled more intensively to monitor any immediate impacts of the department of Conservation's initial three-day aerial poison drop within the National Park. In addition to the physicochemical monitoring, the programme was augmented with biological monitoring of three representative catchment sites draining the operational area and two catchment sites (controls) immediately beyond the boundaries. The results consistently showed no measurable impact of the possum control operation on the physicochemical parameters (1080 and fluoride concentrations) or biological indicators (benthic macroinvertebrate fauna) measured in any of the natural waters draining both the National Park and the buffer zones within the operational poisoning area. No impacts attributable to the possum control operation were measured on these physicochemical parameters in the raw and treated domestic water supplies, or groundwaters monitored. The results of this relatively intensive monitoring programme may provide guidelines for the assessment and establishment of appropriate monitoring of any future possum control operations of this nature.

Ref Type: Report
Keywords: 1080/persistence in water/aerial control/possums/fluoride/poisoning/persistence in invertebrates
Abstract: Public concerns relating to the joint Department of Conservation/Taranaki Regional Council possum control operation on Mount Taranaki/Egmont included issues relating to potential effects of the use of 1080 poison on water quality and water usage, in particular domestic water supplies from catchments draining areas within the aerial poison application zone. Taranaki Regional Council, in 1993, undertook a comprehensive water quality monitoring programme in recognition of these concerns, despite the existence of documented water quality monitoring information for two earlier aerila control operations (Waipoua Forest and Rangitoto Island) which indicated that no contamination of natural water by 1080 resulted from these large scale operations. Taranaki Regional Council results consistently showed no measurable impact of the possum control operation on the physicochemical parameters (1080 and fluoride concentrations) or biological indicators (benthic macroinvertebrate fauna) measured in any of the natural waters draining both the National Park and the buffer zones within the operational poisoning area. No impacts attributable to the possum control operation were measured on these physicochemical parameters in the raw and treated domestic water supplies, or groundwaters monitored. The results of this relatively intensive monitoring programme provided guidelines for the performance of an appropriate monitoring programme in association with the remaining stages (2&3) of the Mount Taranaki/Egmont possum control operations. The programme concentrated on the physicochemical monitoring of seven treated local authority water supplies abstracted from catchments draining the operational area, and was complemented with intensive monitoring of one raw surface water supply catchment, and biological monitoring of representative surface waters in close proximity to the National Park operational area.
Sampling commenced in advance of the aerial operation of 1080 and extended throughout the operational period with one site sampled more intensively to monitor any immediate impacts of the aerial poisoning application within the National Park and adjacent bush. The monitoring confirmed 1993 results, with no detectable concentrations of 1080 measured, in natural or treated water supplies, before, during or within one month following the possum control operation. No measurable impacts of this operation were found from the monitoring of fluoride concentrations and longer term biological indicators (benthic macroinvertebrate fauna) in the representative catchments draining the operational area. The results of both water quality programmes (all three stages of the Mount Taranaki/Egmont possum control operation) have combined to provide the most intensive monitoring of a 1080 poisoning operation to date in New Zealand, and may contribute to the establishment of appropriate monitoring of future possum control operations of this nature.

Keywords: poisoning/acute toxicity/treatment

Ref Type: Conference Proceeding
Keywords: bacteria/livestock/fluoroacetate/poisoning/GMO
Abstract: The workshop consisted of oral presentations and discussion among attendees who are involved in various aspects of the Fluoroacetate Detoxification Project and those who have raised concerns on the possible environmental and conservation outcomes of the use of GMOs to protect ruminant livestock from fluoroacetate poisoning. The aim of the workshop was to establish the precautions required for safe testing of the GMOs and to define those factors that should be established before general use of the GMOs can be considered.
Factors discussed included the producer-driven origins of the project, the technology employed, and the outcome of animal toxicity tests to prove the efficacy of the GMOs. This was balanced by discussion of potential risks to pest control with Compound 1080, and environmental effects of the GMOs through possible alterations to browsing behaviour of domestic and feral ruminants and native animals with prefermentative digestive systems.

Keywords: fungus/sodium fluoroacetate/fluoroacetate/poisoning/aconitase/enzyme/inhibition/fluoride
Abstract: In the present investigation all the six metabolic inhibitors tested showed the inhibitory effects on respiration and mycelial growth. Sodium fluoroacetate which is known to inhibit TCA cycle by poisoning aconitase enzyme activity also showed inhibition. Sodium fluoride which also showed inhibition and is known to inactive enolase enzyme of EM pathway.

Agricultural Compounds and Veterinary Medicines Group. Controlled pesticides. Sodium fluoroacetate (1080) in pest control. VPC - 1080 03/00, -5. 2000.
Ref Type: Report
Keywords: sodium fluoroacetate/fluoroacetate/1080

Ref Type: Pamphlet
Keywords: 1080/poison/rabbits/possums

Agriculture Protection Board of Western Australia. The proposed use of 1080 to control feral goats in Western Australia. 752. 1993. Perth, Agricultural Protection Board of Western Australia. Public Environmental Review.
Ref Type: Report
Keywords: 1080/goats

Keywords: biosynthesis/citrate/fluoroacetate

Abstract: When malate -14C was added to juice vesicles, labelled citrate and succinate were detected after 3 hours; when succinate-14C was added citrate, malate and fumarate were detected; when pyruvate-14C was added citrate, malate, fumarate and succinate were detected. Fluoroacetate and malonate had inhibitory effects. These findings indicate that the TCA cycle operates in juice vesicles. [For parts 1 and 2 see HcA 44, 5088 and 5089.]


Keywords: toxicity/testes/reproductive effects/rats/pathology/target organ


Keywords: fluoroacetamide/fish/aquatic species/toxicity/lethal concentration


Keywords: fluoracetamide/invertebrates/rats/systemic toxicity/poison/lethal dose

Abstract: Fluoracetamide (CH$_2$F CON H$_2$) was studied in the capacity of a poison with systemic effect. This preparation proved to be toxic for *Xenopsylla cheopis* Rotsch. and for *Ceratophyllus consimilis* Wagn. in feeding them through a biomembrane with the nutritional solution containing this poison. Toxemia in albino rats lasted for not less than 19 hours following fluoracetamide administration (the agent was introduced by feeding fleas of the mentioned species on rats). Almost all the fleas (fed on albino rats given the preparation in doses 1.5-2 times lower than the minimal lethal dose) gradually perished - on the 6th -10th day. An opinion is put forward on the expediency of field trial of fluoracetamide not only as a rat poison, but also as a preparation with systemic effect.


Abstract: It was established in laboratory experiments that organic fluorine compounds, fluoroacetamide and sodium fluoracetate at dosages sublethal for rodents and their ectoparasites inhibit reproduction in males and females of Nosopsyllus (Ceratophyllus) consimilis (Wagn.) and Xenopsylla cheopis (Roths.) if the compounds are imbibed, and also have some effect on adults developing from larvae that had eaten faeces of fleas that contained poisoned blood. This effect was more evident in N. consimilis than in X. cheopis, which is less sensitive to fluorine poisoning


Abstract: There is circumstantial evidence that foxes (Vulpes vulpes) feeding on rabbits (Oryctolagus cuniculus) poisoned with sodium monofluoroacetate (1080 poison) die from secondary poisoning. A rabbit-poisoning campaign that occurred during a fox research study provided direct evidence to support the above view


Keywords: acute toxicity/diagnosis/non-target species/persistence in animals/persistence in plants/persistence in water/fluoroacetamide/poisoning


Keywords: acute toxicity/diagnosis/non-target species/fluoroacetamide/poisoning


Keywords: sodium fluoroacetate/fluoroacetate/1080/sodium monofluoroacetate/baits/analysis

Abstract: A sensitive gas chromatographic method was developed for the determination of sodium
monofluoroacetate (Compound 1080 and 1080 poison) in baits and avian tissues. The procedure involves extraction of 1080 with acetone/water (8:1) followed by derivation with pentafluorobenzyl bromide. Cleanup of the esterified extracts was carried out using minicolumns containing Florisil and the eluates were subsequently analyzed by electron capture gas chromatography. Bait samples were initially screened by thin-layer chromatography and identity of derivatized extracts was confirmed by gas chromatography/mass spectrometry.

Keywords: 1080/sodium fluorooacetate/fluoroacetate/baits/analysis
Abstract: A sensitive gas chromatographic method is described for the determination of sodium fluoracetate in baits and avian tissues. Acetone/water extracts of tissues and bait were screened by thin layer chromatography before postcolumn derivization with pentafluorobenzyl bromide. Cleanup of the extracts was carried out using minicolumns containing Florisil. Eluates were analysed by electron capture gas chromatography. The method was applied to tissues from a magpie (Gymnorhina tibicen) that had ingested bait containing compound 1080

Keywords: sodium monofluoroacetate/monofluoroacetate/1080/liquid chromatography/analysis
Abstract: A high pressure liquid chromatographic (HPLC) procedure was developed for the determination of sodium monofluoroacetate (Compound 1080). The procedure utilized an amine (NH-2) bonded column for the reverse phase determination of sodium monofluoroacetate in formulation and technical samples

Keywords: secondary poisoning/ground control/1080/cats/possums/brodifacoum/poisoning/gut/predators/rats/efficacy/carnivores/poison/wildlife
Abstract: A single five night pulse of sodium monofluoroacetate (0.15% 1080) applied in bait stations at two different spacing intervals, 100 and 200 m, along forestry roads in New Zealand beech forest, killed all four of the resident radio-tagged stoats (Mustela erminea) and all three of the resident radio-tagged wild house cats (Felis catus) by secondary poisoning. Gut contents of predators indicated that house mice (Mus musculus), ship rats (Rattus rattus) and bushtail possums (Trichosurus vulpecula) were important sources of the toxin. High kills of predators, possums and rats at both 100 and 200 m spacing regimes suggest that greater efficacy of controlling these pests would be achieved with the latter method. Evidence suggests that routine management of possums and rats using 1080 and brodifacoum has resulted in widespread control of small mammalian carnivores by secondary poisoning in New Zealand forests. However, aerial application of poison can kill large numbers of tomtits (Petroica macrocephala) and robins (Petroica australis) and few other native bird species have been adequately monitored through such operations. Reducing risks to native wildlife is responsible ecological management. Use of bait stations along forestry roads or tracks may be fundamental in mounting cost-effective large-scale ground-based protection of native wildlife through safer predator controls.

Ref Type: Magazine Article
Keywords: bacteria/degradation/fluoroacetate

Keywords: cardiac/sodium monofluoroacetate/heart/rabbits/mode of action
Abstract: In a few cases of the experiments with isolated, perfused rabbit heart preparations having received sodium monofluoroacetate, adrenalin produced only a positive chronotropic effect without any concomitant positive inotropic one in the course of development of heart failure induced by the metabolic inhibitor.

Abstract: Poisoning of livestock by the ingestion of the South African Plant *Dichapetalum cymosum* has long been recognised. The toxic principle of this plant is fluoroacetate (Marais, 1944). More recently the introduction of sodium fluoroacetate as a rat and rabbit poison has provided another source of this toxic substance which may be potentially dangerous to the grazing animal. These facts justify a close study of fluoroacetate poisoning in ruminants since, despite a considerable literature on the biochemical nature of fluoroacetate poisoning in laboratory animals (Peters, 1952), there is little reliable information on its action and toxicity in the larger domestic animals. The most urgent problem however is to obtain an antidote. In some animals, acetate is a major product of fermentation in the rumen, and the concentration of acetate in the blood of these animals is usually 3 to 10 times that of nonruminants. It was not, therefore, anticipated that acetate would prove to be an effective antidote in sheep, but some protective action of acetate has been demonstrated in preliminary experiments which are described in this paper. Data on the toxic dose of fluoroacetate in sheep and some of its biochemical effect are also reported.


Abstract: Advances in knowledge of ruminant nutrition and metabolism during the second half of the twentieth century have been reviewed. Part I is concerned with metabolism in the rumen: Part II discusses utilization of nutrients absorbed from the rumen and lower tract to support growth and reproduction. The time frame was prompted by the crucial advances in ruminant physiology which arose from the work of Sir Joseph Barcroft and his colleagues at Cambridge in the 1940s and 50s, and by the brilliant studies of Robert Hungate on rumen microbiology at much the same time. In reviewing the growth of knowledge of the role of bacteria, protozoa, fungi and bacteriophages in the rumen, outstanding developments have included the identification and characterization of fungi and the recognition that the utilization of polysaccharides in the rumen is accomplished by the sequential activities of consortia of rumen microorganisms. The role of protozoa is discussed in relation to the long standing debate on whether or not the removal of protozoa (defaunation) improves the efficiency of ruminant production. In relation to nitrogen (N) metabolism, the predation of bacteria by protozoa increases protein turnover in the rumen and reduces the efficiency of microbial protein production. This may account for the beneficial effects of defaunation where dietary N intakes are low and possibly rate limiting for growth and production. Current approaches to the measurement of rates of production of short chain fatty acids (SCFA) in the rumen based on the mathematical modelling of isotope dilution data are outlined. The absorption of SCFA from the rumen and hindgut is primarily a passive permeation process. The role of microorganisms in N metabolism in the rumen has been discussed in relation to ammonia and urea interrelationships and to current inadequacies in the measurement of both protein degradation in the rumen and microbial protein synthesis. The growth of knowledge of digestion and absorption of dietary lipids has been reviewed with emphasis on the antimicrobial activity of lipids and the biohydrogenation of unsaturated fatty acids. The protection of unsaturated dietary fats from ruminal biohydrogenation is an approach to the manipulation of the fatty acid composition of meat and dairy products. Discussion of the production of toxins in the rumen and the role of microorganisms in detoxification has focused on the metabolism of oxalate, nitrate, mycoxins, saponins and the amino acid mimosine. Mimosine occurs in the tropical shrub leucaena, which is toxic to cattle in Australia but not in Hawaii. Tolerance to leucaena stems from the presence of a bacterium found in the rumen of Hawaiian cattle, which when transferred to Australian cattle survives and confers protection from mimosine. The genetic modification of rumen microorganisms to improve their capacity to utilize nutrients or to detoxify antinutritive factors is an attractive strategy which has been pursued with outstanding success in the case of fluoroacetate. A common rumen bacterium has been genetically modified to express the enzyme fluoroacetate dehalogenase. The modified organism has been shown to survive in the rumen at metabolically significant levels and to confer substantial protection from fluoroacetate poisoning.


Keywords: poison/occurrence in nature
Ref Type: Report
Keywords: acute toxicity/toxicity/1080/poison/lethal dose
Abstract: Studies of the acute toxicity of compound 1080 to possums have made considerable progress. In a 2-year programme involving eight separate dosing trials of captive animals from North and South Island sources, the estimated LD50 (ie. the dose estimated to kill 50% of a sample population) ranged between 1.3 and 2.1 mg/kg. These are higher doses than the 0.8 mg/kg which has been accepted on the evidence of previous experimenters. It is becoming clear that the estimate may be affected by factors such as the type of possum, its age and sex and perhaps physical condition, the weather, degree of acclimatisation of the animals to captivity, season, time of day and the technique of administering the poison.

Keywords: poison/occurrence in nature

Keywords: poison/occurrence in nature

Aplin, T. E. H. (1971). Poison plants of Western Australia. The toxic species of the genera Gastrolobium and Oxylobium. Wodjil poison (Gastrolobium floribundum S. Moore), breelya or kite-leaf poison (Gastrolobium laytonii J. White), Roe's poison (Oxylobium spectabile Endl) and granite poison (Oxylobium graniticum S. Moore). Journal of Agriculture of Western Australia 12, 154-159.
Keywords: fluoroacetate/poison/occurrence in nature

Keywords: poison/livestock/fluoroacetate/occurrence in nature
Abstract: Toxic species of the genera Gastrolobium and Oxylobium, which cause considerable numbers of livestock deaths in Western Australia as a result of their fluoroacetate content, are described

Keywords: 5-fluorouracil/fluoroacetate/NMR/metabolism
Abstract: Over the last decade, the number of reports of cardiotoxicity and neurotoxicity attributed to 5-fluorouracil (FU) has rapidly increased. Several authors postulated but never experimentally demonstrated that FU might be transformed into fluoroacetate (FAC), a highly cardiotoxic and neurotoxic poison. Using 19F NMR, we demonstrated for the first time, in the isolated perfused rat liver (IPRL) model and in rats, that the last catabolite of FU is not α-fluoro-β-alanine. The metabolism continues and leads to two new catabolites, FAC and 2-fluoro-3-hydroxypropionic acid. IPRL were treated with 15 or 45 mg FU/kg b.w.. Rats were injected intraperitoneally with 180 mg FU/kg b.w.. FU used in these experiments was pure, i.e. free from degradation compounds that can be precursors of FAC. The levels of FAC found in perfusates or in rat urine were low: 0.14% and 0.05% of injected FU for 15 and 45 mg FU/kg respectively in perfusates and 0.006% in rat urine. However, FAC cumulation can occur and might be responsible for the cardiotoxic and/or neurotoxic symptoms.

Keywords: mode of action/pathology/metabolism

Keywords: mode of action/NMR/metabolism/humans/5-fluorouracil/fluoroacetate/liver/rats/analysis/urine/poison/degradation

Abstract: We report the first demonstration of the biotransformation of the anti-cancer drug 5-fluorouracil (FU) into two new metabolites, alpha-fluoro-beta-hydroxypropionic acid (FHPA) and fluoroacetate (FAG), in the isolated perfused rat liver (IPRL) and in the rat in vivo. IPRL was perfused with solutions of pure FU at two doses, 15 or 45 mg kg\(^{-1}\) body weight, and rats were injected i.p. with 180 mg of FU kg\(^{-1}\) body weight. Fluorine-19 NMR analysis of perfusates from IPRL and rat urine showed the presence of the normal metabolites of FU and low amounts of FHPA (0.4% or 0.1% of injected FU in perfusates from IPRL treated with 15 or 45 mg of FU kg\(^{-1}\) body weight, respectively; 0.08% of the injected FU in rat urine) and FAC (0.1% or 0.03% of injected FU in perfusates from IPRL treated with 15 or 45 mg of FU kg\(^{-1}\) body weight, respectively; 0.003% of the injected FU in rat urine). IPRL was also perfused with a solution of alpha-fluoro-beta-alanine (FBAL) hydrochloride at 16.6 mg kg\(^{-1}\) body weight dose equivalent to 15 mg of FU kg\(^{-1}\) body weight. Low amounts of FHPA (0.2% of injected FBAL) and FAC (0.07%) were detected in perfusates, thus demonstrating that FHPA and FAC arise from FBAL catabolism. As FAC is a well-known cardiotoxic poison, and FHPA is also cardiotoxic at high doses, the cardiotoxicity of FU might stem from at least two sources. The first one, established in previous papers (Lemaire et al, 1992, 1994), is the presence in commercial solutions of FU of degradation products of FU that are metabolized into FHPA and FAG; these are formed over time in the basic medium necessary to dissolve the drug. The second, demonstrated in the present study, is the metabolism of FU itself into the same compounds.


Ref Type: Personal Communication

Keywords: humans/poisoning/treatment

Abstract: Thank you for your information.

I want to say to you that compound 1080 is the 3rd cause of intoxication in Antioquia, Colombia, after the medicaments and organophosphates. We treat this intoxication with etanol with good results but we have problems with the determination in laboratory because is difficult, that is the reason for what we haven’t published it. Last year we had 20 patiens with this intoxication in an Universtitary Hospital.

We can be in contact.

Mi address is: Cra.94 No.38-275 Apto204 Medellín, Colombia.

Thank you very much.


Keywords: sodium fluoroacetate/fluoroacetate/liver/muscle/rats

Abstract: Endogenous respiration in cat liver tissue homogenates decreased 5 hrs after intraperitoneal administration of sodium fluoroacetate at a dose of 0.35 mg/kg. In rats the endogenous liver tissue respiration was unaltered even after the intraperitoneal administration of the compound at a dose of 5 mg/kg. At the same time, the endogenous respiration was inhibited in rat skeletal muscle homogenates within 5 hrs after the intoxication but it was not altered in the cat skeletal muscles. *In vitro* sodium fluoroacetate inhibited respiration in the homogenates of cat and rat skeletal muscles and of cat liver tissue and did not affect the respiration in rat liver homogenates. Pyruvate protected completely the cat and rat skeletal muscle preparations and partially cat liver tissue against the fluoroacetate effect *in vivo*.

Keywords: sodium fluoroacetate/fluoroacetate/fluoride
Abstract: In lab. tests sodium azide, mercuric chloride, sodium fluoroacetate, sodium malonate, methylene blue and sodium fluoride inhibited respiration and mycelial growth of P. colocasiae on Colocasia esculenta

Ref Type: Abstract
Keywords: 1080/invertebrates/non-target species/growth control/aerial control

Keywords: treatment/1080
Abstract: Objectives: To identify potential antidotes for 1080 poisoning from the literature on the pharmacology of 1080 and its metabolites; to provide a synopsis of a survey of current veterinary practices for the treatment of animals suffering from 1080 poisoning; to confirm citrate and calcium concentrations and aconitase activity as biochemical markers of 1080 poisoning; to evaluate potential antidotes. Conclusions: Citrate concentration is a reliable biomarker of 1080 poisoning; ionised calcium is not; acetamide shows prophylactic properties at the clinical level; in contrast, glyceral monoacetate does not reduce 1080-induced biochemical changes in citrate;

Keywords: non-target species/birds/pathology/persistence in animals/1080/poisoning/blood/cardiac/serum/citrate/inhibition/Krebs cycle/enzyme/muscle/sublethal effects
Abstract: Public concern over inadvertent kills of native birds following largescale aerial poisoning operations for possum has highlighted deficiencies in information concerning the effects of 1080 on nontarget species. In this study biochemical and histopathological changes were measured in adult male mallard ducks (Anas playtrynchos) dosed orally with 1080. The toxin was quickly absorbed into the blood and distributed to the cardiac tissue. The time taken to reach maximum 1080 concentrations in these tissues corresponded closely with the onset of clinical signs of toxicosis. Tissue and serum citrate accumulation is a direct result of 1080 induced inhibition of the Krebs Cycle enzyme aconitase hydratase. Histopathological lesions indicated that skeletal muscle was a target organ for 1080 induced damage in birds. Dose dependent increases in serum ceratinine kinase (CK) and aspartate aminotransferase (AST) were consistent with extensive muscle necrosis. Skeletal muscle may be a unique avian specific target organ for 1080.

Keywords: product chemistry/acute toxicity/field efficacy/metabolism/mode of action/diagnosis/treatment/persistence in plants/persistence in soil/secondary poisoning/non-target species/pathology/1080/pigs
Abstract: The purpose of this monograph is to summarize current information on sodium monofluoroacetate, to review use patterns, and to provide a base for further studies.

Keywords: fluoroacetate/analysis/NMR/bacteria/degradation/enzyme
Abstract: The stereochemical course of action of haloacetate halidohydrolase H-1 from Pseudomonas sp., strain A, which catalyses the dehalogenation of fluoroacetate to glycolate, has been determined by enzymatic analysis of products from incubations with both enantiomers and 2-fluoropropionate and by 1H NMR analysis of the ester of (-)-alpha-methoxy-alpha(trifluoromethyl)phenylacetic acid with phenacyl glycolate derived from the product of incubation with the (s)-monodeuterofluoroacetate.

**Keywords:** acute toxicity/secondary poisoning/mammals/non-target species/sodium monofluoroacetate

**Abstract:** The primary and secondary toxicity of warfarin, sodium monofluoroacetate (Compound 1080), and methyl parathion were assessed in the mink, a representative surrogate mammalian wildlife carnivore. In a 28-day test, a LC50 value for mink fed warfarin *per se* (primary toxicity) was calculated to be 11.7 ppm (mg/kg) with a 95% confidence interval of 9.2 to 15.0 ppm (mg/kg) and a slope of 2.03. Feeding mink warfarin-contaminated rabbit (minus digestive tract contents) incorporated into diets to provide warfarin residue levels equivalent to the warfarin concentrations fed in the LC50 primary toxicity test did not produce secondary toxicity, suggesting that warfarin may be readily bound and/or metabolized into non-, or less toxic metabolites by the primary consumer. Toxic residues of 1080 for mink (as in secondary toxicity) were not produced in rabbits fed a lethal dose of this compound when the gastrointestinal tract contents were removed from the rabbit carcasses. These results suggested that reports of secondary toxicity from 1080 may be primarily due to consumption of the unmetabolized compound from the gut of the prey species.


**Keywords:** mode of action/NMR/metabolism


**Keywords:** sodium monofluoroacetate/monofluoroacetate/1080


**Keywords:** sodium fluoroacetate/fluoroacetate/mode of action


**Keywords:** sodium fluoroacetate/fluoroacetate/citric acid/metabolism/liver/rats/citrate/rodents

**Abstract:** Sodium fluoroacetate injected into mice at a dose of 4 to 5 mg/kg, 5 hours before irradiation, reduced the mortality produced by 650 to 675 r of whole-body X-irradiation. The high levels of citric acid in the tissues of the poisoned animals returned to normal within 24 hours if 675 r of X-rays were given 5 hours after 5 mg/kg of sodium fluoroacetate, whereas 48 hours were required in the case on non-irradiated control mice. Thus, X-rays interfered with the metabolism of citric acid in the tissues of the mouse as in the tissues of the rat. The liver of the mouse, however, did not behave like the liver of the rat. In contrast to rats, male mice injected with sodium fluoroacetate accumulated citrate in their livers, whereas females did not; whole-body irradiation reduced the level of accumulated citrate in the liver as it did in tissues of the mouse. The injection of sodium fluoroacetate produced a prolonged hypothermia. It is suggested that the fluoroacetate-induced accumulation of citrate protects the animals by complexing magnesium ions necessary for DNase activity.


**Keywords:** 1080/sodium monofluoroacetate/birds/reproductive effects/testes/sublethal effects

**Abstract:** Sodium monofluoroacetate (Compound 1080) is highly toxic to mammals and has been used widely for control of rodents and mammalian predators. In 1972 many uses of 1080 were cancelled, due, in part to mortalities that were reported among non-target animals. Though 1080 baits and dead poisoned animals may be available to birds during avian breeding periods we are unaware of any investigation of long-term exposure in birds or possible effects on avian reproduction. Such studies are of particular interest as testing with rats has shown testicular lesions and atrophy resulting from sublethal 1080 exposure. Our study was undertaken to investigate the short-term acute and long-term sublethal effects of 1080 on European starlings (*Sturnus vulgaris*) with emphasis on testicular morphology. Starlings fed 1080 showed...
Keywords: blood/sodium fluoroacetate/fluoroacetate/metabolism
Abstract: Sodium fluoroacetate (SFA) has been shown to produce hyperglycemia and ketonemia in the rat. Although this SFA-induced diabetes has been described as being partially insensitive to insulin by Engel et al., a significant insulin effect has been demonstrated. Karam and Grodskey reported that greater than normal amounts of insulin were present in the pancreatic tissue of the SFA-treated animal. The present study was designed to investigate the effect of exogenous insulin in reducing blood glucose levels in control and SFA-induced hyperglycemic rats. In addition, the effects of SFA and insulin on the levels of circulating corticosteroid were determined. The hyperglycemia produced by SFA can be significantly reduced by small amounts of insulin. The very levels of plasma corticosteroid found to occur following treatment with SFA can be transiently increased by the administration of insulin. These high levels are thought to be due to a SFA induced decrease in the hepatic inactivation of the adrenal hormone.

Keywords: poisoning
Abstract: From eight trials made during 1967-69 a technique was developed for estimating the reduction, by poisoning, of opossums (Trichosurus vulpecula) from the extent of interference with non-toxic flour-paste baits. The model assumes that opossums do not, through experience and learning, search for other baits close by.
The trial data showed that contagion, an increase in levels of bait interference from night to night and very high acceptance levels were a consequence of baits having been preferentially placed on open ridges and spaced too closely.
Manipulation of baits on randomly-located lines showed that if baits were spaced 40 yards apart and lines were at least 200 yards apart there was little evidence of contagion.
Procedures are given for using interference levels from poisoned areas and untreated control areas to estimate kills.

Keywords: bacteria/acetate/fluoroacetate/metabolism/inhibition/toxicity
Abstract: Oxidation of acetate in salt marsh sediment was inhibited by the addition of fluoroacetate, and also by the addition of molybdate, an inhibitor of sulfate-reducing bacteria. Molybdate had no effect upon the metabolism of acetate in a freshwater sediment in the absence of sulfate. The inhibitory effect of molybdate on acetate turnover in the marine sediment was attributed to inhibition of sulfate-reducing bacteria which oxidized acetate to carbon dioxide. Sulfide was not recovered from sediment in the presence of molybdate, but sulfide was recovered quantitatively even in the presence of molybdate by the addition of the strong reducing agent titanium chloride before acidification of the sediment. Reduction of sulfate to sulfide by the sulfate-reducing bacteria in the sediment was only partially inhibited by fluoroacetate, but was completely inhibited by molybdate addition. This was interpreted as showing the presence of two functional groups of sulfate-reducing bacteria - one group oxidizing acetate, and another group probably oxidizing hydrogen.

Keywords: mode of action/pathology/biochemistry/heart/fluoroacetate/inhibition
Abstract: Chick embryo heart fragments in primary hanging-drop culture were treated with sodium fluoroacetate to induce inhibition ofaconitate hydratase, a mitochondrial enzyme of the tricarboxylic acid cycle. The mitochondria were analyzed in the living myoblasts by phasecontrast timelapse cinemicrography. The results were recorded in 1 16 mm film. After 2030 minutes contact of the cells with the inhibitor some mitochondrion became thickened and swollen. The swelling was polymorphous, asynchronous and reversible; the name mitochondrion could swell and shrink many times. Some mitochondria seemed not to respond to fluoroacetate and remained rodlike. Mitochondria appeared the only cell components to be morphologically affected by fluoroacetate and the changes were specifically caused by the inhibitor. The type of mitochondrial swelling differed from the largeamplitude inspirationdependent swelling of the isolated mitochondria in vitro and from the configurational changes of isolated mitochondria associated with the respiratory states. The evidence pointed to specific connection between the biochemical lesion caused by fluoroacetate and the configurational changes of the mitochondria. The mitochondrial swelling as to a large extent revered by washing the cultures with Tyrode physiological saline solution and the reversal was further accentuated by incubation of the cultures in fresh nutrient medium.

Ref Type: Report
Keywords: baits/1080/poisoning/deer
Abstract: Poisoning of natural baits with 1080 powder dissolved in an adhesive is effective for killing deer in an area of high rainfall and dense vegetation, where conventional methods of control have met with limited success in in recent years. Experiments showed that natural baits treated with the adhesive were fairly readily accepted by deer.

Keywords: sodium fluoroacetate/fluoroacetate/1080/poisoning/rats/birds/poisons/efficacy
Abstract: Sodium fluoroacetate (1080) has been tested in the field as a poison for Rattus norvegicus and R. rattus. Direct poisoning (without prebaiting) was used in thirteen tests on R. norvegicus. In eight of these tests censuses showed kills of at least 89%; in three tests the poison failed, and in two the results were equivocal. Of three similar tests against R. rattus two were successful and one was a failure. Six tests of 1080 after prebaiting gave five successes (including one against R. rattus) and one in which the estimated kill was about 82%. In five out of six tests populations of R. norvegicus which had survived baiting with 1080 showed shyness (refusal) of the poison when it was given in a new bait base. The LD_{50} of 1080 for a strain of white rats was found to be 3.8 mg/kg (approx. range 2.8-5.2). A number of wild birds and some domestic animals were accidentally killed during the tests despite stringent precautions taken in laying the bait and in warning occupiers. It is concluded that (a) although 1080 is probably more effective in direct poisoning than other poisons used in the past, it does not give as consistent results as the standard poisons do after prebaiting; (b) 1080 is too dangerous for general use.

Keywords: NMR
Abstract: Examination of extracts from seeds and foliage of several species known to contain fluoroacetate, using 19F NMR spectroscopy, has shown the presence of the characteristic FCH2-signal in most of them and enabled quantitative determination of their fluoroacetate content. No other fluorine-containing plant metabolites were detected; fluoroacetate was not detected in the extracts of several non-toxic species. The limit of detection is estimated to be ca 4 Fg/g.

Keywords: chemistry/cyanide/fluoroacetate/occurrence in nature
Abstract: This review is divided into sections each dealing with representatives of a separate group of compounds. Within each section, sub-sections describe the chemistry of the compound(s), factors affecting
their concentration in plants, and the effect of the secondary compound(s) upon animals and upon forage nutritive value. Secondary compounds may be either toxic to animals (e.g. cyanide, nitrate and fluoroacetate), cause sub-clinical losses in productivity, (e.g. some mycotoxins and high concentrations of condensed tannins), increase nutritive value (e.g. low concentrations of condensed tannins), reduce mineral availability (e.g. oxalate) or improve plant persistency (e.g. peramine). The important groups of secondary compounds are listed in a table, together with appropriate references

Keywords: fluoroacetate/enzyme/metabolism

Keywords: metabolism/acute toxicity/mode of action/liquid chromatography/fluoroacetate

Keywords: monofluoroacetate/goats/stomach/poisoning/liver/lethal dose/pathology/heart
Abstract: Ten tame eland (Taurotragus oryx), 4 kudu (Tragelaphus strepsiceros), 2 gemsbok (Oryx gazella), 6 springbok (Antidorcas marsupialis) and 33 domestic goats were drenched by stomach tube with extracts of the poisonous plant gifblaar (Dichapetalum cymosum) (Hooker) Engler and Prantl (= D. venenatum Engler and Gilg). Semi-quantitative analyses of the monofluoroacetate (MFA) content of the leaves were conducted at regular intervals and the proven lethal (about LD-100) caprine dose was found to be equivalent to 1.01-1.60 mg/kg MFA. Eland and kudu only succumbed at high dosage levels of 6-8 mg/kg MFA and proved to be much less susceptible to gifblaar poisoning than goats. Springbok and gemsbok were as susceptible as goats, although confirmation is needed in gemsbok to eliminate possible interaction between the immobilizing drugs used and MFA. During separate voluntary intake trials, eland ate limited offerings of both low and highly toxic stages of gifblaar. At these dosages they showed no ill effects. Kudu on the other hand were more cautious and intake was minimal. The lesions caused by gifblaar are described. A few macroscopic lesions observed in some of the animals have not been recorded previously. These include: edema and hemorrhages of the gall bladder with occasional blood-stained bile; edema of the abomasum, periportal area of the liver, pancreas and pulmonary valves; adrenal hemorrhages and petechiae in the urinary bladder. Histopathological changes were described in various organs such as the myocardium where replacement fibrosis became evident in animals which survived for 2 or more days

Ref Type: Report
Keywords: 1080/aquatic species/fish

Keywords: possums/field efficacy/baits/carrot

Keywords: 1080/bait degradation/baits/deer/monofluoroacetate/poison/sodium monofluoroacetate
Abstract: Compound 1080 (sodium monofluoroacetate) in a gel carrier was applied to the leaves of broadleaf (Griselinia littoralis Raoul) baits (cuttings) to poison deer. In two trials on Stewart Island, (New Zealand) assays for F- showed that the poison disappeared during rain, 90% being lost in 207 mm of rain and 81 mm of rain in the respective trials. In one trial significant losses of Compound 1080 also resulted from biodegradation in storage. Baits set to kill deer were sampled after 0, 15, 30, and 45 days of weathering. Only 10% of the treated leaves retained toxic gel after 45 days. About 1.4% of the Compound 1080 was lost from the leaves per millimetre of rainfall. This rate was similar to loss rates for Compound 1080 from other baits commonly used in animal control operations.

Keywords: aquatic species/non-target species

Abstract: Certain poikilothermic animals are resistant to fluoroacetate. Since no-one seems to know how they tolerate fluoroacetate, we have examined some of its effects on the Rainbow trout, and for comparison, on the albino rat. Comparison of the LD50 values for fluoroacetate with the concentrations of it which inhibit hepatic respiration suggests that in neither species is the liver the critical organ. Nevertheless, it is tempting to speculate that trout are relatively immune to fluoroacetate, partly because their aconitrate hydratase is only poorly inhibited by fluoroacetate, and partly because their low body temperature further diminishes the potency of this inhibitor.


Keywords: resistance

Abstract: A 9.5-kb shuttle vector capable of replication and selection in both *Esherichia coli* and *Butyrivibrio fibrisolvens* was constructed. Plasmid pUC118 provided replication functions and ampicillin resistance selection in *E. coli*. In *B. fibrisolvens*, replication was controlled by the native plasmid pRJF1 from strain OB156, and selectability was provided by a 3.5-kb fragment of plasmid pAM1 containing the erythromycin gene. Optimum conditions for transformation were 15 kV/cm, 2 hr recovery, and plating in an agar overlay on medium containing 10 µg erythromycin/ml. Maximum efficiency was $1.1 \times 10^5$ transformants per µg plasmid DNA (average $3 \times 10^4$), and restriction mechanisms reduced efficiency by a factor of $2 \times 10^2$. Nonselective growth for 200 generations gave no measurable loss of plasmid.


Keywords: occupational exposure/1080/possums

Abstract: This paper reviews the health issues concerning the continued use of 1080


Keywords: metabolism/acute toxicity/diagnosis/treatment/1080/pathology

Abstract: Brief notes on the sources, mechanism, toxicity, signs, clinical pathology, lesions, diagnosis and treatment.


Keywords: birds/invertebrates/wasps/poisons/poison/sodium monofluoroacetate/monofluoroacetate/poisoning

Abstract: Vespula vulgaris are widespread, abundant pests in New Zealand. They compete for food with native birds and feed on native invertebrates. The authors poisoned wasps annually over 4 years (1991-95) to see if it was possible to reduce their abundance in two 30-ha beech (Nothofagus) forest sites near Lake Rotoroa. Two different poisons (sodium monofluoroacetate [sodium fluoroacetate] and sulfluramid) were used, mixed with sardine cat food. There was no evidence that one poison was more effective than the other. Between 82 and 100% of the colonies were killed in the poisoned sites, but reinvasion by foraging workers meant that cumulative wasp biomass (measured using Malaise traps) was reduced by only 55-70%. Individual wasps were about 16% heavier in the poisoned sites at the peak of the wasp season (March) than in the non-poisoned sites, although this had a minimal effect on cumulative biomass over the entire season. Conservation gains need to be quantified in order to assess whether the expense of such poisoning operations is warranted.
Keywords: baits/marsupials/non-target species

Keywords: poisoning/occurrence in nature/livestock

Keywords: acute toxicity/strychnine/rabbits/secondary poisoning/cyanide/arsenic
Abstract: Although a number of poisons are used for the destruction of opossums, *Trichosurus vulpecula* (Kerr), very little information on their acute toxic effects is available. A study of the toxicity of four poisons was therefore undertaken. Two of these compounds, sodium monofluoroacetate and sodium cyanide, are used as toxins against opossums in New Zealand, and others, arsenic trioxide and strychnine alkaloid, are used for the destruction of rabbits. Arsenic trioxide and strychnine were suggested as replacements for sodium monofluoroacetate and sodium monofluoroacetate and sodium cyanide by the Rabbit Destruction Council (pers. comm.). They suggested strychnine as a substitute for cyanide to overcome poison shyness and arsenic as a substitute for sodium monofluoroacetate to circumvent the danger of secondary poisoning to farmers dogs. The investigation determined the oral toxicity of these poisons and comments on the suitability of arsenic trioxide and strychnine as substitutes.

Keywords: mode of action/pathology
Abstract: A study was made of the ammonium ion and glutamine in the cerbrum during the course of fluoroacetate poisoning in dogs.

Keywords: fluoroacetate/fluoride/inhibition/occurrence in nature/persistence in plants
Abstract: Callus cultures of *A. georginae* were initiated from leaf discs from young leaves. Growth of callus was slow but predictable with tissue volume up to 2.2 cm-3 being formed. Fluoride concentrations up to 80 ppm in the medium produced no adverse effect on callus growth. Reversible growth inhibition occurred at 160 ppm; apparent death occurred at higher concentrations. Fluoroacetate was detected by gas chromatography in the callus treated with 40, 80 and 160 ppm fluoride

Keywords: aquatic species/fish/toxicity/1080

Keywords: sodium fluoroacetate/fluoroacetate/fluoroacetamide/poisons/rats/zinc phosphide/poisoning/efficacy/treatment
Abstract: Field trials suggest that 3-monthly operations against rats in sewers using either 0.25% sodium fluoroacetate or 2% fluoroacetamide as a direct poison are more effective than 6-monthly treatments with 2.5% zinc phosphide or 10% arsensive oxide using the pre-baiting method. In six paired trials 2% fluoroacetamide gave better results (an apparent 100% clearance in 5 instances) than 0.25% sodium fluoroacetate. There is no evidence, at present, that direct poisoning treatments with 2% fluoroacetamide or 0.25% sodium fluoroacetate are improved by the addition of mould inhibiting substances to the bait.


Abstract: Fluorocitrate inhibits the glial tricarboxylic acid cycle and thereby the synthesis of glutamine, which is the main precursor for transmitter glutamate. We investigated the possibility that there is a functional correlate to fluorocitrate action by recording evoked field potentials in rat hippocampal slices. The excitatory postsynaptic potential (field-EPSP) was markedly depressed after 7-8 h of fluorocitrate action. The population spike was also reduced, but a major part of the reduction may be the result of weaker synaptic activation rather than reduced excitability of the postsynaptic cells. The activity of thin unmyelinated fibres was only slightly affected. Preceding the changes in the field-EPSP there was a decrease in the glutamine content in the fluorocitrate treated slices relative to controls. Only a small decrease in tissue glutamate was seen concomitantly with the synaptic failure, probably because the transmitter pool of glutamate in those fibres stimulated makes little contribution to the total tissue glutamate.

Bergmann, F. and Shimoni, A. (1953). The enzymic hydrolysis of alkyl fluorocacetates and related compounds. Biochemical journal 55, 50-57. Keywords: product chemistry


Abstract: The last stages of the eradication of feral domestic cats Felis catus from sub-Antarctic Marion Island are described. After four seasons of hunting, intensive gin-trapping from 1990 and poisoning with sodium monofluoroacetate from 1991 were incorporated into the eradication campaign. Hunting became totally ineffective at low densities, while trapping became more effective. Poisoning was added to rid the island of any remaining cats. The last live cat was sighted and shot in January 1991, while the last cat trapped in July 1991. No sign of cats has been seen on the island in the subsequent eight years, and it is stated with complete confidence that feral house cats have finally been eradicated from Marion Island.


Abstract: At the moment, there is a lot of interest and a fiery debate about the use of 1080 in controlling possums. Interestingly, there are environmentalists on both sides of the debate. The 'antis' argue that 1080 poisons our environment, while the 'pros' argue that its use greatly reduces possum damage, and allows recovery of our native vegetation from the drastic effects of introduced animals. Unfortunately, the debate is being muddied by claims that are not based on any concrete evidence or even contradicted by well-established knowledge. Perhaps the biggest confusion relates to the nature and use of the bait (the stuff the poison is carried in) versus the nature of the poison itself. Many of the concerns about use of 1080 are
essentially about the form of the bait and the way that the bait is distributed, so that other poisons used in the same ways would present the same problems. Largely neglected in the public debate is the nature of the poison itself, particularly in relation to its status as a natural plant product, rather than being some unnatural creation of unethical chemists.


Abstract: Thermal decomposition of gaseous fluoroacetic acid in silica at 295 - 283° C gives carbon monoxide, formaldehyde carbon dioxide, silicon tetrafluoride and fluoroacetyl fluoride as main products. Elimination of hydrogen fluoride appears to be the initial step in decomposition, followed mainly by formation of formaldehyde and carbon monoxide.


Abstract: This survey aims at promoting the standardization of methods for determining biodegradability. The most important problems met in biodegradation research concern adaptation, toxicity, non-biotic eliminations and analytical restrictions. Consequent rules and recommendations can be divided into two groups, viz one group aiming at adaptation and another group at obtaining reliable measurements. From a classification of frequently used methods it appears that there are only two clearly different groups of methods which show a great many small differences. Adjustment of well known methods to the proposed rules and recommendations calls for an adaptation procedure followed by a procedure for measurements.


Abstract: Sources of propionate and methylmalonate and their use as substrates for juvenile hormone and methyl branched hydrocarbon biosynthesis in insects are reviewed. An unusual pathway for propionate metabolism has been shown to occur in insects and it may be related to the absence or low levels of vitamin B12 found in many species. This pathway suggested the possibility that 2-fluoropropionate might be selectively metabolized in insects to the toxic 2-fluoroacetate. However, 2-fluoropropionate was not toxic to Musca domestica or Periplaneta americana, presumably because it was not metabolized to 2-fluoroacetate rapidly enough. Nevertheless, it is suggested that exploitation of unique metabolic pathways in insects offers the potential for novel control techniques.


Keywords: persistence in soil/sodium fluoroacetate/fluoroacetate/soil/aquatic species/algae/persistence in plants/fungus

Abstract: A range of New Zealand soils, many contaminated by sodium fluoroacetate ("Compound 1080")
or NaFA) were examined for micro-organisms capable of defluorinating this animal poison. Species of *Pseudomonas* and *Fusarium* capable of growth on NaFA were isolated whilst many other soil bacteria and fungi exhibited defluorinating activity when grown on an alternative organic C source. It was concluded that NaFA has a short biological half-life in the soils investigated. Some NaFA-contaminated soils also contained species of the algae *Chlorella* and *Chlamydomonas* which were unaffected by NaFA but growth of a duck weed, *Spirodela oligorrhiza*, was inhibited 73% in the presence of 5 µM–NaFA.


Keywords: persistence in plants/aquatic species/persistence in water/bioassay/fluoroacetate/fluoride

Abstract: The toxic effects of fluoroacetate (Nafa) and fluoride (NaF) upon three different species of duckweed have been compared. Duckweeds proved far more sensitive to Nafa than to NaF; the frond multiplication rate being halved by 0.5mM Nafa compared to 10mM NaF. The frond multiplication rate was proportional to the logarithm of the Nafa concentration, whereas it was linearly related to NaF concentration. Our results suggest that duckweeds could be used as a sensitive bioassay system, and their potential as an indicator of pollution of ponds and streams by Nafa is being investigated.


Keywords: persistence in water/1080

Abstract: The results suggested that significant or prolonged contamination after using 1080 for pest control is highly unlikely, if care is taken to avoid watercourses when aerially sowing 1080 bait.


Keywords: metabolism/persistence in water/1080/fluorocitrate

Abstract: Using a method developed for the analysis of fluorocitrate in water, it is shown that fluorocitrate is product of 1080 degradation, but is rapidly degraded and due to its lower oral toxicity compared with 1080, it is more important to monitor 1080 residues than fluorocitrate after a possum control operation using 1080 bait.


Keywords: bait degradation/1080/brodifacoum/possums


Keywords: non-target species/invertebrates/persistence in animals/1080/secondary poisoning/birds


Ref Type: Abstract

Keywords: 1080/baits


Keywords: non-target species/mammals/metabolism/lethal dose/fluoroacetate/fluorocitrate/citrate/heart/acute toxicity/blood

Abstract: The utility of serum citrate as a peripheral indicator of toxicity was tested as a possible investigational probe for compounds which inhibit citrate metabolism. Fluoroacetate (FA) and its putative toxic metabolite, fluorocitrate (FC), were given to rats and dogs in a series of studies. In rats 3mg/kg FA
(po) caused a 46% depletion in heart ATP concentrations and a 15-fold increase in heart citrate concentrations. Both of these changes were significantly correlated with a fivefold elevation in serum citrate elevations corresponded with the appearance of serious clinical signs and death. In range finding studies with rats or dogs, serum citrate elevations were always observed in a doserelated pattern according to the doses of FA or FC administered. In contrast to FA toxic doses of FC did not reduce heart ATP in either rats of dogs and high correlations were established between serum glucose and serum citrate in both species. Serum total calcium was reduced (18%) in dogs treated with FC (8mg/kg, iv) and a strong inverse correlation to serum citrate was shown. This correlation is biologically meaningful in light of the known chelating effect of citrate on calcium. Clinical manifestations of tremors, tetany, and convulsions in FC treated dogs were consistent with know symptoms of hypocalcemia. No decrease in total calcium was observed in rats treated with either FA or FC. Despite certain species differences in response to the two inhibitors, serum citrate levels were always reflective of nontoxic, toxic or lethal doses.

Keywords: non-target species/mammals/metabolism/acute toxicity/fluorocitrate/dogs

Keywords: fluorocitrate/metabolism/kidney

Abstract: Renal glutamine metabolism was studied in vivo following infusions of fluorocitrate into chronically acidic and alkalotic dogs. Coincident with a dramatic rise in renal cortical citrate concentrations, there was a significant fall in tissue glutamate in both acid-base states. This was accompanied by a significant increase in total renal ammonia production. Glutamine metabolism and ammoniagenesis in alkalotic dogs receiving fluorocitrate simulated that achieved in acidic dogs. The simultaneous administration of α-ketoglutarate and fluorocitrate significantly diminished the fall in tissue glutamate and the rise in ammoniagenesis induced by fluorocitrate alone. These results are compatible with the hypothesis that ammonia production from glutamine is enhanced secondary to increased glutamate deamination. We postulate that this chain of events may be the consequence of impaired α-ketoglutarate production from citrate.

Keywords: pathology/mode of action/sodium fluoroacetate/fluoroacetate

Keywords: bait degradation/1080/persistence in water

Abstract: The rate of leaching of sodium monofluoroacetate (1080) by simulated rainfall was determined for carrot and possum pellet baits containing 0.08 and 0.15% 1080. Carrot baits were highly water-resistant and showed no decline in 1080 concn after 200 mm of rain. It is concluded that it is advisable to use carrot bait in arid areas when rapid restocking of land is required after a control operation, but they may be particularly suitable for forest habitats. Of the two types of pellet (Wanganui No. 7 and RS5) tested, RS5 pellets were the less water-resistant and started to disintegrate after only 5 mm of rain. The 1080 concn also declined more rapidly in these pellets. So that toxicity is retained for the maximum length of time, RS5 pellets should be used in arid areas and Wanganui No. 7 pellets in wetter environments, when pellets are the bait of choice. RS5 pellets should be used if rapid return to stock to the land is required.

Ref Type: Report  
Keywords: bait degradation/1080

Abstract: Objective: To determine the rate of leaching of 1080 by simulated rainfall from commercial 1080 pellets and carrot baits.  
Conclusions / recommendations: Carrot baits are highly water-resistant, and it is advisable to use them
where rapid destocking of land is required; in order to retain toxicity for the maximum length of time, RS5 pellets should be used in arid areas and the more water-resistant Wanganui no 7 pellets in wetter environments. If rapid return of stock to land is required, RS5 pellets should be used; bait type is a more important determinant of 1080 persistence than initial concentration.


Keywords: persistence in water/persistence in soil/1080/baits

Abstract: The results of a programme to monitor the containment and natural breakdown of approximately 12 000 kg of toxic vertebrate pest bait, containing compound 1080 (sodium monofluoroacetate), in a landfill site are reported. The baits were buried in a purpose-dug pit in a managed solid waste disposal site at Winton in central Southland, New Zealand, in August 1996. Compound 1080 is used extensively in a bait form to control a range of introduced vertebrate pests, (e.g., European rabbit, Australian brush tailed possum), which cause considerable economic and environmental damage in New Zealand. Two shallow monitor bores, sited 5 and 13 m from the disposal pit, were sampled weekly for five weeks and thereafter monthly for 13 months. Analyses detected 1080 in 5 of the 28 groundwater/leachate samples. The 1080 concentrations in those samples, except for one result, were low. These were either below or close to the Ministry of Health provisional maximum acceptable value standards (PMAV) for drinking water, currently 0.005 µg ml⁻¹. The concentrations of 1080 in groundwater in the more distant bore (13 m) were markedly lower than those in the nearer bore (5 m). 1080 was first detected in the near bore after 5 weeks and the more distant bore after 16 weeks. The level and frequency of incidence of 1080 in both holes decreased over the sampling period until none was detected after 10 months. In situ sampling of the residual waste material indicated the 1080 concentration in the disposal pit decreased to less than 10% of its original level in 12 months. The active anaerobic bacterial processes operating in the organic refuse pile appear to provide an ideal environment for the rapid natural breakdown of 1080. The findings will assist with the setting of conditions for resource consents concerning the disposal of materials containing 1080 in landfill sites.


Keywords: inhibition/citrate/metabolism/sodium fluoroacetate/fluoroacetate/heart

Abstract: The results do show that the concentration of ATP was considerably decreased in hearts from animals treated with fluoroacetate, but it is not known whether these depressed ATP concentrations are below that required for adequate hexokinase activity in the heart.


Keywords: fluoroacetate/poison/fluorocitrate

Abstract: The increasing biochemical importance of reactions mediated by thiol esters of coenzyme A leads to an interest in the possible metabolic activity of substituted derivatives of CoASH. Of particular interest is monofluoroacetyl coenzyme A, since fluoroacetate is a potent lethal poison. A partial explanation of the toxicity of fluoroacetate has come from the work of Lièbecq and Peters (3) and Martius (4). Peters and collaborators (5) have elegantly demonstrated the formation of fluorocitrate which is a potent inhibitor of the tricarboxylic acid cycle by virtue of its competitive inhibition of the enzyme aconitase (6). The formation of fluorocitrate is presumed to be due to the activation of fluoroacetate to F-acetyl SCoA, which is subsequently condensed with oxalacetate in the presence of the condensing enzyme described by Ochoa, Stern, and Schneider (7). The preparation and properties of F-acetyl SCoA and its reactivity in various enzyme systems are described. Evidence for a fluorocitrate activating system different from that for acetate is reported.


Keywords: fluorocitrate/inhibition/liver

Abstract: 1. The effect of biologically synthesized and purified fluorocitrate on the metabolism of tricarboxylate anions by isolated rat liver mitochondria was investigated, in relation to the claim by Eanes et al. (1972) that this fluoro compound inhibits the tricarboxylate carrier at concentrations at which it has
little effect on theaconitate hydratase activity. 2. That the inhibitory action of fluorocitrate is at the level of theaconitate hydratase and not at the level of the tricarboxylate carrier is indicated by the following findings. Although the oxidation of citrate and $\text{cis}$-aconitate, but not that of isocitrate, was inhibited by fluorocitrate, the exchange of internal citrate for external citrate or L-malate was not. Had the tricarboxylate carrier been affected, these latter exchange reactions would have been inhibited. 3. By usingaconitate hydratase solubilized from mitochondria it was found that with citrate as substrate the inhibition by fluorocitrate was partially competitive ($K_i = 3.4 \times 10^{-8}$M), whereas with $\text{cis}$-aconitate as substrate the inhibition was partially non-competitive ($K_i = 3.0 \times 10^{-8}$M).

Keywords: metabolism/citrate/heart/muscle/biochemistry/fluorocitrate/liver/pathology
Abstract: The metabolism and metabolic effects of fluoroacetylcarnitine have been investigated. 1, Carnitineacetyltransferase (EC 2.3.1.7) transfers the fluoro-acetyl group of fluoroacetylcarnitine nearly as rapidly to CoA as the acetyl group of acetylcarnitine. 2. Fluorocitrate is then formed by citrate synthase (EC 4.1.3.7) but this second reaction is relatively slow. 3. The fluorocitrate formed intramitochondrially inhibits the metabolism of citrate. 4. In heart and skeletal muscle mitochondria the accumulated citrate inhibits citrate synthesis and the beta-oxidation of fatty acids. Free acetate is formed, presumably because accumulated acetyl-CoA is hydrolyzed. 5. In liver mitochondria the accumulation of citrate leads to a relatively increased rate of ketogenesis. Increased ketogenesis is obtained also upon the addition of citrate to the reaction mixture.

Keywords: citrate/metabolism/liver/mode of action/enzyme/fluorocitrate
Abstract: The reversibility of citrate synthesis and the effects of fluorocitrate on citrate synthesis in whole mitochondria have been investigated. Cleavage of citrate to oxaloacetate (trapped as malate) and acetyl-CoA (trapped as acetylcarnitine) in whole liver mitochondria can be demonstrated. The maximum rate of the reversed reaction is at most 1/40 of the maximum rate of citrate synthesis. Citrate and fluorocitrate are competitive inhibitors with respect to oxaloacetate of purified pig heart synthase. The $K_1$ for both compounds was found to be approx. 1.5 mM. Both citrate and fluorocitrate inhibit citrate synthesis and increase ketone genesis in whole liver mitochondria. The probably act as competitive inhibitors with respect to oxaloacetate, since malate counteracts this inhibition. For kinetic reasons it is concluded that the citrate synthesis reaction probably never approaches equilibrium in the intact tissue. The improtanceof citrate in the regulation of citrate and ketone body formation in the liver is discussed.

Keywords: kidney/inhibition/metabolism/monofluoroacetate
Abstract: Hypoxic injury was evaluated morphologically in the proximal tubule and in the medullary thick ascending limb of isolated rat kidneys perfused for 90 min with or without O2 or with various metabolic inhibitors. Inhibition of mitochondrial respiration (with rotenone, antimycin, oligomycin) or of intermediary metabolism (with monofluoroacetate, malonate, 2-deoxyglucose) caused reduction in renal oxygen consumption, renal function and ATP content comparable with those elicited by oxygen deprivation.

Keywords: kidney/metabolism/inhibition/monofluoroacetate
Abstract: Under certain conditions, excess of substrates may be detrimental to the kidney. In isolated rat kidneys perfused with cell-free medium, oxidative metabolism to support reabsorptive transport in the presence of a limited oxygen supply results in hypoxic injury to medullary thick ascending limbs (mTAL). Since inhibitors of mitochondrial respiration markedly reduced this injury, we evaluated the effects of altering the availability of substrate for oxidative metabolism in the mTAL. Inhibition of glucose utilization with 2-deoxyglucose (50 mM) and simultaneous inhibition of long-chain fatty acid metabolism with 2-
tetradeceglycidic acod (10^4 mM) in the absence of exogenous substrates consistently reduced hypoxic cell injury to mTAL. Similarly the direct inhibition of substrate oxidation by the citric acid cycle with monofluoroacetate (5 mM) also reduced the extent of damage to this nephron segment.

Keywords: bacteria/algae/toxicity/sodium fluoroacetate

Keywords: poisoning/reptiles/secondary poisoning/non-target species
Abstract: No observable reaction was shown by snakes which accepted mice that had consumed lethal quantities of either thallium sulphate or of warfarin, dipicarin, or prolin. Snakes fed rodents poisoned with sodium fluoroacetate, endrin, arsenic trioxide or zinc phosphate baits often regurgitated the mice but exhibited no other response. In fourteen snake feeding trials, the Microtus used had accepted baits soaked in a high concentration of sodium fluoroacetate. Twelve of these mice were regurgitated. Snakes fed mice which had eaten baits treated with strychine alkaloid became irritable and reacted with tremors. Five of these snakes died of secondary poisoning.

Keywords: diagnosis/treatment/pathology/sodium fluoroacetate/humans
Abstract: Certain drugs can be used with benefit in a case of sodium fluoroacetate poisoning. These are (1) procainamide (Pronestyl) hydrochloride for cardiac arrythmias, (2) intravenously used alcohol for central nervous system irritability, and (3) vasodepressor drugs such as mephentermine (Wyamine) sulfate to maintain blood pressure. In the future these drugs, which we feel prolonged the life of our patient, should be tried in cases of sodium fluoroacetate poisoning, as they may save the lives of patients who have ingested smaller amounts of the poison.


Keywords: 1080/poison/birds/toxicity/USA/predators/lethal dose/poisons
Abstract: The poison collar was developed in the USA in the late 1970s. It was designed to be an effective and highly selective means of killing Coyotes Canis latrans that preyed on domestic stock, without harming non-target individuals and species (Connolly et al. 1978; Saverie & Sterner 1979). The collar has been exported to other parts of the world, where it is used against mainly medium-sized mammalian predators.
The poison collar consists of two rubber pouches containing poison under low pressure, and two straps with velcro attachments. The collar is fitted around the neck of a sheep or goat and the pouches are positioned around the throat, which is the site of attack by most mammalian predators. The exact position of the pouches depends on the expected predator. A number of young domestic animals (usually at least 20) are fitted with collars and released with a larger flock of adult animals into the camp where losses are being experienced. The predator usually attacks one of the smaller animals. On biting into one of the poison pouches, a lethal dose of poison squirts into the predator's mouth and is ingested.
In the USA a wide spectrum of poisons were tested for use in the collar (e.g. Connelly et al. 1978); Saverie & Sterner 1979; Sterner 1979). Compound 1080 (sodium monofluoroacetate) was found to be the most suitable toxin and was registered for this purpose (Scrivner 1983; Howard & Schmidt 1984). The use of the poison collar and compound 1080 were vigorously opposed and intensively monitored by a number of environmental pressure groups in the USA (e.g. Anon. 1982; Doherty 1982; Sibbison 1984). The issue was eventually settled in court. The verdict was in favour of the use of the collar and compound 1080 because, after extensive testing by impartial organisations, no secondary poisoning was found and no non-target animals were killed (Connelly 1983; Eastland & Beasom 1986). Recent investigations of secondary poisoning concluded that consuming carcasses of Coyotes killed by 1080 poison from a collar poses little,
if any, hazard to Striped Skunks *Mephitis mephitis* and Golden Eagles *Aquila chrysaetos* (Burns et al. 1991).

**Results:**

The vulture’s first meal was at about 18h00 on day one. About 0.5 kg of food was taken. Within 30 min the bird regurgitated its entire crop contents. The bird fed again at midday on day two, taking about 0.3 kg, which it kept down. It fed again at about 17h00 on day two, from the carcass (about 0.5 kg) and from the meat regurgitated on day one (about 0.2 kg). Within about 20 min it regurgitated about 0.3 kg but kept the remainder down until nightfall. On arrival at the cage at 07h30 on day three it was apparent that the vulture had regurgitated about 0.2 kg of food during the night, and that it had been pulling at the carcass, but not feeding much, as its crop was empty.

In addition to feeding from the incisions, and gaining access through them to meat between the skin and skeleton, the bird had tugged and torn the contaminated skin. At no stage did the vulture show any symptoms of 1080 poisoning other than regurgitation. Common symptoms are depression, unsteady gait and loss of balance, closed eyes, hunched posture and raised or fluffed feathers (McIlroy 1984). After returning the bird to the large aviary, it fed on clean meat on the afternoon of day three and showed no signs of having been poisoned.


Abstract: The distribution in Queensland, clinical symptoms and control of heart-leaf poison bush (*Gastrolobium grandiflorum*), which is toxic to livestock at all stages of growth, are described. The toxin is a fluoroacetate. 2,4,5-T diluted with dieselene and applied to the main stem at ground level gave effective control.


Abstract: Mutants of *Escherichia coli* K12 have been isolated that grow on media containing pyruvate or proline as sole carbon sources despite the presence of 10 or 50 µm-sodium fluoroacetate. Such mutants lack either acetate kinase [ATP: acetate phosphotransferase; EC2.7.2.1] or phosphotransacetylase [acetyl-CoA:orthophosphate acetyltransferase; EC2.3.1.8] activity. Unlike wild-type *E. coli*, phosphotransacetylase mutants do not excrete acetate when growing aerobically or anaerobically on glucose; their anaerobic growth on this sugar is slow. The genes that specify acetate kinase (*ack*) and phosphotransacetylase (*pta*) activities are cotransducible with each other and with *purF* and are thus located at about min 50 on the *E. coli* linkage map. Although Pta- and Ack- mutants are greatly impaired in their growth on acetate, they incorporate [2-14C]acetate added to cultures growing on glycerol, but not on glucose. An inducible acetyl-CoA synthetase [acetate: CoA ligase (AMP-forming); EC6.2.1.1] effects this uptake.


Keywords: citrate/flouride/fluoroacetate/citric acid/inhibition/gut

Abstract: The transfer of alpha -methylglucoside and citrate was studied in experiments with everted sacs of rat and hamster small intestine. The transfer of alpha -methylglucoside was stimulated in the hamster tissue by metabolizable hexoses and by citrate, succinate and pyruvate. In the rat jejunum metabolizable hexoses only were effective. Fluoride (10 mmol/litre) inhibited endogenous transfer in the hamster and glucose-dependent transfer in both rat and hamster. Fluoroacetate (10 mmol/litre) inhibited endogenous transfer in tissue of both animals, but inhibited glucose-dependent transfer only in the hamster. This indicated that in the hamster the citric acid cycle is the major source of energy both for endogenous substrate and for added glucose. In the rat, added glucose supplies energy mainly through the glycolytic pathway, although endogenous energy is derived from the citric acid cycle. In the rat, glucose abolished completely the inhibition of alpha -methylglucoside transfer produced by L-proline, although the inhibitory effects of galactose could be only partially overcome. In the hamster, L-proline caused an inhibition which was not completely abolished by the additional energy. The results indicate that in the rat sugars and amino acids compete for energy rather than interact at the carrier level. In the hamster it is possible that sugars and amino acids interact at carrier level in addition to competing for energy. Citrate is more rapidly transferred and metabolized by hamster than by rat intestine. Citrate and unidentified radioactive metabolites accumulated in the serosal fluid, thus establishing the existence of a specific mechanism for citrate transfer.

Keywords: fluoroacetate/citrate/metabolism/testes

Abstract: Regulation of the conversion of pyruvate (derived from glucose) into fatty acids in rat adipose tissue appears to be largely brought about by parallel changes in the proportions of pyruvate dehydrogenase and acetyl-CoA carboxylase in their respective active forms. We conclude from this study as we have previously on other evidence that the concentration of citrate is probably not of great importance in the regulation of fatty acid synthesis.


Keywords: antidote/treatment/poisoning/humans

Abstract: Background: The evidence for efficacy of gastric lavage and activated charcoal for gastrointestinal decontamination in poisoning has relied entirely on volunteer studies and/or pharmacokinetic studies and evidence for any clinical benefits or resource savings is lacking. **Aim of study:** To investigate the value of gastrointestinal decontamination using gastric lavage and/or activated charcoal in acetaminophen (paracetamol) poisoning. **Patients and Methods:** We analyzed a series of 981 consecutive acetaminophen poisonings. These patients were treated with gastric lavage and activated charcoal, activated charcoal alone, or no gastrointestinal decontamination. The decision as to which treatment was received was determined by patient cooperation, the treating physician, coingested drugs, and time to presentation after overdose. **Results:** Of 981 patients admitted over 10 years, 10% (100) had serum concentrations of acetaminophen that indicated a probable or high risk of hepatotoxicity. The risk of toxic concentrations for patients ingesting less than 10g of acetaminophen was very low. In patients presenting within 24 hours, who had ingested 10g or more, those who had been given activated charcoal were significantly less likely to have probable or high tisk concentrations (Odds ratio 0.36, 95% CI 0.23-0.58, p < 0.0001). Gastric lavage, in addition to activated charcoal, did not further decrease the risk (Odds ratio 1.12, 95% CI 0.57-2.20, p = 0.86). **Conclusions:** Toxic concentrations of serum acetaminophen (paracetamol) are uncommon in patients ingesting less than 10 g. In those ingesting more, activated charcoal appears to reduce the number of patients who achieve toxic acetaminophen concentrations and thus may reduce the need for treatment and hospital stay.


Keywords: metabolism/mode of action/persistence in animals/citrate/fluoroacetate/enzyme/biochemistry/aconitase


Keywords: fluoroacetate/poisoning/liver/metabolism/mode of action/lethal dose/citrate/fluorocitrate/rats

Abstract: The mode of action of fluoroacetate in the liver of the rat has been studied. The response of liver tissue to fluoroacetate poisoning depends in a decisive manner on the nutritional state of the animal. In the fed rat a lethal dose of fluoroacetate causes marked accumulation of citrate, rapid fall in the amount of glycogen and decrease of tissue ATP. In the rat starved for 24 hours, the concentration of liver glycogen is very low, the amount of ATP is reduced by about 40% and fluoroacetate poisoning causes only a slight increase in liver citrate. In the fed rat the tricarboxylic acid cycle runs mostly on pyruvate, and fluoroacetate is converted to fluorocitrate; when the tricarboxylic acid cycle runs mostly on fatty acids, as is the case in the starved rat, very little fluoroacetate is converted to fluorocitrate in the liver. In the liver slices obtained for fluoroacetate-poisoned fed rats the endogenous respiration is not inhibited and the citrate previously accumulated is metabolized. The mitochondria isolated from the poisoned liver are inhibited in their ability to oxidize added citrate (by over 50%), cis-aconitate (by about 15%) and oxaloacetate (by about 30%), whereas they oxidize other intermediates of the cycle and pyruvate and glutamate at normal rates. Oxidative phosphorylation is not affected. Extramitochondrial aconitase hydratase is virtually unaffected in the liver cell poisoned with fluoroacetate and in conjunction with extramitochondrial NADP-linked isocitrate dehydrogenase, it provides an alternative metabolic pathway for the citrate which has diffused out of the mitochondria into the cytosol.

Keywords: metabolism/poisoning/mammals/symptoms/Krebs cycle/pathology

Abstract: Fluoroacetate poisoning causes a variety of metabolic effects in animals: block in the tricarboxylic acid cycle at the citrate stage; accumulation of citrate and lowering of adenosine triphosphate in tissues; increased production of ketone bodies; rapid hydrolysis of glycogen in liver, skeletal muscle and heart tissues and a parallel in blood glucose and lactate.

Injected fluoracetate is rapidly distributed in all the tissues of the rat and 3% of it is transformed into fluorocitrate. The synthesis of fluorocitrate occurs in the mitochondria, in the complex formed by the inner membrane and the matrix. In isolated rat liver mitochondria fluorocitrate is formed from pyruvate plus fumarate or from acetate plus fumarate but not from fatty acids plus fumarate. Endogenous fluorocitrate inhibits specifically the mitochondrial-bound aconitate hydratase and not the enzyme present in the soluble cytoplasm. The primary biochemical lesion is soon followed by secondary inhibitions at various sites in the tricarboxylic acid cycle and ultrastructural changes in the mitochondria.

The increased production of ketone bodies is likely to be induced by inhibition of citrate synthase caused by fluorocetyl-SCoA and the accumulated citrate.

Glycogen depletion in all probability is due to adrenalin release or intense sympathetic stimulation as a result of the biochemical changes caused by fluoracetate. The parallel hyperglycemia and increased lactate formation can be explained by the rapid glycogenolysis.

The metabolic changes caused by fluoracetate poisoning are discussed in light of the present knowledge on cell biochemistry.


Keywords: mode of action/pathology/treatment/developmental toxicity/biochemistry/aconitase

Abstract: Correlative biochemical and electron microscopic alterations were observed in chick embryo myoblasts in vitro after treatment with fluoracetate. Fluoroacetate poisoning caused an increase of citrate and a decrease of ATP in the cultures. Cell respiration was only slightly impaired by fluoracetate in the first 10 min but was inhibited to 30% one hour after exposure to the poison. Fluoroacetate did not affect oxidative phosphorylation. The evidence suggests that fluoracetate was transformed in myoblasts into fluorocitrate which inhibited the mitochondrialbound aconitate hydratase as in adult tissues. Ultrastructural changes in the majority of the fluorocitratetreated cells were observed. Very few myoblasts appeared unaffected by the poison. Mitochondria were specifically altered. The early changes occurred in the mitochondrial matrix where the inhibited enzyme is known to be located and were followed by modifications in the configuration and structure of cristae. Exogenous fluorocitrate caused ultrastructural changes in the mitochondria similar to that provoked by fluoracetate. The localization of the early change in the mitochondrial matrix and the evaluation of the structural modifications suggest a correlation between the biochemical lesion, i.e. the inhibition of aconitate hydratase, and the change revealed in the mitochondrial structure containing the inhibited enzyme.


Keywords: fluorocitrate/fluoroacetate/citrate/liver/brain/kidney/heart/acacetate/inhibition/enzyme/aconitate/metabolism

Abstract: The lethal effects of fluoracetate have always been found to be associated with an increase of citrate in the tissues. For this reason, accumulation of citrate is considered an indicator for fluorocitrate formation. The synthesis of fluorocitrate was studied in isolated rat liver, brain, kidney and heart mitochondria. Evidence for fluorocitrate formation was found in liver, brain and kidney mitochondria but not in heart mitochondria. Fluoroacetate was activated and transformed into fluorocitrate in mitochondria metabolizing either pyruvate and fumarate, or acetate and fumarate, or octanoate and fumarate; the fluorocitrate synthesis was demonstrated by citrate accumulation in the system following the inhibition of the enzyme aconitate hydratase. Synthesis of fluorocitrate did not appear to require mitochondrial structural integrity; it occurred in osmotically altered mitochondria and in mitochondria deprived of the outer membrane. When the substrates were pyruvate and fumarate in liver mitochondria, uncoupling of oxidative phosphorylation enhanced citrate formation and did not inhibit fluorocitrate synthesis. With acetate and
fumarate as substrates uncoupling of oxidative phosphorylation inhibited the both citrate and fluorocitrate synthesis. In liver mitochondria fluoroacetate was activated through 2 separate pathways, one associated with pyruvate metabolism and not dependent on oxidative phosphorylation energy, the other associated with acetate metabolism and ATP dependent


Keywords: pathology/metabolism/fluoroacetate
Abstract: Sodium fluoroacetate (20 to 320 µg) and dobutamine (0.5 to 0.8 µg) produced dose dependent positive inotropic effect in isolated frog heart preparation, without affecting the heart rate. The dose dependent increase in cardiac contractility to sodium fluoroacetate was not affected by propranolol (1 x 10^-6 M), whereas the responses to dobutamine were inhibited competitively by propranolol (1 x 10^-6 M). Phentolamine (1 x 10^-6 M), had no significant effect and phenomenon of tachyphylaxis was not observed with either sodium fluoroacetate or dobutamine. Responses to sodium fluoroacetate were not affected either by caffeine (2 mM), or by imidazole (100 µM). However, dose dependent responses to dobutamine were potentiated by caffeine and inhibited by imidazole. The decrease in sodium chloride concentration (from 110 to 165 mM) in frog Ringer solution, inhibited the responses to sodium fluoroacetate while increasing it (from 110 to 165 mM) the responses were potentiated. But the responses to dobutamine were unchanged when sodium chloride concentration in perfusion fluid were altered. It is suggestive from the data that sodium fluoroacetate induced positive inotropic effects are probably due to sodium extrusion mechanism while dobutamine is acting directly through beta adrenoceptors and indirectly involving adenylate CAMP system for the positive inotropic action.


Keywords: sodium fluoroacetate/fluoroacetate/heart/mode of action/amphibian
Abstract: Sodium fluoroacetate (Na FAC, 20 ug to 320 ug) and dobutamine (0.5 ug to 8 ug) produced dose dependent positive inotropic effect in isolated frog heart preparation, without affecting the heart rate. The responses to NaFAC and dobutamine were inhibited when calcium chloride (CaCl2) concentration was increased from 1.58 mM to 317 mM in frog Ringer solution. When CaCl2 concentration was reduced the responses to both NaFAC and dobutamine were potentiated. By reducing the potassium chloride (KCl) concentration in the perfusion fluid the response to NaFAC were potentiated, while increasing the concentration the responses were inhibited. However, the responses to dobutamine were unchanged by changing the KCl concentration in the perfusion fluid. The decrease in sodium chloride (NaCl) concentration potentiated the responses to NaFAC. However the responses to dobutamine were unchanged when NaCl concentration in the perfusion fluid were altered. It is suggested from the data that NaFAC induced positive inotropic effects probably due to sodium extrusion mechanism leading to facilitation of calcium uptake.


Keywords: fluoroacetate/chemistry/analysis

Ref Type: Conference Proceeding
Keywords: 1080/baits/persistence in animals/predators/USA/secondary poisoning
Abstract: Carcasses and viscera of coyotes poisoned by Compound 1080 in single dose tallow baits (SDBs) were fed to 3 coyotes, 3 domestic dogs, 4 striped skunks, and 15 black-billed magpies to determine if these species would be poisoned secondarily. Test subjects received no food other than tissues from poisoned coyotes for periods of 14 to 35 days. Total amounts of contaminated coyote tissues consumed by dogs, coyotes, skunks, and magpies, respectively, averaged 67, 152, 117, and 371% of body weight. Except for one skunk that refused to eat, no mortalities occurred and no evidence of poisoning was seen. The average 1080 residue in tissues fed to nontarget animals from coyotes poisoned by one to three SDBs (5 to 10 mg 1080 per coyote) was 0.29, 0.30, and 0.31 respectively. Highest residue levels observed were
0.66 ppm in muscle, 0.79 ppm in small intestine, and 0.76 ppm in stomach tissue. These concentrations were apparently too low to cause secondary poisoning in the species tested.

Keywords: non-target species/mammals/birds/secondary poisoning/persistence in animals/livestock/livestock protection collar

Keywords: acute toxicity/birds/persistence in animals/1080/temperature/lethal dose/muscle/gut

Keywords: acute toxicity/mammals/non-target species/1080/sodium fluoroacetate/fluoroacetate/treatment

Keywords: secondary poisoning/birds/mammals/persistence in animals/1080/livestock/livestock protection collar/scavenger/dogs/muscle

Keywords: livestock/livestock protection collar/1080/predators/symptoms/time to death/efficacy

Abstract: We investigated the effectiveness of large livestock protection collars (LLPCs) to kill coyotes (Canis latrans) that attacked sheep. The LLPC, designed for sheep and goats >22.7 kg, contained the same formulation of Compound 1080 as the smaller collar (LPC) registered by the Environmental Protection Agency in 1985. In 32 tests involving 19 sheep wearing LLPCs, 12 coyotes made 14 neck or throat attacks. In 10 of the 14 attacks (71%) LLPCs were punctured and all 10 coyotes died. Coyotes that punctured collars showed signs of intoxication in an average of 203 minutes and died an average of 93 minutes later. Time to death did not differ among coyotes that punctured 1 collar compartment versus 2 compartments. The LLPC was more effective in deterring coyote predation on large sheep than the previously registered small LPC.

Keywords: cyanide/foxes/analysis/efficacy/mode of action/baits

Abstract: Fox carcasses are seldom recovered after a 1080-baiting program, making analysis of efficacy difficult. Sodium cyanide was selected as an alternative toxin due to its rapid mode of action. A number of bait techniques were trialled in order to develop an appropriate cyanide delivery system that could be used as a buried bait. Techniques investigated included treated wax and gelatine capsules, a wooden capsule holder and a modified M-44 cyanide ejector. Subsequent trials showed that the modified M-44 ejector had greater efficacy in recovering fox carcasses at bait stations when compared with the other techniques trialled. This paper describes the range of baits trialled and the modifications that allow the M-44 to be used as a buried bait. A protocol for deployment of the M-44 in the field, together with a brief assessment of efficacy for each technique is also provided

Keywords: fluoroacetate/metabolism/citrate/kidney/liver

Abstract: Citrate formation is increased and the oxidation is diminished by the addition of fluoroacetate to kidney homogenates; under the same conditions, citrate formation is decreased and acetocacetate formation is increased while oxidation is unchanged in liver homogenates. At higher concentrations of fluoroacetate, acetocacetate formation is also inhibited in liver homogenates.
Ref Type: Conference Proceeding
Keywords: poisons/poison

Ref Type: Unpublished Work
Keywords: efficacy/1080/sodium fluoroacetate/fluoacetate/foxes/lethal dose/baits/non-target species/birds

Abstract: A single experimental application of Compound 1080 was used to assess the efficacy and hazards associated with efforts to eradicate introduced Arctic fox (Alopex lagopus) on Kiska Island, Alaska. Results from feeding trials showed that 4 mg of 1080 in beef tallow and bees wax pellets was an adequate lethal dose for Arctic foxes. In March and June of 1986, nearly 50,000 single-dose baits were distributed along the coastal areas of Kiska Island. Most foxes on Kiska were killed following the first application in March 1986, but at least one remained until June 1988. There was no evidence of mortality to non-target species like Bald eagles (Haliaeetus leucocephalus) or Common ravens (Corvus corax); however, at least two Glaucous-winged gulls (Larus glaucescens) were killed, probably by directly ingesting bait. It appears the use of Compound 1080 to remove introduced Arctic foxes on Kiska Island has been successful. Several species of island nesting birds appear to exhibit signs (by 1988) of population increase associated with fox eradication. With the eradication of Arctic foxes on Kiska Island, the potential for this insular ecosystem to sustain former numbers of ground nesting birds has been restored.

Keywords: fluoroacetamide/sodium fluoroacetate/fluoacetate/poisoning/symptoms/birds/mammals/humans

Abstract: The symptoms of cases of fluoroacetamide and sodium fluoroacetate poisoning, which happened in Jinli town, Gaoyao City, Guangdong, China between June and November 1995 are described. The onset of poisoning in wild birds and mammals was rapid. Symptoms included vomiting and neurological symptoms. Mortality was high. Symptoms in poisoned humans included dizziness, headache, nausea, vomiting and tics

Keywords: fluoroacetamide/fluorine/blood/urine/analysis

Abstract: A novel method for fast determination of fluoroacetamide, a kind of organic fluorine pesticide, in blood and urine samples was developed with acetamide as an internal standard using gas chromatography/mass spectrometry (GC/MS) after solid-phase microextraction (SPME) technique. The SPME was performed by immersing a PDMS fiber of 100 mum coating thickness in a sample solution for 25 min at 70degreesC with (CH3CH2)(4)NBr to improve the extraction efficiency. After a GC sample injection, the extracted fluoroacetamide was desorbed from the fiber for 4 min to perform the GC/MS detection with a HP-PLOT Q capillary column. The analytical conditions were optimized by examining systematically, the effects of experimental parameters on the ratio of characteristic ion peak areas of fluoroacetamide to acetamide. Under optimal conditions, the ratio was proportional to the concentration of fluoroacetamide ranging from 5.0 to 90 mug/ml with a detection limit of 1.0 mug/ml. The average recovery of fluoroacetamide in blood sample was 92.2%. The established method could be used for the fast and convenient measurement of fluoroacetamide in poisoned sample.

Keywords: non-target species/birds
Abstract: Techniques to protect birds from poisoning include the consideration of bait size and use of dyes.

Ref Type: Unpublished Work
Keywords: 1080/poisoning/birds/non-target species

Keywords: fluoroacetate/humans/livestock/predators
Abstract: Pest management is one the most important aspects of applied ecology included in the school biology curricula. This reflects the need to regulate pest numbers to maximise agricultural production, reduce damage to buildings, check the risk of spread of serious diseases of humans and domestic animals, and minimise the nuisance to people and livestock caused by some pests. Additionally, conservation policies sometimes involve culling predators or competitors of threatened species using pest control techniques. However, the discussions of pest control in biology textbooks are biased heavily towards the control of invertebrate and plant pests, while vertebrate pests are neglected. While no doubt motivated by the relative economic importance of vertebrate and invertebrate pests, this attitude prevents a comprehensive coverage of pest control issues. Compound 1080 (sodium monofluoroacetate) was used as a vertebrate pesticide in the USA from the 1940s until its ban for use on Federal land in 1972, and it is still used widely on private lands. In Australia, it has been in increasing use since its introduction in the early 1950s. This paper compares and contrasts the use of 1080 in both countries focusing on the aims and methods involved, the biological peculiarities of each system and the role of public opinion and pressure in determining the nature of 1080 use.

Keywords: acute toxicity/non-target species/approximate lethal dose/lethal dose/1080

Keywords: bacteria/inhibition/fluoroacetate/toxicity
Abstract: A possible substrate interrelationship between methane-producing and sulphate-reducing bacteria has been studied in the bottom deposits of Lake Vechten. Inhibition of methogenesis in mud samples by chlorine-containing analogues of methane resulted in accumulation of acetate. Fluoroacetate reduced the concentration of methane by about 75%.

Keywords: bacteria/fluoroacetate/inhibition/toxicity

Abstract: An ecological substrate relationship between sulfate-reducing and methane-producing bacteria in mud of Lake Vechten has been studied in experiments using $^{14}$-C labeled acetate and lactate as substrates. Fluoroacetate strongly inhibited the formation of $^{14}$CO$_2$ from [$U$-$^{14}$C]-acetate and $\beta$-fluorolactate gave an inhibition of similar magnitude of the breakdown of [$U$-$^{14}$C]-L-lactate to $^{14}$CO$_2$ thus confirming earlier results on the specific action of these inhibitors.


Keywords: product chemistry/mode of action

Abstract: The fluorocitrate isomer that is a strong inhibitor and inactivator of aconitase has been shown by x-ray crystallographic studies on the rubidium ammonium salt to have the configurations (1R:2R) or (1S:2S) 1-fluoro-2-hydroxy-1,2,3-propanetricarboxylic acid. A possible mechanism for the action of fluorocitrate is proposed which involves the 1R:2R isomer suggested from biochemical data.


Keywords: acute toxicity/non-target species/persistence in animals/sodium fluoroacetate/fluoroacetate/1080/poisoning/dogs/liver/kidney/secondary poisoning/analysis

Abstract: Sodium fluoroacetate (1080) poisoning in dogs is a continuing problem. A recently developed assay for 1080 in tissue was studied to tissue from field cases of suspected 1080 toxicosis in dogs. The assay utilizes C14-1080 internal standards and capillary gas chromatography / mass spectrometry to give clear identification of 1080 levels down to 10 ppb tissue equivalent. The 1080 levels in tissues from field cases of 1080 toxicosis ranged from 45 to 5451 ppb for liver (n=11) and 55 to 297 ppb for kidney (n=5). There were no clear differences in liver 1080 levels for primary poisoning cases vs levels in suspected secondary poisoning cases. For routine diagnostic use a 1080 analysis must be reliable at the 20 ppb tissue level.


Keywords: fluoroacetate/acetate/analysis

Abstract: A method for the quantitative determination of fluoroacetate (FAC) (a rodenticide) residues in animal tissues is described. The procedure involves tungstic acid extraction, partitioning into ethyl acetate, evaporation of ethyl acetate, derivation with pentafluorobenzyl bromide (PFB), and analysis of the resulting derivative (PFB-FAC) by capillary gas chromatography-mass spectrometry (CGC-MS) with specific ion monitoring (SIM). The tungstic acid system extracted 96.8 +- 4.2% of the endogenous $^{14}$C-1080 residues in rat tissues. Recovery of FAC during the extraction, purification, and derivatization procedures is established by use of a 14C-FAC spike. 1,2-Dibromobenzene is used as an internal standard for the CGC-MS analysis. PFB-FAC is identified on the basis of comparative retention times and the relative intensities of m/z 257.9 and 181.0. PFB-FAC is quantitated by comparing the response at m/z 257.9 to a PFB-FAC standard curve. Routine sensitivity of the method allows determination of 10 ppb fluoroacetate in tissue.


Keywords: acute toxicity/secondary poisoning/mammals/persistence in animals/1080

Abstract: Fluoroacetate residues in various tissues of 1080 poisoned ground squirrels and coyotes are listed. The tissues (excluding the stomach) of squirrels poisoned with an average of 0.8mg 1080/kg (low dose) contained from 182 to 1309 ppb Fluoroacetate. In squirrels poisoned with an average of 4.8 mg 1080/kg (high dose), the tissue residues ranged from 535 to 9754 ppb Fluoroacetate. Tissues from coyotes which died after consuming 1080 poisoned ground squirrels were also analyzed for fluoroacetate residues.
Residues in these coyote kidneys and livers ranged from less than 10 ppb to 95 ppb fluoroacetate. The residue findings in this research indicate that a diagnostic assay for 1080 in tissues must be reliable at 10 ppb (or less) fluoroacetate.


Abstract: Mutants of *Coprinus lagopus* unable to utilise acetate were selected on a glucose medium containing the toxic analogue fluoroacetic acid. Tests for interallelic complementation between twenty-five differently isolated *acu-I* mutants proved negative, indicating that the acetyl-CoA synthetase activity is carried on a single polypeptide.


Abstract: The kidneys of rats dying 2 hr after 60 or 80 mg/kg fluorocitrate ip showed degeneration of the mitochondria in the cells of the proximal convoluted tubules with blockages of the tubules and distension of the Bowman's capsule with fluid. In rats killed, or dying, after 2 or more daily or alternative day doses, marked fatty change was observed in the cells of the proximal convoluted tubules, together with degeneration of the tubular cells. Rats dying in this group showed fatty degeneration in the walls of the arcuate, interlobular and glomerular arteries. The histological picture resembled that found in the kidneys of patients dying with lipoid nephrosis. Similar changes were found in hepatoma-bearing rats treated with fluorocitrate, but not in the kidneys of heptoma-bearing rats injected with saline, fluoro-oleic acid or 1-deoxy-1-fluoroglycerol. Fluorocitrate produces a specific block in the citric acid cycle at the aconitase stage. The various known causes of nephrosis in rats are discussed in relation to their action as mitochondrial poisons.


Abstract: In these experiments with atria there was no support for the attractive idea that pyruvate reverses the action of fluorocitrate in causing accumulation of citrate; but it should be stressed that their observations were upon the whole heart. The failure to reverse is, however, consistent with earlier experiments. It appears, however, as if there can be some recovery by washing after a low dose of fluorocitrate, which is enough to restore a return of the beat and improved inotropism. This may be due to washing out citrate. Nevertheless the general toxicity of fluorocitrate could account in part for the asthenic state observed by Peters and Morselli. Regarding the interesting results with noradrenalin, these may be due to reactivation of phosphokinase on the lines described by Murad *et al*.


Abstract: *Gastrolobium* is an endemic Australian genus that produces toxic sodium monofluoroacetate. Past key morphological characters, such as fluorocitrate content and characters associated with pollination syndrome, are shown to be polyphlectic, with fluorocitrate possibly a pleomorphic condition lost in more derived species.


Abstract: in nature/fluoroacetate


Abstract: in excised leaves of mung bean (*Phaseolus aureus [= Vigna radiata]_), illumination with 0.043
gcal/cm min of white light gave a rate of respiration 11-fold greater than in darkness. Feeding 14CO2 or 14C-labelled acids of the tricarboxylic acid cycle in darkness for 2 h labelled the mitochondrial pools of cycle intermediates. 82% inhibition of apparent photosynthesis with 0.1mM 3-(3,4-dichlorophenyl)-1,1-dimethyl-urea largely prevented internally derived 14CO2 fixation and under these conditions 14CO2 evolution continued in the light at a similar rate to that in darkness, showing that light-induced non-photosynthetic processes have no significant effect on endogenous dark respiration. The effect of malonate and fluoroacetate as inhibitors of the tricarboxylic acid cycle suggested that the cycle functions in the light at a rate similar to that in darkness except for a short initial inhibition.


Keywords: inhibition/fungus/sodium fluoroacetate/fluoroacetate/fluoride

Abstract: Sodium fluoroacetate was comparatively less toxic to the growth of the pathogen than other fluoride compounds tested.


Keywords: mode of action/metabolism/Krebs cycle/brain

Abstract: (1) The effects of fluoroacetate and fluorocitrate in striatum slices of the rat brain were studied after metabolizing 3 different labeled substrates in the presence of glucose. The concentration of citrate increased under the influence of these inhibitors; those of glutamine decreased and those of (-aminobutyrate increased only in the presence of fluorocitrate. These inhibitors did not affect acetylcholine synthesis. (2) The effect of these fluoroinhibitors on the labeling of intermediates was rather complicated. The specific radioactivity of various metabolites changed differently according to both the labeled substrate and the inhibitor. The effects of these fluoroinhibitors on the specific radioactivity ratios or citrate/acetylcholine, glutamine/glutamate, (-aminobutyrate/glutamine, and aspartate/glutamate were also discussed in the text. These changes in specific radioactivities and their rations were explained using a model with 3 metabolic compartments. The compartments were characterized by labeled substrate utilization and glutamate-glutamine pool sizes. Pyruvate entered primarily the large compartment with a large glutamate pool, and acetate and citrate each entered primarily a different small compartment with small glutamate pools. In addition, these changes suggested that fluoroacetate and fluorocitrate did not have completely similar effects.


Ref Type: Conference Proceeding

Keywords: zinc phosphide/diphacinone/difenacoum/brodifacoum/lethal dose/sodium fluoroacetate/1080/fluoroacetamide/strychnine/chlorophacinone


Keywords: mode of action/metabolism/mammals/fluoroacetate/acute toxicity/symptoms


Keywords: acute toxicity/fluoroacetate


Keywords: fluoroacetate/dogs/rabbits/welfare/symptoms/brain

Abstract: Spike and dome waves of high voltage occurring at a 3 per second rate have been produced in the EEG of curarized dogs by the administartion of fluoroacetic acid. Six of 8 dogs receiving intravenous injection of 0.05 to 1.0 mg/kg of fluoroacetate (sodium salt or methyl ester) developed cerebral dysrythmias.
strongly resembling clinical grand mal and petit mal seizures. Fourteen of 16 dogs receiving intracranial injections of fluoroacetate (sodium salt or methyl ester) of 41 to 250 per cent of the LD50 developed similar dysrythmias. No definite relation was found between the use or dosage of water or lipid soluble fluoroacetates, the sex, age or size of the dog and the occurrence of the petit mal type dysrythmias. The grand mal seizures were produced more frequently with larger doses. Rabbits, a species which can not be convulsed by the intravenous injection of fluoroacetate in any dosage, convulse when very small doses (40 and 80 per cent of the intravenous LD50) are injected intracranially.

Keywords: fluoroacetate/heart/lethal dose/muscle/rabbits/herbivores/carnivores/mode of action
Abstract: The circulatory changes produced in rabbit, pig, goat, horse and rhesus and spider monkeys by lethal doses of fluoroacetate were examined, and it is concluded that they result from the action of the drug on the heart. The actions of fluoroacetate on the heart are twofold; (1) depression of the excitation and conduction systems and the development of myocardial foci of excitation and (2) the depression of the muscular system. The characteristic response to these actions varies between species. The most significant differences among species were (1) the absence of any effect upon auricular activity or auriculoventricular conduction and a tendency towards various forms of alternation which characterized the rabbit and the monkey (2) the minimum of ectopic rhythms and alternation which characterized the cat (3) the absence of acute changes and the delayed development of idioventricular bradycardia which characterized the rat. Ventricular fibrillation is the cause of death in these species and is preceded by numerous electrocardiographic changes, such as heterotopic rhythms, S-T changes resembling coronary disease, AV and intraventricular conduction blocks and unrelated degrees of electrical and mechanical pulsus alternans. The action of fluoroacetate is considered to be on a specific metabolic system unevenly distributed throughout these species and on which the hearts of these species are dependent to a varying degree, or which is varying sensitive to fluoroacetate.

Keywords: mode of action/acute toxicity/metabolism
Abstract: Conversion of a metabolic intermediate into a very highly toxic compound by the introduction of a single fluorine atom in a strategic position in the molecule has been described for a number of compounds. It appears to be a useful method for producing agents with which the metabolic pathways can be differentiated in a large number of species with a minimum of effort, for it is evident that these agents act by virtue of their close resemblance to natural metabolites. As an example, the variation among species in response to monofluoroacetic acid has been related to certain definite differences in metabolism in the species studied.

Keywords: diagnosis/treatment/acute toxicity/pathology/sodium fluoroacetate/rabbits
Abstract: 1. The ability of various chemical substances to prevent or reverse the toxic effects of sodium fluoroacetate has been studied in mice, rats, rabbits, dogs and rhesus monkeys (*Macacca mulatta*). 2. Commercially available monoacetin containing about 60 per cent glycerol monoacetate has been found to be superior to any other substance yet tested for general use against fluoroacetate poisoning. Certain characteristics of its action have been described. 3. Various factors such as water and electrolyte imbalance have been assigned distinct, but minor roles in the development of the phenomena of fluoroacetate poisoning. 4. The ability of fluoroacetate to potentiate the depressant action of barbiturates has been observed and the autoprotective effect in rats has been further clarified. 5. An outline has been presented, based upon experiments with monkeys, which may be helpful for the guidance of those treating human fluoroacetate poisoning.

Ref Type: Abstract
Keywords: fluoroacetate

Keywords: diagnosis/treatment/acute toxicity/humans/sodium monofluoroacetate/monofluoroacetate/poisoning/analysis/serum

Abstract: Background: The diagnosis of sodium monofluoroacetate intoxication in humans is usually based on a history of ingestion and clinical findings. Although several previous reports have described the clinical course and outcome of patients who ingested this drug, prognostic indicators of short-term survival are not available. Methods: A retrospective study of 38 consecutive cases of sodium monofluoroacetate poisoning at the National Cheng Kung University Hospital, 1988-1993, to analyze the clinical findings and to predict mortality. Results: Seven of 38 patients (18%) died. The most common symptom was nausea or vomiting (74%). The most frequent ECG finding was nonspecific ST-T and T wave abnormalities (72%). Hypocalcemia (42%) and hypokalemia (65%) were the common electrolyte abnormalities. The clinical and laboratory characteristics were compared for the survival and mortality groups. Significant differences in hypotension, respiratory rate, pulse rate, creatinine, potassium, elevated alanine aminotransferase, pH, PCO2, APACHE II score, and subjective respiratory distress were noted. Discriminant analysis identified hypotension, increased serum creatinine, and decreased pH as the most important predictors of mortality, with sensitivity of 86% and specificity of 96%. Conclusions: Hypotension and the early onset of metabolic acidosis and increased serum creatinine are associated with poor short-term survival. These prognostic variables can be useful in the care of patients with suspected sodium monofluoroacetate intoxication. It is suggested that all such patients should be observed intensively for at least 48 h.


Keywords: diagnosis/treatment/mode of action/acute toxicity/humans/sodium monofluoroacetate/monofluoroacetate/resistance/cardiac

Abstract: Hypotension is one of the most important predictors of mortality in sodium monofluoroacetate (SMFA) intoxication. This paper reports the hemodynamic response in one fatal and another survival case of SMFA intoxication. Despite correction of hypovolemia and with inotropic support, the patients remained in shock. Hemodynamic observations have provided evidence that shock after SMFA intoxication is due to diminished systemic vascular resistance and increased cardiac output. This is the first report in which such an invasive hemodynamic investigation has been recorded in a clinical case of SMFA intoxication.


Keywords: fluoroacetate/soil/acetate/bacteria/degradation

Abstract: Chloroform (CHCl3), 2-bromoethanesulfonate (BES) and fluoroacetate have frequently been used as methanogenic inhibitors in rice field soil and in other environments, but their effects on other microbial processes have not received sufficient attention. Therefore, we comparatively determined the effects of CHCl3, BES and fluoroacetate on different microbial processes in rice field soil slurry upon incubation under anoxic conditions: on the reduction of the electron acceptors nitrate, ferric iron, sulfate; on the production of CH4 and CO2; on the temporal change of the electron donors H2, acetate and propionate; and on the turnover of [2-14C]acetate during the early reduction phase (day 7), and during the later methanogenic phase (day 30). The results demonstrate: (1) fluoroacetate inhibited acetate consumption by all microorganisms, (2) BES generally inhibited CH4 production, and (3) CHCl3 not only inhibited methanogenesis, but partially also acetate-dependent sulfate reduction, and perhaps H2-dependent homoacetogenesis. The specificity of the different inhibitors resulted in characteristic patterns of the temporal change of electron donors and acceptors and of CH4. The pattern of propionate change was consistent with production by fermenting bacteria and consumption by sulfate reducers either using sulfate or methanogens as electron acceptor. Sulfate reducers were also found to be important for acetate consumption during the early phase of soil anoxia. Later on, however, methanogenic acetate consumption was much more pronounced. The application of inhibitors with different specificity was helpful for elucidating the flow of carbon and electrons during degradation of organic matter in anoxic rice field soil.
Ref Type: Conference Proceeding
Keywords: poisons/poison/fluoroacetate/invertebrates/toxicity
Abstract: Female fleas were treated by contact with 0.25, 0.5, 0.75 and 1% aqueous solutions of thiotepa (tiotef), and orally by feeding on white mice to which fenitrothion (Sumithion) or barium fluoroacetate had been given at 1.5, 3.0 or 9.0 mg/kg body weight. Resulting changes in the genital system were followed from the first to the fourteenth day of adult life. In females treated with 0.25% thiotepa, slight degenerative changes in the gonads were seen for 3-4 days, but thereafter the ovaries reverted to their normal form and functions. In those treated with 0.5% and 0.75% thiotepa, changes were noted on the second day. Development of the ovaries was delayed, and in 70-75% of females they showed resorption in different degrees. These changes were more evident in females that had been treated with a 1% solution. Fleas that had taken up systemic poisons from mice treated at 1.5-3.0 mg/kg showed no apparent changes in the gonads but laid a greater proportion of non-viable eggs than untreated females. Those that fed on mice that had been treated at 9.0 mg/kg showed delay in the development of the ovaries, complete resorption of the egg-cells or irreversible degenerative changes in the gonads.

Keywords: mode of action/diagnosis
Abstract: NaFA produces toxic effects by metabolic conversion to fluorocitrate, inhibits Krebs' cycle and the formation of ATP, reduces energy supply to cells, and thus causes cellular dysfunction or degeneration. All body cells are potentially affected, although with different sensitivity. Acute renal failure was found in three out of our five cases, and two were in frank uremia. The ARF was reversible and may be either oliguric or non-oliguric. The causes of ARF were not apparent, but direct nephropathy or some other factors might be involved in the pathogenesis of ARF.

Keywords: fluoride/sodium fluoroacetate/fluoroacetate/temperature/Krebs cycle/plasma/mode of action
Abstract: The action of different metabolic inhibitors on phagocytosis by macrophages from mouse peritoneal exudate cultured in vitro was studied. The following metabolic inhibitors were tested: sodium iodosacetate, sodium fluoride, sodium fluoroacetate, sodium melonate, 2-4-dinitrophenol, sodium azide, ouabain and cycloheximide, all at the concentration of 10-3 M. Iodosacetate caused a strong inhibitory effect on phagocytosis, confirming that glycolysis is the main source of energy for the phagocytic process. Fluoride, although it is an effective inhibitor of glycolysis, did not exert any effect. Sodium fluoride blocks anaerobic glycolysis only in vitro at an unphysiological temperature (0. degree. C). Fluoroacetate and malonate, 2 compounds which interfere with the Krebs cycle, did not inhibit phagocytosis; but the Krebs cycle activity is poorly developed in the macrophagic cells. Sodium azide and 2-4-dinitrophenol, 2 inhibitors of oxidative phosphorylation, showed an effect on phagocytosis only after 3 h of contact with the cell cultures. Quabain blocked Na⁺ and K⁺ transport across the plasma membrane and it probably inhibited phagocytosis by interfering with the movements of the cell membrane. The mode of action of cycloheximide on phagocytosis is uncertain. This compound inhibits the protein synthesis and it can perhaps act by preventing the renewal of the cell membrane.

Keywords: metabolism/brain/Krebs cycle/biochemistry/fluoroacetate/fluorocitrate
Abstract: The effect of fluoroacetate and fluorocitrate on the compartmentation of the glutamate-glutamine system was studied in brain slices with L-[U-14C]glutamate, L-[U-14C]aspartate, [1-14C]acetate and y-amin0[1-14C]butyrate as precursors and in homogenates of brain tissue with [1-14C]acetate. The effect of fluoroacetate was also studied in vivo in mouse brain with [1-14C]acetate as a precursor. Fluoroacetate and fluorocitrate inhibit the labelling of glutamine from all precursors but affect the labelling of glutamate to a much lesser extent. This effect is not due to inhibition of glutamine synthetase. It is interpreted as being due to selective inhibition of the metabolism of a small pool of glutamate that preferentially labels glutamine.

Keywords: metabolism/mode of action/fluoroacetate/fluorocitrate/aconitase

Abstract: The concept of lethal synthesis as suggested by Peters is reviewed in the light of the more recent work in this area. It is suggested that fluorocitrate is a "suicide" substrate for aconitase rather than a competitive inhibitor as originally suggested. The use of these substances to study glial-neuronal relationships is considered


Ref Type: Magazine Article

Keywords: residues/liver/pigs/possums/brodifacoum/1080


Keywords: sodium fluoroacetate/fluoroacetate/inhibition/invertebrates

Abstract: Studies in Israel showed that larvae and adults of *Dermestes maculatus* Deg. were attracted by palmitic and stearic acids and were repelled by caprylic acid, a lower homologue. Lauric acid, which strongly deterred the larvae from feeding, stimulated the adults to feed. Palmitic and stearic acids enhanced larval growth and metamorphosis, but caprylic and lauric acids inhibited them. The larvae and adults differed in their response to alpha-fluoro fatty acids. The former were invariably repelled by the fluoro analogues, but the latter fed readily on a diet containing alpha-fluorolaurate and alpha-fluorostearate. It appeared that the adults were incapable of distinguishing between fatty acids and their respective fluoro derivatives. Sodium fluoroacetate was very toxic to the larvae but alpha-fluoro fatty acids were relatively non-toxic, inhibiting growth only at a dietary level of 1%. This moderate effect was ascribed to inhibition of beta-oxidation, whereby the lethal fluoroacetate was not released


Keywords: secondary poisoning/persistence in animals/birds


Keywords: sodium fluoroacetate/fluoroacetate/citrate/rats/heart/liver/spleen/kidney/muscle/poisoning/Krebs cycle/persistence in animals

Abstract: Sodium fluoroacetate was administered intraperitoneally to fasted and fed rats. Hyperglycemia and ketosis developed within four hours. Ketosis persisted between 24-40 hours and hyperglycemia from 40-64 hours in both groups. A single SFA poisoned rat exhibited a prolonged survival, dying on the 14th day of fasting with marked hyperglycemia and ketosis. The citrate content of the heart, liver, spleen, kidney, pancreas and gastrocnemius muscle was estimated in SFA poisoned rats and found to correlate reasonably well with the hyperglycemia and ketosis. With the exception of spleen, citrate levels were all back to normal by 64 hours. Pretreatment with cortisone acetate prevented the ketosis of SFA poisoning and increased the hyperglycemia but did not modify the tissue citrate concentrations. These data are interpreted to indicate that the Krebs cycle blockade in the tissues in general plays a primary role in the etiology of SFA diabetes. The single observation of persistent diabetes, however leaves open the possibility of specific damage to insulin producing cells as a factor in the diabetes.


Ref Type: Report

Keywords: mammals/deer/rabbits/possums/goats

Coleman, J. D., Morgan, D. R., and Sweetapple, P. J. Seasonal constraints on the use of aerially-sown baits loaded with 1080 to control possum populations. [LC9899/123], -21. 1999. Lincoln, Manaaki Whenua -
Landcare Research. Landcare Research contract report.
Ref Type: Report
Keywords: aerial control/possums/field efficacy/1080
Abstract: Objectives: To determine the probability of success of aerial possum control operations conducted over the early spring - autumn period in forest adjacent to pasture and representative of that present in Tb Vector Risk Areas.
Conclusions: Bait acceptance by possums living near forest margins at Waitaha is poorer than that recorded from possums living deep in the forest; condition of possums over the period of the study appeared to be a poor predictor of bait acceptance; bait acceptance could not be predicted from the availability or use by possums of favoured natural foods; there is no strong evidence that baiting outside of winter at Waitaha would result in an operational failure.

Keywords: bacteria/enzyme/microorganisms/fluoroacetate/fluoroacetamide
Abstract: The amiE gene encodes an aliphatic amidase capable of converting fluoroacetamide to the toxic compound fluoroacetate and is one of many genes whose expression is subject to catabolite repression control in Pseudomonas aeruginosa. The protein product of the crc gene, Crc, is required for repression of amiE and most other genes subject to catabolite repression control in this bacterium. When grown in a carbon source such as succinate, wild-type P. aeruginosa is insensitive to fluoroacetamide (due to the repression of amiE expression). In contrast, mutants harbouring the crc-10 null allele cannot grow in the presence of fluoroacetamide (due to lack of repression of amiE). Selection for succinate-dependent, fluoroacetamide-resistant derivatives of the crc-10 mutant yielded three independent pseudorevertants containing suppressors that restored a degree of catabolite repression control. Synthesis of Crc protein was not reestablished in these pseudorevertants. All three suppressors of crc-10 were extragenic, and all three also suppressed a δcrc: :tetA allele. In each of the three pseudorevertants, catabolite repression control of amidase expression was restored. Catabolite repression control of mannitol dehydrogenase production was also restored in two of the three isolates. None of the suppressors restored repression of glucose-6-phosphate dehydrogenase or pyocyanin production.

Keywords: high-performance liquid chromatography/bait degradation/1080/sodium fluoroacetate
Abstract: A total fluorine method routinely used for measuring sodium fluoroacetate (compound 1080 or 1080) in poison baits was evaluated by using a more specific high performance liquid chromatographic (HPLC) technique. The routine method accurately measures 1080 in unweathered baits and adequately estimates the level in baits during the early stages of weathering. In well weathered baits with levels of 1080 below 100 mg/kg the routine method always overestimates the amount of 1080 present. Further investigation showed that most of the overestimation could be attributed to the presence of inorganic fluoride which is not distinguished from 1080 by the routine method. Production of fluoride from 1080 within a poison bait has not previously been suggested as a contributing factor in bait detoxification.

Keywords: high-performance liquid chromatography/sodium fluoroacetate/1080/liquid chromatography
Abstract: Sodium fluoroacetate, also known as compound 1080, has been widely used as a poison for controlling various vertebrate pests. The field use of such a highly toxic compound necessitates the analysis of baits and tissues to monitor to exposure of operators, agricultural stock and protected wildlife species (Rammell and Fleming 1978) Two general analytical methods are currently used, one based on a final fluorine estimation and the other on gas liquid chromatography (GLC). In the fluorine methods the sample extract is ashed and the fluorine determined either colorimetrically (AOAC 1980) or with a fluorideselective electrode (Peters and Baxter 1974). The fluorine methods, although sufficiently sensitive for most purposes, are necessarily nonspecific. The GLC methods which have been described are cumbersome and generally semi quantitative (Stahr et al. 1974, Peterson 1975, Stevens et al. 1976). An
improved GLC method using pentafluorobenzyl derivatisation and electron capture detection was proposed recently (Okuno and Meeker 1980) but the presence of interfering peaks and low, variable recovering were a problem.

The preparation of fluorescent derivatives of monocarboxylic acids using 4-bromomethyl-7-methoxycoumarin (BrMmc) and their separation by high performance liquid chromatography (HPLC) has recently been reported (Lam and Grushka 1978). We have adapted this method to the analysis of sodium fluoroacetate. A simple but efficient method for recovering this compound from baits is also described.

Keywords: non-target species/birds/mammals/secondary poisoning/USA/predators/raptors

Keywords: ground control/efficacy/1080/livestock/livestock protection collar/USA/predators

Keywords: ground control/target species/livestock/livestock protection collar/predators/USA/field efficacy

Ref Type: Conference Proceeding
Keywords: 1080/fluoroacetate/toxicity/sodium fluoroacetate/rodents/rodent/baits/livestock/fish/wildlife/humans/occurrence in nature
Abstract: Compound 1080® is a man-made sodium salt of fluoroacetic acid or fluoroacetate, which occurs in nature as the toxin in many species of poisonous plants. The toxicity of such plants had long been recognized, but the toxic agent was not identified as fluoroacetate until 1944. By that time, the pesticidal potential of synthesized sodium fluoroacetate (code number 1080-44) was being explored in the United States in a war time, crash program aimed at finding new rodenticides. Compound 1080, the main product of that program, proved to be the best rodenticide known up to that time. It was found to be even more toxic to canids than to rodents, so was used experimentally for coyote control beginning in November 1944. Compound 1080 was authorized for operational use in governmental predator control in 1946. Large meat baits, or bait stations, injected with 1080 solution and placed on livestock ranges in winter quickly became a preferred method for reducing coyote populations that preyed on sheep and cattle. The use of 1080 bait stations peaked in Fiscal Year (FY) 1963, when over 16,000 stations were placed by the U. S. Fish and Wildlife Service (FWS) Predator and Rodent Control (PARC) program. After 1963, numbers of 1080 stations declined year by year to 1972 when the use of 1080 and other predaicides on Federal lands and in Federal programs was stopped by President Nixon’s Executive Order 11643, followed by Environmental Protection Agency (EPA) suspension and cancellation of registrations for 1080 and other predaicides. The 1080 cancellation was based partly on high potential hazard to humans, even though no human had ever been killed or seriously injured in connection with the use of this toxicant in coyote control. Paradoxically, most of the political agitation over Compound 1080 focused its use in predator control even though much greater amounts were used for rodent control. The total amount of 1080 sold in the U. S. during 1968-72, the last five years in which 1080 bait stations were used, was approximately 10,003 lb. Only 1.3 percent (129 lb) of that amount was used for predator control. The largest amount of 1080 used for coyote control in the United States in any one year was about 42.4 lb, in FY 1963.

Keywords: mode of action/welfare/rats/sodium monofluoroacetate

Keywords: treatment/1080/pathology/antidote/sodium monofluoroacetate/monofluoroacetate/baits/dogs/CNS/cardiac/muscle/rats/blood/brain


Keywords: persistence in plants/metabolism/fluoroacetate/fluoride/sodium fluoroacetate

Abstract: The uptake and physiological effects of sodium fluoroacetate and sodium fluoride on a number of plant species are compared. Both ionized fluoride and fluoroacetate were taken up by *Helianthus annuus* although the patterns of distribution differed. Fluoride accumulated mainly in the root but a small percentage was translocated to the shoot causing premature senescence of the leaves. Fluoroacetate, however, was translocated to the shoot with little accumulation in the root. On a μgF/ml basis, the fluoroacetate solutions were more toxic reducing dry weight and producing leaf necrosis. However, fluoroacetate did not have the the rapid effect on the water balance of the plants shown by fluoride. The significance of the metabolism of fluoroacetate is discussed in relation to these physiological studies.


Keywords: bait degradation/sodium fluoroacetate/1080

Abstract: This paper reports experiments concerned with the loss of 1080 from a new type of pellet bait made from a mixture of pollard, bran, and molasses (PBM) and compared this with carrot and oat baits. The effect of different amounts of poison applied to baits in different ways was also studied. The experiments were done at Frankston (25 miles south east of Melbourne), Victoria in 1965 and 1966. The results for pellets at Frankston are compared with those for pellets retrieved from the field during poisoning experiments.


Keywords: poisoning/rabbits/carrot/baits/field efficacy/1080

Abstract: It is concluded that the specially prepared pellet baits are as effective for poisoning rabbits as carrot baits, better than oat baits, and generally satisfactory.


Keywords: mode of action/metabolism/pathology/fluoroacetate/heart/brain/kidney

Abstract: Mitochondria were prepared from the heart, kidney and brain of rats intoxicated with fluoroacetate. Incubation with several substrates showed depression of respiration of heart mitochondria with pyruvate and succinate, and depression of kidney mitochondria with pyruvate, succinate, citrate, β-oxobutyrate and L-glutamate; no inhibition of respiration was detected in brain mitochondria. Phosphorylative capacity, as expressed by the P:O ratios, was not affected in any of the tissues. However, a reduction in respiratory control was observed in all cases.


Keywords: fluoroacetate/birds/symptoms/sodium fluoroacetate/poisoning/1080/acute toxicity/lethal dose/mammals

Abstract: The symptoms of sodium fluoroacetate ("1080") poisoning in chickens are cyanosis of the comb and wattles, depression, weakness, disinclination to eat or move about, distention of the crop with fluid and gas, edema of the wattles, dyspnea and moist rales. The necropsy findings on sodium fluoroacetate poisoning in chickens are hemorrhage and edema of the lungs, petechial hemorrhages in the pericardial and mesentric fat, enteritis, congestion of the internal organs and ovarian hemorrhage in laying birds. The most pronounced effect of "1080" is on the lungs, where it causes hemorrhage and edema. All birds that died of "1080" poisoning showed hemorrhage and edema of the lungs therefore these lesions are considered diagnostic. The results obtained after the administration of 1080 to 28 birds of two age groups indicated the following dose levels: Maximum tolerant dose between 4.0 and 5.0 mg/kg, LD₅₀ between 7.0 and 8.0
mg/kg and LD_{50} between 15.0 and 18.0 mg/kg. Laying hens appeared to be more susceptible to 1080 poisoning than hens that were not laying. Chickens are considerably more resistant to 1080 poisoning than are many of the small mammals.


Curry, D. Model permit conditions for the use of sodium monofluoroacetate (1080). 1995. Wellington, Ministry of Health. Ref Type: Pamphlet Keywords: sodium monofluoroacetate/monofluoroacetate/1080

Abstract: Some recent developments in the area of utilizing ruminal microorganisms for the modification and improvement of productivity in ruminants are described. The inoculants, designed for establishment in the new domestic ruminant host, have specific, superior or modified activities, but currently have a restricted geographical or species distribution. Current work has focused on three novel or augmented activities, namely: reducing the toxicity of particular plant poisons, increasing the utilization of plant fibre and the modification of protein supply. The most successful projects so far have tackled the detoxification of the plant poisons, mimosine and fluoroacetate, but projects aimed at increasing the utilization of plant fibre are now well advanced. Molecular techniques have significantly assisted in the identification, differentiation and tracking of organisms and are essential for the construction of modified organisms


Abstract: More than 100 baiting and poison trials using sodium monofluoroacetate (compound 1080) carried out by the New Zealand Forest Service from 1957 to 1961 on fallow, red and sika deer, are described in some detail. Toxicity ratings varied from 1/4 lb to 1 lb (0.11 - 0.45 kg) of 1080 per 1,000 lb (454 kg) of chopped carrot bait, apparently the bait most favoured by these species of deer. If the LD50 for deer is similar to that for sheep (0.45 mg per 1 kg of body weight) a lethal dose for a 11lb (50 kg) deer would be contained in some 1.5 oz (40 g) of toxic carrot at the toxicity levels used. Some deer in the trials consumed more than 4 lb (1.8 kg) of toxic carrot, which would have contained well over 30 lethal doses. More than 500 deer were poisoned on grassy river flats and at least 40 in *Nothofagus* forest edges. The danger to native and exotic birds does not appear to be nearly as great as was anticipated. These trials indicate that large concentrations of deer on open clearings and in forest edges can be effectively reduced by the use of 1080 in carrot bait. It appears unlikely at this stage, however, that this technique will supersede hunting as an economic method of deer control in most of New Zealand's 14,000,000ac (5,700,000 ha) of indigenous watershed-protection and production forests, or in the 1,000,000 ac (405, 000 ha) of exotic production forests.


Abstract: The general insecticidal properties of bis (bis-dimethylamino phosphorus) anhydride, bis (dimethylamino) fluorophosphine oxide, diethyl paranitro-phenyl phosphite (E600) and sodium fluoroacetate are described. All are toxic to aphids when infested plant are dipped in solutions. Although this is thought to be a contact action the possibility that the materials are first absorbed by the leaves and that the aphids are killed by imbibing toxic sap is not excluded. At the lowest concentrations giving a complete kill of aphids, the anhydride is the most persistently effective of the four compounds. E600 is the most phytotoxic compound. When applied to the roots the order of decreasing toxicity of acetate>oxide>anhidride>E600 in sand and soil, and acetate>oxide>anhidride=E600 in culture solution. The anhydride and acetate are more persistent in the plants than the oxide and E600. The amargin of safety between insecticidal dosage and phyocidal dosage is appreciably larger with the acetate than with the other three compounds. When equal dosages are administered to plants by the cut tap root technique the order of decreasing toxicity to aphids is seen to be acetate>oxide>E600>anhidride. All compounds, except possibly E600 appear to be absorbed by the intact roots of the plants. Systemic insecticidal action following application made to leaves of the broad bean is easy to demonstrate with the acetate, demonstrable with difficulty with the anhydride and not at all with E600 and the oxide. Sodium fluoroacetate is an extremely effective systemic insecticide whether applied to the leaves or the roots of the broad bean. It is apparently not phytotoxic at several times the concentration necessary for insecticidal action but may prove to be too generally toxic or persistent for practical use.

Keywords: acute toxicity/invertebrates/persistence in plants/sodium fluoroacetate/fluoroacetate/systemic toxicity


Keywords: fluoroacetamide/efficacy/invertebrates/systemic toxicity

Keywords: persistence in soil/fluoroacetate/fluoroacetamide/soil

Keywords: regulatory toxicology/mammals/rodents/teratogenicity/sodium fluoroacetate/developmental toxicity/reproductive effects

Abstract: The genesis of congenital malformations, especially those induced by drugs, has long been a clinical enigma. In the rat, we have been able to demonstrate the teratogenic activity of three substances, all of which can specifically affect carbohydrate metabolism. Carbutamide, administered by stomach tube at a dose of 500 mg/day on the 9th and 10th days of pregnancy, induces cleft palate and microphthalmia or anophthalmia in nearly 100% of the embryos. The intramuscular injection of 2-deoxyglucose at a dose of 120 mg/day during the 9th and 10th day of pregnancy produces resorption in 17 out of 54 foetuses and foetal anomalies, such as cleft palate or forelimb anomalies in 17 out of those surviving. Sodium
fluoroacetate, 600 micrograms given intraperitoneally on the 9th day, causes eye anomalies, syndactyly and evisceration.


Keywords: mode of action/occurrence in nature/product chemistry/acute toxicity/NMR/monofluoroacetic acid/symptoms/sodium monofluoroacetate/monofluoroacetate/rats

Abstract: Cattle losses in Brazil have been attributed to *Palicourea marcgravii* St. Hil., a toxic plant for cattle. The crude extract from the leaves of *P. marcgravii* was successively fractionated using solvents with different polarities to determine whether monofluoroacetate acid and/or some other substance present in the leaves maybe responsible for the acute symptoms caused by the plant. Authentic sodium monofluoroacetate (SMFA) was used for comparison. The only *P. marcgravii* fraction which induced seizures and death in intoxicated rats was water soluble. The signs and symptoms induced in the animals by the crude extract and water-soluble fraction were the same as induced by SMFA and included tonic seizures and other actions on the CNS. The close-lethality and dose-latency to the 1st seizure curves constructed for the water-soluble fraction of the leaf extract (30-100 mg/kg) and SMFA (0.6-3.0 mg/kg) were parallel. Five animals per dose were used. The potency ratio of SMFA in relation to the water-soluble fraction of the leaf extract was 53.8 (dose-lethality curve) and 64.1 (dose-latency to the 1st seizure curve). The water-soluble fraction contained a substance with hRf = 20 which was the same as that of authentic SMFA. The F-19 NMR spectra of authentic SMFA and the *P. marcgravii* water-soluble fraction were identical. These data demonstrate the presence of SMFA in the water-soluble fraction of *P. marcgravii* leaves and show that monofluoroacetate is the active principle responsible for the signs and symptoms of acute intoxication.


Keywords: occurrence in nature/analysis/monofluoroacetic acid

Abstract: 'Erva de rato' (rat weed) *Palicourea marcgravii* (Rubiaceae) whose natural habitat is in moist woodlands is a shrub found in several Brazilian states. It has long been known as one of the most toxic plants of our pastures, although its active principle had not previously been identified. The present note deals with the isolation of the substance mainly by chromatographic methods, and its identification as monofluoroacetic acid.


Keywords: serum/sodium monofluoroacetate/humans/poisoning/analysis

Abstract: Sodium monofluoroacetate (NAFAc) has been widely used for vertebrate pest control, such as rabbits in Australia. However NAFAc is extremely toxic to all vertebrates and its use is restricted. Although this compound is stringently restricted, the occurrence of accidental and homicidal poisoning is no ever-present possibility. The method developed in this work shows the applicability of SPE with alumina cartridges for the extraction of NAFAc from serum samples. The method is efficient with recoveries of at least 96.8% from spiked serum. The samples were subsequently derivatized with dicyclohexylcarbodiimide (DCC), using 2,4-dichloroaniline (DCA), to make the product volatile for GC analysis.


Keywords: aquatic species/non-target species/invertebrates

Abstract: Of the 6000 organic compounds tested to determine their toxicity to fourth-instar larvae of *Anopheles quadrimaculatus* Say only 175 gave mortalities of over 50 per cent in 58 hours at 1 p.p.m. Twenty-two compounds, in addition to DDT and related compounds, showed toxicity at 0.1 p.p.m. Acetic acid 1-trichloromethyl -2,2,-methylene bis (4,6-dichlorophenyl) diester; benzene hexachloride; and *Synthetic 3956* were superior to the other compounds in their toxicity to anopheline larvae.

Keywords: 5-fluorouracil/fluoride/fluoroacetate/humans/kidney/liver/metabolism/NMR/plasma/rats/urine
Abstract: Capecitabine (Xeloda; CAP) is a recently developed oral antineoplastic prodrug of 5-fluorouracil (5-FU) with enhanced tumor selectivity. Previous studies have shown that CAP activation follows a pathway with three enzymatic steps and two intermediary metabolites, 5'-deoxy-5-fluorocytidine (5'-DFCR) and 5'-deoxy-5-fluorouridine (5'-DFUR), to form 5-FU preferentially in tumor tissues. In the present work, we investigated all fluorinated compounds present in liver, bile, and perfusate medium of isolated perfused rat liver (IPRL) and in liver, plasma, kidneys, bile, and urine of healthy rats. Moreover, data obtained from rat urine were compared with those from mice and human urine. According to a low cytidine deaminase (3.5.4.5) activity in rats, 5'-DFCR was by far the main product in perfusate medium from IPRL and plasma and urine from rats. Liver and circulating 5'-DFCR in perfusate and plasma equilibrated at the same concentration value in the range 25 to 400 μM, which supports the involvement of es-type nucleoside transporter in the liver. 5'-DFUR and alpha-fluoro-beta-ureidopropionic acid (FUPA) + alpha-fluoro-beta-alanine (FBAL) were the main products in urine of mice, making up 23 to 30% of the administered dose versus 3 to 4% in rat. In human urine, FUPA + FBAL represented 50% of the administered dose, 5'-DFCR 10%, and 5'-DFUR 7%. Since fluorine-19 nuclear magnetic resonance spectroscopy gives an overview of all the fluorinated compounds present in a sample, we observed the following unreported metabolites of CAP: 1) 5-fluorocytosine and its hydroxylated metabolite, 5-fluoro-6-hydroxycytosine, 2) fluoride ion, 3) 2-fluoro-3-hydroxypropionic acid and fluoroacetate, and 4) a glucuroconjugate of 5'-DFCR.


Abstract: Caged New Zealand white rabbits were examined for the development, and prevention, of a learned aversion to toxic feed. Two familiar feeds were offered. One feed, a paste, contained sublethal amounts of sodium monofluoroacetate (1080); the other feed, cereal-based pellets, was unpoisoned. On initial poisoning, consumption of both feeds decreased, but more markedly for the 1080-dosed pastes. Suppressed feed consumption was observed for several days and may have been illness induced. A second poisoning elicited a significant depression of consumption of pastes but not pellets. The addition of a mixture of certain drugs (neurotransmitter antagonists) to the poisoned paste appeared to prevent the characteristic depression of this paste intake. We speculate that the drugs disrupted the associative process linking 1080 to recognisable attributes of the toxin or bait itself. The implications of these results on aversion formation in rabbits and pest control are discussed. [References: 29]


Keywords: assay/rats/zinc phosphide/Lethal Dose 50/acute toxicity
Abstract: Eight rodenticides were bioassayed, using 406 recently trapped adult wild Norway rats. Unanaesthetised rats were given the various poisons suspended (or dissolved) in 10% acacia solution, through a metal stomach tube. No significant seasonal variation was observed nor was there any sex variation (except in the case of red squill). The median lethal doses and their standard errors were found to be as follows, in mg/kg:

- 1080 was 0.22 ± 0.01,
- strychnine sulphate was 4.8 ± 0.4,
- ANTU was 6.9 ± 0.5,
- thallium sulphate was 15.8 ± 0.9,
- zinc phosphide was 40.5 ± 2.9,
- arsenic trioxide was 138 ± 13,
- fortified red squill in females was 133 ± 10,
- fortified red squill in males was 276 ± 29,
- barium carbonate was 1480 ± 340.


Keywords: fluoroacetate/fluorocitrate/citrate acid/brain/heart/kidney/aconitase/mode of action/metabolism/monofluoroacetate
Abstract: Monofluoroacetate and monofluorocitrate both show carcinostatic activity against the adenocarcinoma 753 growth in C57BL mice. The administration of monofluoroacetate markedly increased the citric acid levels in the 753 tumor and normal brain, heart and kidney tissue. Monofluorocitrate administration raised the citrate concentration in the tumor and kidney tissue but had no effect on the citric acid levels in mouse brain or heart. *In vitro* studies on seven different experimental mouse neoplasms...
indirectly indicate that all these tumor tissue possessaconitase activity. However, of all the neoplasms studied, adenocarcinoma 755 can efficiently convert fluoroacetate to fluorocitrate as measured by citric acid accumulation in the fluoroacetate poisoned tumor homogenates.

Dilks, P. and Lawrence, B. (2000). The use of poison eggs for the control of stoats. New Zealand Journal of Zoology 27. Keywords: poison/stoats/1080/lethal dose/field efficacy
Abstract: Stoats (Mustela erminea) are an important predator of many forest bird species in New Zealand, and more effective methods for their control are being sought. Stoat control using Fenn traps has been shown to prevent predation on mohua (Mohoua ochrocephala), but this technique is labour-intensive and costly to use for protection of large areas of habitat. We evaluated 1080 delivered in eggs as a poison for control of stoats. The lethal dose has been determined by captive and field trials, but attempts to implement a large-scale control operation have given inconclusive results. To clarify the effectiveness of 1080 eggs as a control technique, we carried out further field trials with radio-tagged stoats in the Makarora Valley. Twenty animals were monitored by radio tracking, and data loggers and video cameras recorded their visits to bait stations. The precise time an individual stoat ate a poison egg could be determined from data logger and video information, and its fate was followed. Sixteen of twenty stoats were killed by 1080 eggs, three died of other causes and one remained alive at the end of the trials.

Abstract: An attempt was made to evaluate a poisoning technique utilizing compound 1080 and carrots for the control of thar. Pre-poisoning and post-poisoning counts were undertaken in three Zones to define the effectiveness of the poison and pre-feeding. Zone I with no pre-feeds had an estimated kill of 11%, Zone II with one pre-feed an estimated kill of 30%, Zone III with two pre-feeds an estimated kill of 51%. Supplementary results were collected on secondary poisoning, identification of 1080 death, whether poisoning took a biased sample of the population, and biological data.

Abstract: The toxicological and some of the pharmacological properties of Castrix, α-naphththiourea, and sodium fluoroacetate are reviewed. Information relating to the toxicity and rodenticidal efficacy of 2-chloro-4-dimethylamino-6-methylpyrimidine is reported. Sodium pentabarbitral has been found to be effective as an antidote for Castrix poisoning.

Dummel, R. J. and Kun, E. (1969). Studies with specific enzyme inhibitors. The Journal of Biological Chemistry 244, 2956-2969. Keywords: chemistry/enzyme/mode of action/analysis/fluorocitrate
Abstract: Isolation of D and L isomers of erythro-fluorocitric acid was accomplished by first separation of diastereomeric racemates as cyclohexamine salts of diethyl fluorocitrate. This was followed by resolution
of the \textit{erythro}-diastereoisomer into optical isomers by fractional crystallization as (+) and (-)-dioxynephedrine salts. Partial hydrolysis to the monoethyl ester of resolved fluorocitrate was achieved by guanidine carbonate and complete hydrolysis to the free acid in NaOH. Purification to the final stage of optically resolved free acids was carried out by fractionation as barium and cyclohexamine salts. Only the L isomer inhibited aconitase activity of rat kidney mitochondria.


Abstract: The alterations in metabolism that occur in hearts poisoned with fluoroacetate have been studied by Williamson et al. They found that the depression of contractility appeared to correlate well with the metabolic inhibition. Under certain experimental conditions, however, fluoroacetate stimulates the force of contraction of the heart. Katzung et al. demonstrated that fluoroacetate stimulates contractility at low frequencies of stimulation and depresses contractility at high frequencies. Pasner demonstrated that fluoroacetate exerts a greater positive inotropic effect when the heart muscle is suspended in a medium containing a low calcium concentration than in high calcium. The present investigation was undertaken to study the effects of fluoroacetate on the metabolism of electrically stimulated rat ventricle strips under conditions in which fluoroacetate stimulates contractility; i.e. the tissue was suspended in a medium containing a low calcium concentration and was electrically stimulated at a low frequency.


Ref Type: Report
Keywords: 1080/non-target species/aerial control/possums/withholding period/mammals/invertebrates/analysis/persistence in water/persistence in animals
Abstract: High concentrations of 1080 in mice suggested significant rodent mortality after possum control operations. Although some 1080 was present in insects, at the maximum concentration detected a 50-g bird would have to eat approximately 300-g of insect material at one session to be affected. Kauri snails were not contaminated. These analyses were undertaken on a small sample and should be treated accordingly. The sowing techniques did not affect bait size and integrity. The risk to non-target forest species, humans and stock was low after 28 days. However, baits from one area contained a significant amount of 1080 for 6 weeks. The streams and rivers of the Waipoua Forest Sanctuary were not contaminated after the sowing of 1080 possum baits.


Ref Type: Abstract
Keywords: secondary poisoning/poisoning/sodium monofluoroacetate/1080/humans/possums/livestock/rabbits/withholding period
Abstract: Sodium monofluoroacetate (1080) was introduced in 1954 for vertebrate pest control in New Zealand. It remains an essential tool for the containment of tuberculosis spread by possums and to reduce possum damage to crops and forests. Whilst stock should be removed from areas where this toxin is being used, there have been concerns that livestock may become contaminated with 1080 after ingestion of a sublethal dose of toxin by eating a bait intended for a rabbit or a possum. To quantitate the risk of such an event, rabbits, sheep and goats have been orally dosed with 0.1 mg/kg 1080 (approximately one quarter of the LD50) and plasma pharmacokinetics and tissue concentrations of 1080 have been measured. The
plasma elimination t1/2 in rabbits, goats and sheep was 1, 5 and 11 hour respectively and tissue concentrations were consistently lower than plasma concentrations. All traces of 1080 were eliminated in one week. The rapid elimination of 1080 couples with destocking practices, suggests that the likelihood of 1080 residues occurring in meat for human consumption or export is extremely remote.

Ref Type: Report
Keywords: regulatory toxicology/sodium monofluoroacetate/1080

Keywords: welfare/possums
Abstract: Increasingly animal welfare considerations have influenced the focus of pest control research and the manner in which it is conducted. In this case study we review the trends and influences on research related to the Australian brushtail possum, considered the most damaging animal pest in New Zealand. The limited public acceptance for killing of animal pests such as rats and possums, carries the caveat that it must be done with minimal pain and distress. Finding control methods that are cost effective, target specific, and humane remains a major ethical and animal welfare issue. There is increasing emphasis on establishing the relative merits of different trap types and poisons (from a welfare perspective) and the development of non-lethal methods and biocontrol. We have initiated new research which will lead to an animal welfare audit of the existing six toxicants commonly used for possum control. The merits of this and all other pest control research will be judged increasingly from a welfare perspective, and research must initiate the use of animal management techniques which minimise pain or distress.

Keywords: acute toxicity/possums/welfare/non-target species/secondary poisoning/1080/brodifacoum
Abstract: In New Zealand there are six toxicants currently registered for possum control: 1080 (sodium monofluoroacetate), cyanide, cholecalciferol (Vitamin D), phosphorus, brodifacoum, and pindone. Their use for killing possums raises a variety of concerns including risks and persistence, which are often different for each toxicant because of the differences in their physical and chemical properties and their toxicological modes in action.

The ideal toxicant for possum control should be inexpensive, usable by farmers, and humane. It should have an antidote and be degradable in soil and water. As far as possible it should be species-specific. It should not leave persistent residues in livestock and should have a low risk of primary or secondary poisoning in non-target species. It should be supported by a comprehensive database of efficacy, toxicology, and risk assessment studies that satisfy local concerns as well as national and international regulatory agencies. Such and ideal pesticide has not yet been identified and may never be. The advantages and disadvantages of the six toxicants currently used for possum control are summarised below ans some of the research questions being addressed regarding their safety and efficacy are outlined. Currently the range of toxicants and baits available allows those involved in possum control to select the most appropriate combination for sustained control of possums, provided they are familiar with the advantages and disadvantages of the different toxicants and baits.

Keywords: 1080/persistence in animals/persistence in invertebrates/persistence in water

Ref Type: Magazine Article
Keywords: 1080/persistence in water/aerial control

Ref Type: Report
Keywords: poisons

Abstract: Toxicity testing of drugs, pesticides, and hazardous compounds has substantially evolved into a battery of standardized tests conducted in a range of surrogate test organisms. The toxicity of these xenobiotics in terms of their LD_{50}, LC_{50}, ED_{50}, MATC, LOEL, LOEC, NOEL or NOEC is extrapolated to humans and wildlife. Historical failures in the risk assessment process have been largely due to over reliance on regulatory toxicology and an “assembly line” mentality to toxicology. The importance of toxicokinetics, receptor studies and biomarkers are reviewed, firstly, with reference to toxicological incidences in drug development programmes, and secondly, with reference to improved environmental risk assessment of pesticides and other contaminants. Ecological risk assessments also require multidisciplinary skills to study the entry, distribution, and biological effect and fate of chemicals to fully characterise and understand the potential adverse implications of contamination. Optimum integration of chemical measurements and biomarker responses is a challenge that will lead to an improved understanding of adverse effects and their significance in both human and ecological risk assessment.

Keywords: sodium monofluoroacetate/monofluoroacetate/1080
Abstract: Sodium monofluoroacetate (1080) is a vertebrate pesticide widely used for possum control in New Zealand. Fluoracetate is also a toxic component of poisonous plants found in Australia, South Africa, South America, and India. Because of its importance and effectiveness in pest control and the highly toxic nature of this compound, its acute sub-lethal and target organ toxicity have been extensively studied. In relation to its use as a pesticide its environmental fate, persistence, non-target impacts and general toxicology have been and continue to be extensively studied. Toxic baits must be prepared and used with extreme care, otherwise humans, livestock, and non-target wildlife will be put at risk. The high risk of secondary poisoning of dogs is a cause for concern. 1080 acts by interfering with cellular energy production. Possums die from heart failure, usually within 6-18 h of eating baits. Long-term exposure to sub-lethal doses can have harmful effects and strict safety precautions are enforced to protect contractors and workers in the bait manufacturing industry. Considerable care is taken when using 1080 to ensure that the risks of using it are outweighed by the ecological benefits achieved from its use. When its use is controversial, risk communicators must take care not to trivialise the toxicity of the compound. The benefits of 1080 use in conservation, pest control, and disease control should be weighed up alongside the risks of using 1080 and other techniques for pest control.

Keywords: acute toxicity/cats/field efficacy/welfare/1080
Abstract: Feral cat populations have had a devastating effect of many native wildlife species. As part of a program to evaluate improved predator control, feral cats were observed after they had ingested a polymer bait loaded with 0.4-1.6 mg sodium monofluoroacetate (1080) per 1-g bait, equivalent of doses of 0.1-1.3 mg per kg body weight. Deaths occurred with 0.6 mg per bait and all higher doses. With the highest dose all animals died within 24 h. An approximate oral LD{sub 50} of 0.28 mg per kg (0.07-0.49) and LD{sub 90} of 0.35 mg per kg (0.14-0.56) were calculated (with 95% confidence limits). Main symptoms were disorientation and lethargy, followed by death. A dose of 2 mg 1080 per bait is recommended as a humane and lethal poison for feral cats.

Keywords: possums/non-target species/1080/acute toxicity
Abstract: Large-scale possums control in New Zealand is dependent on the use of sodium monofluoroacetate (1080). Although 1080 is highly effective, its use is restricted and there is public pressure to find alternatives. An acute toxicity programme has been set up to identify safer, humane, and more target-specific toxins. Possums were dosed with a new rodenticide, cholecalciferol (Vitamin D3). Interim results indicated that cholecalciferol has an LD90 of approx. 20-50 mg/kg in the possum.

Keywords: persistence in water/1080/possums/aquifer

Abstract: Two major control operations were conducted in New Zealand in 1990 using aerially sown baits containing the poison sodium monofluoroacetate (1080) [sodium fluoroacetate] against (1) brushtail possums (Trichosurus vulpecula) in kauri (Agathis australis) mixed hardwood forests of Waipoua Forest Sanctuary, and (2) against brushtail possums and rock wallabies (Petrogale penicillata) in the pohutukawa (Metrosideros excelsa) forests on the volcanic cone of Rangitoto Island. This note briefly reports the results of water-residue analyses carried out to determine the fate of 1080 in waterways. In Waipoua, streams and rivers were monitored for 4 months after 100 t of 1080 possum baits were sown over 17 000 ha of forest. At Rangitoto Island, surface and ground water samples were analysed for 6 months after 20 t of 1080 possum baits were sown over the 2300 ha island. No 1080 was detected in the streams and rivers of the Waipoua forest or the surface or ground water of Rangitoto Island.

Keywords: possums/acute toxicity/1080/lethal dose/field efficacy/bait shyness

Abstract: To improve feral cat control we developed a dry pelleted toxic bait and evaluated the potential of lures. A polymer fish meal bait was preferred by cats from a range of bait types tested. L-alanine further increased bait acceptance by cat in pens trials and catnip may have the potential to increase field acceptance and target specificity. An oral LD90 of 0.38 mg/kg was established for sodium monofluoroacetate (1080) in feral cats voluntarily eating surface-loaded baits. Acute toxicity to cats of warfarin, cholecalciferol and gliflor was tested. However, because the cat proved highly sensitive to 1080, we recommended its use at a dose of 2 mg per cat bait. In preliminary field trials of bait acceptance using non-toxic polymer bait (without flavour or attractants) marked with the plasma marker iophenoxic acid, 50% of 39 cats caught within 3 weeks of laying the baits were marked. Subsequently polymer bait, surface coated with 1080 was used in the successful eradication of feral cats from Matakohe Island (37 ha) Whangerei Harbour, New Zealand.

Ref Type: Magazine Article

Keywords: pest/possums

Keywords: persistence in animals/persistence in water/invertebrates/mammals/metabolism/non-target species/1080/possums/birds

Abstract: New data on the fate of sodium monoacetate (1080) [SMA] in water and its persistence in mammals and invertebrates is summarized. Studies revealed that 1080 was readily degraded in water, mammals and invertebrates. It was found that significant water contamination after the aerial distribution of 1080 bait for the control of possums was very unlikely. The rapid elimination of 1080 from animal tissue confirms that 1080 residues are most unlikely in meat. Analyses of residues in invertebrates indicated there was no long-term contamination of invertebrates and little risk of significant amounts of 1080 passing through the food chain to birds.


Keywords: possums/acute toxicity/1080

Abstract: Sodium monofluoroacetate (1080) is still an essential tool for possum control. We re-assessed the fate of this compound in the environment and found no evidence of water contamination after largescale possum control operations. The toxin is biodegradable in all living systems and will not accumulate in the food chain. Nevertheless, over reliance on a single toxin for a particular pest, such as 1080 for possum control, is unwise, and we are evaluating alternatives. Possums are susceptible to some nonanticoagulant toxins, including gliflor, cholecalciferol, calciferol, and alphachloralose. Of the anticoagulant toxins, broadifacoum is more effective than pindone. Integrated pen and field trials will determine the most cost effective alternatives to 1080 for use in bait stations and for aerial application. Any alternative toxin will need to be subjected to the same scrutiny as 1080 for its environmental fate and impact on nontarget species.


Keywords: possums/acute toxicity/1080/brodifacoum

Abstract: Objectives: To generate data on the safety and effectiveness of new toxins to support their registration for possum control: to determine the effectiveness of anticoagulant toxins for possum control; to conduct limited research on back-up compounds, such as alpha-chloralose.

Conclusions: Cholecalciferol and gliflor show considerable promise as alternatives to 1080; brodifacoum is approximately 800 times more toxic to possums than pindone, is effective for maintenance control, and can significantly reduce possum populations.


Keywords: persistence in animals/persistence in water/1080


Keywords: persistence in animals/persistence in water/1080


Keywords: possums/acute toxicity/1080/non-target species/brodifacoum

Abstract: Over-reliance on a single toxin, such as sodium monofluoroacetate (1080) is unwise. Current possum control strategies should integrate use of cyanide and trapping with 1080-use where appropriate and for the future new alternative toxins are needed. Ideally, an alternative toxin for possum control should be inexpensive and usable by farmers and it should have an antidote. It should be degradable in soil and water. It should be humane and, as far as possible, species specific. It should not persist in livestock and should have low risk of primary or secondary poisoning in non-target species. Such and ideal toxin will be difficult to identify. We have been testing alternative toxins in pen and field trials, and have re-evaluated the susceptibility of the possum to anticoagulants. Brodifacoum is more potent than pindone, but is
persistent in livestock receiving a sub-lethal dose. Cholecalciferol and glifit are effective and have a number of positive attributes. Any alternative toxin will need to be subjected to the same scrutiny that 1080 has received for its environmental fate and impact on non-target species. In the future, greater effort will need to be expended in discussing the risk versus benefit of possum control using 1080 or alternative technologies with a wide range of interest groups, as well as with those directly involved with or affected by pest control.


**Keywords:** persistence in animals/non-target species/occupational exposure/metabolism/1080/secondary poisoning/sodium monofluoroacetate/kidney/livestock/humans/goats/poisoning/blood/muscle/liver/plasma

**Abstract:** Sodium monofluoroacetate (1080), a vertebrate pesticide widely used in New Zealand, was administered orally to sheep and goats at a dose level of 0.1 mg kg(-1) body weight to assess risk to humans of secondary poisoning from meat. Blood, muscle, liver, and kidney were analysed for 1080 residues. The plasma elimination half-life was 10.8 h in sheep and 5.4 h in goats. Concentrations of 1080 in muscle (0.042 mg g(-1)), kidney (0.057 mg g(-1)), and liver (0.021 mg g(-1)) were substantially lower than those in plasma (0.098 mg ml(-1)) at 2.5 h after dosing. Only traces of 1080 (<0.002 to 0.008 mg g(-1)) were found in sheep tissues after 96 hours. Livestock are normally excluded from areas where 1080 is being used for pest control, reducing the risk of secondary poisoning. Even with accidental exposure to a sublethal dose 1080 would not persist in tissues for more than a few days because it is cleared rapidly from the body. Therefore the occurrence of 1080 in meat intended for human consumption is highly unlikely.


**Keywords:** 1080/acute toxicity/biochemistry/excretion/heart/kidney/mammals/metabolism/mode of action/pathology/persistence in animals/rabbits/testes

**Abstract:** Studies on the metabolism and excretion of fluoroacetate in laboratory animals and livestock are reviewed. Both unmetabolised fluoroacetated and at least seven metabolites are excreted in the urine. The elimination half-lives for sub- or near-lethal doses of fluoroacetate are 1 h in rabbits, 2 h in mice, 5 h in goats, and 11 h in sheep. Animals receiving small sub-lethal doses of 1080 metabolise and excrete fluoroacetate within 1 - 4 days. Signs of intoxication occur in most species within 0.5 to 2 h after ingestion and include nausea, vomiting and heart or respiratory failure. Post-mortem signs may include epicardial and diffuse visceral haemorrhage and histological changes in the central nervous system, kidney, testes, and the heart. Livestock must be excluded from areas where 1080 is being used for pest control. A minimum withholding period of 5 days is recommended for livestock where contact with 1080 is suspected, and longer periods where a death in a flock or herd is attributed to 1080.


**Keywords:** persistence in water/1080

**Abstract:** The water monitoring programmes carried out from 1990 to 1993 indicated that although significant contamination of waterways is unlikely, there is a need to more clearly understand how 1080 breaks down in water and to model any consequences of 1080 contamination in waterways.


**Keywords:** persistence in water/occupational exposure/1080

**Abstract:** Sodium monofluoroacetate (1080) is used in aerially sown bait for large scale possum and rabbit control in New Zealand. Although 1080 is known to be biodegradable, we are continuing to explore in more detail the chemical and biological pathways by which this toxin is broken down in the environment.
Public concern about contamination of the waterways has focused our research on the persistence of 1080 in aquatic ecosystems. This paper concludes that significant contamination of waterways with 1080 or fluoride after possum or rabbit control is unlikely, nevertheless further monitoring of water and labotatory studies are planned. We will continue to address concerns regarding 1080 and potential risk to humans from contaminated water.

Keywords: possums/acute toxicity/1080/brodifacoum
Abstract: Objectives: To generate data on new toxins to support their registration and use by farmers for possum control: to determine the effectiveness of gliflor, cholecalciferol, brodifacoum and pindone; to conduct limited research on back-up compounds.
Conclusions: Cholecalciferol and gliflor continue to show promise as alternatives to 1080; brodifacoum and pindone can significantly reduce possum populations, but relatively large amounts of bait are needed; cholecalciferol combined with an anticoagulant such as broadifacoum in a cereal bait may improve cost effectiveness.

Keywords: field efficacy/non-target species/persistence in animals/persistence in plants/persistence in soil/persistence in water/occupational exposure/1080/possums
Abstract: Effective and publicly acceptable pest control requires the fulfilment of three essential prerequisites:
i) data on effectiveness
ii) data on environmental toxicology and non-target impacts
iii) community involvement or acceptance
This paper explores the extent to which current use of sodium mono fluoroacetate (1080) in New Zealand meets these prerequisites and suggests where we need to focus more effort in the future.
Sodium monofluoroacetate (1080) was patented as a rodenticide in the USA in the late 1930s and has been used in New Zealand since 1954 to control introduced animal pests, particularly possums (Trichosurus vulpecula). Possums cause damage to native and exotic forests and spread bovine tuberculosis (Tb) to cattle (Cowan 1991). Over the last 20 years, an extensive database on the effectiveness of killing possums has been collected and some data on environmental toxicology and non-target impacts have been gathered (Seawright and Eason 1994). Despite assurances from the scientific community that the benefits of 1080 use far outweigh the risks, the level of public antagonism to 1080 has become more widespread. This suggests that the scientific community and wildlife managers are not adequately meeting the three essential prerequisites.

Keywords: welfare/possums/acute toxicity/brodifacoum
Abstract: Objectives: To review the need for toxins in possum control: to determine the effectiveness of gliflor, cholecalciferol, brodifacoum and pindone; to review the humaneness of the toxins currently used for possum control in New Zealand. Conclusions: Although the mode of action of these toxins is well understood and the clinical signs in a range of species have been recorded, good comparative data on the relative humaneness of existing toxins are not available for the possum.

Keywords: secondary poisoning/non-target species/persistence in animals/metabolism/1080/brodifacoum/possums/cats
Abstract: To determine the risk of secondary poisoning for animals preying on sub-lethally poisoned brushtail possums, captive possums were treated with near-lethal doses of sodium monofluoroacetate
(1080) or brodifacoum, and toxicant concentrations in blood and tissue were monitored over time. Sodium monofluoroacetate was rapidly eliminated from the blood (within three days). Brodifacoum was retained in the liver and, to a lesser extent, the muscle of possums for eight months after dosing. To determine the potential risk for animals scavenging on the carcasses of possums poisoned with cholecalciferol, cats were fed poisoned carcasses for six days. No changes in behavior, appetite, or body weight were observed. Serum calcium concentrations increased slightly, but remained within the normal range for cats.


Keywords: welfare/possums/regulatory toxicology/acute toxicity

Abstract: Non-tariff trade barriers will be imposed on New Zealand if our pest control techniques are deemed unacceptable in overseas markets. Finding control methods for possums that are economic, effective, and humane is a major ethical and animal welfare issue. The increasing international focus on animal welfare issues makes the development of humane trapping and poisoning techniques a high priority. The current Animal Protection Act (1960) exempts possum control from the requirements of the Act except for one specific section relating to trapping. The pending Animal Welfare Act, however, requires that all wild animals must not be subjected to unnecessary or unreasonable pain, suffering, or distress. This, in essence, means that any method used to kill possums must be humane in its action and effect. This legislation brings New Zealand in line with its major overseas trading partners. For example, the UK Control of Pesticides Regulations (1986) requires that pests should be controlled by methods that are humane, and a more recent European Union Directive (91/414/EEC) requires that vertebrate pesticides do not cause undue suffering. While some data exist for traps, no published quantitative data exist for toxic agents to be able to conform to this legislation and certainly not to the extent that questions relating to their humaneness could be thoroughly answered. Furthermore, literature accounts of the humaneness of different toxicants are inconsistent, and species difference in response to different xenobiotics need to be taken into account. The background to The present situation relating to possum control and The need for a welfare scoring system for selection acceptable toxicants and traps are discussed in this paper.


Keywords: possums/bait degradation/persistence in animals/persistence in plants/persistence in soil/persistence in water/non-target species/mode of action/metabolism/pathology/1080

Abstract: Sodium monofluoroacetate (1080) is a highly toxic vertebrate pesticide widely used for possum control in New Zealand. Fluoroacetate is also a toxic component of poisonous plants found in Australia, South Africa, South America, and India. Because of the highly toxic nature of this compound, its environmental fate, persistence, and non-target impacts have been extensively studied. Current evidence suggests that the risks of using 1080 are outweighed by the benefits achieved from sustained large-scale pest control. However, it toxic baits are not prepared and used with extreme care, humans, livestock, and non-target wildlife will be put at risk. The risk to dogs from poisoned carcasses must not be underestimated.


Keywords: product chemistry/welfare/regulatory toxicology/teratogenicity

Abstract: Increasing regulatory and product safety standards along with the enhanced expectations of todays consumers have influenced the manner in which new pesticides and older compounds subject to reevaluation, face everrising standards in product efficacy, toxicology and environmental risk assessment. Vertebrate pesticides are no exception to this worldwide phenomenon and in this paper we review, using possum control in New Zealand as a casestudy, some of the factors that are likely to influence the future use of toxicants in this field.

Western Australia, 3-8 May 1998: programme and proceedings. pp. 105-110. (Agriculture Western Australia: Forrestfield.)

**Keywords**: non-target species/persistence in plants/persistence in soil/persistence in water/1080/mammals/birds/possums/rabbits/secondary poisoning/metabolism/invertebrates

**Abstract**: New Zealand had no indigenous terrestrial mammals except 2 species of bats prior to human settlement. Introduced mammals have had severe impacts on native flora and fauna, including extinctions of birds and the near collapse of indigenous rainforests. Control strategies currently rely on the large-scale use of vertebrate pesticides, including aerial distribution of sodium monofluoroacetate (1080) baits to control possums (Trichosurus vulpecula) and rabbits (Oryctolagus cuniculus). Studies of the implications of widespread use of 1080 include risks of primary or secondary poisoning to non-target species, accumulation in soil, uptake into vegetation, and persistence in surface water. Results indicate that 1080 is not environmentally persistent under most conditions. It is water-soluble, readily leaches from baits, and does not bind to soil constituents. However, detoxification by soil microorganisms varies with soil conditions, and may be prolonged by drought and cold. Surface water monitoring following aerial 1080 applications revealed no significant contamination. Toxin breakdown in aquaria studies was temperature-dependent, but occurred within 1-2 weeks even at 11°C. Uptake and persistence in plants varied with different species, with peak concentration ranging from 0.06 to 0.08 ppm, and elimination occurring with 1-5 weeks. Metabolism and excretion was rapid in sub-lethally dosed mammals (<5 days) and invertebrates (6-10 days), so 1080 does not bioaccumulate. However, toxic concentrations persist in carcasses for >75 days, increasing the risks of secondary poisoning to scavengers. Some losses of individual native birds have been observed, especially with the use of 1080 bait containing excessive small fragments, but no long term population-level effect have been reported. Native invertebrates have been observed feeding on toxic baits, but adverse effects on invertebrate populations or secondary poisoning of insectivorous birds or bats have not been documented to date.


**Ref Type**: Conference Proceeding

**Keywords**: regulatory toxicology/pathology/1080/teratogenicity/reproductive effects/developmental toxicity

**Abstract**: Sodium monofluoroacetate (1080) has been used in New Zealand to control vertebrate pests since 1954, and although a large historical database exists, little is known about the development toxicity of this pesticide. This investigation was intended to evaluate the development toxicity and teratogenic potential of 1080 in Sprague-Dawley rats following oral intubation. A pilot study was performed to help select doses for the subsequent study an consisted of groups of 5 time mated females. Animals received 1080 at concentrations ranging from 0.1 to 1.0 mg/kg/day from days 617 of gestation. A 60% mortality rate and reductions in maternal body weight and body weight gain as well as decreased litter size and increased resorption were observed at 1.0 mg/kg/day. Consequently, the doses selected for the main study were 0.1, 0.33, and 0.75 mg/kg/day. Groups of 26 timed mated females received 1080 from days 617 of gestation. On day 20 of gestation, litters were delivered via laparohysterectomy. Significant reductions in maternal body weight, body weight gain, and food consumption were noted at 0.75 mg/kg/day. No changes in litter size or resorption were observed, but foetal body weight was significantly reduced at 0.75 mg/kg/day. No external or visceral foetal abnormalities were noted. There were treatment-related effects on skeletal development at 0.33 mg/kg/day and higher. Forelimb malformations occurred at 0.75 mg/kg/day, but were not observed in controls. An increased incidence of bent/rays was observed at 0.33 and 0.75 mg/kg/day when compared with controls. Available data indicate that 1080 is maternally toxic at 0.75 mg/kg/day and higher. Embryolethality was noted at 1.0 mg/kg/day, but not at 0.75 mg/kg/day. Development toxicity was observed at 0.33 mg/kg/day and higher. Sodium monofluoroacetate was considered to be teratogenic at 0.75 mg/kg/day. Reductions in foetal body weight at 0.75 mg/kg/day are likely linked to maternal toxicity rather than a direct effect on the foetus.

Keywords: regulatory toxicology/occupational exposure/pathology/persistence in water/developmental toxicity/reproductive effects/teratogenicity/sodium monofluoroacetate/monofluoroacetate/1080/rats/humans/baits

Ref Type: Report
Keywords: 1080/sodium monofluoroacetate/monofluoroacetate/rats/testes/heart/sublethal effects/regulatory toxicology/treatment/pathology/blood/urine
Abstract: This study was conducted to determine the sub-lethal effects of sodium monofluoroacetate (1080) exposure in rats, and the No-Observable-Effect-Level (NOEL) for chronic exposure. The objectives of conducting toxicity studies of this type are principally: (i) to establish an up-to-date regulatory toxicology database on 1080, (ii) to set Acceptable Daily Intakes (ADIs) for human exposure, and (iii) to provide data to improve risk assessment for workers involved in the pest control industry.

Three groups of 10 male and 10 female Sprague-Dawley rats received 1080 dissolved in water at doses of 0.025, 0.075, and 0.25mg/kg/day by oral gavage once daily for 90days. A group of 10 male and 10 female rats served as the control group, and were administered water. The control and 0.25 mg/kg/day groups included 10 additional rats of each sex that were treated for 90 days, then maintained without treatment for a further 56-day recovery period.

No 1080-related changes in body weight or food consumption were noted when compared with the control group during the treatment or recovery periods. Erythrocyte counts decreased slightly in males at 0.25mg/kg/day when compared with controls. No other changes in clinical pathology parameters derived from blood samples were detected. The only 1080-related findings at necropsy were small testes and epididymis in males at 0.25mg/kg/day, and these observations were corroborated by a reduction in the weight of the testes. 1080-related increases in heart weight were noted in both males and females at 0.25 mg/kg/day when compared with controls. No effects were noted in the lower-dose groups. Microscopic changes in the testes and the heart were seen only in males at 0.25mg/kg/day when compared with controls and included severe hypospermia in the epididymis, severe degeneration of the seminiferous tubules of the testes, and cardiomypathy. The testicular and epididymal effects were also evident from the sperm evaluation, which indicated severe decreases in all three sperm parameters evaluated, concentration, % motile, and % abnormal, at 0.25 mg/kg/day. There were no microscopic changes or effects on sperm parameters at 0.025 and 0.075 mg/kg/day when compared with controls. The effects in males at 0.25 mg/kg/day were evident following both the treatment and recovery periods. No recovery in sperm evaluation parameters was noted, although there appeared to be a slight improvement in the microscopic changes, and effects were slightly less severe after the 56-day recovery period. This suggested a slight reversal in both the hypospermia and seminiferous tubule degeneration at 0.25 mg/kg/day in the males following 56 days with no treatment.

Based on the results of this study, the NOEL for rats administered 1080 via oral gavage for 90 days was 0.075 mg/kg/day. Since this study is similar to that derived from an earlier developmental study (0.1 mg/kg/day) there is no reason to adjust, on the basis of these data, the Ministry of Health guidelines for acceptable levels of 1080 in water. Concentrations of 1080 in rats dosed with 0.25 mg/kg/day were 0.28g/mL one hour after dosing and 0.075 g/mL 12 hours after dosing. Rat urine collected from the same animals contained 0.06 g/mL. These 1080 concentrations can be cross-correlated with 1080 concentrations determined in blood and urine samples from workers in the pest control industry to enhance the power of human risk assessment estimates and assist in defining acceptable and unacceptable levels of exposure.

Keywords: possums
Abstract: Vertebrate pesticides for wild animal control and pesticides in general are coming under steadily increasing scrutiny both nationally and internationally. Further research will need to be undertaken if these pesticides are to be continued to be used in New Zealand. For example, wildlife management agencies in
the United States (US) have spent many millions of dollars on upgrading the toxicology databases on old toxicants such as cyanide, 1080, and diphacenone to meet current US EPA data requirements. In New Zealand we can anticipate that the six toxicants currently registered for possum control will remain under similar scrutiny by the community, scientists, and pest managers. Issues such as safety, how they are used, humaneness, and how they are perceived in New Zealand and internationally by regulatory authorities and overseas markets, will determine their future. The advantages and disadvantages of existing toxicants are summarised, and research questions relating to their use are identified.


**Keywords:** 1080/heart/monofluoroacetate/plasma/rats/regulatory toxicology/reproductive effects/sodium monofluoroacetate/testes/treatment/urine/brain

**Abstract:** Groups of Sprague-Dawley rats received sodium monofluoroacetate (Compound 1080) at 0.025, 0.075, and 0.25 mg/kg by oral gavage once daily for 90 days and were then euthanised. The control and 0.25 mg/kg/day groups included additional rats of each sex that were treated for 90 days, then maintained without treatment for a further 56-day recovery period. Microscopic changes were restricted to the testes and the heart, and were seen only in males dosed with 1080 at 0.25 mg/kg/day and included severe hypospermia in the epididymides, severe degeneration of the seminiferous tubules of the testes, and cardiomyopathy. Sperm evaluation indicated severe decreases in all three sperm parameters evaluated (concentration, % motile, and % abnormal) at 0.25 mg/kg/day. There were no microscopic changes or 1080-related effects on sperm parameters at 0.025 and 0.075 mg/kg/day. The no observable effects level (NOEL) for rats administered 1080 via oral gavage for 90 days was 0.075 mg/kg/day. The lowest observable effects level (LOEL) dose was 0.25 mg/kg/day. After dosing with the LOEL dose of 0.25 mg/kg/day, mean concentrations of 1080 in rat plasma were 0.26 g/ml at 1 h and 0.076 g/ml at 12 h. Rat urine collected from the same animals contained 0.059 g/ml.


**Keywords:** acute toxicity/mammals


**Keywords:** non-target species/secondary poisoning/mammals/1080/scavenger/predators


**Keywords:** acute toxicity/mammals/non-target species/sodium monofluoroacetate


**Keywords:** product chemistry/acute toxicity/field efficacy/metabolism/mode of action/diagnosis/treatment/secondary poisoning/non-target species/pathology/1080

**Abstract:** The literature (from 1945 to 1977) relating to 1080 is reviewed.


**Keywords:** metabolism/persistence in animals/sodium monofluoroacetate/1080/rats/fluorine/blood/liver/kidney/gut/fluoride/monofluoroacetate/plasma/stomach/convulsions/symptoms

**Abstract:** Male rats were used to study the inorganic (ionic) and organic fluoride concentrations in plasma, liver, kidneys and stomach content after oral doses of 0, 2.2, 3.5, 4.0, 5.0 and 7.0 mg sodium monofluoroacetate (SMFA, Compound 1080)/ kg bodyweight. Tissue and plasma ionic fluoride concentrations were observed to be higher in all rats given SMFA as compared to rats in the control group. The observation suggests the in vivo defluorination of SMFA. Homogenates of liver obtained from SMFA-poisoned rats showed significant increases in ionic fluoride concentration during a 3-day storage period at 4 degrees C, with the total fluoride concentration (organic and inorganic) remaining constant. The average
percentages of distribution of SMFA (organic fluoride) in plasma, liver and kidneys were 7.05, 5.07 and 1.68 respectively. Plasma and tissue SMFA concentrations were generally lower than the corresponding stomach fluid SMFA concentrations for all dosage groups. Lethal concentration of SMFA in the liquid stomach content was in the range 84.9 - 189 ug/mL corresponding to the total (ionic and organic) fluoride concentrations in the range of 16.1 - 36 ug/mL.


Keywords: sodium monofluoroacetate/monofluoroacetate/1080/fluoride/plasma/liver/analysis

Abstract: Sodium monofluoroacetate (rodenticide) (SMFA) was quantitated in plasma and liver homogenates after total fluoride analysis using an O2 combustion method and fluoride selective electrode. The organic content of the samples were estimated by difference between total fluoride and inorganic fluoride. Recoveries (%+-SD) of SMFA in aqueous samples (dog and rat), plasma and (bovine and rat) liver homogenates were 99.1+- 2.3, 95.2+-3.3 and 95.3+-2.9, respectively. The within-run coefficient of variation in the 10.0-0.072 mg/ml (or mg/g) range for all samples was 4.7% or less. The method is suitable for quantitation of SMFA in biological materials and as a laboratory diagnostic aid in cases of acute SMFA intoxication


Keywords: fluoroacetamide/poisoning/monoacetin/lethal dose/toxicity/treatment

Abstract: Acetamide at 200 mg/kg given orally one hour after the administration of 20 mg/kg of fluoroacetic acid (FAA), failed to save a sheep. Another sheep given the two substances simultaneously also died. Repeated doses of 0.4 ml/kg of monoacetin were similarly unable to save a sheep from a lethal dose of FAA. Both acetamide and monacetin did nothing to reverse the occurrence of hyperglycaemia, a common finding in FAA poisoning. In toxicity trials 200 mg/kg of acetamide had no ill effect on one sheep, while in another sheep monoacetin caused depression and pain at the site of injection of the drug


Keywords: fluoroacetate


Keywords: diagnosis/pathology/treatment/fluoroacetate


Keywords: diagnosis/sodium fluoroacetate/fluoroacetate/fluoroacetamide/poisoning/non-target species

Abstract: Of the 143 cases investigated, guinea-pig kidney citrate levels were normal (less than 50 µg/g) in 63 cases. In the remaining 80 cases the citrate levels were elevated, ranging from 70 -1200 µg/g. The highest values were obtained after the injection of suspect baits.


Keywords: diagnosis/pathology/mammals/sodium fluoroacetate/fluoroacetate/strychnine/poisoning/dogs


Keywords: poisoning/dogs/sodium fluoroacetate/fluoroacetate/fluoroacetamide/strychnine

Abstract: The results of laboratory investigations are reported in a case of mass poisoning in which about 70 dogs died shortly after consuming purchased poultry meat. Clinical and pathological findings indicated either strychnine or sodium fluoroacetate (FAC) or fluoroacetamide (FAA) poisoning. Toxicological examination revealed poisoning by FAC or FAA. The toxicological and public health implications of the case are discussed
Keywords: non-target species/secondary poisoning/mammals/diagnosis/pathology/poisoning/dogs/sodium fluoroacetate/fluoroacetate/fluoroacetamide

Keywords: poisoning

Ref Type: Conference Proceeding
Keywords: sodium fluoroacetate/fluoroacetate/strychnine/poisoning/dogs/rodents/poisons/poison/diagnosis
Abstract: Sodium fluoroacetate and strychnine are by far the most common source of poisoning in Israel. The former is used as a rodenticide and the latter is used for destroying stray dogs as possible vectors of rabies. Dogs may be victims of poisoning either by eating the bait or poisoned rodents. Both poisons affect the central nervous system and at a certain stage of poisoning the clinical signs can be similar. The pathological lesions may be absent, or not characteristic or even identical (hemorrhages in the pancreas and thymus) and therefore in some cases the diagnosis without chemical-toxicological examinations can be difficult. Differential diagnostic methods and toxicological evaluation of these two poisonings are discussed

Keywords: mode of action

Keywords: non-target species/aquatic species/mammals/invertebrates/diagnosis/pathology/metabolism/mode of action/product chemistry/treatment/acute toxicity/target species/welfare/birds/secondary poisoning/bait degradation/persistence in animals/persistence in plants/persistence in soil/persistence in water/occurrence in nature/1080/rabbits/possums/deer/cats/lethal dose
Abstract: Sodium monofluoroacetate (CH2FCOONa), also known as 1080 first used in the United States to control gophers (Geomys spp) squirrels (Sciurus spp., Spermophilus spp), prairie dogs (Cynomys spp), other rodents (Rodentia) and coyotes (Canis latrans): domestic use is currently restricted to livestock protection collars on sheep and goats to selectively kill depredating coyotes. However, Australia, New Zealand, and some other nations continue to use 1080 to control rabbits, possums, deer, foxes, feral pigs and cats, wild dogs, wallabies, rodents and other mammals. The chemical is readily absorbed by ingestion or inhalation. At lethal doses, metabolic conversion of fluoroacetate to fluorocitrate results in the accumulation of citrate in the tissues and death within 24 hr from ventricular fibrillation of from respiratory failure; no antidote is available. At sublethal doses, the toxic effects of 1080 are reversible. Primary and secondary poisoning of nontarget vertebrates may accompany the use of 1080. Sensitive mammals including representative species of livestock, marsupials, felids, rodents, and canids died after a single dose of 13 mg/kg BW. High residues were measured in some poisoned target mammals, and this contributed to secondary poisoning of carnivores that ingested poisoned prey. Sublethal effects occurred in sensitive mammals at greater than 2.2 mg 1080/L in drinking water or at 0.8 ± 1.1 mg 1080/kg in the diet. Sensitive species of birds died after a single 1080 dose of 0.62.5 mg/kg BW, after daily doses of 0.5 mg/kg BW for 30 days after 47 mg/kg in diets for 5 days, or after 18 mg/L in drinking water for 5 days. Adverse effects occurred in birds at dietary loadings as low as 1013 mg 1080/kg ration. Amphibians and reptiles were more resistant to 1080 than birds and mammals. LD50 values were greater than 44 mg/kg BW in tested amphibians and greater than 54 mg/kg BW in tested reptiles, resistance 10 1080 was attributed to their reduced ability to convert fluoroacetate to fluorocitrate and their increased ability to detoxify fluoroacetate by defluorination. Mosquito larvae reportedly died at 0.0250.05 mg 1080/L, but fishes seemed unaffected at 13 mg/L;
however, data on 1080 in aquatic ecosystems are incomplete. Acute LD50 values in terrestrial insects ranged from 1.13.9 mg/kg BW to 130.0 mg/kg BW in larvae feeding on fluoroacetate-bearing vegetation. Residues of 1080 in exposed insects were usually low (>4mg 1080/kg fresh weight) or negligible and were usually eliminated completely within 6 days, suggesting low risk to insectivorous birds. Loss of 1080 from baits occurs primarily from microbial defluorination and secondarily from leaching by rainfall and consumption by insect larvae, leachates from 1080 baits are probably held in the upper soil layers. The use of 1080 seems warranted in the absence of suitable alternative control methods.

Keywords: field efficacy/ground control/1080

Keywords: poisoning/field efficacy

Keywords: humans/sodium fluoroacetate/treatment/analysis/diagnosis/poisoning

Keywords: NMR/analysis
Abstract: This investigation was carried out to evaluate 19F NMR as an anal. tool for the measurement of trifluoroacetic acid (TFA) and other fluorinated acids in the aquatic environment. A method based upon strong anionic exchange (SAX) chromatog. was also optimized for the concn. of the fluoro acids prior to NMR anal. Extn. of the analyte from the SAX column was carried out directly in the NMR solvent in the presence of the strong org. base, DBU. The method allowed the anal. of the acid without any prior cleanup steps being involved. Optimal NMR sensitivity based upon T1 relaxation times was investigated for seven fluorinated compds. in four different NMR solvents. The use of the relaxation agent chromium acetylacetonate, Cr(acac)3, within these solvent systems was also evaluated. Results show that the optimal NMR solvent differs for each fluorinated analyte. Cr(acac)3 was shown to have pronounced effects on the limits of detection of the analyte. Generally, the optimal sensitivity condition appears to be methanol-d4/2M DBU in the presence of 4 mg/mL of Cr(acac)3. The method was validated through spike and recovery for five fluoro acids from environmentally relevant waters. Results are presented for the anal. of TFA in Toronto rainwater, which ranged from <16 to 850 ng/L. The NMR results were confirmed by GC-MS selected-ion monitoring of the fluoroanilide deriv

Keywords: fluoroacetate/fluoride/sodium fluoroacetate
Abstract: *Dichapetalum cymosum* (Gifblaar) has a relatively high concentration of fluoroacetate. In order to find out whether Gifblaar metabolizes this poisonous compound fluoroacetate-2-14C was synthesized by fluorinating methylbromoacetate-2-14C with anhydrous potassium fluoride dissolved in acetamide. Optimal conditions for the reaction was found to consist of heating at 100°C for 30 minutes with a potassium fluoride plus acetamide (1:1) to methylbromoacetate ratio of 1.4:1. This led to a yield of 58% methylfluoroacetate-2-14C which was separated from the other reaction products by vacuum microdistillation and then quantitatively converted to sodium fluoroacetate.

Keywords: persistence in plants/metabolism/occurrence in nature/fluoroacetate
Abstract: It was shown that application of fluoroacetate to leaf disks of *Dichapetalum cymosum* (Gifblaar) did not lead to an inhibition of oxygen uptake or accumulation of citrate, in contrast to the 'control plant' *Parinarium capense* which lacks fluoroacetate. The addition of fluorcitrate did, however, inhibit the oxygen uptake of both plants and caused an accumulation of citrate. From the results it was deduced that
either citrate synthetase or acetate thiokinase from *D. cymosum* had different affinities for the fluoronated derivative and the 'normal' metabolite. The addition of fluoropyruvate to leaf discs caused a decrease in oxygen uptake and no change in the citrate concentration. From this it was deduced that fluoropyruvate inhibited pyruvate oxidase in both plants. It was concluded that the tolerance of *D. cymosum* to such high concentrations of fluorooacetate may be ascribed to the fact that the 'lethal synthesis' of fluorocitrate does not take place in the plant most probably because citrate synthetase has different affinities for fluoroacetylcoenzyme A and acetylcoenzyme A.


Keywords: Krebs cycle/fluoroacetate

Abstract: The evidence obtained by respiration studies in the presence of malonate and by tracer experiments indicates that *Dichapetalum cymosum* has an active Krebs cycle. The label pattern found among the amino acids after feeding pyruvate-1,14C, pyruvate-2,14C, pyruvate-3,14C, citrate 1,5,14C and acetate-2,14C indicates that the plant does contain an active Krebs cycle. The results indicate that the Krebs cycle may play a more important role in young leaves than in old leaves.


Keywords: fluoroacetate

Abstract: Fluoroacetate-2,14C and acetate-2,14C were fed to intact leaves of *D. cymosum* and *P. capensis*. In comparison with acetate, fluoroacetate was found to be relatively inactive metabolically, both in regard to the rate at which it was metabolized and the diversity of labelled compounds that originated from it. The results indicate that fluoroacetate is not initially primarily defluorinated to acetate since the labelled products arising from fluoroacetate differed qualitatively in important respects from those which arose from acetate. The present results are in line with the hypothesis that the relative insensitivity of *D. cymosum* to fluoroacetate should be ascribed to the fact that this plant does not readily convert fluoroacetate to fluorocitrate.


Keywords: metabolism/bacteria/fluoroacetate/toxicity


Keywords: rats/1080/efficacy

Abstract: Five poisons (ANTU, thallium sulfate, 1080, zinc phosphide and arsenic trioxide) gave good or moderately good kills when presented in standard corn bait to groups of wild brown rats in a large indoor pen; two (strychine sulfate and fortified red squill) gave poor kills. Of 3 poison selected as reasonably safe for field work in residential communities and exposed in various bait preparations to free-living populations in city-block test units, only one (ANTU) gave good kills.


Keywords: mice


Ref Type: Conference Proceeding

Keywords: fluoroacetate/bacteria/enzyme/degradation

Abstract: We have isolated from activated sewage sludge a pseudomonad which has the ability to grow on the toxic fluoroacetate as its sole carbon and energy source. From this organism we have purified to homogeneity a haloacid dehalogenase that converts fluoroacetate to glycolate. The enzyme has a monomer molecular weight of about 35 000 and contains no detectable metals or cofactors. The thermodynamically difficult reaction of breaking a methyl carbon-fluorine bond is catalyzed at reasonable rates (kcat= 20 sec-1,
Km=1 mM). The pH profiles of kcat and kcat/Km suggest a single catalytic base (pKa=7), presumably involved in deprotonating water. The enzymic reaction occurs via an SN2 mechanism as evidenced by 1) conversion of (S)-2-chloroproprionate to (R)-lactate, 2) conversion of only the (S)-isomer of racemic α-fluorophenylacetate to (R)-mandelate, and 3) slow tight-binding inhibition by vanadate. Vanadate is known to form pentacoordinate structures which apparently mimic the the SN2 transition site.


Abstract: Trifluoroacetic acid (TFA) is an atmospheric decomposition product of a new generation of refrigerants that will replace current ozone-depleting CFCs. The effect of TFA on microbial methanogenesis was assessed using environmental samples from four distinct methanogenic systems; the anaerobic digester, the rumen, freshwater sediments and marine sediments. TFA exhibited no toxicity, as evidenced by the rate of methanogenesis, at concentrations up to 10 mM. [1-14C]TFA was used to test for biodegradation (release of 14CO2) in methanogenic marine sediments. No significant release of 14CO2 was observed. As a control, the toxic monofluoroacetate (MFA) which is not an atmospheric degradation product of CFC replacements, was found to inhibit methanogenesis in freshwater and anaerobic digestor samples at or above concentrations of 0.1 mM. We conclude that TFA is inert in these methanogenic systems and there is no evident toxicity to either the methanogenic or fermentative populations.


Ref Type: Magazine Article
Keywords: occurrence in nature/biosynthesis/fluoroacetate


Ref Type: Pamphlet
Keywords: 1080


Ref Type: Report
Keywords: regulatory toxicology/lethal concentration/legislation/1080


Keywords: mode of action/pathology/treatment/brain/fluorocitrate/analysis

Abstract: Glia are thought to be important in brain extracellular fluid ion and pH regulation, but their role in brain stem sites that sense pH and stimulate breathing is unknown. Using a diffusion pipette, we administered the glial toxin, fluorocitrate (FC; 1 mM) into one such brain stem region, the retrotrapezoid nucleus (RTN) for 45-60 min. This dose and time period were chosen so that the effects of FC would be largely reversible. Within minutes, tissue pH decreased, and respiratory output increased. Both recovered almost completely after cessation of FC administration. The response to systemic CO2 stimulation was unaffected by FC treatment compared with that following control diffusion. Anatomic analysis showed, at the center of FC administration, some small (mean a diameter = 5.1 mu m) cells that stained for DEAD Red, a marker for altered cell membrane permeability, and some fragmented glia (glial fibrillary acidic protein immunohistochemistry). The average RTN tissue volume that contained such DEAD Red-positive cells was 271 nl, similar to 23% of the volume of one RTN region. Reversible disruption of glia in the RTN, a region known to contain central chemoreception, results in an acidic local pH and in stimulation of respiratory output.

Evans, B. and Soulsby, R. (1993). The impact of sodium monofluoroacetate (1080) rabbit poisoning operations on California quail populations. (Otago Fish and Game Council: Dunedin.)

Keywords: non-target species/rabbits/birds/1080/poisoning

Keywords: strychnine/sodium fluoroacetate/fluoroacetate/1080/baits/poisoning/serum

Abstract: Mongooses (Herpestes auropunctatus) have been introduced into most of the larger Caribbean islands, some notable exceptions being Dominica, Tobago and Montserrat. Rabies in Caribbean mongooses is present in Puerto Rico, Cuba, the Dominican Republic (and presumably Haiti), and Grenada. Bat rabies is known on Cuba, Grenada and Trinidad, although mongooses found on Trinidad are free of the disease. None of the other islands is known to have rabies, although it could be present in sequestered bat populations. All reported case numbers of mongoose rabies in the Caribbean are underestimates, and available information is at best incomplete and at times fragmentary. Nevertheless, data are presented from the 4 affected islands. Mongoose reduction campaigns have been undertaken on Cuba and Grenada. In Cuba strychnine sulfate inoculated into labelled eggs is used, whereas in Grenada sodium fluoroacetate (1080) has been used in boiled cowhide baits. Mongoose poisoning is unsatisfactory and ineffective in the long-term. Because many mongooses naturally exposed to rabies virus develop serum neutralizing antibodies and are considered to be immunized possibly for life, vaccination in the wild has been under consideration since the mid-1970s. Early attempts to produce a pill coated with ERA vaccine for enteric absorption in mongooses were not very successful, but new modified vaccines and recombinant techniques hold considerable promise.


Keywords: 1080/acute toxicity/aquatic species/dermal/non-target species/product chemistry/regulatory toxicology

Abstract: In the U.S., pesticides are registered by the Environmental Protection Agency (EPA) under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). This act was amended in 1998 to require that each pesticide registered before 1984 be registered within a 9 year period. The registration process has increased data requirements and costs and has caused cancellation of many minor use pesticides that do not generate sufficient profit to justify data generation costs.

In 1998, the U.S. Environmental Protection Agency (EPA) notified registrants of its intent to cancel the registration for the only Compound 1080 technical product (held by Tull Chemical Co) and all Compound 1080 rodenticide use registrations. These notifications occurred because the registrants had not submitted required data to maintain the registrations. All rodenticide uses were subsequently cancelled in 1990. This resulted in the loss of a chemical critical to managing vertebrate pests. However, EPA allowed the Animal and Plant Health Inspection Service (APHIS) to maintain a technical Compound 1080 registration for use only in the APHIS Livestock Protection Collar (LPC). APHIS is currently providing data to reregister the COMPOUND 1080 technical product. Prior to 1992, six product chemistry and three toxicology studies (acute dermal rabbit, eye irritation rabbit, and skin irritation rabbit) were submitted to the EPA, along with some non-target hazard studies. In a Data Call-In issued on September 30, 1992, EPA required only a minimal amount of additional data for the APHIS technical product. To date, APHIS has supplied 11 studies to the EPA under the 1993 Data Call-In: eight product chemistry studies, bluegill sunfish and rainbow trout toxicity studies, and an aquatic invertebrate toxicity study. Avian dietary toxicity studies on bobwhite quail and mallard duck are scheduled to be completed in April 1994.


Keywords: liver/inhibition/biochemistry/fluorocitrate

Abstract: The fluorocompounds generally increased the dephosphorylation of adenine and pyridine nucleotides. A definite quantitative and qualitative difference, however, existed with respect to the pattern of breakdown produced by the fluorocompounds from those resulting throught he action of DNP.

Keywords: liver/inhibition/biochemistry/fluoroacetate/fluorocitrate

Abstract: The effect of fluoroinhibitors on the oxidative phosphorylation of rat liver mitochondria has been studied. Fluoroacetate per se had no effect, while synthetic fluorocitrate and fluoropyruvate directly interfered with phosphorylation.


Keywords: regulatory toxicology

Abstract: Vertebrate pest control has made substantial progress, worldwide, in the past century - moving from what were uncoordinated private efforts to trap, shoot, or poison animal pests to organized IPM approaches employing a variety of pest control tactics. Some of the tools of the past are still critically important in these programs, but as new pest problems and new constraints arise, these tools are often found wanting. This paper briefly examines developments in vertebrate pest control in the past 100 years and summarizes some of the current lines of research that will carry us into the future.


Keywords: biochemistry/enzyme/fluorocitrate


Keywords: enzyme/fluorocitrate/inhibition/mode of action

Abstract: As an approach to the study of controlling mechanisms of enzyme activity in complex systems, we are in the process of determining the influence of relatively minor chemical alterations (e.g. exchange of one or more hydrogen by fluorine atoms) in well known enzyme substrate molecules on their reactivity with purified enzymes. The immediate purpose of these experiments is to obtain specific inhibitors for certain key enzymes, which then are further studied in complex biochemical systems with the aid of these specific inhibitors (1-5). In the course of this work an unexpected observation was made: the enzymatic condensation of acetyl coenzyme A with B-monofluoro-oxaloacetate yielded in isomer of monofluorocitrate which did not inhibit aconitase (4). It seemed likely that this enzymatic reaction produced only of the four isomers of monofluorocitrate. The elucidation of stereochemical and enzyme inhibitory relationships of the remaining three isomers to this enzymatically synthesized fluorocitrate has been the subject of further experiments. It will be shown in this paper that the aconitase-inhibitory effect of synthetic monofluorocitrate is actually due to one isomer, synthesized enzymatically from fluoroacetyl coenzyme A and oxaloacetate. The separation of diastereoisomers of synthetic monofluorocitrate acid and the comparison of chemical and enzyme-inhibitory properties of these with enzymatically formed isomers considerably diminished uncertainties regarding the true structure and mode of action of the inhibitory species of monofluorocitric acid.


Ref Type: Report

Keywords: 1080/toxicity/humans/poisoning/occupational exposure/heart

Abstract: The safety of 1080 (sodium monofluoroacetate) is an important issue in New Zealand because the chemical is biologically active in a wide range of animal species, and is widely used as a pest control agent. Each year the amount of 1080 applied in New Zealand is estimated to exceed its total use in all other countries combined. To date, knowledge of 1080 toxicity in humans largely relies on case reports from acute poisonings and extrapolation from animal experiments. If humans in New Zealand are exposed to 1080, this is most likely to occur amongst workers who are manufacturing and distributing 1080 products, and health effects will should also be first evident in this group.

This report examines the availability, completeness, access to and quality of information needed to conduct a study of chemical exposures and the health of workers in the pest control industry.
We have found that the population at risk of occupational exposure to 1080 can be readily defined from lists of licence-holders. A full historical cohort based on all 1080 licensees would have enough power to detect an increased risk of heart disease, provided a high level of follow-up was achieved. However, we advise against attempting to carry out such a study. In our view, the historical data are not adequate to develop a robust measure of personal exposures to 1080. Moreover, there is insufficient information in the historical employment records to confidently link license holders with records of subsequent hospitalisation and mortality. Employment records since 1989 are likely to be more complete but the fragmentation of the workforce in recent years would increase the complexity of any study and add a degree of variability to any measures based on employment histories.

A cross-sectional study of the current workforce would be achievable provided all (or most) contractors could be identified and agreed to participate. However the demographic profile of this occupational group suggests that recruitment to and retention in such a study would be challenging. Follow-up of a cross-sectional study of the current workforce could be achieved. Such a study would provide the most robust exposure measurements and enable assessment of potential confounders. A cross-sectional survey would also provide a sampling frame for further more intensive health assessment studies with greater sensitivity to detect impaired function. Finally, a cross-sectional study of the current workforce, or the could form the baseline data for a prospective cohort study.

We recommend that the Animal Health Board:

• Does not carry out a retrospective cohort study
• But does investigate further the possibility of conducting a cross-sectional survey.

If a cross-sectional study is carried out, we recommend it is implemented in such a way that

• it can be converted to a prospective cohort study at a later date
• it may be used as a sampling frame for more intensive health studies of workers with different exposure profiles

Keywords: fluoroacetate/antidote/sodium fluoroacetate/citrate/metabolism/enzyme/treatment/aconitase/fluorocitrate/1,3-difluoro-2-propanol/4-methylpyrazole

Abstract: Administration to rats of sodium fluoroacetate (1.5 mg kg-1 body wt) resulted in a three fold increase in kidney citrate levels within 1 h of dosing. Administration to rats of 1,3-difluoro-2-propanol (DFP) (100 mg kg-1 body wt), the major ingredient of the pesticide gliflor, also resulted in citrate accumulation in the kidney but only after a 2 h lag phase. Inhibition of aconitate hydratase activity and elevation of kidney citrate levels in the DFP-treated animals was a consequence of the metabolism of DFP to (-)erythrofluorocitrate. A standard curve relating aconitate hydratase inhibition to concentration of fluorocitrate was employed to determine the pattern of kidney fluorocitrate accumulation for each treatment. Kidney fluorocitrate accumulation patterns for both sodium fluoroacetate and DFP-treated animals were found to correspond closely with their respective citrate accumulation profiles. Intraperitoneal injection of 4-methylpyrazole (90 mg kg-1 body wt), 2 h prior to sodium fluoroacetate administration had no effect on the accumulation of either kidney citrate or fluorocitrate. In contrast, kidney citrate accumulation was significantly reduced when 4-methylpyrazole was administered to rats 2 h prior to DFP. Kidney fluorocitrate levels were also found to be significantly reduced in these animals and they displayed no signs of intoxication. The antidotal effects of 4-methylpyrazole were found to be due to its inhibition of an NAD+ - dependent alcohol dehydrogenase involved in the conversion of DFP to difluoroacetone, an intermediate in the pathway of (-)erythroidfluorocitrate synthesis.

Keywords: 1,3-difluoro-2-propanol/4-methylpyrazole/antidote/rats/citrate/kidney/aconitate/flouride/defluorination/poisoning/fluoroacetate/1080/f
fluoroacetamide

Abstract: Administration to rats of 1,3-difluoro-2-propanol (100 mg kg⁻¹ body weight), the major ingredient of the pesticide gliftor, resulted in accumulation of citrate in the kidney after a 3 hour lag phase. 1,3-Difluoro-2-propanol was found to be metabolized to 1,3-difluoroacetone and ultimately to the aconitate hydratase inhibitor (-) erythrofluorocitrate and free fluoride. The conversion of 1,3-difluoro-2-propanol to 1,3-difluoroacetone was found to be catalyzed by an NAD(+) dependent alcohol dehydrogenase, while the defluorination was attributed to microsomal monooxygenase activity induced by phenobarbitone and inhibited by piperonyl butoxide. 4-Methylpyrazole was found to inhibit both of these processes in vitro and when administered (90 mg kg⁻¹ body weight) to rats, 2 hours prior to 1,3-difluoro-2-propanol, eliminated signs of poisoning, prevented (-) erythrofluorocitrate synthesis, and markedly decreased citrate and fluoride accumulation in vivo. 4-Methylpyrazole also appeared to diminish (-) erythrofluorocitrate synthesis from fluoroacetate in vivo, and this was attributed to its capacity to inhibit malate dehydrogenase activity. The antitodal potential of 4-methylpyrazole and the potential for 1,3-difluoro-2-propanol to replace fluoroacetate (compound 1080) as a vertebrate pesticide is discussed.

Keywords: acute toxicity/fluoroacetate/poisoning/rats/rodents/temperature/lethal dose

Ref Type: Report
Keywords: 1080/dogs/poison/poisons/rabbits/strychnine
Abstract: Opossum control for animal health reasons cannot be effectively carried out without the use of 1080. It is an impossible task to cover effectively with other poisons large tracts of indigenous forest, gorse and scrub, which are usually ideal opossum habitat, to obtain the level required for animal health purposes. Furthermore, the topography is such that manpower alone cannot cover the ground successfully and thoroughly. Even where possible the cost of using manpower alone with the less efficient methods would at least double or treble the cost with a lot lower percentage kill which in the long-term would force continuing operations.

Rabbit control without 1080, particularly in the high country of both islands, would force the use of less effective poisons and methods. It is impossible to control rabbits in the rough inaccessible areas without the use of an efficient poison.

If the agricultural pests destruction movement was forced once again to resort to the use of arsenic and strychnine the cost would increase.

Rabbit control without poison would be impossible in rough areas. While it could be possible to control some areas of New Zealand with the less effective methods (e.g. dogs, traps, night shooting) the cost would double or treble what it is today. This would be brought about by the immediate need for large increases in staff and equipment.

1080 is the most efficient poison for the control of animal pests that affect agricultural production. Unless a suitable replacement is made available before the use of 1080 is curtailed, the pest destruction movement cannot guarantee the protection it now offers.

Keywords: fluorocitrate/metabolism/dogs/citrate/inhibition/kidney
Abstract: Acid-base status is considered the major factor controlling renal NH₄⁺ production from glutamine, with maximal values found in chronic acidosis. However, metabolic inhibitors have been shown to increase NH₄⁺ production without acid-base change; the mechanism for this increase is unclear. Fluorocitrate was administered to dogs with chronic metabolic alkalosis. Following fluorocitrate total renal NH₄⁺ production rose from 32 ± 5 to 104 ± 15 µmol/(min . 100 mL glomerular filtration rate (GFR)) (p<0.01) and glutamine extraction rose from 26 ± 8 to 65 ± 8 µmol/(min . 100 mL GFR) (p<0.01). These values approximate maximal values found in chronic acidosis. Lactate utilization fell from 165 ± 19 to 99 ± 7 µmol/(min . 100 mL GFR) following fluorocitrate (p<0.01). Citrate extraction fell to zero and alanine production rose from 27 ± 4 to 46 ± 7NH₄⁺ µmol/(min . 100 mL GFR) (p<0.01). Oxygen consumption
remained unchanged following fluorocitrate, $584 \pm 29$ vs. $549 \pm 29$ $\mu$mol/(min . 100 mL GFR). These results demonstrate that in the presence of metabolic inhibition in the kidney, ATP production remains constant. This is achieved by increased utilization of one substrate, glutamine, when the ATP production from other substrates is reduced. Thus the necessity to maintain constant ATP production appears to modulate renal $\text{NH}_4^+$ production.

Ref Type: Report
Keywords: 1080/baits/carrot/humans/occupational exposure
Abstract:
• The workers involved in the two aerial cereal bait operations and one ground paste bait operation that were monitored appeared protected from above-BEI exposure to 1080.
• Some workers monitored during the manufacture of 1080 baits, and during three aerial carrot bait operations, had instances of above-BEI exposure to 1080.
• The exact source(s) or route(s) of exposure to 1080 during the factory manufacture of 1080 baits or carrot 1080 bait distribution processes cannot be identified from these results.
• Continuation of worker monitoring against the BEI provides a means to ensure that 1080 handling practices and protective equipment minimise worker exposure to acceptable levels.

Ref Type: Report
Keywords: 1080/analysis/baits/brodifacoum/cyanide/humans/occupational exposure/urine
Abstract:
• Present procedures appear adequate to protect most workers from exposure to 1080 exceeding the BEI, on most occasions. However, ACP should confirm the identity of the workers against the numbered samples submitted to Landcare Research for analysis from April 2002, as some of these were above the BEI.
• Two factory workers had exposure to 1080 over the limit set by the BEI, which occurred during successive monitoring occasions, and in successive urine samples taken over a number of days each time. Protective procedures and equipment used by these individuals in 1080-handling tasks should be reviewed.
• The comparatively high concentrations measured in samples from one worker in 2001 and 2002 appear to be the result of contamination during sampling. Follow-up monitoring of this individual is recommended.
• The exact point(s) or route(s) of exposure to 1080 during the factory manufacture of 1080 baits cannot be identified from these results.
• No conclusions can be made regarding effects on the health of workers who had exposure levels over the BEI, from these results. The BEI is a measure of acceptable exposure to 1080 only.

Recommendations
• Monitoring of urine for concentrations of 1080 indicative of exposure should be continued in the long term for ACP factory workers. Special emphasis should be given to the two workers who have been exposed to 1080, i.e. more frequent monitoring until they return samples consistently below the BEI following all procedures involving the handling of 1080.
• ACP should consult Occupational Safety and Health (OSH) for advice regarding the implementation of an appropriate schedule for routine monitoring of workers for exposure to 1080, and appropriate responses when individual workers return samples that exceed the BEI.
• All sample collection carried out on-site at the factories must adhere to strict clean-up protocols to avoid the risk of sample contamination. This should include removal of all protective clothing and showering before providing a sample into an appropriate clean container. Samples should be given in an area well away from the areas of the factory where 1080 is stored and handled.
• Sample collection in future should be carried out within a 2-hour ‘end of shift’ period to enable a
strict comparison with the BEI.

Based on these results, consideration should be given to monitoring of pest control industry workers involved in production and/or use of other vertebrate pesticides, e.g. brodifacoum and cyanide.

Ref Type: Magazine Article
Keywords: persistence in water/residues/aerial control/analysis
Abstract: Debate about the risks and benefits of using the vertebrate pesticide 1080 to control possums in New Zealand continues. In particular, the potential of aerially applied 1080 carrot or cereal pellet baits to contaminate water is a concern, especially the risk of 1080 contaminating water catchments used for human drinking supplies. The Pest Control and Wildlife Toxicology team at Landcare Research analyses water samples collected after aerial 1080 operations to check for any contamination by the pesticide. The Landcare Research Toxicology Laboratory maintains a database of water samples they have analysed, which includes the results from over 1550 water samples collected from streams on days immediately following 1080 baiting operations in an area. So far, water samples taken following 210 possum control operations, conducted in different areas throughout New Zealand during 1990 to 2003, have been analysed for 1080 concentrations. It is important to note that these samples have been taken predominantly from within or adjacent to baited areas, where there would be the greatest chance of detecting contamination were it to occur.

Residues of 1080 can be detected in water at concentrations as low as 0.1 part per billion (ppb), which is equivalent to 0.1 microgram of 1080 per litre of water. Of the samples analysed to date, most (96.3%) contained no detectable residues of 1080. Residues were found in 3.7% (58) of all samples, but in most of these (51) the 1080 measured was less than 1 ppb (Figure). Where positive results were found in water samples, these have been mostly in small streams and associated with the observation of bait in the water. Of the 1550 samples, 107 were taken from reticulated town water supplies (drinking water), but none of these contained detectable 1080 residues.

In the Drinking-Water Standards for New Zealand, issued in 2000 by the Ministry of Health, the Provisional Maximum Acceptable Value (PMAV) for 1080 in water is 3.5 ppb. The PMAV value is one that, on the basis of present knowledge, is not considered to cause any significant risk to the health of the consumer over a lifetime of consumption of the water. However, the Ministry of Health also recommends that water taken from catchments sown with 1080 baits should not be used for human supply until tests show that the concentration of 1080 is below 2 ppb. The figure of 2 ppb is an approximation of 50% of the PMAV value, and is applied to testing water for 1080 as a conservative measure.

In the few instances where the 1080 concentration in water samples exceeded the 2 ppb threshold, this was limited to a single sample taken at a particular site. For example, a water sample collected 2 hours after an aerial operation at Te Kopia Scenic Reserve, Rotorua, in 1999 was 4 ppb, and a further sample taken from the same location 24 hours later was 1 ppb. These individual samples did not represent any hazard to human drinking water supplies.

These ongoing results suggest that significant or prolonged contamination of waterways after 1080 baiting operations is unlikely if due care is taken by pest control operators in planning and running 1080 baiting operations. Regulations stipulate that poison baits must not be laid in any catchment that provides water for human consumption, except where approved by local authorities such as the Medical Officer of Health. Continued water sampling and testing following 1080 baiting operations are prudent actions to ensure minimal risk to the public of contaminated water, and more information about testing water for 1080 can be found at http://www.landcareresearch.co.nz/services/laboratories/toxlab/protocol_water.asp.

Ref Type: Report
Keywords: occupational exposure/1080/carrot/baits/dermal/urine/humans/aerial control
Abstract: Conclusions
As indicated by previous monitoring efforts, workers with duties preparing toxic carrot baits in the field appear to be those with the highest potential for unacceptable exposure to 1080.

Review and modification of personal protective equipment used by workers in aerial carrot-baiting operations appeared to reduce the incidence of unacceptable (above-BEI) exposure, however individual worker practice is likely to have contributed to continuing detectable exposure to 1080.

A formal industry standard operating procedure for carrot baiting operations, including specifications for protective equipment and compliance monitoring would provide a consistent standard from which to determine whether the exposure of workers is being minimised in future.

Recommendations

- Establishment of an industry standard operating procedure for aerial carrot baiting operations should be considered in conjunction with worker training in the use of personal protective equipment, including correct procedures for selection, fit testing, cleaning/maintenance and storage.
- Workers handling 1080 cereal pellet baits should further minimise their risk of dermal exposure by wearing gloves and washing frequently with clean water.
- Worker compliance in the use of protective equipment when preparing or handling toxic baits or solutions should be obligatory during future operations. This includes proper use of face shields, masks and gloves at all times, and regular washing-off of dye stains from bare skin using clean water.
- In conjunction with this, regular worker monitoring during aerial carrot-baiting operations should continue, in order to ensure that 1080 handling practices and protective equipment continue to minimise worker exposure risk.
- Where individual workers show detectable concentrations of 1080 in urine samples at the end of an operation, clearance should be confirmed by monitoring for up to five days afterwards.
- When interpreting the results of worker monitoring against the BEI, employers should consult Occupational Safety and Health, New Zealand, for advice on appropriate actions to minimise worker exposure.


Ref Type: Report
Keywords: regulatory toxicology/sodium fluoroacetate/fluoroacetate/1080/risk assessment/acute toxicity/toxicity/inhalation/testes/target organ/degradation/fish/invertebrates/algae

Abstract: There has been ongoing research to address concerns about the potential risks of using 1080, resulting in a considerable literature and knowledge base about the compound. In particular, the last decade has seen an increasing focus on regulatory toxicology of 1080 and on field-based studies investigating the long-term effects of 1080 on non-target populations in New Zealand.

- 1080 has high acute toxicity through the oral and inhalation routes.
- 1080 is mildly irritating to the skin, and irritating to the eye.
- 1080 is not mutagenic and is therefore not anticipated to be a carcinogen.
- 1080 is a developmental toxicant, and can have teratogenic effects, effects on growth, and effects on reproductive tissue (testes) at particular doses and frequencies of exposure.
- Heart and testes are especially recognised as target organs of 1080, although effects on other organs have been described.
- 1080 is degraded in natural aquatic environments, due to both dilution and/or dispersion and biotic degradation. Acute toxicity to fish and aquatic invertebrates appears to be relatively low, although some algae and aquatic plants are sensitive to 1080.

Keywords: bait degradation/1080/dogs

Keywords: efficacy/1080/poison/sodium fluoroacetate/fluoroacetate/dogs/treatment

Abstract: The efficacy of aerial baiting with 1080 poison (sodium fluoroacetate) for the control of wild dogs (Canis familiaris familiaris and C. familiaris dingo) in the temperate rangelands of north-eastern New South Wales was studied. In each year from 1991 to 1993, 2 indices of the abundance of dogs, one a raw count of sets of footprints per km of transect (SF) and the other an ln-transformed frequency corrected for sightability of signs (CI), were used to quantify the changes in abundance caused by aerial baiting. Abundance of dogs at a nil-treatment site was estimated concurrently. The SF index found the 1991 baiting to be efficacious. Both measures of abundance showed baiting to be efficacious in 1992 and 1993. Reductions of 66.3-84.5% in the abundance of dogs at the treatment site were found for the CI measure. The SF measure displayed abundance changes of 76.1-91.1%. The indices of abundance measured prior to the annual baiting in 1992 and 1993 were similar, indicating that populations returned to their initial abundance within 1 year.


Keywords: fluoroacetate/bacteria/enzyme/GMO

Abstract: Recent advances in the biotechnology of ruminal bacteria have been made in the characterization of enzymes involved in plant cell wall digestion, the exploration of mechanisms of gene transfer in ruminal bacteria, and the development of vectors. These studies have culminated in the introduction and expression of heterologous glucanase and xylanase genes and a fluoroacetate dehalogenase gene in ruminal bacteria. These recent studies show the strategy of gene and vector construction necessary for the production of genetically engineered bacteria for introduction into ruminants. Molecular research on proteolytic turnover of protein in the rumen is in its infancy, but a novel protein high in essential amino acids designed for intracellular expression in nominal organisms provides an interesting approach for improving the amino acid profile of ruminal organisms.


Keywords: treatment/mode of action/acute toxicity/pathology/humans


Keywords: persistence in water/1080/possums/fluoride

Abstract: Public concerns about a possum control operation on Mount Taranaki/Egmont in 1993 and 1994 included issues reating to potential effects of the use of 1080 poison on water quality and water usage; in particular domestic water supplies from catchment draining areas within the aerial poison application zones. A comprehensive water monitoring program was undertaken in response to these concerns. Natural surface waters within and outside the operational zones, major water supplies (raw and treated) and groundwaters were sampled and analyses for residues of 1080 and fluoride were performed. Sampling commenced in advance of the first aerial operation of 1080 and extended throughout the operational periods with two sites sampled more intensively to monitor any immediate impacts of the initial aerial poisoning operations within the National Park. The result showed no measurable impact of the possum control operation on 1080 and fluoride concentrations measured in any of the natural waters draining both the National Park and the buffer zones within the operational poisoning area or in the raw and treated domestic supplies, or groundwaters monitored. The results of this intensive monitoring may provide guidelines for the assessment and establishment of appropriate monitoring of any future possum control operations of this nature.


Keywords: field efficacy/possums/ground control/1080/lethal dose

Abstract: A method is presented for quantitatively assessing the likely effectiveness of specific bait size and 1080 concentration for controlling brushtail possums with a known weight distribution. Data from aerial
1080 operations for the control of brushtail possums in New Zealand show that estimates of the bait size and toxic concentration required derived from the mean parameters [pest weight, bait size, and lethal dose (LD95)] will not be accurate. This inaccuracy is most likely to lead to an underestimate of the amount of toxin presented to each animal, so that many operations currently run the risk of sub-lethally dosing possums and thereby possibly inducing some degree of poison shyness. On the basis of more accurate quantitative assessments of bait effectiveness we recommend that the 1080 concentration be increased to 0.15% and that baits less than 5 g be excluded to ensure that when mean possum weights are less than 3 kg more than 95% of possums are lethally dosed by a single bait.

Ref Type: Magazine Article
Keywords: deer/1080/non-target species
Abstract: Editorials and letters in recent issues of hunting magazines express concerns about the effects of aerial 1080 (sodium monofluoroacetate) poisoning operations for possum control on deer populations, other non target species and the environment. This article summarises the most recent available information on non-target kills and environmental effects of 1080. It is not usual in this magazine to cite references, but we have provided these details here for those readers who wish to examine the evidence more closely.

Fraser, K. W. and Sweetapple, P. J. A comparison of the effectiveness of two toxic loadings (0.08% and 0.15%) for control of deer during aerial 1080 poisoning using carrot baits. [LC9900/084], -22. 2000. Lincoln, Manaaki Whenua - Landcare Research. Landcare Research contract report.
Ref Type: Report
Keywords: field efficacy/aerial control/deer/1080/treatment/possums
Abstract: Objectives: To determine whether higher deer kills can be achieved by using a toxic loading of 0.15% 1080 rather than 0.08% 1080 in a routine aerial poisoning operation using carrot baits, by comparing the reductions in red deer density achieved with the two treatments on Mt Titiraupenga in winter 1997. Conclusions: the reductions in red deer densities in our two treatment blocks (92.8% and 91.6%) were considerably higher than those recorded in similar studies (between c.30% and c.65%). We have been unable to demonstrate whether the higher toxic loading (0.15% 1080) was more effective in killing deer. Several other factors including the variation in pre-control densities of both red deer and possums between the two treatment blocks, the overall considerably lower possum densities throughout the study area, and the difference in predominant aspect (and possibly other habitat-related variables) are likely to have affected our comparison. Our post-control pellet-group density estimates suggest that residual red deer densities are greater than or equal to 0.3 deer/km² in each of the blocks. In the absence of recreational hunting and immigration from adjacent (controlled) areas, red deer numbers will take about 10 years to recover to their pre-control levels in each of the treatment blocks. Despite the considerable differences in pre-control possum densities and the present kills between two treatment blocks, residual possum numbers are now very low throughout the control area. It appears that the higher toxic loading did not adversely affect the possum kill in the 0.15% 1080 treatment block, although this result should be tested further under conditions where both treatment blocks used for the comparison are more similar in terms of possum densities, aspect, and other potential variables than was the case in the present study. Possum populations could take up to 10-13 years to recover to pre-control levels in the 0.15% 1080 block but are likely to recover quicker in the 0.08% block because of higher post-control densities.

Ref Type: Report
Keywords: legislation/wildlife
Abstract: Issues involving introduced wildlife and their management are often controversial subjects, reflecting the diverse range of views held, particularly on environmental issues. Previously there has been little original research on public perceptions in relation to introduced wild animals and their management in New Zealand. Since public attitudes ultimately play some part in determining official policy and can affect the success of some conservation and management programmes, there is a need for better understanding of how people perceive introduced wildlife and related issues. Indeed, recent changes in environmental legislation make specific provision for some public consultation in areas such as national and regional pest
management strategies and the application of pesticides.

One of the challenges facing the agencies responsible both for the conservation of New Zealand's native flora and fauna and for the control of introduced wild animals (either for conservation or economic reasons) is to reflect public sentiments in their policies and practices. I surveyed public attitudes on introduced wildlife and related issues in 1994 to document the range of views held, quantify the levels of support for various issues, and to provide a baseline for more detailed research. The results presented here illustrate the divergence of views that exist within contemporary New Zealand society.


Keywords: baits/lethal dose/reptiles/pindone

Abstract: The attractiveness of two vertebrate pest-control baits (non-toxic RS5 and pindone-impregnated AgTech) to captive skinks (*Oligosoma maccanni*) was assessed with timelapse video and feeding trials in New Zealand. *O. maccanni* were attracted to both bait types. When dry, pindone baits were more palatable than RS5 baits. However, when wet the palatability of both baits increased and was similar. Bait size had no significant effect on palatability. Lizards ate an average of 0.01 g of RS5 baits or 0.02 g of AgTech Pindone bait, over two days. On the basis of published susceptibility data, it is unlikely that this level of consumption would expose skinks to lethal doses of these vertebrate pest toxins. Potential sublethal effects of such doses require further study.


Keywords: diagnosis/welfare/secondary poisoning/poisoning/1080/livestock/dogs/heart/mammals/symptoms/time to death

Abstract: From this experiment one may say that "1080" poisoning: 1. seems to exert its action primarily on the heart 2. it is a slow-acting poison as far as solipeds are concerned 3. it is a very toxic chemical as indicated by the small amount that proved lethal - the lethal dose was 5 mg per kilogram bodyweight. 4. heart muscle from poisoned animals transmits the poison to other animals that may consume it. Apparently the poison has an affinity for cardiac tissue 5. there was practically no struggling or violence showed by any of the animals used in the test


Keywords: NMR/1080

Abstract: Fluorine-19 nuclear magnetic resonance (19F NMR) spectroscopic measurement were used to determine the chemical nature and amounts of organofluorine in dosed meat baits. Earlier work implied that sodium monofluoroacetate (compound 1080) in meat baits was broken down into other organofluorine compounds such as fluorocitrate. No chemical evidence was found for such compounds. Only monofluoroacetate was detected in the prepared 1080 bait samples. Once the baits have aged, aqueous extraction fails to recover all the added 1080. Analysis using 19F NMR confirmed that the 1080 present in the aqueous extracts of the bait is recovered by Kramer's liquid chromatography method. It was shown here that the aqueous extracts do not recover all the 1080 in the meat bait.


Ref Type: Unpublished Work

Keywords: birds/1080/sodium monofluoroacetate/baits/lethal dose/poisoning/temperature/sublethal effects/mammals/symptoms/resistance/secondary poisoning/rodents

Abstract: A study of the effects of Compound 1080, sodium monofluoroacetate (SMFA) was conducted with captive Turkey Vultures (*Cathartes aura*). Fifteen birds were dosed individually with SMFA in meat baits at levels of 20-100mg/kg body wt. The behavioural responses of dosed birds were monitored with video recordings and dose responses to sublethal and lethal doses were obtained. The sensitivity of Turkey Vultures to SMFA poisoning was temperature dependent over the range of 7.6-28.6°C. Severe sublethal effects including ataxia (inability to perform voluntary muscular movements) and intention tremors of the head were observed at 75% of the lethal dose at both high and low temperatures. The debilitating effects of high sublethal doses would probably result in death of dosed birds in the wild. The lethal dose at 8-9°C
was 100mg/kg. The high lethal dose levels indicate that Turkey Vultures are more resistant to the effects of SMFA than most species of mammals and birds. Emesis (vomiting) within 2-5 hr of exposure was a characteristic symptom of poisoned vultures, but the amount of SMFA regurgitated by dosed birds was not determined. Increasing clinical symptoms were observed with increasing doses of SMFA at each temperature studied. Clinical symptoms at 50% of the lethal dose included lethargy, wing and head droop, and difficulty of arousal from sleep. The onset of intention tremors occurred 40-65 hr after a sublethal dose and tremors persisted 3 days at low doses and persisted undiminished for 11 days (until euthanasia) in severe cases. The high resistance of Turkey Vultures to SMFA indicates that birds are probably at low risk of lethal doses from secondary poisoning after consuming poisoned rodents, but the extent of permanence of the nervous system damage exemplified by intention tremors following sublethal doses is unknown.

Abstract: It was found that fluoride, mono-iodoacetate and fluoroacetate inhibited sperm motility, while 2,4-dinitrophenol and arsenite stimulated initial vigorous motility which was not, however, maintained. With 10-4 and 10-3M cyanide, initial motility was good and well maintained

Keywords: diagnosis/treatment/mammals/non-target species/sodium fluoroacetate
Abstract: Sodium fluoroacetate, commonly called "1080" has obtained wide-spread use since the war as a potent rodenticide. Because of its varied pharmacologic properties and biochemical interest, it has become increasingly important in laboratory studies. Experimental poisoning in laboratory animals was studied during and since the war by many workers, but no previous report of a case of human poisoning is known to us.
A case of poisoning with what was probably relatively pure sodium fluoroacetate in a 2 year old Negor child is reported. Cardiac and central nervous system symptoms predominates, as in experimental animals, but the child recovered completely without sequelae. This clinical picture presented by this case is briefly compared with that seen in experimental poisoning, and the literature on fluoroacetate poisoning is briefly reviewed.

Keywords: metabolism/citrate/biochemistry/fluoroacetate/rats
Abstract: Injections into rats of some fluoro compounds followed by [2-14C]acetate led to reduction in the 14CO2 expired as follows; fluoroacetate 40%, fluorocitrate 30% and fluoropyruvate 50%. The carcasses of the poisoned animals contained more radioactivity than the other tissues examined. In male rats, whereas generally fluoroacetate induced no rise in citric acid content of the liver, fluorocitrate injections caused an immediate rise in the citric acid level.

Keywords: inhibition/fluoroacetate/liver/citrate/poisoning/fluorocitrate/rats/metabolism
Abstract: In presence of fumarate, rat liver mitochondria responds with citrate accumulation to fluoroacetate poisoning. This response is not sex-dependent. There is a time lag to inhibitory effect of fluoro compounds on respiration. Rates of respiration of fluoroacetate and control system of starved and fed animals were in close agreement. Testosterone did not abolish the effect of fluoroacetate on fluorocitrate accumulation, whereas progesterone significantly reversed it only on liver mitochondria of male rats. Progesterone, like DNP, when in combination with fluoroacetate, inhibited respiration. In normal nutritional states, irradiation does not significantly increase citrate accumulation in the liver mitochondria of male rats.

Keywords: metabolism/persistence in animals/fluoroacetate/excretion/kidney/liver/fluorocitrate/heart/brain/urine
Abstract: Syntheses and purification of fluoroacetate 2-c14 is described. During a 4 day period following
injection of fluoroacetate into intact rats, 3% of the label appeared in the respiratory CO2 and 32% was excreted in the urine. Radioautography of the urinary ether extracts revealed at least seven radioactive components. The appearance of urinary fluoroacetate sharply decreased by 48 hr. While that of the fluorocitrate reached maximum in 24 hr. Fluorocitrate in the urine represented only 3% of the total radioactivity administered. The major radioactive component was not inhibitory toaconitase. Concentration of the label was very high in heart, kidneys, liver and brain. Percentage of radioactivity of the homogenates of liver and kidney distributed equally within the subcellular fractions, but the concentration of activity was about four times greater in the mitochondrial fraction of the kidney than in the liver. Fifteen times as much labeled fluorocitrate was found in the mitochondrial fraction as the liver. Analysis of liver constituents revealed incorporation of activity into fatty acids and small amounts of label in cholesterol. The results indicate the existence of several pathways of fluoroacetate metabolism hitherto not extensively investigated.


Abstract: Since the discovery of 'lethal synthesis' by Peters great effort has been expended on understanding the details of this mechanism and the total effect of the fluoroinhibitors in biological systems. Here we present data from our in vivo and in vitro experiments with radio-active fluoroinhibitors. Major points discussed are 1) comparison of the subcellular distribution of fluoroinhibitors in the rat liver and brain at convulsive and non-convulsive doses 2) recovery of fluoroinhibitors from brain mitochondria by density-gradient sedimentation 3) effect of DL-erythro-fluorocitrate on the ability of brain mitochondria to accumulate calcium in vitro and changes in the respiration-dependent mitochondrial calcium after administration of fluoroacetate 4) penetration of fluoro compounds into cerebral mitochondria and 5) changes in the metabolism and membrane transport of cerebral mitochondria as a function of enzyme inhibition by fluoro compounds


Keywords: metabolism/persistence in plants/fluoroacetate/algae
Abstract: Sodium fluoroacetate (1mM) caused an accumulation of citrate and altered the lipid composition in cells of Gloeocapsa sp. LB795. It also inhibited acetylene reduction (nitrogen fixation) by the algae - markedly under aerobic conditions, but much less so in the absence of oxygen. This inhibition is largely the result of the conversion of fluoroacetate to fluorocitrate which, by inhibiting aconitate hydratase (EC4.2.1.3.), interrupts the synthesis of the 2-oxoglutarate required for the assimilation of NH4+. The consequent accumulation of NH4+ within the cells of Gloeocapsa sp. inhibits nitrogenase synthesis and, since oxygen rapidly inactivates pre-existing nitrogenase, nitrogen fixation by Gloeocapsa sp. decreases under aerobic conditions.


Keywords: sodium fluoroacetate/poisoning/symptoms/treatment/1080
Abstract: Clinical symptoms and treatment are described for a domestic cat which had consumed, and then vomited up within 1 hour, a dead chipmunk killed after eating 1080 treated bran laid for rodent control. Survival of the cat considered largely due to it having initially vomited up most of the dead chipmunk


Keywords: aconitase/poisoning/enzyme/inhibition/fluoroacetate/poison/rats/citric acid
Abstract: The effect of hyperoxia on activity of the superoxide-sensitive citric acid cycle enzyme aconitase was measured in cultured human epithelial-like A549 cells and in rat lungs. Rapid and progressive loss of >80% of the aconitase activity in A549 cells was seen during a 24-hr exposure to a PO2 of 600 mmHg (1 mmHg = 133 Pa). Inhibition of mitochondrial respiratory capacity correlated with loss of aconitase activity in A549 cells exposed to hyperoxia, and this effect could be mimicked by fluoroacetate (or fluorocitrate), a
metabolic poison of aconitase. Exposure of rats to an atmospheric PO2 of 760 mmHg or 635 mmHg for 24 hr caused respective 73% and 61% decreases in total lung aconitase activity. We propose that early inactivation of aconitase and inhibition of the energy-producing and biosynthetic reactions of the citric acid cycle contribute to the sequelae of lung damage and edema seen during exposure to hyperoxia.


Abstract: Mutants (9) of *P. blakesleeanus* were isolated based on their resistance to fluoroacetate. None of the isolates used acetate as their sole carbon source. Genetic complementation experiments revealed that all the mutants belonged to the same complementation group. Biochemical analysis indicated that acetate-induced acetyl-CoA synthetase activity was abolished in all mutants. This suggested that they were affected in the gene coding for acetyl-CoA synthetase (faa).


Abstract: Since late 1998, staff at most Department of Conservation 'mainland island' sites have been investigating alternatives to brodifacoum-laced baits laid in bait stations for controlling rodents. A workshop session was held as part of the 2001 annual 'mainland island' hui (meeting) to discuss and review the different rodent control techniques tried by managers on the New Zealand mainland since 1998, and to make recommendations regarding the issues surrounding the different techniques. The consensus was that currently there are two main options (other than brodifacoum) available for rodent control on the New Zealand mainland: kill-trapping and a range of other toxins (1080, cholecalciferol, warfarin and pindone). The main reported advantage of trapping was that the technique has a much greater public acceptance than toxins. Toxins, however, were reported to be less labour-intensive than trapping and can be used over relatively large areas. The most commonly expressed concern was that very little is understood about the impacts of mice and what techniques are available to control them.


Abstract: Since late 1998, staff at most Department of Conservation 'mainland island' sites have been investigating alternatives to brodifacoum-laced baits laid in bait stations for controlling rodents. A workshop session was held as part of the 2001 annual 'mainland island' hui (meeting) to discuss and review the different rodent control techniques tried by managers on the New Zealand mainland since 1998, and to make recommendations regarding the issues surrounding the different techniques. The consensus was that currently there are two main options (other than brodifacoum) available for rodent control on the New Zealand mainland: kill-trapping and a range of other toxins (1080, cholecalciferol, warfarin and pindone). The main reported advantage of trapping was that the technique has a much greater public acceptance than toxins. Toxins, however, were reported to be less labour-intensive than trapping and can be used over relatively large areas. The most commonly expressed concern was that very little is understood about the impacts of mice and what techniques are available to control them.


Abstract: A mechanism for the interconversion of citrate, isocitrate and cis-aconitate ions by the enzyme aconitase is suggested.


Abstract: Analogs of citrate provide excellent probes of mechanism in citrate-utilizing enzymes. The basic principles listed here must hold, but now that the detailed structures of large proteins with bound substrate can be determined by X-ray diffraction techniques, the stereochemical significance of citrate can be further investigated.

Keywords: mode of action/fluoroacetate/biochemistry/heart/rodents/poisoning/serum/citrate/citric acid/inhibition

Abstract: Myocardial levels of adenine nucleotides, inorganic phosphate (Pi) and hexose phosphates were measured as a function of the time after fluoroacetate (FAc) administration (6 mg/kg ip) to the rat. ATP content was progressively depleted, reaching at 6 hr 60% and at 18 hr, 45% of the control values. AMP and ADP levels increased during the initial 2 hr and later declined. Intracellular Pi accumulated in great amounts, with a maximum at 4 hr, while serum Pi increased continuously throughout the experiment. Citrate levels reached a maximum at 6 hr and remained nearly constant thereafter. These results suggest that the energy reserves of the tissues are progressively exhausted during the intoxication and the reactivation of the citric acid cycle by the accumulated citrate, postulated by previous authors, does not occur under the present conditions. Fructose diphosphate (FDP) levels were unaltered during the intoxication, while fructose-6-phosphate (F6P) and glucose-6-phosphate only showed transient initial increases. The FDP/F6P ration, which is indicative of intracellular phosphofructokinase (PFK) activity, was not significantly altered, in spite of the striking changes produced in the levels of PFK effectors. This suggests that the PFK activation usually occurred with a depletion if high-energy phosphates and Pi accumulation is blocked in the poisoned tissue. In vitro experiments were performed in which PFK activity was evaluated in the presence of concentrations of substrates and metabolites simulating those found in vivo. It was observed that in the physiological pH range (6.9 - 7.1), PFK is strikingly activated in the assays corresponding to intoxicated hearts, regardless of the high citrate levels. The suggests that the activation associated with the fall of ATP is quantitatively more important than the citrate inhibition. However, at lower pH values this activation is not produced, irrespective of the levels of ATP, AMP, Pi or citrate. It is suggested that intracellular acidification, possibly associated with the accumulation of citric acid, might be the main factor responsible for the blockade of PFK activation observed in intoxicated hearts in vivo.


Keywords: product chemistry/fluorine/chemistry/analysis/fluoroacetate/soil/bacteria/enzyme/biochemistry


Keywords: defluorination/fluoroacetate/chemistry/enzyme/biochemistry

Abstract: Studies on the mechanism of the reaction \[ \text{XCH}_2\text{COO}^- + \text{OH}^- \rightarrow \text{X}^- + \text{HOCH}_2\text{COO}^- \] (where X= F, Cl and I) catalyzed by the enzyme haloacetate halidohydrolase indicate that the hydroxyl group of glycolate is derived from water. No evidence can be obtained for the reversibility of the dehalogenation. In addition the exchanges between glycolate and H218O and between chloroacetate and 36Cl- are not catalyzed by the enzyme.


Ref Type: Conference Proceeding

Keywords: degradation/chemistry/fluorine/enzyme


Keywords: non-target species/invertebrates/possums/poisoning/sodium fluoroacetate/fluoroacetate/1080/baits/bees/honey/humans


Keywords: metabolism/rabbits/persistence in animals/1080/non-target species/lethal dose

Abstract: The persistence of 1080 in plasma, liver, kidney, and muscle was studied in rabbits administered sodium monofluoroacetate (1080) at two dose levels (sub-lethal and lethal) with a view to assessing risk
from consumption of meat from lethally or sub-lethally poisoned rabbits by non-target species. The plasma elimination half-life in rabbits receiving a sub-lethal dose was 1.1 h. The tissue retention of 1080 was greater in rabbits dosed with lethal dose than those which received a sub-lethal dose. Irrespective of dose of 1080 given, the concentration of 1080 in muscles, kidney and liver was substantially lower than in plasma. The plasma fluoride (F) concentration in sub-lethally poisoned animals increased initially but returned to normal within 3 h. Elevation of plasma F in lethally dosed animals was higher (at least x3) and was the highest in animals which died early. In contrast the tissue F concentration in these animal was variable. In sub-lethally poisoned animals only muscle citrate was elevated. In contrast, the tissue citrate concentrations in lethally dosed animals were variable but the plasma citrate levels were elevated in animals which died later. Abnormal electrocardiographs were recorded from 13% of rabbits given the sub-lethal dose.


Abstract: The turnover of the blood citrate is extremely rapid as measured by the conversion of intravenously administered citrate-C14 to respiratory C14O2. Approximately 85% of the radioactive carbon of the labeled citrate that is retained in the rat is converted to C14O2 in 3 hours. Approximately 1% of the administered radioactivity was recovered in protein and lipid in the kidneys and liver. The incorporation of C14 into the kidney tissue fractions was greater than that into the corresponding liver fractions. In vivo and in vitro experiments demonstrated a divergent action of fluorooacetate and fluorocitrate as inhibitors of metabolism. In the intact animal fluorooacetate treatment inhibited the urinary excretion of administered citrate-C14 and enhanced its conversion to respiratory C14O2, fluorocitrate treatment resulted in an augmentation of the urinary excretion of the citrate-C14 and depressed its conversion to respiratory C14O2. Studies of the metabolism of liver and the kidney slices in the presence of fluorooacetate and fluorocitrate indicated a difference in the mechanism of action of these inhibitors. Although the distribution of citrate in the subcellular fractions of liver differed from that found in kidney after fluoro-inhibitor administration, the localization in each of the tissues was the same, regardless of whether the rat received fluorooacetate or fluorocitrate.


Abstract: High indices of mortality in cattle have been reported in Brazil as a consequence of Palicourea marcgravii (Pm) acute intoxications. It has been established that Pm leaves contain monofluoroacetic acid (MFA), the active toxic principle of the plant. Rational therapy for MFA poisoning involves the use of a substance that might prevent fluorocitric acid formation. The present work was undertaken to verify if acetamide, a MFA antidote and an acetate donor, protects rats against both Pm and MFA intoxications. It was verified that acetamide protected rats from both convulsions and death. Future experiments should be carried out on cattle to examine the efficacy of acetamide, and particularly under field conditions.


Abstract: A general modeling methodology to evaluate the potential effects of pesticides on non-target wildlife populations is described, and its use within a resource management framework is demonstrated. Attention is focused on interfacing relatively simple numerical and analytical procedures with available data to specify initial baseline population parameters, representing density-dependent relationships affecting non-target natality and survival rates, and interpreting simulated non-target population responses
to different pesticide-use schemes within a management framework. The methodology involves use of a Leslie matrix model with variable age-specific natality and survival rates. Natality and survival rates can vary as a function of non-target population density, the density of competitor, predator, and/or prey populations, and/or abiotic environmental factors. Required model input includes estimates of initial density of the non-target population, age-specific natality rates, the relative magnitudes of age-specific survival rates, the relationship of natality and survival rates to the appropriate population densities and/or abiotic environmental factors, and the magnitude of pesticide-induced mortality. Model output includes estimates of the density of the non-target population over time, the mean lowest density reached, the mean recovery time, and the probability of extinction resulting from a specified scheme of pesticide use. Use of the model within a management framework is demonstrated by evaluating the effects of 4 hypothetical coyote control schemes, using Compound 1080, on great horned owl populations in the United States.


Gregg, K., Cooper, C. L., Schafer, D. J., Sharpe, H., Beard, C. E., Allen, G., and Xu, J. (1994). Detoxification of the plant toxin fluoroacetate by a genetically modified rumen bacterium. Bio/technology 12, 1361-1365. Keywords: fluoroacetate/bacteria/degradation/GMO/occurrence in nature Abstract: The construction of rumen bacteria that are able to detoxify an important natural poison supports the feasibility of using genetically modified rumen bacteria to aid animal production.

Gregg, K. (1995). Engineering gut flora of ruminant livestock to reduce forage toxicity: progress and problems. Tibtech 13, 418-421. Keywords: gut/livestock/bacteria/degradation/fluoroacetate/poisoning Abstract: The rumen bacterium Butyvibrio fibriosolvens has been genetically modified to detoxify fluoroacetate (a poisonous component of trees and shrubs in Australia, Africa and Central America) and has been shown to persist when it is returned to the rumen. Such bacteria may save animals from poisoning, thereby reducing economic losses for livestock industries in those countries. The ability to make genetic changes to rumen bacteria raises important questions about their practicality, and about the environmental factors that must be considered before releasing modified strains. The fluoroacetate-detoxifying bacterium provides an important model by which these issues can be examined.

Gregg, K., Hamdorf, B., Henderson, K., Kopecny, J., and Wong, C. (1998). Genetically modified ruminal bacteria protect sheep from fluoroacetate poisoning. Applied and environmental microbiology 64, 3496-3498. Keywords: metabolism/pathology/fluoroacetate/symptoms/poisoning Abstract: Four strains of Butyrivibrio fibrisolvens, transformed with a gene encoding fluoroacetate dehalogenase, maintained a combined population of 10(6) to 10(7) cells ml(-1) in the rumens of test sheep. Five inoculated sheep showed markedly reduced toxicological symptoms after fluoroacetate poisoning when behavioral, physiological, and histological effects were compared with those of five uninoculated control sheep.


**Keywords:** citrate

**Abstract:** Rat-liver mitochondria were incubated with [1,5-14C]citrate in the presence of fluorocitrate to block oxidation in the Krebs cycle. The reaction products were analysed enzymatically and by anion-exchange chromatography. Incorporation of 14C into acetyl-L-carnitine or ketone bodies via a backward action of citrate synthase was not observed. The optimal rate of citrate synthesis from pyruvate and malate in the presence of fluorocitrate was 15 nmol . mg⁻¹ . min⁻¹. In the absence of fluorocitrate, but in the presence of malonate, citrate was oxidized to succinate at a rate of 4 nmol . mg⁻¹ . min⁻¹.

We conclude that the synthesis of citrate by intact rat liver mitochondria is an irreversible process. The possible mechanism underlying this phenomenon and the consequence for metabolic regulation are discussed.


**Keywords:** mode of action/acute toxicity/fluoroacetate


**Keywords:** occurrence in nature


**Keywords:** bait degradation/sodium fluoroacetate/fluoroacetate


**Keywords:** fluoroacetate/occurrence in nature/biosynthesis/bacteria/fluoride

**Abstract:** Field-grown *Dichapetalum cymosum* plants which appeared normal were invariably found to be infested with bacteria. It has not yet been ascertained whether the bacteria can synthesise fluoroacetate but seedlings of *D. cymosum*, when grown from surface sterilised seed in an aseptic environment, appear to synthesise fluoroacetate. A callus culture of *D. cymosum* was established which appears to be internally devoid of microorganisms. The culture grows well in the absence of fluoride and then does not contain fluoroacetate. Fluoride (0.78 to 6.24 mM) does not affect the growth of the callus but results in the production of up to 1227 mg fluoroacetate per kg fresh callus.


**Ref Type:** Report

**Keywords:** algae/toxicity/sodium monofluoroacetate/monofluoroacetate/fluoride


**Keywords:** bait degradation

**Abstract:** Sodium monofluoroacetate (SMFA) is a highly toxic substance and its determination is needed in several areas. Its chromatographic (GC or HPLC) determination is difficult because of its ionic and hydrophilic properties. A simple, sensitive and selective capillary zone electrophoretic method is described for the determination of SMFA. It is well separated from structurally related compounds (formate, acetate, chloroacetate, bromoacetate, etc) in an acidic electrolyte buffer containing 5 mmol/1 phthalate (pH 4.61) and 0.3 mmol/1 cetyltrimethylammonium bromide (CTAB) or in a basic electrolyte solution containing 5 mmol/1 4hydroxy benzoate 0.3 mmol/1 CTAB and 10 mmol/1 ammonium (pH 9.49). Good resolution was achieved at relatively low electric field (200250) kV/cm and CTAB concentration (0.3 mmol/1). The separation selectivity was improved in acidic phthalate buffer. Using bromoacetate as internal standard, the calibration graph for SMFA was linear over the concentration range 110 jug/ml. The detection limit was 0.4 jg/ml. The method was applied to the determination of SMFA in rodenticide baits.

Keywords: NMR/sodium fluoroacetate/fluoroacetamide/fluoroacetate/analysis


Ref Type: Conference Proceeding
Keywords: liver/fluoroacetate/poisoning/metabolism/chemistry


Keywords: fluoroacetate/liver/birds

Abstract: Studies on the effect of fluoroacetate on chicken liver gluconeogenesis revealed that fluoroacetate intoxication blocked the tricarboxylic acid cycle in fed or fasted birds; this decreased the generation of ATP required for gluconeogenesis A decrease of glucose synthesis with reduced substrates. Lactate was especially observed in isolated hepatocytes incubated with fluoroacetate which was explained by decreased amount of available energy for glucose synthesis, decreased activity of the malate shuttle and decreased activity of lactate dehydrogenase


Keywords: inhibition/fluorocitrate/liver/enzyme/aconitase/biochemistry

Abstract: The effects of synthetic fluorocitrate were studied on a) the oxidation of citrate and cis-aconitate by rat liver mitochondria b) the activity of the aconitate hydratase found in the liver cell sap c) the activity of the aconitate hydratase solubilized from liver mitochondria. Fluorocitrate was found to be a potent inhibitor of oxidation of citrate but only a weak inhibitor of oxidation of cis-aconitate: 6-7 uM-fluorocitrate (containing 4% of the inhibitory isomer) caused 94% inhibition of the oxidation of citrate (2mM) whereas 1mM-fluorocitrate was necessary to provoke the same inhibition when cis-aconitate (2mM) was the substrate. The degree of inhibition varied in relation to the respiratory state of mitochondria when fluorocitrate was added. The inhibition could be partially reversed by cis-aconitate. The aconitate hydratase extracted from the mitochondria was much less inhibited by fluorocitrate than was the mitochondria-bound enzyme, and the aconitate hydratase found in the cell sap was even less sensitive. 0.3 mM fluorocitrate was required to cause 50% inhibition of the reaction citrate > cis-aconitate, catalysed by the aconitate hydratase extracted from the mitochondria, and 1.2 M-fluorocitrate for the extramitochondrial enzyme. For both enzymes the reaction citrate > cis-aconitate was 2-3 times more sensitive to fluorocitrate than was the reaction isocitrate > cis-aconitate. The inhibition was of the competitive type for both reactions.


Keywords: fluoride/persistence in plants

Abstract: In order to assess the levels of fluoride ingestion through intake of tea, studies were conducted with four different brands of tea leaves commonly available in the Indian market. Four most prevalent methods for the preparation of tea with various contact times (2,4,6,8 and 10 min) of tea leaves with water show that: (a) leaching of fluoride is least in case of leaf tea as compared to powdered tea (F levels increasing with decreasing grain size); (b) leaching of fluoride reached a maximum after a contact of about 6 min; (c) there is no difference between levels of fluoride with or without addition of milk in the English style where tea leaves are not boiled, while for the Indian style, addition of milk and subsequent boiling resulted in reduction of fluoride levels and (d) ingestion of fluoride per cup of tea ranged from 1.55 mg/l to 3.21 mg/l amounting to an intake per day per person of fluoride between 0.3 to 1.9 mg.


Keywords: fluorocitrate/metabolism/inhibition/brain
Abstract: Several studies have supported the involvement of glutamatergic-mediated neuronal events in regulating neurotrophin mRNA expression in the central nervous system. The effects of glutamate are mediated through ionotrophic or metabotrophic glutamate receptors. Glutamate levels at the synaptic cleft are regulated by an equilibrium between calcium-dependent glutamate release into the synaptic cleft and glutamate uptake primarily into glial cells. In the present study, we used in vivo microdialysis and in situ hybridization to investigate whether blockade of glial cell metabolism will influence glutamate levels in the extracellular space and mRNA levels of two neurotrophins, nerve growth factor (NGF) and brain-derived neurotrophic factor (BDNF) in the hippocampal formation. Female Long Evans rats were anesthetized with pentobarbital and placed into a stereotoxic apparatus. A total of 1-2nmole of fluorocitrate, an inhibitor of glial cell metabolism, was injected into the hippocampal formation. Over a 4 hour time period, fluorocitrate treatment resulted in a significant increase (3-5 fold) in glutamate levels over time, while glutamine levels significantly decreased. These data support the decreased metabolic activity of glial cells as assessed by the selective effect of fluorocitrate on glutamate and glutamine levels. In situ hybridization histochemistry revealed that fluorocitrate injections into the hippocampal formation increases the expression of NGF and BDNF mRNA in dentate granule cells. The fluorocitrate-induced increase in NGF and BDNF mRNA was blocked by pretreatment with the N-methyl-D-aspartate (NMDA) receptor antagonist, AP5. The present results provide evidence that mRNA expression of neurotrophins in the hippocampal formation can be modified by glial activity, as well as neuronal activity regulating levels of synaptically-released glutamate through NMDA receptors.

Keywords: metabolism/persistence in animals/1080/excretion/rodents/analysis
Abstract: Data are presented which indicate that the rat possesses the capacity for metabolizing sodium monofluoroacetate (1080). Distribution of the 1080 is rather uniform throughout the animal with the exception of a lower liver content usually found.

Keywords: liver/fluoroacetate/citrate

Keywords: fluorine/soln/occurrence in nature/persistence in soil/fluoroacetate
Abstract: A number of tropical soils growing toxic plant species which contain organically combined fluorine have been studied with a view to establishing the relationship between plant and soil in terms of fluorine. The analyses of the soils for total fluorine and water-soluble fluoride showed that there was no correlation with the levels of total and organically-combined fluorine in the leaves of the plant species. Some of the most toxic plants grew in soils having low levels of mineral fluorine. Examination by electrodialysis, gas-liquid chromatography and infra-red spectroscopy, supported by chemical analysis, has revealed the presence in significant amounts of what appears to be fluoroacetate in several of the soils supporting species known to contain toxic fluorinated fatty acids. The origin of the naturally-occurring fluoroacetate in these soils is discussed.

Keywords: fluorine/fluoroacetate/soln/occurrence in nature
Abstract: 1. The tissues of a number of toxic plants, including Acacia georginae, from Africa, Australia and South America, were analysed for the presence of organic and inorganic F. The presence of organically combined F was established in most of the species but the concentration of such F was very variable. A waxy exudate on the surface of the toxic leaves of A. georginae contained significant quantities of F and is believed to be part of an excretory mechanism. Only a small proportion of the exudate was identified as fluoroacetate, and other fluorinated organic compounds appear to be present. 2. Tissues of 13 toxic species from Africa, Australia and South America were analysed for organic and inorganic F. Organically combined F was found in most of the species, but varied in concentration. In African Dichapetalaceae the F content was generally higher in stems and roots than in leaves; in Australian Gastrolobium and Oxylobium spp. and Brazilian Palicourea marcgravii the reverse situation was found. Large amounts of organic F were
found in most seeds but not in those of Acacia georginae. None of the toxic species examined grew in high-F soils, but some grew in soils with very low F content. A waxy exudate on the outside of the toxic leaves of A. georginae contained significant amounts of organic F and appeared to be part of an excretory mechanism. Only a small proportion of the exudate was fluoroacetate and other fluorinated organic compounds seemed to be present. Crystals which appeared to be a complex mixture containing calcium oxalate, chloride, F, Mn and Si were found on the outer surface of roots and stems of Dichapetalaceae, and were also thought to be associated with a detoxication process.


Keywords: metabolism/fluoride/sodium monofluoroacetate/monofluoroacetate

Abstract: Plants of *Acacia georginae* (one of numerous toxic tropical species now known to contain monofluoroacetate) were cultivated in nutrient-washed quartz, and in soil. Attempts were made to induce the formation of organic fluorine by treatment of the roots with a solution of ammonium fluoride. Only small amounts of carbon-fluorine material were measured in the leaves and roots, and examinations by physico-chemical methods failed to detect any evidence of the presence of monofluoroacetate in any of the plants. Similar plants were treated with sodium monofluoroacetate which underwent considerable degradation to an acid-labile form of fluorine (probably inorganic fluoride). The results of the analysis of the roots and leaves for fluorine revealed that the difference between acid-labile (diffusible) fluoride and total fluorine cannot be taken as a measure of the organic fluorine.


Keywords: persistence in water/1080/rabbits


Keywords: fluoroacetate/bacteria/biosynthesis/enzyme

Abstract: The striking similarity between the labelling patterns within the two fluorometabolites recorded in every experiment demonstrates that there is a single fluorination enzyme in *S. cattleya*.


Keywords: biosynthesis/fluoroacetate

Abstract: Using 19F NMR spectroscopy, 13C-labelled glycines and pyruvates are shown to be incorporated at high levels into fluoroacetate and 4-fluorothreonine by resting cells of *Streptomyces cattleya*; the labelling patterns illustrate a conversion of glycine via serine to pyruvate, where the C-2 and C-3 carbon atoms of pyruvate contribute both carbon atoms of fluoroacetate and C-3 and C-4 of 4-fluorothreonine respectively.

Hamilton, J. T. G. Biosynthesis of organofluorine compounds in plants and bacteria. 1997. Queen's University of Belfast (Northern Ireland)Editor.

Ref Type: Thesis/Dissertation

Keywords: biosynthesis/bacteria/fluorine/fluoroacetate/NMR/metabolism/enzyme

Abstract: Organofluorine compounds are relatively rare in nature compared with other organohalogens. Notwithstanding the obvious biochemical interest and potential biotechnological significance, the mechanism by which fluorine is inserted into these compounds has yet to be elucidated. This investigation re-examined the organofluorine compounds in the seeds of the West African plant Dichapetalum toxicarium and further probed the biochemical processes involved in fluoroacetate and 4-fluorothreonine formation in the actinomycete *Streptomyces cattleya*. An unidentified fluorinated natural product previously isolated from seed oils of *D. toxicarium* was identified as threeo-18-fluoro-9,10-dihydroyxystearic acid. Using GC/MS the presence of SomegaS-fluoro-palmitoleic, -stearic, -linoleic, -arachidic and -eicosenoic acids was established from this source. To facilitate studies with *S. cattleya* GC/MS and HPLC procedures for the quantitative determination of fluoroacetate and 4-fluorothreonine in culture supernatant.
were developed, and GC/MS and $^{19}$F NMR methodologies established for the measurement of stable isotope label in both fluorometabolites. Using these techniques glycine has been shown to be a highly effective precursor of both fluorometabolites. The $\alpha$-carbon atom of glycine is incorporated efficiently into both C-1 and C-2 of fluoroacetate and also C-3 and C-4 of 4-fluorothreonine but the carboxyl carbon of the precursor is not retained in either metabolite. This pattern of labelling is consistent with the metabolism of glycine via serine to pyruvate and the utilisation of pyruvate or a closely related metabolite as the substrate for the fluorinating enzyme. Studies with $^{13}$C-labelled pyruvates provide strong support of the postulated pathway. The extent to which labelling in C-1 and C-2 of fluoroacetate parallels that in C-3 and C-4 of 4-fluorothreonine in experiments using $^{13}$C-labelled precursors suggests that both fluorometabolites arise from a common intermediate, a conclusion implying that a single fluorinating enzyme exists in S. cattleya. 4-Fluorothreonine biosynthesis does not appear to proceed via a direct condensation of glycine and fluoroacetaldehyde as originally postulated, but instead may involve fluoroacetaldehyde and 2-aminomalonate.

Ref Type: Magazine Article
Keywords: 1080/persistence in animals
Abstract: What is 1080? It's a tasteless, odourless white powder named sodium monofluoracetate, or C2H2FNaO. It's been used for possum and rabbit control in New Zealand since the 1950s.

Fluoroacetate (the active ingredient of 1080) is a natural compound found in plants from South America, South Africa and Australia. The most toxic species is found in South Africa, which can carry 8mg/g of fluoroacetate in its seeds. You'll also find very low amounts of fluoroacetate in tea and in guar gum, a common ingredient in foodstuffs.

The toxin prevents animals from browsing on the plant's leaves. Scientists can replicate this natural compound in the lab, and it's this that is used in 1080 baits.

There is very little actual poison in a 1080 pellet. Only 0.15% of a bait, at most, is fluoroacetate. The rest is a matrix of cereal or carrot, which acts as a lure. Carrot baits are fiddly, expensive and degrade quickly in wet weather, and are used less nowadays, particularly in aerial drops.

Keywords: occurrence in nature/biosynthesis

Ref Type: Report
Keywords: poisoning/wasps/baits/non-target species/1080/efficacy
Abstract: The feasibility of the aerial application of bait to kill wasps was investigated as a technique for large-scale poisoning of wasps in areas of 1000-5000 ha. Methods of bait dehydration and pelletisation into a form suitable for aerial delivery were tested. Bait attractiveness to wasps was determined and interest in baits by non-target species recorded. A simulated aerial application was used to test the efficacy of a toxic freeze-dried formulation for wasp control. Baits were produced that were sufficiently robust for aerial application, but processing reduced attractiveness to wasps. Aerial baiting of wasps is technically feasible, but reduced attractiveness of pelletised baits, non-target issues, and successes with current ground-based operations mean further improvements are needed before it would be worth adopting.

Keywords: sodium fluoroacetate/fluoroacetate/poisoning/dogs/convulsions/cats/cardiac/treatment
Abstract: Clinical signs usually occur between 15 minutes and 2 hours after ingestion and may involve either the cardiovascular system or the nervous system or both. Dogs ordinarily have convulsions whereas in cats there may be a combination of convulsions and cardiac disorder.
Keywords: dogs/symptoms/poisoning

Keywords: persistence in water/sodium monofluoroacetate

Keywords: citrate/metabolism/serum/rodents/gut/kidney/blood

Abstract: Determinations of citrate concentrations in serum and tissues were made in fluoroacetate-injected rats given cortisol. The increment of serum citrate is less in the cortisol treated rats than in the controls injected with fluoroacetate, but the accumulation of citrate in the heart and small intestine following fluoroacetate is equally great in both groups. Lower concentrations of citrate in the kidneys of cortisol-treated rats are probably due to difference in citrate of tubular urine. In the adrenalectomized rat fluoroacetate causes a greater rise of serum citrate than in the intact rat but there is no greater increase of tissue citrate. Calculation of citrate distribution ratios i.e. the ratio of the concentration of citrate in intracellular water to that of extracellular fluid, indicates that the distribution ratio following fluoroacetate is increased by cortisol and decreased by adrenalectomy. Cortisol does not apparently influence the intracellular accumulation of citrate but alters the distribution of citrate between cells and extracellular fluid, possibly due to an effect upon the efflux of citrate from cells.

Keywords: acute toxicity/fluoroacetate/1080/poisoning

Abstract: Application of principles involving bait size and type should much reduce the incidence of bird poisoning in the course of 1080 campaigns against forest and pasture pests.

Keywords: acute toxicity/fluoroacetamide/1081/fluorine

Keywords: poisoning/antidote/treatment/rabbits/acute toxicity

Abstract: Acetamide, an antidote to monofluoroacetamide derivatives, has received toxicologic and pharmacologic investigations. The acute toxicity of acetamide for several species by different routes of administration was very slight, there being an about 10g/kg in mice or rats by the intravenous injection of...
acetamide. By subacute toxicity studies in rats and rabbits, there was neither marked effect on body weight gain, nor any gross signs of toxicity. During the studies of repeated application in rats and rabbits, clinical observations, hematologic data, organ function values, urinalysis, and terminal gross and microscopic examinations of tissues were obtained. No evidence of drug effect was observed in rats or rabbits that received daily injection of 1,000 mg/kg or less for 90 consecutive days. Acetamide did not exhibit significant activity in any of the pharmacologic tests such as its actions on the central nervous system, cardiovascular and respiratory systems, peripheral systems, and blood.


Keywords: mode of action


Keywords: inhibition/metabolism/fluorocitrate

Abstract: The effect of fluorocitrate on glial and neuronal amino acid metabolism was studied. One nmol of fluorocitrate administered intrastriatally in the rat caused a 95% reduction in glutamine formation from [14C]acetate, a substrate which enters the glial cells selectively. The metabolism of [14C]glucose which enters neurons, was unaffected by fluorocitrate treatment except for the glutamine formation. This is evidence that fluorocitrate is a selective inhibitor of the glial Krebs' cycle. [14C]Citrate and 2-oxoglutarate labelled amino acids in a manner similar to [14C]acetate, which shows that these substrates are taken up and metabolized by glial cells. Differences in the labelling of y-aminobutyric acid (GABA) from [14C]acetate and citrate suggest that astrocytes associated with GABAergic and glutamatergic nerve terminals may differ in their preference for amino acid precursors.


Keywords: mode of action/NMR


Keywords: mode of action


Keywords: mode of action/metabolism/brain/fluoroacetate/citrate

Abstract: Glial-neuronal interchange of amino acids was studied by C-13 nuclear magnetic resonance spectroscopy of brain extracts from fluoroacetate-treated mice that received [1,2-C-13]acetate and [1-C-13]glucose simultaneously. [C-13]Acetate was found to be a specific marker for glial metabolism even with the large doses necessary for nuclear magnetic resonance spectroscopy. Fluoroacetate, 100 mg/kg, blocked the glial, but not the neuronal tricarboxylic acid cycles as seen from the C-13 labeling of glutamine, glutamate, and gamma-aminobutyric acid. Glutamine, but not citrate, was the only glial metabolite that could account for the transfer of C-13 from glia to neurons. Massive glial uptake of transmitter glutamate was indicated by the labeling of glutamine from [1-C-13]glucose in fluoroacetate-treated mice. The C-3/C-4 enrichment ratio, which indicates the degree of cycling of label, was higher in glutamine than in glutamate in the presence of fluoroacetate, suggesting that transmitter glutamate (which was converted to glutamine after release) is associated with a tricarboxylic acid cycle that turns more rapidly than the overall cerebral tricarboxylic acid cycle. [References: 47]


Keywords: fluorocitrate/aconitase/treatment/enzyme

Abstract: More than 50% of the total aconitase activity in *Escherichia coli* was lost when cell-free extracts were prepared under air by a French press, by osmotic rupture of spheroplasts or by sonic treatment, as
shown by the fact that the enzyme activity of the extracts prepared by sonic treatment under N₂ was more than twice that of the extracts prepared by the other methods. When the extracts prepared by sonic treatment under N₂ were gently shaken under air at 25°, about 70 to 80% of the original activity was lost over 30 min, but a constant level of the enzyme activity remained even after prolonged incubation. The remaining aconitase activity after a long aerobic incubation was the same whether the extracts were prepared by sonic treatment under air or N₂. Aconitase was stable when cell-free extracts were incubated under anaerobic conditions or when fluorocitrate, in concentration less than 1µM, was added during aerobic incubation. Citrate was less effective than fluorocitrate in preventing enzyme inactivation. Aconitase in the extracts, which had been incubated under air with fluorocitrate, was stable against oxygen inactivation and showed different Vₘₐₙₜ and Kₘ values from those of the aconitase in the extracts that had been incubated under air without the addition of fluorocitrate.


Keywords: acute toxicity/mammals/mode of action/rats


Keywords: secondary poisoning/mammals/non-target species/predators/USA


Keywords: mammals/birds/non-target species/secondary poisoning/1080/strychnine/rabbits

Abstract: Monofluoroacetic acid was first prepared in Belgium in 1896 (Atzert 1971), but was not seriously investigated as a pesticide in the United States until World War II eliminated major sources of raw materials for red squill, thallium, and strychnine. Studies by the U.S. Fish and Wildlife Service showed that sodium monofluoroacetate (1080) was an effective rodenticide, predacide, and insecticide, and resulted in it widespread use from the late 1940s through the 1960s.

Although laboratory studies have repeatedly shown that 1080 theoretically poses hazards to nontarget wildlife through both primary poisoning (the toxic bait is ingested directly) and secondary poisoning (the result of consuming and animal killed by primary poisoning), few field data are available to assess the effect of 1080 on nontarget populations. The objective of this study was to evaluate the primary and secondary effects on nontarget wildlife of an operational program using 1080 treated gain bait to control ground squirrels. Specific objectives were to determine efficacy of 1080 for control of California ground squirrels (Spermophilus beecheyi); primary hazards to other rodents, rabbits, and seed eating birds; and secondary hazards to raptors and mammalian predators.


Keywords: field efficacy/possums/1080/acute toxicity

Abstract: A significant proportion of brushtail possums (Trichosurus vulpecula) in New Zealand survive pest control operations using sodium monofluoroacetate (1080) baits. To be effective, bait needs to contain an appropriate concentration of 1080 and be eaten in amounts lethal to all possums, In our trials, the acute toxicity of 1080 to captive possums was estimated when the toxicant was included in different bait types, and results compared with published data for 1080 administered in aqueous solutions by oral gavage. The effectiveness of baits containing different 1080 concentrations, and of different palatabilities, was also assessed. Captive possums that fed on baits in this trial were less susceptible to 1080 (LD50 = 1.5 mg/kg) than in previously reported trials where the toxicant was administered to caged possums by oral gavage (LD50 = 0.8 mg/kg; P < 0.001). The differences in the acute toxicity of 1080 in water and in baits are attributed mainly to the reduced bioavailability of 1080 in baits. Also in our trial, captive animals feeding voluntarily on baits more closely approximated the status of animals in the wild than when acute toxicity was estimated by anaesthetizing possums and intubating solutions by oral gavage. Genetic polymorphisms caused some animals to be much more susceptible to 1080 toxicosis than others. Body mass differences cause females and young possums to ingest a higher toxic dose (mg/kg) than adult males, and the concentrations of toxicant affected the amounts of bait eaten and the resultant mortality. For the range of
baits tested, the palatability of bait was a more important determinant of amounts eaten, and the percentage of possums sublethally poisoned, than was toxicant concentration. Possums that ate baits of low palatability and inappropriate 1080 concentration ingested small doses of 1080 and either endured a protracted time to death or survived. The size and quality of bait have implications for the management of wild populations of possums in different climatic areas where aerial and land-based methods of control are used.

Henry, S. J. Biodegradation of sodium monofluoroacetate ("Compound 1080"). -45. 1984. Botany Dept, University of Canterbury, New Zealand. Ref Type: Thesis/Dissertation Keywords: sodium monofluoroacetate/sodium fluoroacetate/fluoroacetate/soil/degradation/enzyme/analysis/bacteria Abstract: A species of Penicillium capable of degrading "Compound 1080" (sodium fluoroacetate, SFA) was isolated from leaves of Griselinia littoralis. The growth of Penicillium sp on a "1080" gel infers that the SFA component of this gel, when applied to leaves, may be degraded before being leached into the soil. The optimal conditions for growth and SFA degradation by this Penicillium sp were investigated, and subsequent attempts were made to induce vigorous SFA degrading ability for a crude enzyme extract. This enzyme was studied for qualitative analysis of SFA residues by enzymic assay. The constitutive nature of this enzyme was observed as SFA could be broken down by enzyme extracts not previously adapted to SFA.

Herrmann, D. B. J., Herz, R., and Fröhlich, J. (1985). Role of gastrointestinal tract and liver in acetate metabolism in rat and man. European Journal of Clinical Investigation 15, 221-226. Keywords: liver/metabolism/acetate Abstract: Ntc acetate uptake/release by various tissues was studied in vivo in fed, starved and Paromomycin-treated rats and in patients with cirrhosis of the liver. In humans the portal vein, hepatic vein and hepatic arterial blood flow rates were determined simultaneously. In rats acetate is only intestinally produced and released into the portal vein. Intestinal production is decreased by 33% in starved and Paromomycin-treated rats compared to fed animals. Portal vein-hepatic vein acetate differences are linearly related to the portal vein acetate concentration (r = 0.92). Acetate uptake from the portal vein by the liver was found when the portal venous concentration exceeded 180 µmol 1⁻¹. In humans the hepatic net acetate uptake from the portal vein/net acetate release into the hepatic vein, measured as µmol min⁻¹, is linearly related to the portal vein acetate concentration (r = 0.97). Furthermore, portal vein-hepatic vein differences are correlated to the arterial concentration (r = 0.96). The data indicate that the liver may homeostatically regulate the systemic acetate concentration in rat and man.

Heyward, R. P. and Norbury, G. L. (1999). Secondary poisoning of ferrets and cats after 1080 rabbit poisoning. Wildlife research 26, 75-80. Keywords: secondary poisoning/non-target species/mammals/cats/1080/treatment/rabbits/persistence in animals Abstract: The incidence of secondary poisoning was determined by using radio-telemetry to assess the survival of 68 ferrets and 21 cats on two treatment sites and one control site in the dry tussock grasslands of New Zealand. The treatment sites were aerially poisoned with 1080-coated carrot baits (0.02% wt/wt) to control rabbits. The control site was not poisoned. Ferrets and cats were monitored at two-weekly intervals for at least 1 month before, and 2 months after the poison operations. Muscle samples from ferrets and cats that died within 50 days of poisoning on the treatment sites were assayed for 1080. In all, 7-11% (n = 28) of ferrets on one site and 8-15% (n = 26) of ferrets at the other site apparently died of secondary 1080 poisoning. Natural mortality rates of ferrets were 46-81% per annum. While we have evidence that secondary poisoning of cats does occur, we monitored insufficient numbers of cats to reliably estimate mortality rates. Declines in predator numbers are commonly observed after rabbit poisoning. This study indicates that secondary poisoning contributes to these declines.

Hickling, G. J. (1994). Behavioural resistance by vertebrate pests to 1080 toxin: implications for sustainable pest management in New Zealand. In 'Proceedings of the science workshop on 1080.' (A. A. Seawright and C. EasonEds.) pp. 151-158. (The Royal Society of New Zealand: Keywords: resistance/1080/bait shyness/possums

Keywords: poisoning/baits/non-target species/behaviour/aversion/possums/rabbits/cyanide/efficacy/1080/cholecalciferol

Abstract: Vertebrate pest control operations using toxic baits can have unintended consequences for non-target species, some of which may themselves be pests. Learned avoidance behaviour (termed 'aversion') can be induced by sublethal dosing, which can arise when species with high and low susceptibilities to a toxin co-exist in the same area. In such cases the less-susceptible species (e.g., possums Trichosurus vulpecula) may be sublethally poisoned by control work targeting the more-susceptible species (e.g., rabbits Oryctolagus cuniculus). A case study of rabbit control on North Canterbury farmland is presented to demonstrate this effect. When control is being repeated at frequent intervals, it is prudent to vary the control methods used. Nevertheless, aversion induced by the use of one toxic bait (e.g., cyanide paste) can in some situations 'generalise' so that the efficacy of control using other toxins (e.g., 1080 and cholecalciferol in cereal baits) is also compromised. A case study of initial and follow-up possum control in four discrete areas of Canterbury forest provides an example of this problem. The implications of these findings for future pest management in New Zealand are discussed.


Keywords: fluoroacetate/developmental toxicity/regulatory toxicology brain/inhibition/heart/reproductive effects/metabolism/rats/teratogenicity

Abstract: The developing nervous system in vivo, specifically its neuroblasts, has been found to be unusually susceptible to acute metabolic injury by ionising radiation, certain sulphydryl reagents, other inhibitors and antimetabolites. It has been found to be relatively insensitive to acute interference with glucose and oxygen metabolism except late in development. In the first third of gestation the neural tube is resistant to radiation and possibly other agents but this period is in need of more investigation. Injuries in the latter two thirds of gestation cause the development of progressive malformations of the nervous system during growth that carry over into adult life. The most important mechanisms that determine the form of the malformation are the actual destruction of building blocks (neuroblasts) and the time during gestation (critical period) at which the injury occurs. These experiments carried out on experimental animals, chiefly rats and mice invite attention to the possibility that a variety of agents met act during nervous system development to produce malformations.


Ref Type: Report

Keywords: lethal dose/acute toxicity/birds

Abstract: This report is a compilation and analysis of the results of nearly 10 years of testing the lethal dietary toxicities of pesticidal and industrial chemicals to young bobwhites (*Colinus virginianus*), Japanese quail (*Coturnix c. japonica*), ring-necked pheasants (*Phasianus colchicus*), and mallards (*Anas platyrhynchos*). A total of 131 compounds were tested. Toxicities are expressed as median lethal dietary concentrations (LC50) and are based on 5 days of dietary exposure to the test compound followed by 3 days of untreated feed. From these data statistical comparisons between toxicities are possible for a given species. Certain classes of pesticides - organochlorine compounds, organophosphates and organometallic compounds - contained most of the compounds judged "highly toxic". The most frequent order of species response was bobwhite > Japanese quail > ring-necked pheasant > mallard. This order correlates with their body sizes at the ages tested.


Keywords: persistence in plants/chemicals
Keywords: acute toxicity/mode of action/lethal dose
Abstract: The literature is reviewed on 38 pesticides used against vertebrate pests. Each pesticide is dealt with separately and information given on physical and chemical properties, mode of action, known antidote, current usage and legal status. Chronic and acute toxicity information is listed according to species, sex, lethal dose and mode of administration. A glossary of relevant terms and abbreviations and an index of common, alternative and trade names is also included.

Keywords: 1080/pigs/acute toxicity/efficacy
Abstract: Experiments were conducted which examined the toxicity and acceptability of warfarin and 1080 poison to penned feral pigs. Warfarin was very toxic and highly acceptable. Maximum mortality was 11 of 12 at 0.08% concentration for 2 or 3 days, or 0.1% concentration for 2 days. 1080 toxicity was 2 of 19 at 0.05% for 1 day. Bait intake declined significantly when bait was poisoned with 1080.

Keywords: sodium monofluoroacetate/1080/baits/monofluoroacetate/analysis
Abstract: A reaction-capillary gas chromatographic procedure using photo-ionization (PID) or flame-ionization (FID) detection was developed for the determination of sodium monofluoroacetate (compound 1080), a pesticide, in tissues and baits. Fluoroacetic acid from tissue (1 g) and bait (10 g) extracts was first partitioned into ethyl acetate and then into 0.5 M benzyldimethylphenylammonium hydroxide. Benzylation was achieved by pyrolysis of the quaternary ammonium salt in the injection port. Chloroacetic acid was used as the internal standard. A linear relationship (r= 0.999) was observed between the peak area ratio of the substrate/internal standard and the fluoroacetic acid concentration. The detection limit for compound 1080 using the described analytical procedure was 15 µg/kg with PID and 100 µg/kg with FID.

Ref Type: Magazine Article
Keywords: poison
Abstract: Poison plants were a major deterrent to early settlers in parts of Western Aust. and thereby helped to preserve some areas of high conservation value. Now, ironically, plants that were for more than a century thought of as pests are endangered. In this companion piece to King and Kinnear's '1080: The Toxic Paradox' in the present issue of Landscope, CALM research scientist Steve Hopper tells the story of some of Western Australia's killer fauna.

Keywords: monofluoroacetate/soil/bacteria/metabolism
Abstract: Chem Abstr 60: 9630d 1964

Keywords: monofluoroacetate/soil/fluoroacetate/enzyme/bacteria/temperature/resistance/degradation
Abstract: Monofluoroacetate is currently in extensive use as an agricultural insecticide and rodenticide. However, this fluoroacetate compound differs from other halo-carboxylic acids in having an extremely strong C-F bond which, for example, does not break even on distillation with concentrated sulphuric acid at 170 degrees celsius and is only 50% broken after 20 hours of boiling with 20% caustic potash. For this reason there is a doubt as to whether fluoroacetates decompose when released into the environment. In South Africa a toxic plant known locally as Gifblaar has been found to be a fluoroacetate, and the concentration of the toxic compound is known to fluctuate on a seasonal basis. The problem of the enzymes associated with the formation and decomposition of these compounds in nature has therefore arisen, after being hitherto unknown. The author has previously determined the levels of monofluoroacetamide residues

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dispersed in various plants, and discovered that soil contains a bacterium which breaks the C-F bond in monofluoroacetamide. This paper reports on the bacterium, which has been isolated and provisionally termed the C-F bacterium, and gives the results of research into the properties on the C-F bacterium and the enzymes which break the C-F bond. The properties of the C-F bacterium isolated from soil, which has the ability to break the C-F bond in monofluoroacetate, were studied, and some reasrch was done into the character of the C-F bond-breaking enzyme extracted from that bacterium;

1. The bacterium is a gram-negative bacillus with polar flagella, and measures 0.3-0.7 by 0.5 to 2 µ.
2. The bacterium can be cultured at a pH ranging from 5.0 to 9.0, at an optimum temperature of 25-30 degrees
3. Its temperature resistance is low, the bacterium being killed by one minute at 60 degrees
4. Study of its physiological properties showed that this bacterium strongly resembles *Psuedomonas indoloxidans*, but it is regarded as a separate species lacking the ability to oxidise indole.
5. This bacterium breaks the C-F bond in monofluoroacetate, but has no effect on difluoroacetate
6. The enzyme which breaks the C-F bond occurs only inside the bacterium and is not excreted from it
7. The enzyme extract solution was comparatively stable at low temperatures but unstable at high temperatures, and was found to be completely deactivated after 2 days at 35 degrees Celcius or 3 minutes at 100 degrees Celcius
8. The optimum temperature of the enzyme was 28 degrees celcius after testing for 3 hours, and 24 degrees after 4 hours
9. The enzyme showed little dependence on pH, but the optimum pH range was from 7.5 to 8.0
10. Salting out the enzymes with ammonium sulphate gave almost complete precipitation at an Osbourne saturation of 0.395
11. The enzyme had an effect only on the FCH2CO- radical in the experiment
12. The enzyme is believed to participate in the following reaction:

   \[ \text{FCH}_2\text{COONa} + \text{H}_2\text{O} \rightarrow \text{HOCH}_2\text{COONa} + \text{HF} \]

Ref Type: Internet Communication
Keywords: humans/1080/poison
Abstract: The toxin 1080 is used in New Zealand for the control of the introduced marsupial the brushtailed possum (Trichosurus vulpecula) for conservation purposes and for controlling the effects of Bovine Tuberculosis. The use of this poison is controversial. This report outlines a research project aimed at understanding how the quality of consultation processes affects the way that Mäori communities deal with the use of 1080 in their local areas.
Mäori differ little to Päkehä in their range of views on the use of toxins in their local environments. On the whole, few people whether Mäori or Päkehä, are comfortable when toxins such as 1080 are aerially dropped in their local area, particularly when they take water from that area. For the community groups involved, it appears the issue is not purely about the use of 1080. Rather it is about the level of control local people feel they have over their own local environment.
Authorities or people representing them must involve iwi and try to increase their sense of control. This means that they must work on their relationships with iwi and see these interactions as part of an ongoing process. Public controversy is less likely to constrain pest control operations if agencies manage pests in partnership with the appropriate iwi group. In a true partnership situation, agency representatives must respond honestly to the requests of the community and the community need to feel that the agency hears and responds to their concerns. Overall, it appears many agency representatives may need assistance with the communication processes involved in developing partnerships with iwi (or indeed any other community group). In particular it is important that representatives distinguish between informing groups and working with them in a partnership situation.

Keywords: brain/fluorocitrate/fluoroacetate/citrate/poisoning/citric acid/strychnine/convulsions
Abstract: Fluoroacetic and fluorocitric acid toxicity is often characterised by seizures, however the mechanism of this activity is unknown. Intrathecal (i.t.) injection of fluorocitrate in mice resulted in seizures after an average latency of 15 seconds, while intracerebroventricular (i.c.v) injection produced seizures after 36.5 minutes and required higher dosages to achieve this effect. This indicates that the
probably site of fluoroacetate and fluorocitrate neurotoxicity is the spinal cord. To mimic citrate accumulation characteristic of fluoroacetate and fluorocitrate poisoning, citric acid was injected i.t. and also found to produce seizures. The structurally unrelated compounds EDTA, EGTA, glutamic acid and lactic acid also produced seizures identical to fluorocitrate. The ability of these compounds to chelate Ca2+ correlates well with their ability to cause seizures when administered i.t. and coadministration of calcium greatly attenuated the neurotoxicity of these compounds as well as fluoroacetate and fluorocitrate. In contrast, Ca2+ was unable to inhibit seizures elicited by strychnine, suggesting calcium's ability to inhibit chelators of divalent cations is not due to a general anticonvulsant effect. These results suggest that changes in Ca2+ concentration in the spinal cord may be responsible for some forms of seizure activity.

Hornshaw, T. C. Development of dietary LC(,50) and reproduction test protocols using mink and ferrets as representative mammalian carnivores. 228. 1984. Michigan State University Editor.

Ref Type: Thesis/Dissertation
Keywords: ferrets/carnivores/wildlife/reproductive effects/sodium monofluoroacetate/monofluoroacetate/1080/acute toxicity/toxicity

Abstract: Representative mammalian wildlife species have not been designated as toxicological models for testing substances of environmental concern. The mink (Mustela vison) and the European ferret (M. putorius furo) have been suggested as representative mammalian species since they are among the most sensitive mammalian species to the toxic and reproductive effects of several substances. Also, as carnivores, these species are subject to the effects of bioaccumulation of lipophilic compounds. Therefore, dietary LC(,50) and reproduction tests were initiated with these species, using sodium monofluoroacetate (Compound 1080), o-cresol, tetramethylthiuram disulfide (thiram), and a polychlorinated biphenyl (Aroclor 1254) as test substances to develop protocols for these tests. The results of the various tests demonstrate that mink and ferrets may be used in subacute and reproduction tests with a wide range of test substances, since the test substances used represented a wide range of solubilities, volatilities, acute toxicities, modes of action, and chemical classes. Since the tests were conducted indoors under controlled conditions, it is expected that the results should be reproducible in similarly equipped laboratories. Factors demonstrated in these tests that may affect the determination of toxicity of a substance include the age of the animal at the beginning of a test and the carrier used to introduce the substance into the diet, while the diet's composition (as long as it meets the nutrient requirements of the test species) and the season of the year may have little or no effect on the results of the test. Dietary LC(,50) tests may be conducted with as few as 32 animals (3 test concentrations plus control, 8 animals per concentration) if an accurate acute oral LD(,50) is available, while reproduction tests may require 64 animals (3 test concentrations plus control, 16 animals per concentration) if unproven breeders are used.


Keywords: acute toxicity/non-target species/pathology/1080/ferrets/blood/testes/reproductive effects

Abstract: The toxicity of sodium monofluoroacetate (Compound 1080) to mink (Mustela vison) and European ferrets (Mustela putorius furo) was evaluated through LC50 and reproduction tests. Subacute dietary exposure to Compound 10890 resulted in dose dependent decreases in body weights and feed consumption in both species. The mink were more sensitive to Compound 1080 than were the ferrets. The 28d dietary LC50 test, however, revealed that young, rapidly growing animals may be unsuitable for tests of this duration unless precautions are taken to assure that they do not "outgrow" potentially lethal concentrations of the test chemical.


Keywords: temperature/sodium fluoroacetate/fluoroacetate

Abstract: The authors carried out a theoretical evaluation of body temperature changes in mice after the administration of 5 mg FAc/kg at environmental temperatures of 30°, 23° and 17°C. A differential equation...
for the course of the body temperature, based on the reciprocal relationship of heat production and heat output, was formed and an analogue computer study was done. Changes in effective heat conductivity during several hours' exposure to FAc did not significantly influence the course of the body temperature. The effectiveness of their influence and the significance of the environmental temperature for adjustment of the body temperature in the presence of limited heat production is discussed.


Abstract: New Zealand has a multiplicity of important ecologically challenging, animal control problems that must be seen to be believed. They are the consequence of intentionally introducing a number of mammals for sport, food, fur, or mistakenly, as predators of the introduced rabbits. These introduced mammals have upset the natural stability of the habitats over large areas by destroying vegetation, thus also causing extensive erosion. The principal reasons for the destructiveness of the exotic big game animals, fur bearers, and wild pigs and goats to certain habitats in New Zealand are (1) some of the soils are highly susceptible to erosion, (2) the mountainous country often gets high intensity rainfall, and (3) many of the endemic plants have little innate resistance to heavy, selective, grazing or browsing. As a result of these introductions, an irreversible change in the composition of the vegetation has occurred throughout many of the mountain ranges. However, where enough soil has remained, and where browse-resistant and unpalatable plants have replaced adequately those destroyed by the browsing mammals, a new and stable equilibrium of the animal-vegetation-soil complex has developed. But on some mountains both the A and B soil horizons have been lost.

It appears that the problem species of introduced mammals cannot be eradicated from New Zealand. Consequently, it would seem to be more prudent from a long term viewpoint to accept the concomitant vegetational changes, especially where they do not adversely affect watershed conservation. Therefore, a logical long-term objective toward the noxious animal problem is to strive for habitat stability, whether by reseeding, shooting by private hunters, or, wherever the exotic animals have upset seriously the soil-vegetation stability of the original communities, by intensive animal control by government personnel.

Better means of either repelling troublesome mammals or of achieving more effective reduction of their numbers with chemicals and other means are urgently required now to protect critical areas and localised sites where the introduced mammals are still depleting the land or are maintaining it in an unstable condition. In the future we must learn to tolerate deer in some areas while at the same time controlling them more effectively in other.


Abstract: There is little evidence in the literature indicating that pest vertebrates have developed genetic resistance to rodenticides. This study has confirmed that Long-Evans rats, thus presumably also wild rats, have the propensity of developing considerable genetic resistance to the rodenticide sodium monofluoroacetate (commonly called compound 1080). After five generations of non-intensive selective breeding, the approximate LD50 changed from 2 mg/kg of 1080 for the parents to 3.5 mg/kg for the F4 generation. The percentage survival of F4 rats stomach-tubed with 5 mg/kg of 1080 was 3.75 times as great as occurred with the parental stock and 4.75 at 6 mg/kg.


Abstract: Deer mice (Peromyscus maniculatus) conditioned by sublethal doses to avoid eating oat kernels dipped in sodium fluoride (1080) were held for 1, 2, 4 and 8 months without access to any oats. When tested for aversion, no mouse tested directly with poisoned oats, at all 4 kernels offered each day, although 9% ate fatal amounts. Of 32 mice prebaited with clean oats for 2 days, only 72% consumed lethal amounts. Deer mouse control should not employ the same poison at intervals shorter than 8 months.

Keywords: toxicity/rabbits/antidote/metabolism/citric acid

Abstract: All rabbits given fluoroacetyl glycine (1.5 mg/kg body-weight) without antidote died from ventricular fibrillation within 2 to 6 h. More than half of those given reserpine and oxytocin as antidote survived and all of those given acetamide before and together with fluoroacetyl glycine survived. None of those given acetamide 1.5 h after fluoroacetyl glycine survived. It is suggested that fluoroacetic acid derivatives may cause a blockage of the metabolism of citric acid in rabbits.


Keywords: metabolism/fluoroacetate/fluoroacetamide/invertebrates

Abstract: Work carried out by the author since 1959 on the energy metabolism of Schistosoma japonicum is summarized under the headings: influence of the composition of the medium on respiration and glycolysis; identification of a functional tricarboxylic acid cycle; effects of fluoroacetate and its derivatives on the tricarboxylic acid cycle; effects of fluoroacetamide on glycolysis. Findings are compared with those of other workers, particularly with regard to S. mansoni.


Keywords: fluorocitrate/fluoroacetate

Abstract: Preliminary enzymatic studies with R and S tritated fluoroacetate have been performed, and the amount of enzymatically synthesized T2O and tritated fluorocitrate has been quantitated after chromatographic resolution. The results show a dilution of counts in fluorocitrate (as compared to T2O) with time. These studies are presently being investigated in depth as a possible means of determining the absolute configuration of the inhibitory isomer of fluorocitrate.


Keywords: lethal dose/birds

Abstract: Acute po LD50 values for 14 common pesticides (4 central nervous system stimulants and 10 anticholinesterases) were determined on mallard ducks (Anas platyrhynchos) aged 36 hr, 7 days, 30 days and 6 mo. The youngest mallards were more sensitive than the oldest to 6 compounds and less sensitive to 8. the extremes in susceptibility to a compound between age groups were generally less than 3-fold. The 4 central nervous system stimulants produced LD50 values that decreased from 36 hr to 7 or 30 day old animals, and increased from animals aged 7 or 30 day old animals, and decreased from animals aged 7 or 30 days to 6 mo. the results indicate that young animals are not always more susceptible to pesticides than adults of a species. It is recommended that age-susceptability factors be considered in the development of standardized toxicological protocols.


Keywords: sodium monofluoroacetate/monofluoroacetate/wildlife/birds/ferrets/deer

Abstract: LD50's for birds and ferrets and mule deer.


Keywords: secondary poisoning/fluoroacetate/sodium monofluoroacetate/ferrets/mammals/persistence in animals


Keywords: product chemistry

European journal of neuroscience 12, 239-246.
Keywords: mode of action

Keywords: mode of action

Keywords: sodium fluoroacetate/treatment/mode of action/rabbits/dogs/fluoroacetate/poisoning

Ref Type: Report
Keywords: 1080/baits/poisoning/invertebrates/sublethal effects
Abstract: Caged weta (Hemideina thoracica) were offered 1080 poison impregnated grain based pellets in the laboratory. 50% of the weta offered the toxic baits died, while the other 50% suffered sublethal poisoning which altered their behavioural patterns. This did not occur with the control group of those offered non-toxic baits.

Keywords: metabolism/treatment/fluoroacetate/fluorocitrate/aconitase/biosynthesis/persistence in plants
Abstract: Succinate metabolism was investigated in scutella of germinating wheat cv. Severdonskaya and maize cv. Voronezhskaya 76 seeds, Ricinus communis endosperm, and sunflower cv. Trudovik and soyabean cv. Amurskaya cotyledons. In scutella, succinate oxidation via the conventional mitochondrial succinate dehydrogenase coexisted with a tenoyltrifluoroacetone- and malonate-insensitive succinate oxidase system, which was strictly confined to the glyoxysomal membranes. Malate and H2O2 were identified as products of this glyoxysomal succinate oxidase complex. The complex was most active during enhanced operation of the glyoxylate cycle, with a pH optimum at 7.5-8 and an apparent Km value for succinate of 18 ± 4 mM, which is much higher than that known for succinate dehydrogenase. Neither sunflower or soyabean cotyledons, nor R. communis endosperm demonstrated glyoxysomal succinate oxidase activity. Treatment of [1.4-14C]-succinate-fed maize scutella with tenoyltrifluoroacetone, an inhibitor of succinate dehydrogenase, dramatically reduced label incorporation into the sugar fraction, increased 14CO2 evolution, and did not significantly affect the amino acid labelling pattern. Fluoroacetate, which is known to convert to fluorocitrate, an inhibitor of aconitase, suppressed both the tricarboxylic acid and the glyoxylate cycles, decreased the label incorporation from succinate to organic acids and potentiated the biosynthesis of labelled amino acids, notably alanine, glutamic acid, aspartic acid, serine, valine, and lysine. Thus, succinate oxidation by the glyoxysomal succinate oxidase complex was associated with its conversion to amino acids, organic acids, and CO2. It was concluded that succinate oxidation in cereal scutellum glyoxysomes, which bypassed a control pressure from the tricarboxylic acid cycle and respiratory chain, enables rapid succinate mobilization during large-scale synthesis through the glyoxylate cycle

Keywords: liver
Abstract: 1. Rat liver cytoplasmic acetyl-CoA synthetase was partially purified (purification factor = 23, yield = 30%).
2. The apparent $K_m$ s for acetate, coenzyme A, ATP and MgCl$_2$ were determined and found to be 52.5 µM, 50.5 µM, 570 µM and 1.5 mM, respectively.
3. The partially-purified enzyme showed a low affinity for short-chain carbon substrates other than acetate.
4. The properties of the partially-purified enzyme were compared with those of enzymes from other sources.

Keywords: poisoning/rats/1080/brodifacoum/birds/baits/field efficacy

Abstract: This paper desribed the impact of nine poison operations on ship rats in four areas (35 ha to 3200 ha) of North Island forest. Poisoning with 1080, brodifacoum, or pindone killed 87-100% of rats, based on trapping and tracking-tunnel indices. Rat population took 4-5 months to recover. Operations to protect nesting birds should therefore coincide with the onset of nesting and be repeated each year, although not necessarily with the same methods. Population reduction declined each year at Mapara, King Country during three annual 1080 operations which used the same lures and baits, but remained high at Kaharoa, Bay of Plenty, where poison toxicity was higher, non-toxic bait was pre-fed, and poisoning methods varied each year. Mouse tracking rates increased in poisoned forests 3-6 months after poisoning if the initial kill of rats exceeded 90%, peaked 7-9 months after poisoning then declined to pre-poison levels.


Keywords: field efficacy/target species/non-target species/persistence in animals/persistence in plants/persistence in soil/persistence in water/1080/brodifacoum/mammals

Abstract: Toxins, especially sodium monofluoroacetate (1080) and brodifacoum, are widely used throughout New Zealand for control of introduced mammals that are considered pests. This level of toxin use (not necessarily with these toxins) is unlikely to decline for at least 5-10 years. Ecological consequences derive both from mammal population reduction or eradication, and from using toxins as the control method. Scientists have not examined the net ecological outcomes of these consequences at the community level due to their daunting complexity, although managers usually manipulate whole communities and key conservation legislation demands that they do so. A food web could be a useful conceptual framework to generate hypotheses about toxin movement through communities, and to explore net outcomes of pest control at the community level. It could also sharpen objectives for ecosystem restoration on the New Zealand mainland, and help to find common ground between different participants in ecosystem management. We interpret present evidence to suggest that the ecological costs of using toxins are much less than the damage costs if they are not used, due to the magnitude of known impacts of introduced pest mammals. This suggestion deserves exploration; it may not be true when persistent toxins such as brodifacoum are used repeatedly. Research on toxin use should continue on its present broad front, but we suggest that priorities are to measure net ecological outcomes at the community level, to reduce toxin use, and to improve pest control strategies and techniques in the maintenance phase of control operations. Finally, we suggest that an annual ecosystem management conference in New Zealand, which explicitly brings together managers, policymakers, landowners, and scientists from the many disciplines now relevant to the complex field of pest mammal control, would enhance progress and co-operation.


Keywords: cardiac/muscle

Abstract: Excess H$_2$O$_2$ contributes to myocardial reperfusion injury. We detail the effect of H$_2$O$_2$-induced oxidant stress on the tricarboxylic acid (TCA) cycle in isolated heart muscle cells. Cardiomyocyte exposure to bolus H$_2$O$_2$ (>50 µM) acutely suppressed TCA cycle activity. Loss of cardiomyocyte TCA cycle function on cellular H$_2$O$_2$ exposure was supported by the rapid in situ inactivation of aconitase along with cardiomyocyte membrane peroxidation. Without peroxidation, the loss of aconitase catalysis was itself sufficient to jeopardize TCA cycle activity. Only H$_2$O$_2$ dismutation completely preserved both cardiomyocyte aconitase activity and TCA cycle flux during H$_2$O$_2$ overload. Restoration of aconitase catalysis after alleviation of the oxidant insult was prohibited by cell-permeable metal chelators, and TCA cycle flux could not be reestablished in peroxidized cells, even if aconitase activity had recovered. The characteristics of aconitase inactivation-reactivation observed are consistent with adverse redox changes to the enzyme's (Fe-S) cluster. These data demonstrate that specific aspects of the TCA cycle in heart muscle are sensitive to H$_2$O$_2$-induced oxidative stress and identify a peroxidative component of the injury process.

Keywords: fluoroacetate/citrate/blood/convulsions/mammals/symptoms
Abstract: The effect of continued administration of sublethal doses of fluoroacetate to sheep was investigated.


Keywords: sodium fluoroacetate/fluoroacetate/1080/poisoning/symptoms/convulsions/heart/livestock/mammals/lethal dose
Abstract: Under conditions of the experiment, the m.l.d. of sodium fluoroacetate for sheep was between 0.25 and 0.50 mg per kilogram of body weight. The m.l.d. was also the minimal dose producing symptoms. The time interval between administration and manifestation of symptoms varied inversely with the size of the dose. Symptoms of poisoning were motor irritation, excitation, rapid pulse becoming weak, general weakness, convulsions and death; heart action ceased before respiration. All animals showing symptoms died. The 2 survivors received the lowest dosage and appeared normal at all times. A modified field rodent bait prepared with steam rolled oats, containing 1 mg sodium fluoroacetate per gram of gram was used in this experiment.


Keywords: product chemistry


Keywords: citrate/treatment/mammals/fluoroacetate/fluorocitrate/aconitase/Krebs cycle/mode of action/citic acid/liver/brain/symptoms/poisoning/inhibition/invertebrates
Abstract: Nissol (2-fluoro-N-methyl-N-1-naphthylacetamide), which is selectively toxic to several species of insects and mites but not very toxic to mammals, is hydrolysed to the substituted naphthylamine and fluoroacetate in all three types of organism. Such hydrolysis is common to the N-containing derivatives of fluoroacetic acid, all of which cause accumulation of citrate in treated organisms through (it is thought) conversion of the fluoroacetate to fluorocitrate, a known inhibitor of the activity of aconitase on citrate in the Krebs cycle. To find whether this is the likely mode of action of Nissol, the amounts of citric acid in mice, house-flies (Musca domestica L.) and two-spotted spider mites (Tetranychus urticae Koch) were determined before and up to 12 h after they had been treated with half the respective LD50's and LC50 of the compound. Preliminary tests, in which mortalities were recorded 24 h after treatment, showed the LD50 for mice to be 200 mg/kg body weight by intraperitoneal injection, those for house-flies to be 14 mg/kg by injection and 525 mg/kg by topical application, and the LC50 for mites to be 250 p.p.m. [cf. RAE/A 61, 274] by the slide-dip technique [cf. 52, p.103]. In the main tests, the amounts of citric acid found 12 h after treatment with Nissol were in mg/g, 0.30 in mice (as compared with 0.13 in untreated examples), 0.68 in house-flies (0.48) and 0.60 in mites (0.36). The amounts in mouse tissues varied from 81.1 mg/kg in liver to 512.5 mg/kg in brain, compared with 41.0 and 166.0 in untreated examples. These rises, together with the fact that typical symptoms of organofluorine poisoning were observed, suggest that Nissol acts by inhibition of aconitase in all three test species.


Keywords: 1080/poisoning/dogs


Keywords: metabolism/bone/sodium fluoroacetate/fluoroacetate/blood
Abstract: The mechanism by which the utilization of transferrin-bound iron is linked with cellular metabolism was investigated using rabbit reticulocytes and bone marrow cells. The rate of metabolism was altered by the use of inhibitors which act at different sites in the metabolic pathway (NaF, sodium fluoroacetate, rotenone, 2,4-dinitrophenol, NaCN) and by the addition of metabolic substrates (inosine, sodium pyruvate, sodium lactate). Measurements were made of the rates of iron and transferrin uptake and, in many of the experiments of cellular ATP and NADH concentrations. The results showed that there was a
significant correlation between the rate of iron uptake and the ATP concentration of the cells, but no correlation was found with the NADH concentration. The rate of transferrin uptake was inhibited to a lesser degree than that of iron uptake, and only when the ATP concentration had fallen below that necessary to inhibit iron uptake. It is concluded that the rate of uptake of transferrin-bound iron by immature erythroid cells is dependent on the intracellular concentration of ATP but is independent of the NADH concentration.


Keywords: efficacy/sodium monofluoroacetate/monofluoroacetate/1080/USA/field efficacy

Abstract: Damage by Belding's ground squirrels (*Spermophilus beldingi*) to alfalfa and the efficacies of 3 baiting regimes to reduce damage were evaluated in southcentral Oregon during March-July 1977. Regimes examined were number of applications (1 or 2) and inclusion of a baited border around baited fields. Bait was sodium monofluoroacetate (1080) on oat groats.


Keywords: field efficacy

Abstract: The manufacture of "1080" is still on a limited scale and for the experimental work still under way. Indications are that, because of its high toxicity, the material will become, under volume production, a relatively cheap poison. At the present time, the many unknowns regarding it and the restricted basis on which it is being produced preclude the use of "1080" by the public or even by rodent control operators generally. It is reasonably ceratin that the discovery of "1080" assures this nation of a highly effective economic poison which can not be denied this country through any future interruptions of world trade.


Keywords: fluoroacetate/citrate/sodium monofluoroacetate/monofluoroacetate

Abstract: BaCl2, MgCl2 and sodium monofluoroacetate increase the formation of citrate from oxaloacetate by a rabbit kidney cortex homogenate. Mg++ is twice as effective as Ba++. Ba++ seems to have more than one concentration optimum, and inhibits at higher concentrations. MgCl2 and sodium fluoroacetate are equally effective, over a wide range of concentrations. The other halogen acetates do not increase citrate formation from oxaloacetate. The effects of BaCl2 and MgCl2 in increasing citrate formation can be accounted for by the inhibition of citrate utilization by the tissue, Mg++ being somewhat superior to Ba++ in this respect. The slight inhibition of citrate utilization at higher concentrations of fluoroacetate can only account for about 60% of the increased citrate formation from oxaloacetate, in the presence of fluoroacetate. The possible mechanisms of action of Ba++ Mg++, and fluoroacetate, in this system, are discussed.


Keywords: toxicity/rats/liver/kidney/occurrence in nature/pathology/heart

Abstract: Toxicity of the shrub was demonstrated in guinea-pigs, rats and calves, fed on extract of ground material from the leaves or branches. Calves developed hydropericardium with haemorrhages on the epicardium and endocardium. The peritoneal cavities contained 1.5-2 litres of fluid. Haemorrhages also occurred on the lungs and there was some haemorrhagic enteritis. Histologically, there were degenerative changes of the myocardium and extensive congestion of the liver and kidneys. Congestion was also observed in the lungs, meninges and intestinal mucosa. Clinical and PM findings were similar to those in calves poisoned by *D. cymosum* in which the toxic principle is fluoracetic acid. The acidic component of *D. ruhlandii* was shown to be toxic to guinea-pigs. This extract was not identified but some properties indicate the presence of fluoracetic acid in the crude acidic extract.


Keywords: tolerance/fluoroacetate/rats/citrate/brain/resistance

Abstract: The citrate content of rat brain appears to have no relation to the tolerance to fluoroacetate which has been observed. The citrate which accumulates in rat brain as the result of a small dose of fluoroacetate does not prevent the further formation of citrate when larger doses of fluoroacetate are given. Small doses...
of fluoroacetate increase the resistance in rats to challenging doses of of fluoroacetate or 4-fluorobutyrate. Resistance to fluoroacetate of 4-fluorobutyrate could not be evoked when rats were intially treated with small doses of 4-fluorobutyrate.


Abstract: In rats, administration of bovine growth hormone led to an increase in urinary calcium excretion associated with a fall in renal concentration of citrate. Plasma citrate was uncahlnged, while urinary citrate either increased or remained constant.


Abstract: S-1 is a new oral formulation of 5-fluorouracil (5-FU) containing 1M tegafur and 0.4M 5-chloro-2,4-dihydroxyxypyrine (CDHP) and 1M potassium oxonate (Oxo). It has been reported to have a high antitumour activity and low gastrointestinal toxicity in rats bearing murine and human tumors. We further studied the possible inhibition of the toxicictes caused by the products of 5-FU metabolism with the use of CDHP, a new inhibitor of 5-FU degradation and Oxo, an inhibitor of 5-FU phosphorylation. In a model of pentylenetetrazole-induced convulsions in mice, intravenous injection of fluoroacetate (3 mg/kg), 2-fluoro-b-alanine (30 mg/kg) and 5-FU (over 300 mg/kg) significantly augmented the occurrence of convulsion. However coadministration of an equivalent dose of CDHP with 5-FU almost completely suppressed the 5-FU-augmented convulsions, suggesting that inhibition of 5-FU catabolism by CDHP may lead to a decreased risk of development of 5-FU neurotoxicity.


Abstract: Oxidative metabolism of *R. stolonifer* (Ehrenberg ex Fr.) Lind. [soft root pathogen of *Pyrus communis*] was studied manometrically using a Warburg constant volume respirometer. The respiratory rates were directly dependent on the phase of fungal growth. Maximum $Q_{O_2}$ [µl of O$_2$ consumed/h . mg$^{-1}$ dry weight of fungal mycelium] values (26.0) were obtained at 120 h of culture age. Inhibition caused by sodium fluoride and sodium fluoroacetate suggests the occurence of an EMP pathway and TCA [tricarboxylic acid] cycle in the oxidative metabolism. Sodium malonate could not produce suppression. All the tested antibiotics produced respiratory inhibition. A highly significant inhibitory effect was produced by ampicillin (calculated value of t = 11.54 significant at 0.001 probability). $Q_{O_2}$ values were considerably suppressed by the fungicides such as sulfate, cosan, brassicol, thiram and captan.


Abstract: 5-Fluorouracil is widely known to be toxic to the hematopoietic and gastrointestinal systems. It also has cardiac toxicity, but this is perceived to be rare. During a 16-month period from January 1990 through April 1991, approximately 910 patients were treated with 5-fluorouracil. Five of these developed life-threatening toxicity consistent with coronary artery spasm for an incidence of .55%. The acute events occurred on the third or fourth day of the 5-day infusion and after the fourth intravenous bolus in the patient on bolus therapy. Each of the patients had ST elevation and ventricular arrhythmias, four had acute myocardial infarction, and two had cardiac arrests. In these cases and those previously reported, cardiac toxicity is consistent with drug- or metabolite-mediated increases in coronary vasomotor tone and spasm, leading to the full spectrum of signs and symptoms of myocardial ischemia in susceptible individuals.

toxicity/convulsions/analysis/fluorocitrate/kidney/flouride/humans

Abstract: A series of 1-(di)halo-2-fluoroethanes reported in the literature to be nontoxic or of low toxicity were found to be highly toxic by the inhalation route. Experiments were performed that showed the compounds, 1,2-difluoroethane, 1-chloro-2-fluoroethane, 1-chloro-1,2-difluoroethane, and 1-bromo-2-fluoroethane to be highly toxic to rats upon inhalation for 4 hr. All four compounds had 4-hr approximate lethal concentrations of less than or equal to 100 ppm in rats. In contrast, 1,1-difluoroethane (commonly referred to as HFC-152a) has very low acute toxicity with a 4-hr LC50 of >400,000 ppm in rats. Rats exposed to the selected toxic fluorothanes showed clinical signs of fluoroacetate toxicity (lethargy, hunched posture, convulsions). 1,2-Difluoroethane, 1-chloro-2-fluoroethane, 1-chloro-1,2-difluoroethane, and 1-bromo-2-fluoroethane were shown to increase concentrations of citrate in serum and heart tissue, a hallmark of fluoroacetate intoxication. F-19 NMR analysis confirmed that fluoroacetate was present in the urine of rats exposed to each toxic compound. Fluorocitrate, a condensation product of fluoroacetate and oxaloacetate, was identified in the kidney of rats exposed to 1,2-difluoroethane. There was a concentration-related elevation of serum and heart citrate in rats exposed to 0-1000 ppm 1,2-difluoroethane. Serum citrate was increased up to 5-fold and heart citrate was increased up to 10-fold over control citrate levels. Metabolism of 1,2-difluoroethane by cytochrome P450 (most likely CYP2E1) is suspected because pretreatment of rats or mice with SKF-525A, disulfiram, or dimethyl sulfoxide prevented or delayed the toxicity observed in rats not pretreated. Experimental evidence indicates that the metabolism of the toxic fluorothanes is initiated at the carbon-hydrogen bond, with metabolism to fluoroacetate via an aldehyde or an acyl fluoride. The results of these studies show that 1-(di)halo-2-fluoroethanes are highly toxic to rats and should be considered a hazard to humans unless demonstrated otherwise.


Keywords: fluoroacetate/fluoroacetamide/defluorination/metabolism/bacteria/aconitase

Abstract: Fluoroacetate or fluoracetamide, after conversion to fluoroacetate, inhibit aconitase and therefore block the tricarboxylic acid cycle; consequently these chemicals are toxic to animals and are used as pesticides. There have been at least two occasions when accidental contamination of soil and water by fluoracetamide has occurred. This communication reports the isolation of bacteria able to use these compounds for growth.


Keywords: occurrence in nature/mammals

Abstract: Feeding experiments carried out with cattle and horses could prove the toxic effects of P.marcgravii (Rubiaceae) in all cases. The typical symptoms of "sudden death", however, are observed in ruminants only. This difference could not be explained so far. Apart from fluoroacetate, two more substances also have influence the toxic effects and have been isolated from P.markgravii for the first time: N-methyltryamine and 2-methyltetra-hydro-Beta-carboline (2-Me THBC). Structure elucidation of these compounds is mainly accomplished by H-NMR, C-NMR and MS techniques. Due to the small quantity of fluoroacetate (5.4 mug/g plant), the main toxic effect obviously lies in the two discovered substances. In contrast to the slow death of horses (monogastrics), the "sudden death syndrome" of cattle (ruminants) can be explained as a result of the higher resorbility of these two substances in the gastro-intestinal system. Given orally, both substances influence the monoamine oxidase type A (MAO-A): N-methyltyramine acts as a competitive substrate, and 2-Me THBC is one of the most effective MAO-A-inhibitors. Thus, the decomposition of the specific MAO-A-substrates noradrenaline and adrenaline as well as of N-methyltyramine itself is inhibited. The alpha and beta receptors of the sympathetic system are stimulated more strongly, which leads to a drastic rise in blood pressure and thereby to a more rapid distribution of fluoroacetate in the body. This results in a reinforced input of fluoroacetate in the cells of especially active organs of the body (heart etc.). Thus even smaller quantities of fluoroacetate are lethal.

Keywords: efficacy/baits/poisons/cyanide/strychnine/sodium fluoroacetate/fluoroacetate/1080/fumigant/ground control/rodents/field efficacy

Abstract: Filed trials were conducted to determine the efficacy of three fumigants and two acute poisons against the crested porcupine *Hystrix indica*, in forest plantations and croplands. The highest mortality was obtained with the use of a two ingredient gas cartridge, followed by sodium cyanide and aluminium phosphide. Strychnine baits were less effective than baits prepared from sodium fluoroacetate (1080). Further large-scale operational research studies are needed to develop the use of a two-ingredient gas cartridge as a single management tool against *H. indica* and other burrowing porcupines.


Abstract: A procedure was developed for the determination of sodium monofluoroacetate as the free acid by capillary gas chromatography with massselective detection. Commercially available polyethylene glycol capillary columns were compatible with injections of highly acidic aqueous solutions which were required for this relatively strong acid. Using monochloroacetic acid as an internal standard, a coefficient of variation of less than 2% was routinely obtained from replicate injections of a 100 jg/ml solution of sodium monofluoroacetate in 1 M HC1. The monofluoroacetic acid/monochloroacetic acid detector response ratio was a linear function of sodium monofluoroacetic acid is obtained, the method offers advantages over previously described chromatographic methods for the determination of sodium monofluoroacetate. The average analyte recovery from 30 to 40 g biological samples fortified with between 2.5 and 100 mg of sodium monofluoroacetate was 81% with relative standard deviation typically less than 7%. The instrument limit of detection was 200 pg sodium monofluoroacetate when the detector was operated in the selected ion monitoring mode.


Keywords: 1080/mode of action/occurrence in nature/tolerance


Keywords: mammals/fluoroacetate/tolerance/occurrence in nature/marsupials/rodents

Abstract: The tolerance to fluoroacetate of *Macropus fuliginosus, Trichosurus vulpecula* and *Rattus fuscipes* from the south-west of Western Australia is unusually high. *T.vulpecula* and *R. fuscipes* from eastern Australia are much more susceptible than conspecifics from Western Australia. This tolerance appears to be an adaptation to the presence of monofluoroacetic acid in many species of the plant genera *Gastrolobium* and *Oxylobium*, which occur within the range of these mammals in Western Australia. The co-evolution of this defence mechanism in plants and the development of tolerance to fluoroacetate by herbivores is discussed.


Keywords: fluoroacetate/1080/tolerance/occurrence in nature/marsupials/mammals

Abstract: The tolerance of the three species of *Bettongia* to fluoroacetate has been determined. *B.gaimardi* is comparable with most species of herbivorous mammals, *B.lesueur* is highly tolerant and *B.penicillata* has an exceptionally high tolerance. These differences reflect the past distribution of these species in relation to plants containing fluoroacetate. The relevance of these tolerance levels in the management of *Bettongia* populations (by the control of introduced predators) is discussed. A more general role for 1080 in the conservation of threatened fauna in Western Australia is suggested.


Keywords: tolerance/fluoroacetate/marsupials/1080/sodium monofluoroacetate/acute toxicity/lethal dose

Abstract: The tolerances to sodium fluoroacetate (1080) were estimated for *Dasyurus geoffroii* (LD 50, ca. 7.5 mg 1080 kg-1), *D.hallucatus* (ca. 7.5 mg kg-1), *Antechinus flavipes* (ca. 11.0 mg kg-1) and *Phascogale calura* (ca. 17.5 g kg-1) from western Australia and comparisons were made with *D.viverrinus* (ca. 1.5 mg kg-1) and *A.flavipes* (ca. 3.5 mg kg-1) from south-eastern Australia. The species from western Australia have had evolutionary exposure to naturally occurring fluoroacetate and were more tolerant to the toxin
than dasyurids from south-eastern Australia. Presumably, they have acquired this tolerance through feeding on prey which had fed on plants containing fluoroacetate.

Keywords: aerial control/non-target species/1080/marsupials

Ref Type: Magazine Article  
Keywords: 1080/acute toxicity/non-target species/tolerance  
Abstract: Ecology is about relationships - how different things affect populations of animals, plants and other microorganisms, and how populations affect each other. Many thousands of years ago, a genus of leuminous plants in Western Australia learned how to make a poison commonly known as 1080 to deter seed-eating and browsing animals. In doing so, these plants have profoundly affected the ecology of the State. Dennis King and Jack Kinnear describe how scientists' increased knowledge of the ecology of 1080 can provide a means of controlling introduced species, primarily foxes, which threaten the survival of many species of our wildlife.

Keywords: persistence in soil/1080  
Abstract: Soils from temperature regions of Western Australia contain a diverse assemblage of bacteria and fungi which can defluorinate 1080. Rates of defluorination differed markedly with different species of microorganisms, ranging from 289%. No thermophilic defluorinating microorganisms were found in soil from semiarid or arid regions. Optimal defluorination by soil bacteria occurred at netural to alkaline pH while defluorination by fungi was greatest at Ph5. Defluorination rates in soil were greatest at temperatures which fluctuated between 11° and 28°C with moisture levels of 815%. Defluorination rate in soil did not seem to be closely related to inoculum size, unless 1080 was the only source of carbon.

Keywords: acute toxicity/mammals/1080

Keywords: tolerance/1080/birds

Keywords: aquatic species/1080/toxicity  
Abstract: During the course of some experiments to determine the effects of certain of the new herbicides of fish, we set up some tests, largely out of curiosity, using the new rodenticide 1080. In view of the extreme toxicity of this substance, as reported by ER Kalmach (*Science* 1945, 102,232) we were certainly surprised to find that fingerling bream and bass would survive in concentrations of 1080 as great as 370 ppm for an indefinite period and with no apparent discomfort.

Keywords: ion chromatography

Keywords: fluorocitrate/mode of action/bacteria/degradation

Abstract: Nuclear magnetic resonance (NMR) spectroscopy was employed for the purpose of identifying samples of materials suspected of containing sodium fluoroacetate (Compound 1080). Acquisition of routine proton (H-1) and carbon (C-13) NMR spectra provided a straight-forward means for determining the presence of Compound 1080 in the samples and thus afforded a simple method for analysis and identification of this compound.


Abstract: It was concluded that (--)-erythro-fluorocitrate specifically inhibited citrate transport by its covalent binding to two proteins fractions associated with the mitoplast of liver, kidney, heart and brain tissue.


Abstract: (Conclusions section from Russian article). 1. The character of variation of the total electricity of the skeletal muscles of a rat poisoned with FA (fluoroacetate) (5 mg/kg, intraperitoneally introduced) allow subdivision of the process of poisoning into three stages: Stage 1, characterised by decrease of electrical activity (EA) to 15% of the original level; Stage 2, characterised by an increase of EA of approximately 50% above the original level, and Stage 3, characterised by an irreversible decrease of EA to 5-10% of the orginal level. 2. An argument in favour of Stage 2 (characterised by a considerable increase in EA) representing a compensating, mainly heat-regulating, stimulation of brain structures due to a powerful afferentation caused by hypothermia is discussed. 3. Stage 2 coincides with the period when the loss of body heat and a decrease in total oxygen intake proceed at a lower rate. A similar pattern was observed previously in rodents poisoned with FA and FA-related compounds. The authours believe that this is a consequence of compensatory stimulation of the central nervous system. 4. It is suggested that the final stage of an almost complete cessation of EA reflects a weakening of activity of the central nervous system and consequently a cessation of neurotrophical effects on the periphery.


Abstract: Citric acid content in blood and organs at various time intervals after ip fluoroacetate administration was determined in albino rats. The content of citric acid in blood, heart, skeletal muscles and brain reached the maximum 0.5, 1 and 2 h (for two latter organs). In liver the increased amount of citric acid was determined to the end of the second hour only. In all organs studies except the liver the citric acid content diminished 2-3 hours after the poisoning. It was concluded that in the blood citric acid accumulates as a result of its release from organs. The liver not damaged by the gift is able to increased utilisation of citric acid and then accumulates it as a result of detoxification inhibition. Two hours after poisoning the initial fall in endogenous breathing of skeletal muscles is substituted by its temporal increase. This increase coincides in time with the increased citric acid formation in muscles. It is suggested that the course of both processes may be explained by the utilization of fatty acids the mobilization of which constitutes the part of compensatory processes forming in central nervous system.


Keywords: occurrence in nature/fluoracetate


Keywords: occurrence in nature/fluoracetate
Keywords: baits/metabolism/toxicity/fluoroacetate/invertebrates
Abstract: New candidate insecticides for Solenopsis invicta Buren were prepared which should require metabolism to the known toxicants fluoroacetic acid and trichlorfon before appreciable toxicity could be expressed. Cholesteryl fluoroacetate, sitosteryl fluoroacetate, N-dodecyl 2-fluoroacetamide and to a lesser extent, several fatty acid esters of trichlorfon gave delayed kill of imported fire ant workers. In certain cases, these compounds gave delayed kill over an increased range of concentrations compared to the underivatized toxicants

Keywords: fluorocitrate/Krebs cycle/mode of action/pathology
Abstract: Fluorocitrate, a Krebs cycle inhibitor, induces neurons to rapidly expel multitudinous lysosomes, mitochondria and other cytoplasmic constituents into their axons. After convulsive seizures commence, spectacular axonal balloons develop owing to obstruction of axonal flow by "log jams" of extruded organelles. A swelling of neuronal mitochondria is apparently responsible for the disgorgement of cytoplasmic material into axons.

Keywords: poisoning/1080/baits/birds/persistence in animals/non-target species
Abstract: The use of 1080 baits for rodent control can apparently lead to mortality of yellow-billed magpies. Birds die in the nest making recovery of the bodies unlikely.

Keywords: 1080/poison

Keywords: acute toxicity/birds/non-target species/1080/toxicity/sodium monofluoroacetate/monofluoroacetate/lethal concentration
Abstract: Standard 8-day toxicity experiments were conducted with mallards (Anas platyrhynchos) and northern bobwhite (Colinus virginianus) exposed to a range of dietet sodium monofluoroacetate (Compound 1080) concentrations. Food LC50 estimates for mallards and northern bobwhite were 527 and 385 ppm respectively. Food avoidance tests in which birds were given free choice between equal amounts of clean and contaminated food indicated that mallards and northern bobwhite avoided consumption of 1080-treated food at levels equal to or greater than 236 ppm and 95 ppm respectively. Although water LC50 estimates for both species were approximately an order of magnitude less than those estimated from the food LC50 experiments, these differences could be largely attributed to the fact that, on a w/w basis, both species utilize from 5 to 10 times as much water as food. Water avoidance tests showed that mallards avoided consumption of 1080-contaminated water at concentrations between 13 and 24 ppm. Bobwhite avoided consumption of 1080-contaminated water at concentrations greater than 9 ppm.

Keywords: ground control/bait degradation/field efficacy/1080/baits/predators/dogs

Ref Type: Report
Keywords: 1080

Keywords: sodium fluoroacetate/fluoroacetate/heart/mammals/muscle/mode of action
Abstract: In the isolated papillary muscle of the guinea-pig sodium fluoroacetate (Fac) produced, after an
initial decrease in the force of concentration, a transient positive inotropic effect which was due to an increase in the rate of force development. Time to peak force was shortened and relaxation time was prolonged whereas total contraction time was barely affected. Threshold and maximally effective concentration for the positive inotropic effect were $1 \times 10^{-3}$ and $5 \times 10^{-3}$ M, respectively.


**Keywords:** metabolism/defluorination/fluoroacetate/liver/flouride/bone/rats

**Abstract:** An earlier report showing enhanced accumulation of ionic fluoride in bones of rats given fluoroacetate (FAc) suggested an *in vivo* defluorination of fluoroacetate. Rat liver an organ which shows minimal pathological and biochemical effects in FAc intoxication was found to possess defluorination activity *in vitro*. Subcellular fractionation of livers from male Sprague-Dawley rats was performed in 0.25 M sucrose and yielded the following fractions: whole homogenate, nuclear, mitochondrial, microsomal and 105,000 g supernatant. Defluorination activity was measured by incubating subcellular fractions and their boiled controls with FAc (1 hr. 37°C, pH 7.4, in 0.1 M tris-HCl or 0.1% Triton X-100) and comparing the difference in ionic fluoride content at the end of the incubation. Defluorination activity based on protein content was consistently the highest in the 105,000 g supernatant fraction, the only fraction showing an activity increase over the original homogenate. The microsomal fraction had minimal activity. Defluorination activity in the 105,000 g supernatant as a function of time after fraction isolation at 4°C revealed a time-dependent reduction in activity. After 24 hr at 4°C, activity was almost completely lost. The time-dependent loss of activity at 4°C could be regained when glutathione (GSH) was added to this fraction at a final concentration of 5 mM. Furthermore, GSH significantly increased the defluorination activity in all subcellular fractions. A study of the optimum pH for defluorination activity in the 105,000 g supernatant fraction was performed in 0.1 M Tris-maleate buffer. Surprisingly, a complete loss of activity with this buffer resulted throughout the pH range studied (pH 5.6-8.0). Furthermore, defluorination activity of all subcellular rat liver fractions was completely inhibited by maleate and stimulated by glutathione. These results are consistent with the involvement of a sulfhydryl group in the defluorination of FAc in rat liver.


**Keywords:** metabolism/persistence in animals/defluorination/rats/fluoroacetate


**Keywords:** fluoroacetamide/fluoroacetate/enzyme/biochemistry

**Abstract:** 2,4-dinitrofluorobenzene (DNFB) reacts with glutathione to form a stable product similar to that formed with the model glutathione-S-transferase (GST) substrate, 1-chloro-2,4-dinitrobenzene (CDNB). DNFB is approx. 40 times as reactive as CDNB in this chemical reaction. The enzymatic defluorination of DNFB also proceeds at a more rapid rate that that of CDNB in the GST assay. Fluoroacetamide (FAM) like fluoroacetate (FAC) undergoes no discernable chemical defluorination. Its enzymatic defluorination is approx. 10% of that observed for FAC and only 0.2% of the rate for DFNB. An antibody raised tot he the fluoroacetate specific dehalogenase (FSD) precipitated both FAC and FAM defluorinating activity but had no effect on either CDNB or DFNB activity. The data are consistent with the hypothesis that DNFB is metabolised by the GST while FAM is metabolised by the FSD.


**Ref Type:** Conference Proceeding

**Keywords:** rodents/poisons/poison/fluoroacetate/rats/mammals/invertebrates

**Abstract:** In view of the ecological disadvantages of using wide-spectrum insecticides such as DDT, there is need for a method of biological control. The prospects for developing a system along these lines are discussed. It has been found in the laboratory that Entobakerin (a proprietary preparation of Bacillus thuringiensis) can cause high mortality in fleas in 7-9 days, depending on the dosage used, and is also pathogenic to the larvae. The outlook for the use of sterilisants such as thiopeta (tiotef) is considered. Some
rat poisons (fenitrothion (Sumithion) and barium fluoroacetate) at dosages of 0.12-0.45 mg/kg body weight can sterilise fleas on the rats. At the same time, it has been shown that carbaryl (Sevin) similarly used in doses sublethal to rodents stimulates reproduction in fleas on the rodents. The intensification of the pathogenic effect of B. thuringiensis on Coleoptera by its use in combination with trichlorphon (chlorofos), DDT, gamma -BHC and other insecticides suggests the possibility of elaborating an integrated method of control for fleas using B. thuringiensis together with insecticides at dosages too low to be harmful to mammals

Keywords: liquid chromatography/sodium fluoroacetate/1080
Abstract: A liquid chromatographic (LC) method is described for the determination of sodium fluoroacetate in meat baits and formulations. Baits were extracted with water, ultrafiltered, partitioned into butanone, back-partitioned into dilute base, and diluted with acetonitrile. Aqueous formulations of 1080 were diluted with acetonitrile. The solutions were esterified with p-bromophenacyl bromide, using crown either catalysis, and chromatographed on a 10 p.m reverse phase column. Ultraviolet absorbance was monitored at 260 nm. Samples spiked to contain 1 mg and 10 mg 1080/100 g meat gave recoveries of 84.0 - 103.4%

Keywords: ground control/bait degradation/field efficacy/sodium monofluoroacetate/monofluoroacetate/1080/predators/dogs

Keywords: metabolism/enzyme/biochemistry

Keywords: analysis/fluoroacetate/occurrence in nature
Abstract: A. bilabiata [Arrabidaea bilabiata] and P. marcgravii are poisonous plants (endemic to the Amazonian area) which cause 'sudden death' in grazing animals. A new method involving 19F-NMR spectroscopy, which can detect amounts of fluoroacetic acid (a toxic principle from P. marcgravii) at contents below 4 µg/g, is described. Fluoroacetic acid was quantified in the leaves of A. bilabiata and P. marcgravii (3.0 and 5.4 µg/g, respectively), and in the seeds of A. bilabiata (64.1 µg/g)

Keywords: poisoning/treatment

Keywords: mode of action/metabolism/1080

Keywords: metabolism

Keywords: fluoroacetate/defluorination/enzyme/residues/bacteria
Abstract: Fluoroacetate dehalogenase catalyzes the hydrolytic defluorination of fluoroacetate to produce glycolate. The enzyme is unique in that it catalyzes the cleavage of the highly stable carbon-fluorine bond in an aliphatic compound. The bacterial isolate FA1, which was identified as Burkholderia, grew on
fluoroacetate as the sole carbon source to produce fluoroacetate dehalogenase (FAc-DEX FA1). The enzyme was purified to homogeneity and characterized. The molecular weights were estimated to be 79,000 and 34,000 by gel filtration and SDS-polyacrylamide gel electrophoresis (PAGE), respectively, suggesting that the enzyme is a dimer. The purified enzyme was specific to haloacetates, and fluoroacetate was the best substrate. The activities toward chloroacetate and bromoacetate were less than 5% of the activity toward fluoroacetate. The K-m and V-max values for the hydrolysis of fluoroacetate were 5.1 mM and 11 mumol per minute milligram, respectively. The gene coding for the enzyme was isolated, and the nucleotide sequence was determined. The open reading frame consisted of 912 nucleotides, corresponding to 304 amino acid residues. Although FAc-DEX FA1 showed high sequence similarity to fluoroacetate dehalogenase from Moraxella sp. B (FAc-DEX H1) (61% identity), the substrate specificity of FAc-DEX FA1 was significantly different from that of FAc-DEX H1: FAc-DEX FA1 was more specific to fluoroacetate than FAc-DEX H1.


Keywords: occupational exposure/dermal/inhalation/humans/regulatory toxicology/reproductive effects/sodium fluoroacetate/fluoroacetate/rats/soil/analysis

Abstract: Sodium fluoroacetate, a restricted-use rodenticide, was improperly applied to kill rats in a South American steel mill. As a result of this application, several workers were seriously injured. During plant decontamination, cleanup levels were developed to prevent significant exposure of workers, who could inhale contaminated dust, contact dust or soil dust in outdoor areas or on plant floors and who could contact contaminated surfaces. On the basis of a health risk analysis, the following cleanup levels for sodium fluoroacetate were developed - air cleanup levels 0.05 mg/m3, soil/dust cleanup levels 100 mg/kg and wipe sample cleanup levels 0.2 mg/100 cm3. These risk-based cleanup levels were ultimately used to assist the regulatory agencies in reaching a decision to reopen the plant.


Keywords: fluoroacetate/metabolism/brain/sodium fluoroacetate

Abstract: 1. Sodium fluoroacetate, at concentrations of 1 mM or less, which have no effect on the respiration of rat-brain-cortex slices incubated in Krebs-Ringer phosphate medium containing glucose, suppresses the formation of 14C-labelled glutamine from [14C6]glucose, the effect being greater in a medium containing 105 m-equiv. of K+ ions/l. than in one containing 5 m-equiv. of K+ ions/l. There is a concomitant increase in the amount of 14C-labelled glutamate formed. 2. Sodium fluoroacetate (1 mM) suppresses the accelerating action of NH4+ ions on the rates of oxygen consumption and of the formation of 14C-labelled glutamine from [14C6]glucose by the brain cortex slices. 3. Sodium fluoroacetate (1 mM) increases the amount of free ammonia in the brain-cortex slices after incubation in the presence of glucose for 1 hr at 37 degrees. 4. The yields of 14C-labelled glutamine and 14C-labelled aspartate derived from [14C5]glutamate by rat-brain-cortex slices, incubated in Krebs-Ringer phosphate medium containing glucose, are diminished in the presence of sodium fluoroacetate (1 mM). 5. The addition of Amytal (0.5 mM) diminishes the enhanced rate of formation of 14C-labelled glutamate from 14C6glucose due to 1 mM sodium fluoroacetate. 6. The results are consistent with the conclusion that sodium fluoroacetate, at 1 mM or less, inhibits the utilization of NH4+ ions by rat-brain-cortex slices.


Keywords: poisoning/treatment/antidote/rats

Abstract: 1. The effect of activated charcoal on the elimination of amiodarone and chloroquine was studied in the rat. 2. The study consisted of two separate experiments. Amiodarone and chloroquine were injected subcutaneously at doses of 200 mg kg-1 and 100 mg kg-1, respectively. Six rats in both experiments were put on a charcoal-containing diet 48hr after drug administration, while the control groups remained on a normal diet. 3. Treatment with repeated oral activated charcoal had no effect on the true elimination of amiodarone and chloroquine.
4. These results suggest that, after the distribution of amiodarone and chloroquine into peripheral compartments, their rate of elimination cannot be significantly accelerated with multiple oral doses of activated charcoal.

Keywords: brain

Keywords: mode of action/treatment

Keywords: mode of action/metabolism

Keywords: fluorine/flouride/metabolism/acute toxicity/chronic poisoning/mode of action
Abstract: The various aspects of the problem of fluoride toxicity have been discussed. The ubiquitous distribution of this element has been pointed out. The acute and chronic toxicity and the important mechanisms of this toxicity are reviewed. Since it is even yet incomplete, more investigation will have to be carried out in order to complete the picture of this important present-day problem.

Keywords: fungus/sodium fluoroacetate/fluoroacetate
Abstract: In connection with the possible development of the fungus for the biological control of aphids, growth and production of azygospores of Entomophthora obscura were studied through batch cultures in media containing glucose, or vegetable oil, and yeast extract in the laboratory in Paris. In media containing 3% glucose and 1% yeast extract, an 8-h lag phase occurred and sporulation began only at the 40th hour of culture; spore maturation lasted 4 days on average. Young mycelial stages were characterised by high nucleic acid and protein but low lipid concentrations. During sporogenesis, the quantity of lipids and chitin increased and the concentration of the total polyosides (chitin excluded) was lower in comparison with the mycelial stages. Sporulation was induced by means of medium starvation in carbon and/or nitrogen. The only sporulation inhibitor that allowed considerable growth was sodium fluoroacetate

Keywords: mode of action

Lazarus, M. (1956). The toxicity and relative acceptability of some poisons to the wild rabbit, Oryctolagus cuniculus (L.). CSIRO wildlife research 1, 96-100.
Keywords: poisons/poisoning/rabbits/fluoroacetate/1080/strychnine/field efficacy/target species
Abstract: Laboratory tests of nine substances already in use or considered suitable for poisoning wild rabbits, Oryctolagus cuniculus, showed that only sodium fluoroacetate (1080) seems to have any considerable advantage over strychnine and phosphorus.

Keywords: metabolism/1080/sublethal effects/brain/mode of action/humans
Abstract: Epidemiological studies and case reports provide evidence for an association between Parkinson's disease and past exposure to pesticides. Susceptibility to the effects of pesticides and other putative
neurotoxins depends on variability in xenobiotic metabolism possibly generated by genetic polymorphisms, aging and variation in exposure to environmental agents including pesticides. The simplest mechanistic hypothesis for the association of pesticides with Parkinson's disease is that pesticides or their metabolites are directly toxic to mitochondria, although modulation of xenobiotic metabolism by pesticides provides an adjunct or alternative hypothesis.


Keywords: marsupials/1080/poisoning/efficacy

Abstract: The fate of 26 radiocollared individuals from three targeted marsupial species were followed during a 1080 poisoning operation on a eucalypt plantation, to investigate where animals die in relation to the bait-line. Fifteen of the 26 animals died during the poisoning operation; eight of ten Tasmanian pademelons (*Thylogale billardierii*), one of seven Bennett's wallabies (*Macropus rufogriseus rufogriseus*) and six of nine brushtail possums (*Trichosurus vulpecula*). The proportions of radio-collared animals that died within each species did not reflect kill rates calculated from more reliable absolute density data. Radio-collared carcasses were found between 8 m and 83 m from the bait-line (mean distance 31 m). Seventy-five per cent of carcasses were found inside shelters (i.e. inside windrows, hollow logs, dens or under fallen vegetation). Twelve of the 15 poisoned radio-collared carcasses were found intact. Three carcasses were not found but recovered collars showed carnivore's teeth marks, suggesting that Tasmanian devils (*Sarcophilus harrisii*) or spotted-tailed quolls (*Dasyurus maculatus*) had moved and/or consumed them.


Keywords: poisoning/non-target species

Abstract: Line transect surveys were used to monitor species densities before and after poisoning. Targetted species: red-bellied pademelon (*Thylogale billardierii*); the red-necked wallaby (*Macropus rufogriseus* subspecies *M. r. rufogriseus*), the common brushtail possum (*Trichosurus vulpecula*) and European rabbit (*Oryctolagus cuniculus*). One non-target species, the common wombat (*Vombatus ursinus*), was also monitored. Good kill of pademelon but speculates red-necks come into vacated habitat. No sig. effects detected with wombats, possums and rabbits.


Keywords: metabolism/fluoroacetate/biochemistry

Abstract: Chemical or biological changes occurring in the body, which transform foreign substances to metabolites with nutritional, pharmacological or toxic effects are discussed. Examples include the conversion of beta-carotene to vitamin A and of organofluorides to the toxic fluoroacetic acid. Organisms may transform the different stereoisomers of a substance in different ways


Keywords: metabolism/fluoroacetate/humans/excretion

Abstract: The cardiotoxicity of 5-fluorouracil (FU) was attributed to degradation compounds present in the injected vials, fluoroacetalddehyde (Facet) and fluoromalonaldehydic acid (FMald). FU-NaOH vials were much less cardiotoxic than FU-Tris vials on the isolated perfused rabbit heart model since Facet and FMald are stored in stable depot forms in FU-Tris vials whereas, in FU-NaOH vials, they are extensively transformed. Cardiotoxic fluoroacetate (FAC), coming from Facet metabolism, was found in urine of patients, who with a ratio FAC/FU catabolites 10-30 fold lower in patients treated with FU-NaOH than in those than in those treated with FU-Tris.


Keywords: 5-fluorouracil/humans/metabolism/fluoroacetate
Abstract: We previously demonstrated that pure 5-fluorouracil (FU) was metabolized, via its major catabolite α-fluoro-β-alanine, into highly cardiotoxic compounds, 2-fluoro-3-hydroxypropionic acid (FHPA) and fluoroacetate (FAC), in rats (Proc AACR 36: A2415, 1995). Does this metabolic pathway occur in humans? Fluorine-19 nuclear magnetic resonance analysis of urine samples from two patients (Y, Z) treated with continuous IV infusion of FU (1 g/m²/d over 4 days) revealed the presence of FHPA and FAC. However, these compounds could also arise from respective metabolism of fluoromalonic acid semi-aldehyde (FMASA1d) and fluoroacetaldehyde (Facet) which are degradation compounds of FU present in the solutions injected to patients. Since 10.5 (Y) and 4.9 (Z) µmoles of Facet were injected with FU, the amounts of FAC detected in urine over 5 days (2.8 (Y) and 1.3 (Z) µmoles) did not permit to conclude to a metabolism of FU itself into FAC. On the other hand, the large amounts of FHPA in urine (810 (Y) and 340 (Z) µmoles over 5 days) comparatively to those of FMASA1d injected to patients (9.9 (Y) and 7.4 (Z) µmoles) suggests that FU itself is metabolized to FHPA in humans. This study constitutes an indirect proof of this metabolic pathway. The direct proof will only be obtained when solutions of FU free of degradation compounds (a lyophilisate form for example) will be commercially available.

Keywords: fluoroacetate/enzyme/aconitase/citrate/Krebs cycle
Abstract: The present studies demonstrate that ketone bodies and fatty acids inhibit renal ammoniagenesis and gluconeogenesis in vitro through their oxidation in the mitochondria. They also suggest that direct transamination of glutamine into alanine may be significant when oxidation of pyruvate is inhibited by fluoroacetate.

Keywords: fluoroacetate/inhibition/dogs/blood/resistance/cardiac
Abstract: The circulatory effects of selective metabolic inhibition of glycolysis and of the tricarboxylic acid cycle by iodoacetate and fluoroacetate were studied in intact chloralose-anesthetized dogs. Pulmonary arterial blood pressure and vascular resistance increased after administration of both inhibitors, but neither systemic hemodynamics nor myocardial contractility changed significantly. Coronary blood flow did not change after iodoacetate administration but increased four- to five-fold after fluoroacetate. Administration of normal saline had no effect on any of the parameters. The changes in pulmonary arterial blood pressure and coronary blood flow after fluoroacetate were not mediated via the autonomic nervous or adrenergic neurohormors because they still occurred after autonomic nervous system inhibition. Neither myocardial oxygen consumption nor left ventricular work changed. A selective increase in myocardial blood flow also occurred in conscious dogs after fluoroacetate administration; hepatic artery flow was reduced, but other organ flows did not change significantly. These results indicate that pulmonary pressor and coronary dilator effects may be produced in intact dogs by selective metabolic blockade, in the absence of reduced oxygen supply or impairment in the electron transport system. These results also suggest that the increases in pulmonary arterial blood pressure, coronary blood flow, and cardiac output that occur during hypoxia probably are related to separate metabolic events in the tissue.

Keywords: toxicity/fluoroacetate

Keywords: toxicity/fluoroacetate

Keywords: mode of action/citrate/fluoroacetate

Keywords: poisoning/1080/residues/poison/humans

Abstract: (from text) In man the action on the central nervous system produces epileptiform convulsive seizures followed by severe depression. Twenty-two cases of poisoning by this material, with 12 deaths have been reported. In another instance, 4 men died from the consumption of 1080 which had been stored in soft drink or whiskey bottles. Also, four suicides have occurred as the result of drinking 1080. Five confirmed deaths and three possible deaths of small children have been traced to the consumption of 1080 solutions from souffle cups and from chewing on empty cups containing dried residues of the poison.


Keywords: welfare/pest


Keywords: metabolism/persistence in soil


Keywords: fluoride/sodium monofluoroacetate/monofluoroacetate/baits/1080/analysis

Abstract: Hot aqueous alkaline conditions were used to defluorinate sodium monofluoroacetate (Compound 1080) with a mean efficacy of 98% and a coefficient of variation of 2%. The liberated fluoride was determined by ion-selective electrode.


Keywords: 1080/possums/rabbits/Tb

Abstract: New Zealand's environment evolved without herbivorous mammals. Humans introduced and actively assisted in the colonisation of a range of mammals throughout New Zealand. Introduced mammals have affected agricultural production, changed the local composition of native flora and fauna and contributed to the ecological degradation of the environment. In defined areas, possums are the major vector of tuberculosis for cattle.

Aerial and ground deployment of 1080 bait provides a cost-effective means of reducing rabbit, wallaby, possum, feral goat and deer populations in areas where they were negatively impacting on agricultural or conservation values. Because of their continuing impacts, an estimated $30 million will be spent controlling these animals in 1993/94, largely using 1080 bait.

Use of 1080 poison through has caused problems and provoked controversy. It can kill some nontarget species. It has induced local "shyness" problems in target species and its increased use has given rise to concerns over its fate in the environment.

Introduced herbivores will continue to place New Zealand's environment and agricultural production at risk, requiring their control. Until an acceptable form of biological control is available, environmental research and management data indicates that 1080 is the toxin of choice for large scale feral/wild animal control. Rejection of the use of 1080 by stakeholders would have major implications for New Zealand's ability to preserve its unique ecological heritage and maintain acceptance of exported primary produce.


Ref Type: Report

Keywords: 1080/possums/birds/Tb/deer

Abstract: The possum problem Australian brushtail possums (*Trichosurus vulpecula*) are a major pest in New Zealand. They browse...
native vegetation and prey on native birds and insects. Possums have been linked to persistent problems of bovine tuberculosis (Tb) in cattle and deer herds, threatening an export trade currently valued at $5 billion.

Llewellyn, M. C. Assessment of wallaby populations poisoned with 1080-inpregnated baits. Lake Okataina and Makatit Dome. Contract report prepared for Department of Conservation, 7p. 1988. Ref Type: Unpublished Work Keywords: baits/poisoning/1080


Lloyd, B. D. Evaluating the potential hazard of aerial 1080 poison operations to short-tailed bat populations. Conservation Advisory Notes No. 108, -12. 1994. Wellington, New Zealand, Department of Conservation. Ref Type: Report Keywords: 1080/invertebrates/non-target species/aerial control/mammals/bats/poison Abstract: Available relevant information was reviewed to assess the potential hazard of aerial 1080 poison operations to short-tailed bat populations. Although there is insufficient information available to provide a reliable evaluation of the hazards, the information that is available indicates that short-tailed bat populations are unlikely to suffer from direct poisoning caused by bats consuming arthropods that have fed on 1080 baits. Because of their low fecundity bat populations may take a long time to recover from relatively minor mortality episodes.


Lloyd, B. D. and McQueen, S. M. (2000). An assessment of the probability of secondary poisoning of forest insectivores following an aerial 1080 possum control operation. New Zealand journal of ecology 24, 47-56. Keywords: secondary poisoning/non-target species/birds/1080/lethal dose/invertebrates

Lloyd, B. D. and McQueen, S. M. (2002). Measuring mortality in short-tailed bats (Mystacina tuberculata) as they return from foraging after an aerial 1080 possum control operation. New Zealand journal of ecology 26, 53-59. Keywords: bats/1080/baits/secondary poisoning/poisoning/possums/symptoms/analysis/behaviour Abstract: Lesser short-tailed bats (Mystacina tuberculata) feed on arthropod taxa known to consume 1080 baits. Thus, they may be vulnerable to secondary poisoning after control operations for brushtail possums (Trichosurus vulpecula) using aerially broadcast 1080 baits. Short-tailed bat mortality was monitored during 11 days after 1080 baits were broadcast over their winter foraging area. Monitoring involved catching a sample of 269 bats as they arrived at a roost after foraging, then holding them in captivity for 48
hours. None of the captured bats displayed any symptoms of 1080 poisoning. Power analysis indicates that there was a $\geq 0.95$ probability of detecting mortality when the actual mortality rate was above 11.1 deaths per thousand foraging flights. Uncertainties in assumptions about the bats’ behaviour meant that the overall population mortality corresponding to this minimum detectable mortality rate may range from 5.4 to 28.4%, with the best estimate of 14.4%. Although it can be concluded that this 1080 operation probably did not cause major mortality of the short-tailed bats, several replicate trials are required before a generalised conclusion can be drawn about the fate of short-tailed bats following aerial 1080 operations. More information about short-tailed bat population demography is required to assess the impact of 1080 operations on population viability.

Keywords: diagnosis/treatment/mode of action/sodium fluoroacetate/1080/cats
Abstract: Sodium fluoroacetate (compound 1080) is a potent rodenticide that has been restricted to use by professional exterminators. Owing to its high toxicity in dogs and cats, it has been responsible for the deaths of these animals after they have ingested rodents killed by the compound. Fortunately, the use of compound 1080, and therefore, the poisoning of pets have diminished during recent years. However, the practitioner should not rule out compound 1080 poisoning in carnivorous pet animals, even though there is no specific satisfactory treatment. Diagnosis and prognosis are discussed.

Keywords: cats/mode of action/pathology/welfare/inhibition/poisoning/CNS/brain/fluoroacetate/symptoms

Keywords: inhibition/aconitase/fluoroacetate/enzyme/citrate/poisoning/biochemistry
Abstract: The fluorotricarboxylic acid fractions isolated from tissues poisoned with fluoroacetate have been shown to inhibit the following reactions of the enzyme aconitase: citrate to isocitrate, isocitrate to citrate, cis-aconitase to citrate, cis-aconitate to isocitrate. The reaction citrate to isocitrate is inhibited to the same degree as the reverse reaction; the two reactions starting with cis-aconitate are less sensitive to the inhibitor. It is considered that this inhibitor of aconitase has a direct relation to the accumulation of citrate in fluoroacetate poisoning.

Keywords: fluoroacetate/fluorocitrate/persistence in plants/fluoride/aconitase/analysis/secondary poisoning/biosynthesis
Abstract: Plants were collected from an area high in atmospheric fluoride. Animals grazing on this area showed severe fluoride injury. Analyses of plants indicated accumulation of fluorocitrate and fluoroacetate concentrations of 896 ug and 179 ug/g leaf dry weight. The presence of these compounds was established by chromatographic techniques, inhibition of aconitase and i.r. spectral analysis.

Ref Type: Report
Keywords: 1080/baits/humans/secondary poisoning/persistence in animals/honey
Abstract: Honey was sampled from beehives within the flight zone of a possum poisoning operation using 1080 with "jam" bait which is an attractive forage for bees. The methodology required some determination of bee activity and estimation of sample age so as to establish the link between samples and the poisoning operation. The highest concentration of 1080 detected in the honey was 15 ppb and subsequent tests showed a gradual decay down to 3 ppb after 59 days. The honey source that the samples were taken from would have eventually gone on sale after 16 weeks, hence there would not have been any detectable level of 1080 in the sale product, although under different circumstances this time could be considerably shorter. There is no risk of acute poisoning from such low levels of 1080 and with regard to sublethal effects, there has been little research done. Aspects of risk management for Medical Officer of Health approvals, that
include such factors for consideration as toxicity, decay, public perception and oracticla options for reducing levels of contamination are discussed.


Abstract: Concern over certain animal damage control methods used by the US Fish and Wildlife Service, primarily the predacide Compound 1080, prompted a Presidential Order in 1972 banning the use of toxicants ion public lands. This continuing ban of 1080 use has been reinforced by the recent policy address issued by the Secretary of the Interior. Following the initial ban, greater emphasis was placed on aerial hunting of coyotes for prevention and correction of damage to sheep and goats. Aerial hunting is expensive, however, and has only limited application in timbered, mountainous areas of many national forests. Inthe period since toxicants were banned, numbers of grazing livestock reported as lost to predationon western national forests has increased. Numbers of toxic bait stations (1080) used throughout the West, from 1960 tot he 1972 ban, showed a strong inverse relationship with numbers of livestock reported lost to predation on national forests during these same years.


Ref Type: Report

Keywords: residues/1080/baits/dermal/muscle/gut/possums/treatment/acute toxicity/toxicity/poisoning/metabolism/excretion/mammals/birds/degradation

Abstract: Objectives

- To determine the effect of exposing captive long-fin eels to 1080 from RS5 cereal pellet baits deployed in the water column (primary exposure) via: (a) ingestion and dermal absorption and; (b) via dermal absorption only.
- To determine the effect of exposing captive long-fin eels to 1080 through the ingestion of possum muscle and gut tissue that contained 1080 (secondary exposure).
- To measure the concentration of 1080 in eel muscle tissue following primary and secondary exposure.
- To report findings and engage Ngāi Tahu tangata whenua and relevant stakeholders in a dialogue process regarding the use of 1080 in possum control and potential effects on longfin eels.

Methods

- Wild-sourced eels were acclimatised for 21 days in a wet-laboratory before being exposed to 1080 in scenarios representative of primary or secondary exposure.
- In Trial 1, to simulate direct access to baits in waterways, 16 eels were exposed to 1080 from RS5 cereal baits (0.16%) wrapped in plastic mesh (Mesh) and 16 eels had free access to RS5 cereal 1080 bait (Free) placed directly into the water column.
- In Trial 2, to simulate secondary exposure where eels scavenge the carcasses of possums poisoned by 1080, 24 eels were presented with three boluses of either muscle tissue (8.3 µg/g) from possums poisoned by 1080, or gut tissue (1.4 µg/g) from the same possums. As a control 24 eels were presented with either non-poisoned possum muscle or gut tissue.
- In each trial eels were monitored daily for mortality and clinical signs of toxicosis.
- In Trial 1, water samples were collected and analysed for 1080 residue at 0, 5, and 48 h after bait deployment, and eel tissue 4 d after bait deployment.
- In Trial 2 eel tissue was sampled and analysed for 1080 residue 12 d after beginning the 1080-poisoned-tissue feeding regime.

Results

- No 1080 was detected in water samples from the control treatments in Trial 1 or 2.
- In Trial 1, 1080 concentrations in water samples from the free- and meshed-pellet treatments were 0.057 µg/ml and 0.025 µg/ml respectively 5 h after baits were placed in the tanks. These concentrations declined to <MDL and 0.0038 µg/ml respectively after 48 h. No 1080 was detected in any of the eel tissue
samples from the pellet-free or pellet-mesh treatments.

- In Trial 2, no 1080 was detected in water samples. There were detectable concentrations of 1080 in the muscle of eels (mean = 0.011 µg/g) that had consumed possum muscle containing residues of 1080. Also, there were detectable concentrations of 1080 in the muscle of eels (mean = 0.010 µg/g) that had consumed possum gut containing residues of 1080. No significant difference in 1080 residue was detected in eels that had consumed contaminated possum muscle (mean = 0.012 µg/g) or gut (mean = 0.038 µg/g) tissue in the last 3 days of the trial ($t = 2.17$; d.f. = 7; $P = 0.067$).

Conclusions

- 1080 leached from cereal pellet baits is unlikely to kill eels.
- Eels did not eat cereal 1080 baits in this study, suggesting that the risk of acute toxicity in eels from the consumption of baits in the field is low.
- Risk to eels of acute 1080 poisoning following the consumption of possum tissue containing concentrations of 1080 up to 8.3 µg/g over 12 d also appears to be low.
- Residues of 1080 will occur in eel muscle after eels consume tissue from 1080-poisoned possums, indicating the potential for secondary contamination of eels that scavenge possum carcasses in field conditions.
- The detection of 1080 in the muscle tissue of an eel 9 d after it last consumed possum gut tissue containing residual 1080 suggests that the metabolism and excretion of sublethal doses of 1080 in long-fin eels may be slower than in mammals and birds.

Recommendations

- To reduce response variation in the endpoints measured, all experiments were carried out in the laboratory under controlled conditions (e.g. environmental parameters and feeding regime). Although field conditions can increase variation in the response of biological endpoints, these may be balanced against a reduction in eel stress and benefits from increased environmental realism associated with field trials. Field trials could include eels and possum carcasses in natural waterways, monitoring of the presence and degradation of possum carcasses in and around (within 2 m) waterways after an aerial operation, and monitoring of wild eel stocks for 1080 residues before and after aerial baiting operations.
- Proactive measures should be taken to address likely concerns regarding potential 1080 contamination of eels for human consumption. To minimise negative impacts to the commercial fishing sector an in-depth study should be undertaken to evaluate the toxicokinetics of 1080 in eels so that an adequate withholding period can be established for eel harvest following baiting operations.
- Given the apparent potential for eels to carry 1080 residues as the result of scavenging possum carcasses, initial evaluations of other scavenging aquatic fauna such as kanakana or piharau (Geotria australis; freshwater lamprey), which are also gathered for human consumption, should be considered.
- As an additional risk-minimisation measure, the timing of aerial 1080 control operations with the hibernation period for eels and outside commercial fishing seasons should be implemented in appropriate areas.

Ref Type: Report
Keywords: pest/1080/New Zealand
Abstract: The objective of this research was to find a better way for scientists to have meaningful dialogue with the wider community about contentious scientific issues. We tested a dialogue process that combined principles from Franklin Covey's "The 7 Habits of Highly Effective People" programme with aspects of tikanga Māori (Māori custom) on two pest control issues: the use of 1080 to control mammalian pest species and the introduction of biological control agents for weeds. We invited stakeholders with a history of involvement in these issues, as well as groups that traditionally have played a lesser role (e.g. women, youth, and the elderly), to participate in discussions or debate on these topics. The dialogue occurred at four 2-day hui around New Zealand: two in the North Island and two in the South Island.

This report outlines the background of this work, the processes and activities used during each hui, and our overall reflections on this project.
Important lessons learned were:

1. The process proved to be a successful formula for engaging stakeholders in dialogue. It helped people discover common ground, learn more about the standpoints of others, and build trust and understanding.

2. Much time has to be spent building relationships with stakeholders prior to the dialogue event. The event itself is just the tip of the iceberg.

3. While it seems a good idea to cast the net widely when looking for participants, they need to see that they will benefit from attending.

4. Taking 2 days out to attend a hui was a problem for some groups and prevented them from attending. By contrast many of those who did attend said they would have liked it to be longer.

5. Providing support through information and guidance was an important part of helping people to deal with a culturally unfamiliar environment.

6. Getting women to present formally to the group was difficult, but they were very good at working within the group and interacting less formally.

7. Participants need to be present at the hui for the entire time because the dialogue process builds upon itself.

8. Much of the success of the process came from finding common ground, which then allowed people to discuss the science and work through the problem.

9. Complex problems require the negative aspects of a solution to be balanced against other alternatives. The strength of dialogue in this situation was that it allowed each participant to weigh up the positive and negative points for themselves in an environment where those in authority were not able to move into persuasion mode.

10. People need time and a reason to consider issues and to develop their own understanding and solutions. Most experts have had years to consider the issues, other people need more than just a public meeting for this. "Taking people with us" therefore means providing a reason and opportunities for them to participate in piecing together an understanding of the issues rather than trying to persuade them.

11. People are taught to speak, but are not taught to listen. To exchange knowledge we need to develop our listening skills. It takes training, effort, work, and self-aware reflection to build good listening skills.

12. Effective facilitation is essential for good dialogue.

13. Removing participants from familiar surroundings assisted with breaking down barriers between groups. Being placed in a "new" environment helped participants to become more open to "new" ideas or alternative perspective.


Keywords: target species


Keywords: pigs/baits/field efficacy


Keywords: product chemistry/occurrence in nature


Keywords: 1080/foxes/lethal dose/sodium monofluoroacetate/monofluoroacetate/baits/non-target species

Abstract: The M-44 ejector delivered a reliable lethal dose of 1080 (sodium monofluoroacetate) to captive foxes, with a capsule dose of 2.0 mg of 1080, if a 'collar' modification was used. Behavioural observations indicated that the collar influenced the orientation of the fox's mouth to the M-44 bait upon activation, resulting in a much greater amount of 1080 entering its mouth. This dose is below the 3 mg currently used in fox baits in Victoria and may increase the margin of safety for non-target species during 1080 baiting
programs. The authors discuss some of the potential advantages of the ejector over the use of meat baits, such as the elimination of bait caching and improved target specificity. The potential for the M-44 to deliver an even lower lethal dose of 1080, which is closer to the reported theoretical bait LD100 of 1.25 mg for this species, may further reduce the risk of 1080 baiting to non-target species such as tiger quolls.

[References: 25]


Keywords: acute toxicity/welfare/mammals/1080/treatment


Keywords: convulsions/brain/fluoroacetate/citrate

Abstract: In addition to its well known effect in producing hyperphagia, resulting in obesity, and histological damage focused relatively selectively in the ventromedial hypothalamic area, systemically administered gold thioglucose (GTG) also increased the sensitivity to insulin hypoglycemic convulsions. The change was in the convulsive response to equal hypoglycemia, rather than in the degree of hypoglycemia in response to insulin. The effect suggests that a relatively discreet control center is involved in adjusting brain functions to metabolic alterations, in this case hypoglycemia. These results compare the effects of GTG lesions on insulin hypoglycemic and fluoroacetate-induced convulsions. GTG lesions did not alter the sensitivity to another metabolic convulsant, fluoroacetate, which blocks the Krebs cycle by blocking the conversion of citrate to isocitrate. Thus, although related in both cases to a shortage of available cellular fuel, the metabolic convulsions induced by insulin hypoglycemia and fluoroacetate must be qualitatively different.


Keywords: 1080/strychnine/baits/lethal dose/secondary poisoning/predators/persistence in animals

Abstract: Separate groups of California ground squirrels were laboratory fed either strychnine or 1080-treated baits in amounts representative of low or high consumption rates expected to occur in a control program. Acute and chronic secondary toxicity was subsequently evaluated with captive groups of 4-7 coyotes. In these acute tests, a single feeding of 2 squirrels, which had consumed either a low (0.5 mg) or high (3.0 mg) lethal dose of 1080, was fed to each coyote of the test groups. No mortality occurred in the coyotes given 2 low-dose squirrels, but 5 of 6 coyotes that were given 2 squirrels receiving the high 1080 dose (ie 6 times the low dose) died. In the chronic 1080 test, 1 of 7 (14.2%) coyotes that consumed a low-dose squirrel for 5 consecutive days died. This suggests little secondary hazard for 5 low (0.5 mg) multiple doses.


Keywords: acute toxicity/non-target species/secondary poisoning/birds/citrate/approximate lethal dose

Abstract: The sensitivity to sodium fluoroacetate (1080) of 9 species of native animals from north western Australia was assessed using the increasing dose procedure to determine the Approximate Lethal Dose (ALD) for each species. Increases in plasma citrate concentration was also determined for some species. Granivorous birds from this region (e.g. ducks, corellas) were generally more sensitive to 1080 than their counterparts from southern Australia, and theoretically be at risk from primary poisoning during 1080 grain-based baiting programs. However, the tolerance to 1080 of birds of prey from these areas is sufficient that these species face little risk of secondary poisoning during pest control programs aimed at rodents or rabbits. The risk of primary poisoning to raptors from meat baits containing 6 mg 1080 per bait or less appears to be low. The coexistence of brown falcons and barn owls with fluoroacetate-bearing vegetation over parts of their range has probably contributed to their development of tolerance to fluoroacetate.


Keywords: baits/non-target species/poisoning/1080/tolerance/rodents/predators
Abstract: The acceptability of three types of non-toxic predator baits to a variety of indigenous non-target species was determined in the laboratory. The bait-types tested were: Dried Meat Bait (DMB), Probait and two sizes of FoxOff(TM) baits (30 g and 60 g). The potential poisoning risk, if the baits had been toxic, was calculated for each species from their consumption of non-toxic bait and their sensitivity to 1080. Three species consistently sampled baits; Dasyurus geoffroii, Trichosurus vulpecula and Rattus fuscipes. Where species have had exposure to fluoroacetate-bearing vegetation, their consumption of bait and their level of tolerance to 1080 was such that only 2 of 15, 4 of 15, and 3 of 6 species were considered to be potentially at some risk from toxic DMBs, Probait, and FoxOff(TM) baits, respectively. In contrast, and mainly because of their lower tolerance to 1080, the theoretical risk for those species without evolutionary exposure to fluoroacetate-bearing vegetation was such that 6 of 12, 8 of 12, and 8 of 9 species theoretically face a high or moderate risk from 3-mg DMBs, Probait, and FoxOff(TM) baits, respectively. We emphasise, however, that theoretical risk does not necessarily equate to a practical risk, and these results are best used to determine which non-target species should be monitored at the population level during predator-control operations. Factors affecting the potential risk to non-target indigenous animals, and some cautions when extrapolating data from laboratory-based studies to the field situation, are discussed.

Martinez, R. R. (1979). Diagnosis and frequency of the most commonly identified intoxications of dogs in the Mexico City area. Veterinaria, Mexico 10, 45-49.

Keywords: diagnosis/dogs/strychnine/zinc phosphide/warfarin/fluoroacetate

Abstract: Among 49 dogs diagnosed clinically as poisoned, strychnine was demonstrated in 21, zinc phosphide in 2, lead in 3, dieldrin in 1, warfarin in 3, thalium in 1, an organic phosphorus insecticide in 1 and probably fluoroacetate in 2; the cause was not determined in 15. Death was usually sudden


Keywords: chemistry/heart/mode of action/5-fluorouracil/citrate/Krebs cycle

Abstract: In order to search into the underlying mechanisms of ECG changes suggestive of ischemia observed in humans and in rabbits after administration of 5-fluorouracil (5-FU), experiments were performed in anesthetized open-chest guinea pigs. The substance produced similar ECG changes in this species as well, after a rather long latent period of around 3 hours intravenous administration. The incidence of ECG abnormality in animals given 60 mg/kg was 7/7, while that in animals given 30 mg/kg was 4/9. With 10-20 mg/kg, ECG changes were not observed during an experimental period as long as 5 hours. Associated with these ECG changes, a depletion of the high-energy phosphate compounds of the ventricular myocardium was observed. Analysis of tricarboxylic acid cycle (TCA cycle) intermediates revealed an accumulation of citrate within the myocardium, suggesting a malfunction of TCA cycle resulting from an inhibition of aconitase by fluorocitrate, as a cause of depletion of the high-energy phosphates. It is probable that the accumulation of citrate was due to the formation of fluorocitrate, an inhibitor of aconitase, from 5_FU via alpha-fluoro-beta-alanine, a major degradation product of 5-FU, for it is known that beta-alanine is usually converted to acetate.


Keywords: fluoroacetamide/fluoroacetate/poisoning/citrate/fluorocitrate/muscle/invertebrates/metabolism

Abstract: In the American cockroach and mouse, both fluoroacetate and fluoroacetamide poisoning led to large large citrate concentrations in the body. In the cockroach poisoned with fluoroacetamide, fluoroacetate and fluorocitrate were found in muscle. It thus seems probable that the first step in fluoroacetamide poisoning is hydrolysis to fluorocitrate. This hydrolysis was more rapid in cockroach homogenates than in mouse homogenates, which may account for the selective toxicity of fluoroacetamide to the cockroach.


Keywords: testes/fluoroacetamide/reproductive effects

Keywords: sodium monofluoroacetate/rats/monofluoroacetate/fluoroacetamide/testes/reproductive effects
Abstract: The lesions caused by sodium monofluoroacetate on the testis of the albino rat are described. They consist of regressive modifications of the seminiferous tubules which initially cause damage to the intermediate stages and only later to the spermatogonia. The action of sodium monofluoroacetate is similar to that of fluoroacetamide.

Keywords: testes/fluoroacetamide/reproductive effects/rats/treatment/sublethal effects
Abstract: Morphological changes of atrophic testis, obtained by treating normal rats with fluoroacetamide, are studied at various times after treatment. The data show that the testicular germinal epithelium is fully regenerated 165 days after treatment.

Keywords: product chemistry/fluoroacetate

Keywords: poisons/sodium fluoroacetate/fluoroacetate/1080/efficacy/baits/lethal dose/rodents
Abstract: The rat poisons sodium fluoroacetate ("1080") and "Castrix" were tested against *Rattus conatus* and *Melomys littoralis* in cages, and against *R. conatus* in settled field populations. Feeding tests show that the LD<sub>50</sub> for *R. conatus* and *M. littoralis* respectively are: sodium fluoroacetate, 1.42 mg/kg, 2.23 mg/kg, Castrix, 4.46 mg/kg, 5.62 mg/kg. An I.T.F. of 3.5 is obtained at a poison strength of 1:1000 with 1080 and at 1:250 with Castrix. Both these white powders which can be used with grain are technically good rat poisons. There are strong indications that the general use of Castrix would be more dangerous than that of 1080. The latter (which is water soluble) at a strength of 1:1000 could replace, without any loss of efficacy, the expensive thallous sulphate in food baits for use in Queensland canefields. Though highly toxic, neither of these two new rat poisons can replace yellow phosphorus un bread snap baits.

Keywords: kidney/citric acid/Krebs cycle/fluorocitrate/rodents/pathology
Abstract: The morphological changes that occurred in the pars recta tubules of rat kidney after single intraperitoneal injections of sodium fluorocitrate, a competitive inhibitor of aconitase, at 15 or 60 mg per kg body weight are described. A gamut of pathological changes occurred along the length of renal proximal tubules during fluorocitrate poisoning. These changes must be related in part to the physiological, functional and metabolic capacities of different segments of the proximal tubules.

Keywords: fluoroacetate/occurrence in nature

Abstract: A brief review is presented of the occurrence of organofluorine compounds in plants and of the effects of feeding plants with F. The compounds are found in Dichapetalum cymosum, Acacia georginae, Palicourea mar certification, Gastrolobium spp. and Oxylobium spp. The influence of F location in a molecule on toxicity is discussed and the toxicities of a range of organofluorine compounds, both naturally occurring and synthetic, are summarized. Distribution of fluoroacetate in Acacia georginae is considered and the various findings are related to the incidence of poisoning of sheep and cattle in the field. Difficulties in detection of organofluorine compounds are emphasized and possible areas of further investigation are indicated.
Keywords: product chemistry

Keywords: sodium fluoroacetate/fluoroacetate/warfarin

Keywords: 1080/poison/acute toxicity
Abstract: Eutherian carnivores were more sensitive to 1080 poison than marsupial carnivores. Both groups of animals displayed similar symptoms but there was wide intra- and interspecific variation in the time to onset, the sequence of occurrence and duration of the symptoms. The risks that individual carnivores face from primary and secondary poisoning have been assessed. Theoretically, dingoes probably face the greatest risk amongst the species studied, followed by members of the smaller dasyurids and feral cats. Members of the dasyurids and long-nosed bandicoots probably face the least risk. Factors likely to influence the actual effect of 1080-poisoning campaigns on carnivore populations are discussed.

Keywords: 1080/poison/acute toxicity

Keywords: acute toxicity/non-target species/mammals/1080/marsupials

Keywords: 1080/tolerance/fluoroacetate/mammals/rodents/acute toxicity/diagnosis/baits/time to death
Abstract: Most rodent species that have been tested in Australia and elsewhere are highly sensitive to 1080 poison. A few native species, particularly members of the 'pseudo-mouse group' (Conilurini), part of whose range is in Western Australia, are much more tolerant. These species may have developed this tolerance from being exposed to indigenous plants that contain fluoroacetate. The most common signs of poisoning amongst rodents are depression, hypersensitivity to stimuli, respiratory distress and convulsions. Signs of poisoning first appeared amongst the species tested in this study 0.4 - 38.1 h after dosing. Deaths occurred 0.7 - 205.8 h after dosing. The susceptibility to 1080-poisoning of the 14 species of rodents tested in Australia depends on both sensitivity and body size, and is discussed in relation to typical baits and concentrations of 1080 used against vertebrate pests. Individuals of most species of rodents would appear to face a considerable risk if pest-poisoning campaigns are carried out within their range, but the crucial factor governing the actual effect on populations will be how many individuals find and eat the baits.

Keywords: 1080/poison/herbivores/lethal dose/symptoms

Keywords: non-target species/acute toxicity/1080

Keywords: 1080/pigs/poisoning/lethal dose/analysis/mammals/poisons/baits/birds/non-target species/field efficacy
Abstract: Acute oral LD50s (median lethal doses) and 95% confidence limits of 1080 poison for feral pigs,
Sus scrofa, obtained by moving average and probit analysis methods are 1.04 (0.84 - 1.27) mg/kg and and 1.00 (0.72 - 1.28) mg/kg respectively. These values are slightly higher than LD50s obtained for pigs by intraperitoneal dosing but similar to those obtained by oral dosing for other eutherian mammals. Signs of poisoning, either vomiting or increasing lethargy and laboured respiration, appeared from 1.97 to 47.3 h (median 6.2 h) after dosing, and deaths from 2.8 to 80 h (median 16.1 h) after dosing. Although 1080 is one of the most toxic poisons for pigs it has disadvantages, including the relatively large amounts that must be distributed in baits to kill pigs, and the comparatively greater susceptibility to it of many non-target birds and mammals. For example, 36 species out of a selection of 40 non-target species likely to feed on poisoned baits are more susceptible to 1080 than pigs. In practice many other factors such as bait acceptance will govern what proportions of target and non-target populations will be poisoned. Attention to methods of poisoning or baiting techniques could minimise the risk non-target animals face from pig-poisoning campaigns.

Keywords: 1080/possums/baits/aversion/lethal dose/field efficacy
Abstract: A knowledge of the sensitivity of the brushtail possum (Trichosurus vulpecula) to 1080 poison is important as a basis for planning effective control campaigns. This study assesses the effects that experimental procedure may have on determining the LD50 of 1080 for brushtail possums and reports on the variation in sensitivity within an between different populations of the species in Australia, where it is indigenous. LD50s obtained ranged from 0.39 -0.92 mg/kg with 95% confidence limits of from 0.29 -1.20 mg/kg. These figures are similar to those obtained by Ministry of Agriculture and Fisheries researchers in New Zealand but are less than those obtained by the New Zealand Forest Service and bring into question which figures are valid for free roaming possums in the bush. This is important in regard to the toxic loading of baits, particularly given the reported aversion by some possums to baits containing the recently increased concentrations of 1080 recommended for possum control in New Zealand forest areas.

Keywords: non-target species/birds/acute toxicity/1080/lethal dose/sodium monofluoroacetate/monofluoroacetate/tolerance/fluoroacetate/poisoning/convulsions/baits
Abstract: Birds in Australia vary greatly in their sensitivity to 1080 poison (sodium monofluoroacetate). Median lethal doses (LD50s) range from 0.63 mg kg-1 for red-browed firetails, Emblema temporalis, to approximately 278 mg kg-1 for the emu, Dromaius novaehollandiae. Significant differences occur between the sensitivity of different groups of birds and may be related to differences in their metabolic rates. A few species may also have developed a tolerance to 1080 from being exposed to indigenous plants that contain fluoroacetate, or to insects and other animals which have fed on such plants. The most common signs of 1080 poisoning among birds are depression, flushed feathers, a reluctance to move and convulsions. Signs of poisoning first appeared among the species tested at 1-60 h after dosing, and deaths follow between 1 h to almost 11 days after dosing. The susceptibility of 48 species of birds in Australia to 1080 poisoning is discussed in relation to typical baits and poison concentrations used against vertebrate pests. Theoretically, fewer types of birds are likely to be at risk from dingo-poisoning than pig-poisoning campaigns that also use meat baits but higher concentration of 1080. Individuals of 39 out of the 48 species could be at risk from rabbit and other pig-poisoning campaigns. The impact on the bird population will depend, among other factors, on the amount of bait individuals eat and on the poisoning methods employed.

Keywords: acute toxicity/mode of action/rabbits/possums/birds/mammals/non-target species/1080

Keywords: non-target species/acute toxicity/1080/reptiles

Keywords: non-target species/mammals/acute toxicity/1080

Abstract: The sensitivity of a species to 1080 poison is difficult to predict from toxicity data for other, closely related species. LD50s of practical use for evaluating the risk species might face from 1080-poisoning campaigns can be obtained for untested members of some groups by the use of either values fro similar species, regression equations involving body weight, or the lower 95% confidence limits of the distribution of LD50s of members in each group.

Among the 171 species for which there are data there was considerable variability in the time until signs of poisoning became apparent (0.1 h ->7 days), the time to death (0.1 h-> 21days) and the time until animals began to show signs of recovery (2h-18 days). Marsupial carnivores generally showed signs earlier and died or recovered quicker than eutherian carnivores, eutherian herbivores and the marsupial herbivores of eastern Australia, even though the last three groups have lower LD50s. Reptiles and amphibians generally were the slowest to show signs of poisoning, to die or to recover, and the highest LD50s.

All species in Australia for which toxicity data are available were ranked according to the percentage of their body weight they would have to eat of various poison baits to receive and LD50. Many non-target species require lower percentages than the target animals consumption of lethal bait may be affected by various factors. Finally, an evaluation is given of the major groups of animals potentially most at risk in 1080-poisoning campaigns in Australia, based on their susceptibility to 1080.


Keywords: non-target species/birds/mammals/1080


Keywords: bait degradation/poisoning/dogs


Keywords: 1080/baits/foxes/lethal dose/field efficacy

Abstract: Data are presented on the sensitivity of foxes to 1080 poison, which, although not meeting the requirements for the calculation of a precise LD50, provide a basis for determining the appropriate amount of 1080 to use in baits to control foxes. Amounts of 2.5 mg per bait appear ample, based on the lethal dose of c. 0.15 mg/kg for foxes, but further trials may be necessary to confirm whether this provides sufficient allowance for possible reduced bioavailability and reductions in 1080 concentration in meat baits under different environmental conditions.


Keywords: 1080/birds/mammals/rabbits/foxes/non-target species/field efficacy

Abstract: Populations of non-target birds and mammals on a semi-cleared grazing property near Braidwood, New South Wales, did not appear to be affected by a trail-baiting campaign against rabbits, *Oryctolagus cuniculus*, using pellet bait and 1080 poison. Rabbit numbers were reduced by about 90% and those of the fox, *Vulpes vulpes*, another exotic pest, by about 75%. Populations of both pest species began recovering soon after the campaign, indicating the need for continued control measures.


Keywords: secondary poisoning/non-target species/rabbits/acute toxicity/1080/cats/dogs/poisoning

Abstract: The potential hazards that rabbits, *Oryctolagus cuniculus*, and other animals that may be poisoned during rabbit-control campaigns present to different carrion-eating animals were evaluated by comparing the amounts of 1080 that carrion-eaters could ingest from feeding on poisoned corpses with their measure sensitivity to the poison. Foxes, *Vulpes vulpes*, dingoes, *Canis familiaris* dingo, dogs, *Canis f. familiaris*,...
and cats, Felis catus, probably face greater risk of secondary poisoning than other animals from feeding on rabbits poisoned with 1080-treated carrots. The extent to which other carrion-eating animals, particularly what and how much of the different tissues and organs of poisoned animals they eat, whether they vomit or regurgitate partly digested food, and whether they quickly develop and aversion to the taste or smell of 1080. Secondary poisoning hazards during rabbit-control campaigns can be minimised by using the minimum effective concentration of 1080 in baits for rabbits, by using the minimum effective number of 'free foods' of bait, and by removing all dead animals that can be found from the treated area.


Keywords: 1080/poison/tolerance/fluoroacetate/birds/rabbits/possums/baits/poisoning

Abstract: The likelihood of an animal being killed by pest-control programs with 1080 depends on many factors. The animal's sensitivity to the poison is a key factor, but this may vary according to the animal's age or breeding condition, or whether its ancestors developed a tolerance to 1080 through feeding on plants that naturally contain fluoroacetate. Measurements of sensitivity to 1080 can vary according to differences in the experimental procedure used to obtain them, and may not necessarily indicate sensitivity under field conditions.

Body size is also important in influencing what amounts of 1080 may prove lethal to different animals; small animals, such as passerine birds, are often more tolerant to 1080 than pests such as rabbits, Oryctolagus cuniculus, and brush-tail possums, Trichosurus vulpecula, but can be killed by eating much smaller total amounts of 1080. Their fate during a baiting program depends on many factors, but principally on how many baits or poisoned animals they encounter and how much 1080 they ingest.

The susceptibility of animal populations to 1080-poisoning can be gauged also by assessing their ability (in terms of reproductive an dispersal capacities) to recover from reductions in numbers caused by poisoning programs. Predictions of potential susceptibility should be compared with measurements of the actual impact of poisoning programs on populations. Results from field studies indicate that such predictions are likely to overemphasise the risk that non-target animals face, but more studies are required on rare and endangered species.


Keywords: 1080/poison

Abstract: Sodium monofluoroacetate (1080) has been proved during the last 15 years to be an extremely effective poison against warm-blooded animal pests in America. In Australia and New Zealand it is being used successfully against the rabbit. Its properties are such as to commend it for the control of all mammalian pests and as it is likely to be used more widely in this country in the future, it is desirable that farmers, hunters, and others should be informed about its nature and properties


Keywords: secondary poisoning/mammals/persistence in animals/deer/heart/sodium monofluoroacetate/1080/muscle/liver/humans


Keywords: 1080/poison/baits/honey

Abstract: Trials by Wallaceville Animal Research Centre have shown that: Bees are attracted to jam baits in which 1080 is used as a poison, but the baits can be laid only by, or under the supervision of, approved operators. They are instructed not to lay baits within 1/4 mile of apiaries. Close watch on 1080 poisoning operations in the past six years has produced no evidence of mass mortalities of bees.

McIntosh, I. G., Bell, J., Poole, W. S. H., and Staples, E. L. J. (1966). The toxicity of sodium monofluoroacetate (1080) to the North Island weka (Gallirallus australis greyi). New Zealand journal of science 9, 125-128.

Keywords: acute toxicity/birds/non-target species/persistence in animals/secondary poisoning/1080

Keywords: sodium monofluoroacetate/monofluoroacetate/1080/humans/non-target species

Abstract: Sodium monofluoroacetate (1080) is an extremely effective poison against warm-blooded animal pests; its properties are such as to commend it for the control of all animal pests. As it is used extensively in New Zealand and overseas, it is desirable that farmers, hunters and others should be informed about its nature and properties. This article examines its poisonous properties, the precautions to be taken by users and the risks to humans, domestic animals and wildlife.


Ref Type: Report
Keywords: 1080/non-target species/amphibian


Keywords: diagnosis/sodium fluoroacetate

Abstract: A boy, aged eight years, was admitted to hospital in status epilepticus following the ingestion of sodium fluoroacetate ("1080"). Subsequently, he was resuscitated from cardiac arrest, but was left with severe neurological impairment. This widely-used agricultural poison is cardiototoxic and neurotoxic, and stringent precautions exist to control its use.


Keywords: occurrence in nature/product chemistry/biosynthesis


Keywords: metabolism/defluorination/fluoroacetate

Abstract: The brush-tailed possum from Western Australia was found to be nearly 150 times more resistant to fluoroacetate intoxication *in vivo* than the same species from South Australia. Acetone powder preparations from the liver of animals from both populations showed similar abilities to convert fluoroacetate into fluorocitrate. Aconitate hydratase activity in liver preparations from both Western Australian and South Australian animals was similarly and competitively inhibited by fluorocitrate. Both animals were capable of defluorinating fluoroacetate at similar rates by a glutathione-dependent enzymatic mechanism resulting in the formation of free fluoride ion and S-carboxymethylcysteine. Glutathione was also capable of partial protection against the toxic effects of fluoroacetate *in vitro* by a further unelucidated mechanism.

Mead, R. J. The biochemistry and coevolutionary role of monofluoroacetic acid in plant-animal interaction in Australia. 1980. University of Western Australia Editor.

Ref Type: Thesis/Dissertation
Keywords: biochemistry/monofluoroacetic acid/occurrence in nature/tolerance


Keywords: mammals/mode of action/metabolism/fluoroacetate/citrate/rodents/marsupials/possums/kidney/liver/defluorination/toxicity/rats/1080/sodium fluoroacetate/plasma/fluorocitrate/inhibition/tolerance

Abstract: Levels of citrate in kidneys and livers of rats with normal glutathione levels increased 6.8 and 1.7-fold respectively after dosing with 1.5 mg of compound 1080 (=95% sodium fluoroacetate) per kilogram bodyweight. In animals with liver glutathione levels 15% of normal increased in plasma and liver citrate levels after dosing with fluoroacetate were significantly greater than those of control animals. Cysteamine and N-acetylcysteine, like glutathione, partially protected aconitase hydratase from fluorocitrate
inhibition in rat liver preparations but were unable to replace glutathione as a substrate for the defluorination of fluoroacetate in vivo. The in vivo defluorination patterns of four mammal species with differing sensitivities to fluoroacetate did not indicate a direct relationship between tolerance and rate of defluorination and it as also suggested that a high level of activity of glutathione-S-transferase responsible for the defluorination of fluoroacetate is not the major mechanism for circumventing fluoroacetate toxicity in resistant mammals.


Keywords: fluoroacetate/1080/occurrence in nature/tolerance/mammals/marsupials

Abstract: Fluoroacetate-bearing species of Gastrolobium and Oxylobium occur in SW but not SE Australia. Populations of grey kangaroos (Macropus fuliginosus), bush rats (Rattus fuscipes) and rat kangaroos (Bettongia penicillata) whose ranges include these plants are highly resistant to fluoroacetate, while an island population of B. lesueur, separated from contact with fluoroacetate-bearing vegetation for at least 7000 yr is moderately tolerant. The grey kangaroo includes these plants in its diet and it appears that the production of fluoroacetate as a protection against herbivore grazing pressure and the development of genetic resistance to the toxin is a co-evolutionary event which has occurred in Western Australia. SE Australian populations of B. gaimardi and R. fuscipes are highly susceptible to fluoroacetate and it is suggested that R. fuscipes and Bettongia radiated from the east into Western Australia, the western populations evolving a degree of resistance dependent upon the extent of exposure to fluoroacetate-bearing vegetation. Eastern populations of M. fuliginosus are as resistant as western populations and it is suggested that the grey kangaroo evolved in Western Australia and spread eastward, retaining tolerance to fluoroacetate in the absence of specific selection pressure.


Keywords: tolerance/fluoroacetate/occurrence in nature/marsupials/citrate

Abstract: The tolerance to fluoroacetate of three geographically separated populations of the macropodid marsupial, the quokka (Setonix brachyurus) in southwestern Australia is compared in terms of elevation of plasma citrate levels in response to dosing with 1080. The populations from mainland Western Australia and from Bald Island off the south coast of W.A. are currently in contact with fluoroacetate-bearing plants. These populations have a much higher tolerance to fluoroacetate and are more genetically homogenous for the resistance than the population on Rottnest Island off the west coast of Western Australia. The latter population has been isolated from contact with fluoroacetate-bearing vegetation from some 5,000-7,000 years, but is much more tolerant than are macropodids in southeastern Australia where fluoroacetate-containing plants are not known to occur.


Keywords: 1,3-difluoro-2-propanol/1080/mode of action/rodents/treatment/antidote

Abstract: Administration to rats of 100 mg per kilogram of 1,3-difluoro-2-propanol (DFP), the major ingredient of the pesticide Glifor, resulted in citrate accumulation on the kidley after a 3-h lag pahse. Inhibition of aconitate hydratase in the kidney and symptoms typical of sodium fluoroacetate poisoning in DFP-intoxicated rats suggested metabolism of DFP to (-)erythrofluorocitrate. The conversion of DFP to the toxic metabolite was found to involve defluorination by a microsomal mixed-function oxidase in the liver, induced by phenobarbitone and inhibited by piperonyl butoxide. Administration to rats of pyrazole (90 mg per kg body weight) decreased the activity of the mixed-function oxidase-dependent defluorination of DFP. When administered to rats either 2 h before or 2 h after DFP (100 mg per kg body weight) it eliminated symptoms of poisoning, prevented citrate and fluoride accumulation, and decreased aconitate hydratase inhibition in the kidney. The antidotal properties of pyrazole, the mode of toxic action of (-)erythrofluorocitrate and the potential for DFP to replace 1080 in fauna management programs in Australia is discussed.


Ref Type: Report
Keywords: sodium monofluoroacetate/1080/invertebrates/non-target species/temperature/persistence in plants

Abstract: Results show that insects are most affected and molluscs the least. In descending order the taxa most severely repressed were; Coleoptera, Collembola, Diptera, Hymenoptera, Orthoptera, Opiliones and earthworms. Mollusca, Amphipoda, Acarina and Araneida showed no change. The significant drop in insect numbers after heavy rain suggests strongly that the control plots had become contaminated with 1080. 1080 adsorbs to cellulosic leaf litter, and persists in the litter for at least three months. Results show that the insects associated with the breakdown of leaf-litter are the most severely affected by 1080. Breakdown of 1080 can take more than 120 days at a temperature of 5 degrees Celsius. Tests showed that after 113 days at 5 degrees, 1080 still contained a concentration of 1.5 mMol/L. In the forest the average temperature for leaf litter in winter was at 5 degrees. Comparison of the Whitecliffs data with that of other lowland podocarp/broadleaf forests over one year, shows that 1080 has a severe impact on many other invertebrates. At Whitecliffs, insect larvae, comprising coleoptera, hymenoptera, diptera and lepidoptera dropped dramatically from July through to October, then stabilised for the remainder of the year at the crash level. Insect larvae in other forests followed the normal pattern of continual rise from July until the onset of the following winter.

Meenken, D and Johnson, B. Effects on water quality of 1080 possum poisoning operation by manual bait application. 00/1, 1-23. 2000.
Ref Type: Report
Keywords: 1080/poisoning

Ref Type: Report
Keywords: 1080/persistence in water/baits/ground control/poisoning

Abstract: Executive Summary
A substantial database exists on water quality after aerial 1080 possum and rabbit poisoning operations in New Zealand (see Appendix 1.). However, no water quality investigations have been undertaken to assess the effect of ground-based 1080 poisoning operation. This is due to the perception that manual application of toxic bait is less likely to result in significant quantities of bait entering watercourses compared to aerial application.

A meeting with Dr Gillian Durham, the then Director of Public Health, at the Ministry of Health on 19 February 1999, discussed model permit conditions, in particular the requirements for drinking water supplies and monitoring. At the meeting it was agreed that the perceived risk from ground applications of 1080 was much lower than from aerial applications and that was why statutory requirements were much less involved for the former. It was agreed that the Wellington Regional Council (WRC) would monitor a ground 1080 operation and report on water quality effects, so that Ministry could promulgate national advice on the appropriate approach to ground application of 1080.

The WRC subsequently designed a study to investigate a “worst case” scenario. A 14-ha catchment in the Wairarapa was poisoned with 1080 cereal baits (0.15% 1080 w/w) on 26 November 1999. Baits were hand-broadcast at approximately 10 kg/ha.

Duplicate water samples were collected during and after bait application, and during subsequent rainfall events. Sample collection was automated using a Manning Sampler, with sampling intervals set for 15 or 30 minutes. A total of 52 samples were analysed for 1080 by the Landcare Research laboratory at Lincoln. None contained detectable concentrations of 1080.

This study provides support for the assertion that ground-based 1080 possum poisoning operations do not have a measurable effect on water quality.


Keywords: persistence in water/1080
Abstract: A possum (Trichosurus vulpecula) control operation using aerially sown baits containing sodium monofluoroacetate (1080) was conducted in June 1993 in and adjoining Tararua Forest Park, New Zealand.
In total, 66 water samples from eight sites collected over a period of 4 months were analysed for residual 1080 potentially resulting from the control operation. No 1080 was detected in any of the samples (quantifiable level 0.0003 mg l^{-1}).

Keywords: secondary poisoning/mammals/non-target species/persistence in animals/1080/stomach/dogs/scavenger

Keywords: inhibition/fluorocitrate/kidney/biochemistry/rodents
Abstract: Rat kidney mitochondria, in the presence of ATP, Pi and magnesium ions, converted pyruvate and bicarbonate to malate, fumarate and citrate, and, in the presence of glutamate, also to aspartate. The addition of fluorocitrate strongly inhibited pyruvate utilisation and 14CO2 incorporation into organic acids. The inhibition of 14CO2 incorporation into organic acids in the presence of fluorocitrate appeared to be caused by malonyl coenzyme A produced by fluorocitrate stimulation of acetyl-CoA carboxylase.

Keywords: acute toxicity/non-target species/mammals/pathology/diagnosis/1080/lethal dose/heart
Abstract: Objectives: To establish whether the diagnosis of acute and long-term poisoning with 1080 in sheep can be improved; to determine any long term effects of acute 1080 poisoning on the health, productivity and survival of sheep.
Conclusions: Phase 1 - Acute and Sub-acute effects of 1080 All the sheep that died of 1080 poisoning died within 4 days of exposure. There were no reliable bioindicators of 1080 exposure in sheep that survived the first 4 days after exposure. Gross and microscopic pathology of the lungs provides a good indicator in sheep dying from 1080 poisoning. Lungs were wet and heavy with clear fluid draining from the cut surface. The trachea was usually filled with frothy liquid. Pulmonary congestion and oedema was diffuse, affecting all lobes equally in all sheep that died. Cardiac damage was typified by necrosis and mineralisation within the myocardium of the left ventricle in half of the sheep that died of 1080. there were no abnormalities in the heart or lungs of sheep that were killed 14 days after exposure. Residues of 1080 in blood, stomach, or muscle, and elevated serum citrate concentrations in the blood can be used as short-term indicators of 1080 exposure. Changes in electrocardiogram characteristics can be detected for 36 h after 1080 exposure. An increase in heart rate can be measured for 48 h after exposure. Phase 2 - Long-term effects of a near lethal dose of 1080 If death does not occur within the first four days of exposure to a single dose of 1080, subsequent adverse effects on the health of sheep are unlikely.

Keywords: fluoroacetate/1080/rabbits/field efficacy/mode of action

Keywords: NMR
Abstract: Eight fluorinated compounds were tested as putative probes to measure carboxylesterase activity employing 19F nuclear magnetic resonance spectroscopy. The method takes advantage of the sensitivity of fluorine resonances to the changes in the chemical bonding in the covalent structures where they are located. Determination of the kinetic parameters of ethyl fluoroacetate and diethyl fluoromalonate in hemolysates showed that these probes were well suited to study carboxylesterase activities in complex systems. The potential of these probes for noninvasive applications was demonstrated in measurements of carboxylesterase kinetic parameters in intact erythrocytes. The presence of carboxylesterases was established in several strains of the bacterium Helicobacter pylori employing 19F nuclear magnetic
resonance spectroscopy, and the kinetic parameters of these enzymes for ethyl fluoroacetate and diethyl fluoromalonate were measured.

Keywords: metabolism

Keywords: metabolism/mode of action/1,3-difluoro-2-propanol/kidney/rats/fluoride/citrate/4-methylpyrazole/acoinitase/enzyme

Abstract: The biochemical toxicology of 1,3-difluoroacetone, a known metabolite of the major ingredient of the pesticide Gliflor (1,3-difluoro-2-propanol), was investigated in vivo and in vitro. Rat kidney homogenates supplemented with coenzyme A, ATP, oxaloacetate, and Mg2+ converted 1,3-difluoroacetone to (--)-erythro-fluorocitrate in vitro. Administration of 1,3-difluoroacetone (100 mg kg(-1) body weight) to rats in vivo resulted in (--)-erythro-fluorocitrate synthesis in the kidney, which was preceded by an elevation in fluoride levels and followed by citrate accumulation. Animals dosed with 1,3-difluoroacetone did not display the 2-3 hour lag phase in either (--)-erythro-fluorocitrate synthesis or in citrate and fluoride accumulation characteristic of animals dosed with 1,3-difluoro-2-propanol. We demonstrate that the conversion of 1,3-difluoro-2-propanol to 1,3-difluoroacetone by an NAD+-dependent oxidation is the rate-limiting step in the synthesis of the toxic product, (--)-erythro-fluorocitrate from 1,3-difluoro-2-propanol. Prior administration of 4-methylpyrazole (90 mg kg(-1) body weight) was shown to prevent the conversion of 1,3-difluoro-2-propanol (100 mg kg(-1) body weight) to (--)-erythro-fluorocitrate in vivo and to eliminate the fluoride and citrate elevations seen in 1,3-difluoro-2-propanol-intoxicated animals. However, administration of 4-methylpyrazole (90 mg kg(-1) body weight) to rats 2 hours prior to 1,3-difluoroacetone (100 mg kg(-1) body weight) was ineffective in preventing (--)-erythro-fluorocitrate synthesis and did not diminish fluoride or citrate accumulation in vivo. We conclude that the prophylactic and antidotal properties of 4-methylpyrazole seen in animals treated with 1,3-difluoro-2-propanol derive from its capacity to inhibit the NAD+-dependent oxidation responsible for converting 1,3-difluoro-2-propanol to 1,3-difluoroacetone in the committed step of the toxic pathway

Keywords: baits/sodium monofluoroacetate/monofluoroacetate/1080/dogs/bait degradation/invertebrates

Abstract: Wild dog and dingo baits impregnated with the toxin 1080 and exposed at two different sites in the field suffered significant reduction in weight compared with controls as a result of ant activity. In one case a bait was completely destroyed in five days, while others were reduced in weight by over 70% during the same period. Sun-drying of baits for 48h before laying did not significantly reduce damage by ants. Ant activity may detoxify baits before they are taken by wild dogs.

Keywords: occurrence in nature/high-performance liquid chromatography/fluoroacetate

Keywords: metabolism/occurrence in nature

Keywords: fluoroacetate/degradation/persistence in plants/occurrence in nature/bacteria

Abstract: The fluoroacetate-containing plant, *Dichapetalum cymosum*, is capable of releasing CO2 from fluoroacetate. Fluoroacetate is more readily degraded by the old than the young leaves of the plant. An aseptic callus culture of *D. cymosum* is also capable of degrading fluoroacetate albeit at a much lower rate
than the leaves of the plant. Inoculation fo the cells with *Psuedomonas cepacia* isolated from the plant increased the rate of CO₂ release from fluoroacetate about five-fold.


Keywords: fluoroacetate/fluoride/occurrence in nature/biosynthesis

Abstract: Studies utilising 19F NMR spectroscopy have demonstrated that callus culture of *Dichapetalum cymosum* can efficiently convert fluoropyruvate to fluoroacetate, fluorolactate and fluoride. The conversion of fluoropyruvate to fluoroacetate is unusual in a biological system and the possible role of fluoropyruvate in the biosynthesis of fluoroacetate is discussed.


Keywords: occurrence in nature/biosynthesis/enzyme

Abstract: The presence of this enzyme in *D. cymosum* probably explains why this plant is not poisoned by its production of fluoroacetate.


Keywords: fluoroacetate/biosynthesis/persistence in plants/occurrence in nature

Abstract: A cell-free extract derived from callus tissue of *Dichapetalum cymosum* was able to oxidatively decarboxylate fluoropyruvate to give fluoroacetate. By employing sodium monomethyl acetylphosphate, an inhibitor of the pyruvate dehydrogenase complex (PDC) fluoroacetate production was increased and it was demonstrated unambiguously that PDC is not responsible for this transformation in *D. cymosum*.


Ref Type: Thesis/Dissertation

Keywords: fluoroacetate/metabolism/high-performance liquid chromatography/liquid chromatography/bacteria/enzyme/occurrence in nature

Abstract: A fast and sensitive method was developed for the determination of fluoroacetate in *Dichapetalum cymosum* using high-performance liquid chromatography. The highest concentrations of fluoroacetate were found in the immature seeds, flowers and young leaves of the plant. The young leaves are more toxic than the older leaves. Folially applied fluoroacetate is also more readily accumulated by the young than by the older leaves of *D. cymosum*. Fluoroacetate can be taken up by the roots of *D. cymosum* and be transported to the leaves. It was, however, demonstrated in this study that aseptically grown *D. cymosum* seedlings, as well as an aseptic callus culture of the plant, is capable of producing fluoroacetate. A pseudomonad was isolated from *D. cymosum* and identified as *Pseudomonas cepacia*. It was established that an isolate of this bacterium could grow in fluoroacetate enriched solutions without any reduction in growth rate. This bacterium is capable of defluorinating fluoroacetate and also of liberating CO₂ from fluoroacetate. It seems as though the synthesis of N-methyl alanine and the occurrence of N-methyl serine in *D. cymosum* is a result of the symbiosis between the plant and its endophyte. An aseptic callus culture of *D. cymosum* is capable of degrading fluoroacetate albeit at a much lower rate than the leaves of the plant. By contaminating the callus with *P. cepacia*, isolated from the plant, the rate of CO₂ release from fluoroacetate was increased about five fold. A *D. cymosum* crude mitochondrial enzyme extract can release CoASH from fluoroacetyl-CoA at a rate of 29.5 nmoles/min/mg protein, indicating the presence in the extract of an enzyme which is probably fluoroacetyl-CoA hydrolase. This enzyme could not use acetyl-CoA as a substrate. The presence of the fluoroacetyl-CoA hydrolase-like enzyme in *D. cymosum* together with the ability of the plant and its endophyte to degrade the fluoroacetate, helps to explain why *D. cymosum* is not poisoned by the high fluoroacetate concentrations which occur in the plant at times.


Keywords: metabolism/occurrence in nature/NMR/1080

Abstract: *Pseudomonas cepacia* was isolated from the stems and seeds of the fluoroacetate accumulating
plants *Dichapetalum braunii* and *D. cymosum*. The fluoroacetate concentration in the seeds of *D. braunii* was 8000 ppm. This is probably the highest concentration of fluoroacetate yet found in a living organism *P. cepacia* isolated from these extremely toxic seed can break down fluoroacetate and is able to grow in fluoroacetate concentrations up to 10mM. It metabolizes fluoroacetate to several other fluorinated compounds, including fluorocitrate and fluoroglutamate. It is proposed to fluoroacetate enters the citric acid cycle as fluotoacetyl-CoA and is then converted to fluorocitrate, fluoroaconitate, 4-fluoro-isocitrate and 4 fluoro-2-ketoglutarate. The keto acid then undergoes a transamination reaction to form 4-fluoroglutarate.

*P. cepacia* isolated from the stems of *D. cymosum* only defluorinated fluoroacetate and did not metabolise it further, as was the case with the *D. braunii* isolate. The defluorination rate of the *D. cymosum* isolate was about five times faster than that of the *D. braunii* isolate.


Keywords: fluoroacetate/bacteria/metabolism/occurrence in nature/defluorination


Keywords: metabolism/occurrence in nature/NMR/bacteria/defluorination/biosynthesis

Abstract: A 16-18 kb pairs plasmid was isolated from the fluoroacetate-metabolizing bacterium, *Pseudomonas cepacia*. This strain of *P. cepacia* is a natural symbiont of the fluoroacetate-producing plant, *Dichapetalum cymosum* (Hook.) Engl. After transformation of *B. subtilis* with this plasmid, the transformed bacterium was also able to defluorinate fluoroacetate when cultured in a fluoroacetate-enriched medium. The extent of defluorination was measured by a fluorine-specific electrode as well as by 19F-nuclear magnetic resonance spectroscopy.


Keywords: metabolism/occurrence in nature/fluoroacetate/invertebrates

Abstract: In nature organofluorine metabolites are few and far between. Fluoroacetate is found in some plants and in one bacterial source. However, the remaining metabolites are normally unique to one particular organism.


Keywords: metabolism/inhibition/cyanide/citric acid/aconitase/invertebrates

Abstract: Changes in different metabolite concentrations in non-feeding larvae of *Cochliomyia macellaria* (F.) (*Callitroga macellaria*) were investigated in their dependence on heat, cold, anaerobiosis and inhibitors. With the exception of dinitrophenol, all factors inhibited the oxidative metabolism to some extent. This was seen by the increased production of lactate, pyruvate and alanine. Polyolformation was correlated with the inhibition of the electron transport system whilst polyolphosphate formation depended on additional factors. Tests with 14Cl and 14C-glucose showed the greater importance of the hexose-monophosphate shunt during anaerobiosis, cyanide and fluorooric acid blocked metabolism. After the application of fluorooric acid the concentrations of malate, asparagine, aspartate and citric acid were determined, and it was possible to suggest a diagram of metabolism during fluorooric acid action which shows a bypass of the aconitase step and the possibility of an oxidative ATP-production at a low rate.


Keywords: mode of action/invertebrates/reproductive effects/aconitase/fluorooricitate


Keywords: non-target species/birds/aerial control/1080/poisoning/poison/possums/wallaby/mammals

Abstract: Bird populations were monitored for one year (October 1990-October 1991) to determine whether the 1080 poison used to eradicate possums and wallabies on Rangitoto Island had had any detrimental effects on them. There was no significant decline in bird numbers recorded immediately after poisoning,
with four species increasing in abundance (P<0.001). Twelve months after the operation the abundance of four bird species had significantly (P<0.001). The poisoning does not appear to have had any negative effect on the bird populations of Rangitoto, while the removal of browsing mammals may in future prove to have beneficial effects.


Keywords: rodents/1080/rats/poisoning/field efficacy/non-target species/birds

Abstract: Both ship rats (*Rattus rattus*) and mice (*Mus musculus*) were trapped on Rangitoto Island over a 15 month period. A two month decline in mouse abundance was noted following poisoning; following this the population recovered rapidly, reaching a peak of 12 captures per hundred trap nights in autumn then declining over winter. A longer decline in ship rat abundance was observed, although this reached a pre-poisoning level of 16 per hundred trap nights in April. Thereafter the population did not reach pre-poisoning levels again.


Keywords: fluoroacetate/inhibition/aconitase/fluoride/occurrence in nature

Abstract: A number of exotic plants are known to contain fluoroorganic compounds. The toxic component of more than a dozen plant species is known to be fluoroacetate. Indirect evidence using extraction with non-polar solvents combined with paper chromatography, inhibition of aconitase and infra-red spectrometry indicated the presence of fluoroacetate and fluorocitrate in soybean and crested wheat grass exposed to atmospheric fluoride. Gas chromatographic analyses of organic acids isolated from crested wheat grass collected from areas of high atmospheric fluoride pollution showed the presence of two peaks that corresponded with the methyl esters of authentic fluoroacetate and fluorocitrate. The study also showed the that organic acid pattern in fluoride-exposed plant was significantly changed compared to control tissues.


Keywords: fluoroacetate/tolerance/fluorine/bone/developmental toxicity/chronic poisoning

Abstract: The tolerance to dietary fluoroacetate and its effect upon skeletal fluorine deposition in the rat has been studied. It has been shown that the rat will survive the addition of 20 ppm fluoroacetate to the diet, during which time there was a sharp retardation of growth rate, that sufficient physiologic adjustment was made to recover normalcy, that exposure to the toxicant conditions the animals to further increases of dietary fluoroacetate with only transitory outward effects and that this conditioned physiologic tolerance was quickly lost. Further it has been shown that there was an increased storage of fluorine in the femuri when dietary fluoroacetate was fed. It appears that fluoroacetate contributed an amount of fluorine to the femuri equivalent to that contributed by the basal diet.


Ref Type: Conference Proceeding

Keywords: poisons/brodifacoum/1080/livestock/blood/possums/muscle/liver/humans/secondary poisoning

Abstract: Increasing concerns over environmental contamination following poison operations for vertebrate pest control include those about the risks of human exposure to poisons from food. To determine whether brodifacoum or 1080 ingested by livestock at near-lethal dose levels would be transferred to milk, sheep were dosed and then blood sampled and milked. Brodifacoum and 1080 were transferred to the milk in sheep but at levels 30 or more times lower than those found in the bloodstream. Possums were fed LD₉₀ levels of 1080, brodifacoum, or cyanide then muscle and liver samples were collected when the residue level was expected to be highest for each poison. There was no loss of brodifacoum or 1080 residues in meat after cooking, but there was a decrease in the concentration of cyanide found in cooked compared to raw meat.

Ref Type: Report
Keywords: 1080/blood/brodifacoum/cholecalciferol/cyanide/humans/liver/muscle/persistence in animals/secondary poisoning

Abstract:
• Brodifacoum was detected in the blood of high-dose ewes at 2 days and 4 days after dosing, but not from 8 days onwards. Five of eight high-dose ewes had detectable concentrations of brodifacoum in their milk 2 days after dosing. There was no brodifacoum detected in any ewe's milk from 4 days after dosing.
  • At 4 hours after dosing, the concentration of 1080 in ewes' blood was approximately 30 times higher than in milk. No ewes had detectable 1080 in their milk at 72 hours after dosing.
  • At 10 days after dosing, concentrations (mean SE) of brodifacoum in possum muscle and liver were 0.06 0.02 g/g and 0.60 0.12 g/g respectively. Brodifacoum concentrations in both possum muscle and liver were not significantly affected by cooking. • At 8 hours after dosing, concentrations (mean SE) of 1080 residue in possum muscle and liver were 0.64 0.14 g/g and 0.40 0.05 g/g respectively. 1080 concentrations in both possum muscle and liver were not significantly affected by cooking.
  • At 5 minutes after dosing, concentrations (mean SE) of cyanide in possum muscle and liver were 0.50 0.47 g/g and 1.60 0.56 g/g respectively. This was suggestive of a cooking effect, however the reduction of cyanide concentrations in possum liver and muscle were not statistically significant.
  • At 2 days after dosing, concentrations (mean SE) of cholecalciferol in possum muscle and liver were 0.04 0.01 g/g and 1.30 0.42 g/g respectively. Cholecalciferol concentrations in possum liver were reduced by cooking.

• Brodifacoum and 1080 can be transferred to milk and are likely to detectable for 4 and 6 days, respectively.
• Brodifacoum, 1080, cyanide and cholecalciferol can be transferred to liver and muscle tissue.
• Risk to human consumers from 1080, brodifacoum or cyanide in muscle or liver is not likely to significantly reduced by cooking.
• Risk to human consumers from cholecalciferol in liver is likely to be reduced by cooking.


Keywords: diagnosis


Keywords: high-performance liquid chromatography

Abstract: A simple isocratic high-performance liquid chromatographic (HPLC) method for the quantitative analysis of monofluoroacetic acid (MFA), the toxic substance of Dichapetalum cymosum, in plant material, rumen contents (gastric contents), and liver samples is described. A suitable HPLC column that gives optimum sensitivity, accuracy, precision, and separation of MFA is identified. A C-610 organic acid analysis column at ambient temperature with 0.02M H3P)4 as an eluent and ultraviolet detection at 210 nm is utilised to quantitate MFA. Using the method, the average percentage recovery in plant material, bovine liver, and rumen samples is 94.8%, and a detection limit of 12 ug/L is achievable.


Keywords: monofluoroacetate/poisoning/liquid chromatography/stomach/temperature/occurrence in nature

Abstract: A new high performance liquid chromatography method was developed for measuring monofluoroacetate (MFA) for a variety of biological samples. The method was used in the laboratory over 24 months to investigate suspected MFA poisoning in 50 samples including stomach contents of cheetah
(1), bird (1), horse (1), man (2), sheep (2), cat (7), dog (13) and cattle (17), and in bait (5) and water (1).
MFA was detected in 66% of samples from cases of suspected poisoning, reflecting the extent of the problem. Stability of MFA in samples was also determined so as to have a time-bound baseline for the acceptance of samples submitted. Level of MFA decreased with time so that, after 14 days at room temperature, only 50% of the spiked dose could be identified. It is suggested that samples be examined within 7 days of death if they cannot be kept frozen.

Abstract: The effect of a lowered environmental temperature on the manifestations of the effect of sodium fluoroacetate (FAc) was studied in male strain H mice aged 9-12 weeks. It was found that only a small decrease in the environmental temperature (from 23 degrees Celsius to 17 degrees) during FAc intoxication (5 mg/kg bodyweight) induced further depression of the already lowered level of respiratory exchange and body temperature. Simultaneously it enhanced the toxic effect of the given dose of FAc. Mortality after 5 mg FAc/kg rose from 3% (at 23 degrees C) to 47% (at 17 degrees C) while LD50/3 days fell on exposure to cold from 12.1 mg/kg to 5.16 mg/kg. These results can be used when studying the radioprotective effect of FAc, to fix a suitable environmental temperature for the experiments.

Keywords: metabolism/sodium fluoroacetate/fluoroacetate/temperature
Abstract: The role of temperature in the mechanism of protective action of sodium fluoroacetate (FAc), was studied on H-strain males, mice, aged 9-12 weeks. After FAc application (5 mg/kg body weight) animals were kept at temperatures 17º, 23º, and 30ºC and irradiated at these temperatures with 800 R. Change in the ambient temperature in the course of intoxication by FAc significantly influences the body temperature of experimental animals, but does not affect the degree of protection or its time course. These results correspond with the opinion that the degree of protection by FAc is determined by the consequences of blocking of aconitase, which is proportional to FAc dose, rather than hypothermy.

Abstract: A comparison of long-term hypothermic effects of radioprotective substances and their protective effectiveness was carried out in mice after acute and prolonged irradiation. As radioprotective substances were used AET, cystamine, serotonein, 5-methoxytryptamine, cysteamine-S-phosphate, sodium fluoroacetate and some double combinations of the substances. The irradiation was carried out with dose rates 38.3 and 612.5 mGy/min, the hypothermic reaction was evaluated according to total oxygen consumption, measured during 5 hours after the drug administration. The results demonstrated the existence of a correlation between the suppression of metabolic processes and both short-term and long-term protective effectiveness of radioprotective substances. The protective effectiveness of a drug is the higher, the greater decrease of oxygen consumption is induced by this substance in the investigated time interval. An analogous dependence was also demonstrated between the duration of hypothermic and radioprotective effects. The found correlation is valid for both acute and prolonged irradiation (correlation coefficient 0.79-0.87; p<0.01).

Keywords: sodium monofluoroacetate/monofluoroacetate/1080/possums/ferrets/poisoning/mammals/field efficacy
Abstract: We assessed the impact on populations of non-target of a manually applied 1080 "jam" operation targeting possums in hilly pastoral land south-west of Dunedin in mid-winter 1991. We found no evidence that mice (*Mus musculus*) were poisoned, but ferret (*Mustela furo*) numbers apparently declined immediately after poisoning. The removal of small mammalian predators after a poisoning operation could
decrease the immediate predation pressure on native wildlife and rabbits (*Oryctolagus cuniculus*). Observed decreases in bovine tuberculosis reactor rates in deer and cattle herds after some poisoning operations may therefore result from killing of non-target mammals, especially ferrets, rather than possums.


Abstract: The density of rabbits (*Oryctolagus cuniculus*) in the modified tussock grasslands of the Mackenzie Basin, South Island, New Zealand, in August-September 1991 was determined within 26 one-ha quadrats spread over 1000 ha. The area was poisoned with 1080 [sodium fluoroacetate]-carrot baits and dead and live rabbits counted. The overall kill rate was 93%. Wide variability in rabbit densities amongst the quadrats was correlated with burrow density, but vegetation was not a significant predictor of rabbit numbers. High density quadrats were not all spatially clumped together. Variation amongst quadrats of 0-43% of rabbits dying underground shows that searching burrows as well as the surface will provide the most accurate rabbit densities. Poisoning efficacy was 90% in 77% of the quadrats, but two low-density quadrats recorded kill rates <70%. Nine per cent of carcasses had been partly eaten by predators, suggesting a potential for the predators to be killed during rabbit control operations via secondary poisoning. The average density of 19 rabbits per ha confirms the classification of this area as a moderate to high rabbit-prone zone, with the rabbit population imposing grazing pressure equivalent to at least 1-2 sheep per ha at the beginning of spring. Sustainable agriculture cannot be attained in these semi-arid regions of New Zealand without cheap, widespread and effective rabbit control.


Abstract: The Noises Islands lie in Hauraki Gulf about 24km northeast of Auckland. Most are bush-clad and none are permanently inhabited. Norway Rats (*Rattus norvegicus*) were first reported from the group in 1957. Eradication campaigns were carried out on Otata (21.8ha) and Motuhoropapa (9.5ha) Islands to test the practicability of such operations and as a conservation measure.

The first campaign on Otata was conducted in September 1979 using the acute poison 1080 and Talon. Rat sign was absent until June 1980. A second campaign was begun in September 1980 using the same poisons in different baits. The baits were laid in places likely to be visited by rats, and were also maintained in 133 covered bait stations until December 1981. There has been no evidence of rats on Otata since April 1981. Rats reappeared on Motuhoropapa in January 1981 after two years without definite signs of their presence. An eradication campaign was commenced in April 1981 using the same poisons, baits and procedures as in the second operation on Otata. Seventy-five bait stations were maintained until February 1983. The present status of the rats is uncertain, and efforts to ensure their removal are continuing.

The greatest practical difficulty encountered during the campaigns has been detecting the existence of rats when they are present in very low numbers.


Abstract: Cattle losses in Brazil have been attributed to Palicourea marcgravii St. Hil., a toxic plant for cattle. The crude extract from the leaves of P. marcgravii was successively fractionated using solvents with different polarities to determine whether monofluoroacetate and/or some other substance present in the leaves may be responsible for the acute symptoms caused by the plant. Authentic sodium monofluoroacetate (SMFA) was used for comparison. The only P. marcgravii fraction which induced seizures and death in intoxicated rats was water soluble. The signs and symptoms induced in the animals by the crude extract and water-soluble fraction were the same as induced by SMFA and included tonic seizures and other actions on the CNS. The dose-lethality and dose-latency to the 1st seizure curves constructed for the water-soluble fraction of the leaf extract (30-100 mg/kg) and SMFA (0.6-3.0 mg/kg) were parallel. Five animals per dose were used. The potency ratio of SMFA in relation to the water-soluble fraction of the leaf...
extract was 53.8 (dose-lethality curve) and 64.1 (dose-latency to the 1st seizure curve). The water-soluble fraction contained a substance with hRf = 20 which was the same as that of authentic SMFA. The 19F NMR spectra of authentic SMFA and the P. marcgravii water-soluble fraction were identical. These data demonstrate the presence of SMFA in the water-soluble fraction of P. marcgravii leaves and show that monofluoroacetate is the active principle responsible for the signs and symptoms of acute intoxication.

Keywords: fluoroacetamide/baits/field efficacy
Abstract: Populations of the rock hyrax, *Procavia capensis*, live in man-made rock terraces bordering fruit plots. They destroy fruit trees by browsing and breaking branches. In an experiment to control these animals using fluoroacetamide-treated fruit baits, rock hyrax damage was completely prevented in all treated plots.

Keywords: acute toxicity/ground control/sodium fluoroacetate/fluoroacetate/zinc phosphide

Ref Type: Conference Proceeding
Keywords: efficacy/sodium fluoroacetate/brodifacoum/zinc phosphide/rodents

Keywords: sodium fluoroacetate/fluoroacetate/fluoroacetamide/baits/1080/1081/efficacy/rodents
Abstract: Laboratory trials were carried out in order to establish the minimum active ingredient concentration of sodium fluoroacetate (1080) and of fluoroacetamide (1081) in wheat baits employed against *Microtus guentheri*, the Levant vole, and *Meriones tristrami*, Tristram's jird, without interfering with the toxicants' efficacy. Using a mixture of treated and untreated grain enabled a greater reduction in the a.i. concentration compared with that which could be achieved when all the grains offered contained a lower a.i. concentration of the toxicants. For *M. tristrami*, the lowest efficient final a.i. concentration in the bait was 0.0125% for 1080 mixed bait (1:10 mixture of 0.05% poison grains mixed with filler grains) and 0.01% for 1081 mixed bait (1:10 mixture of 0.1% poison grains with filler grains); and for *M. guentheri*, -0.005% mixed bait of 1080 or 1081 (1:10 mixture of 0.05% poison grains with filler grains). This leads to a reduction of the hazards involved in the use of prepared baits of these toxicants in the field.

Keywords: fluoroacetate/baits/sodium fluoroacetate/rodents/birds
Abstract: Whole wheat grain bait, treated with sodium fluoroacetate, is used to control field rodents in Israel. However, this bait constitutes a potential primary non-target hazard to seed-eating birds. In the present study black-, red-, green- and yellow-dyed whole wheat and sorghum grains, as well as undyed ones, were offered to feral pigeons, *Columba livia*, and to chukar partridges, *Alectoris chukar*, in the laboratory during 4 days. Grains were offered either piled on trays, or scattered. Consumption levels varied significantly (P<0.05) among varieties. The pigeons preferred undyed grain; black and yellow grains were consumed the least. The partridges preferred the undyed and black grains to all the other colored grains. When no undyed alternative was offered, the pigeons preferred red and green, and the partridges - black wheat. The pigeons preferred wheat whole grain, and the partridges - sorghum whole grain. When the pigeons received sorghum, a disliked grain, no significant difference (P>0.05) was observed in the consumption of the differently dyed grains.

Keywords: possums/field efficacy/baits/bait shyness
Ref Type: Conference Proceeding
Keywords: possums/poisoning/baits/aversion/1080/field efficacy/aerial control
Abstract: Major causes of failure of aerial poisoning operations against possums identified were; sublethal toxic loading, unsersize sublethal baits, nonlearned behavioural aversion to 1080, and failure to encounter bait. Dislike of bait was not a major cause of failure. Progress has been made towards solving these problems, but failure to encounter bait remains a likely major reason for possums surviving aerial poisoning. Improvements in the aerial sowing of bait are essential if the full benefit of this progress is to be realised.

Ref Type: Report
Keywords: 1080/poisoning
Abstract: Both achieved kills of 80%; Patchy distribution with the aerial drop; hunters made profit for half the total kill by averaging 8.2 possum skins /hr (selling skins)

Keywords: field efficacy/possums/1080
Abstract: The behavioural responses of captive possums (Trichosurus vulpecula) was observed during first encounters with non-toxic and toxic carrot and pellet baits used in pest control programmes. Possum confronted with new baits first used smell in a highly discriminating way, and then taste, which sometimes changed their initial response. Toxic carrot baits were rejected by 27.5% of possums, equally by smell and taste aversion, and toxic baits. Such non-learned aversion mechanisms therefore have an important role in the feeding behaviour of possums. A range of flavours tested, using barley as a food base, showed that only orange-flavoured barley was significantly preferred to non-flavoured barley: 19 flavours had no significant effect, and 19 others significantly reduced barley consumption. Orange and cinnamon, which was ranked fourth and repels some bird species, were tested as masks for 1080 baits. Both flavours effectively masked the aversive smell and taste of 1080. The levels of toxic flavoured bait rejection were low and did not differ from those of non-toxic (flavoured or non-flavoured) baits. Very few possums were observed vomiting, a behaviour in other species that may assist survival.

Keywords: field efficacy/aerial control/possums/1080
Abstract: Aerial delivery of 1080 (sodium monofluoroacetate) baits is the main technique for reducing populations of New Zealand's foremost vertebrate pest, the Australian brushtail possum, in large areas of inaccesible country. Surveys after pilot-controlled aerial sowing of baits in seven operations in forests showed that inaccurate navigation along the swaths left up to half the target zone untreated. Kill was estimated to average 75%. Inadequate coverage with baits was therefore believed to be a major factor in the survival of possums during aerial control operations. This was confirmed in field trials using rhodamine B as a biomarker to reveal acceptance of non-toxic baits. More possums were unmarked in partially treated blocks than in completely treated blocks. After a large scale aerial control operation, proportionally more possums survived in untreated gaps than it treated areas. Six operations that used navigation guidance systems (Decca Flying Flagman and GPS) yielded complete coverage and high levels of kill (mean of 92%) in five. Precision sowing of possum baits prevents survival of possums by failure to encounter baits, and enables lower rates of bait application. This will give large cost savings and improved environmental safety. A small proportion of a population may still not be targeted because of individual dislike of bait or failure to encounter baits because animals stayed in the forest canopy during operations. Development of more palatable and longer lived baits may facilitate local extermination of possums.

**Keywords:** field efficacy/aerial control/treatment/possums

**Abstract:** Four aerial sowing treatments of non-toxic possum bait were compared in a pine plantation of flat terrain. Baits were dyed with Rhodamine B and treatment were assessed by the proportion of dy-marked possums captured. Sowing was least accurate where flight paths were not marked, but the resulting bait-free patches did not prevent possums from finding and eating bait. Where larger gaps were deliberately created in bait dispersion acceptance of bait by possums was slower and overall, less than where coverage was assisted by flight line marking. Sowing bait at a rate of 3 kg/ha was as effective as 10 kg/ha. These results have two main implications for routine aerial control. First, because incomplete coverage of a target area will yield poorer kills, navigation aids should be used in systematic sowing and sowing equipment improved. Second a cost-saving can be achieved by reducing sowing rate to 3 kg/ha and possibly lower. Trials are required in other habitat types to test the general applicability of this result.


**Ref Type:** Report

**Keywords:** non-target species/invertebrates/ground control/1080/possums

**Abstract:** Objectives: To extend the initial field testing of the efficacy of IVA (isovaleric acid) as a bee repellent in 1080 apple paste; to extend the initial field testing of the efficacy of IVA-treated 1080 paste in killing possums. Conclusions: IVA reduces the likelihood of bees being poisoned or hives being contaminated. However, we have not established the level of hazard remaining. The likelihood of bees feeding on 1080 paste varies seasonally, and IVA itself may also vary seasonally in repellancy to bees. IVA can be included in possum paste without reducing the effectiveness of control operations.


**Keywords:** field efficacy/ground control/aerial control/1080/possums/birds/non-target species

**Abstract:** Maintenance of many of New Zealand's fragile ecosystems and a large proportion of its agricultural production are presently dependent on the use of sodium monofluoroacetate (1080) poison for controlling possums. The growing demand for possum control by land managers has highlighted the need of maximum efficiency in operational methods and minimum environmental impact. Several major improvements in control techniques have been made in the last five years. Specifications for bait production have reduced the possibility of possums being sublethally poisoned, costly waste, and the risk of birds and other non-target species eating small toxic fragments. Aerial distribution of baits has become more accurate through the use of navigation guidance systems. This has led to high kills being attained using reduced application rates of toxic bait and to a consequent further reduction in environmental risks. Hand-laid bait "feeders" have been developed as restricted sources of toxic bait for use in some areas where wide-spread aerial poisoning may be inadvisable. Bait formulations are also being improved by using water or inexpensive materials, repellents that deter non-target animals not possums, and polymer coatings that improved bait-life. Such improvements will help sustain the use of 1080 until superior alternative control techniques are developed.


**Ref Type:** Report

**Keywords:** non-target species/invertebrates/ground control/1080/possums/birds

**Abstract:** Objectives: To test new formulations of low-sugar pastes against bees and possums; to assess the safety of promising pastes to fruit- and nectar-eating birds and bats; to assess the shelf- and field-life of promising pastes.

**Conclusions:** Two pastes, BB3 and BB16, are suitable as possum baits and are more target-specific than BB13. They can also be used as prefeed paste, but this may reduce efficacy, perhaps because of the more obvious change in taste when 1080 is added compared with the sugar-rich BB13. It is unlikely that bees
will feed on the pastes and contamination of hives and honey from using these bait types is therefore also unlikely. The two new pastes were less attractive than BB13 to most captive and wild birds. The runny texture of BB3 and the development of fluid on the surface of BB16 present a hazard as leakage from both applicator guns and containers may occur. Furthermore, 1080 is rapidly lost from baits in the field by drainage of fluid.


Keywords: field efficacy/1080/possums/brodifacoum

Abstract: The probable cause of possums (Trichosurus vulpecula) becoming 'shy' towards 1080 [sodium fluoroacetate] bait, a growing problem in the control of this pest, was determined. Possums captured from North Canterbury, New Zealand, (n = 131) were offered sublethal baits (1 or 2.5 g) followed by lethal (6 g) baits 2 days later. Most possums became bait shy and the proportion becoming shy appeared to be related to the size of the initial sublethal dose. Most of a group of survivors retested after 3 months with toxic pellets were still shy. Shyness was not overcome by changing to a different mask (orange flavour, as opposed to cinnamon flavour) or toxin (brodifacoum), but changing to both a different bait base (carrot) and mask (orange) resulted in most shy possums eating a lethal quantity of bait. Possums therefore appeared to learn to recognise the bait base as the cue for avoiding poisoning. More shy possums than naive possums rejected non-dyed, non-masked, non-toxic pellets, confirming that shy possums recognised the bait base. Green dye appears to act as a secondary cue for avoiding pellets as a higher percentage of 'shy' possums than naive possums rejected dyed baits.


Keywords: field efficacy/aerial control/1080/possums

Abstract: Field trials showed that high application rates (20-35 kg/ha) of 1080 pellet and carrot baits for possum control were unnecessary, wasteful, and environmentally unsound. Reducing the standard operation rate to 5-10 kg/ha has saved conservatively, $8.9 million/year. In our most recent trials, kills averaging 95% were gained with 2 kg/ha indicating further potential savings of $3 million/year or more. A new helicopter bait-application bucket has been developed to overcome the common problem of buckets becoming blocked below rates of 3-4 kg/ha. The new bucket can apply baits uniformly at rates as low as 0.5 kg/ha, promising not only great efficiency but enhanced environmental safety.


Keywords: non-target species/field efficacy/ground control/1080/baits

Abstract: The risks to non-target species of a newly developed bait containing either 0.15% 1080 or 0.6% cholecalciferol in a gel matrix were assessed. Very few of them ate gel bait. The safety of the gel bait is further enhanced by its placement in the purpose-designed bait station from which little spillage occurs, and which can be placed so that it is out of reach of most non-target animals. Comparative data show that nontarget species are considerably less susceptible to cholecalciferol than to sodium monofluoroacetate (1080). Risks to non-target species could be further reduced by use of the cholecalciferol form of the bait.


Ref Type: Report

Keywords: field efficacy/bait degradation/non-target species/invertebrates/ground control/1080

Abstract: Objectives: To test three possum pastes (BB3, BB16 and CP (i.e. cyanide prefeed) against AHB specifications for attractiveness to bees; dehydration; toxicity; bait shape; field stability, including wind resistance, detoxication, and rain resistance; palatability; and efficacy. Following renegotiation with AHB, to assess two further variations on BB3 coded as SB(i) and SB3(ii), against selected specifications.

Results: The performance of paste baits against the nine specifications is summarised. CP and SB(ii) were the best performing pastes. BB3, although superceded by the SB3 pastes, is regarded as potentially useful, while BB16 and SB3(i) performed poorly.
Ref Type: Conference Proceeding
Keywords: 1080/poisoning/monofluoroacetate/sodium monofluoroacetate/mammals/USA/Krebs cycle/heart/brain/non-target species/livestock/blood/liver/brodifacoum/regulatory toxicity/rats/soil/invertebrates/ baits/dogs
Abstract: Monofluoroacetate, the active component of 1080, occurs naturally in toxic plants in Australia, South Africa, and South America. Manufactured 1080 (sodium monofluoroacetate) is used to control introduced mammals in New Zealand, Australia, Israel, Mexico and the USA. It is a broad-spectrum poison that acts by interfering with the energy-producing Krebs cycle in cell mitochondria, particularly in the heart, lungs and brain. Used correctly, it is a highly cost-effective vertebrate pesticide. Because 1080 is used more widely in New Zealand than elsewhere, its fate in water and its effect on non-target species, especially livestock and native fauna, have been comprehensively assessed. Sub-lethal doses of 1080 consumed by livestock do not cause persistent toxic residues in meat, blood, the liver, or fat. This is in marked contrast to the prolonged persistence of the anticoagulant toxicant brodifacoum. Nevertheless, if livestock become exposed to 1080 bait, a minimum withholding period of 5–10 days is advised to permit elimination. Regulatory toxicology studies, conducted to assess human health hazards, indicate that prolonged exposure of rats to sub-lethal doses of 1080 may lead to malformations in developing embryos, but no evidence of mutagenic effects was detected. Environmental studies show that operational use of 1080 causes minimal long-term water and soil contamination, and current evidence suggests that populations of common bird species and invertebrates are not adversely affected, but further monitoring of rarer species after aerial application of baits is continuing. In cold or dry conditions, 1080 may persist in baits or in possum carcasses for several weeks or months, posing a hazard to dogs, which are particularly susceptible to the poison. The greatest potential risks from 1080 are therefore to scavenging dogs, and to bait manufacturing workers with a high degree of exposure to 1080. Constant vigilance is required to minimise these risks.

Keywords: baits/Tb/possums/analysis/toxicity/efficacy/cholecalciferol/livestock/1080/brodifacoum/degradation/bait degradation
Abstract: Possum populations must be maintained at very low density if the aims of Tb eradication and conservation of particularly vulnerable native species are to be met. The present tactic of initial 'knockdown' followed by annual maintenance control allows for reinfestation in between annual operations. Development of toxic baiting methods for 'continuous' control of possum populations is therefore desirable. Six baittype/presentation-methods designed for prolonged field life were exposed to field conditions at a forest-edge site in Westland. Samples of baits were collected at 2-monthly intervals for up to 26 months, and assessed for palatability to possums and toxicant concentration. Regression analysis was used to predict the time at which reductions in palatability and toxicity would lead to inadequate bait efficacy. Field life varied between 2 and >26 months, the most durable option tested being a solid gel bait containing cholecalciferol. This bait type was selected for assessment in 'continuous' control of possums in forest-edge habitat in Westland. Baits were placed up trees beyond the reach of livestock and left in place for 10 months. Trap-catch monitoring showed baits were effective in reducing the number of possums, but this was achieved only after improving the visibility, attractiveness, and accessibility of bait stations. As the study predicted that cholecalciferol gel bait should remain effective for longer than 2 years in the field, there appears to be considerable potential for improving the efficiency (and probably environmental safety) of long-term control using this new tool.


Keywords: fluoroacetate/citric acid/persistence in plants
Abstract: In laboratory experiments, O₂ uptake by P. mungo seeds germinated at 30 deg C, (a) rose sharply for 4-5 h, then (b) remained constant for 1-2 h and (c) again increased. Iodoacetate and fluoroacetate inhibited the increase in (c), but did not affect (a) or (b). Aspartic-acid content decreased from 16.2 to 7.7 moles/100 seeds in 9 h. Citric acid and malic acid were the main organic-acid constituents. Citric-acid content decreased while that of malic acid was unchanged, although it was leached freely into the medium, especially in the first 6 h.

Keywords: welfare/poisoning/possums/degradation
Abstract: Pest control operations and experimentation on sentient animals such as the brushtail possum can cause unnecessary and avoidable suffering in the animal subjects. Minimizing animal suffering is an animal welfare goal and can be used as a guide in the design and execution of animal experimentation and pest control operations. The public has little sympathy for the possum, which can cause widespread environmental damage, but does believe that control should be as painless as possible. Trapping and poisoning provide only short-term solutions to the possum problem and often involve methods that cause suffering. Intrusive experiments connected with these methods of control and published in the last 6 years are reviewed. Many of the experiments do not attain the welfare standards required by members of the public. Possums also act as vectors for bovine tuberculosis. While this is not as important in the minds of the public as environmental degradation, as long as people wish to continue raising cattle, this disease needs to be controlled. Immunocontraception is a humane means of controlling possums with wide public acceptance. The use of vaccines for cows and/or possums would also cause far less suffering than present eradication operations. Research into these methods does require some intrusive experimentation. This can be reduced if live animals are not used for secondary antibody harvesting, if adequate analgesia is provided, and if potential vaccines or contraceptives are tested under conditions that would be experienced in the field.

Keywords: aconitase/biochemistry

Keywords: metabolism/biochemistry/fluoroacetate/poisoning/fluorocitrate/aconitase/mode of action/enzyme/inhibition
Abstract: 1. The competitive inhibition of aconitase by natural fluorocitrate has been established. 2. On the other hand, synthetic fluorocitrate has been shown to inhibit aconitase in both a competitive and an apparent irreversible fashion. 3. The dissociation constants of the aconitase-fluorocitrate complexes for both the natural and synthetic fluorocitrates have been measured. The affinity of aconitase for the synthetic compound is much greater than for the natural compound. 4. The possible reasons have been discussed for the difference between the two preparations of fluorocitrate in inhibiting the isolated aconitase and also for the difference between the action of these compounds on the isolated aconitase system as compared to their action in vivo and on the kidney-particle system.

Keywords: mode of action/acute toxicity/fluorocitrate/brain/rats/fluoroacetate/target organ/symptoms

Keywords: fluoroacetate/bacteria/biosynthesis
Abstract: Fluoroacetaldehyde is converted to fluoroacetate and 4-fluorothreonine in *Streptomyces cattleya* indicating that it is the biosynthetic precursor of both of these secondary metabolites.

Abstract: Development of aversions, or learned 'bait-shyness', in frequently poisoned possum (Trichosurus vulpecula) populations is becoming increasingly detrimental to the efficacy of pest-control operations in New Zealand. This experiment aimed to identify the effects of prefeeding, a common management procedure, on the subsequent development of aversions in possums. Wild possums (n = 96) were captured and acclimatised, then allocated to one of three treatments groups that for seven days received either (i) no prefeed, (ii) plain RS5 cereal baits, or (iii) green-dyed and cinnamon-lured RS5 cereal baits. The possums were then offered a standard green-dyed and cinnamon-lured RS5 bait that contained a sublethal dose (0.4 mg kg⁻¹) of the toxin sodium monofluoroacetate (1080). The possums were tested for development of an aversion towards a toxic RS5 1080 bait, a prefeed bait, and a prefeed bait containing an alternative toxin, brodifacoum. Most (96%) of the non-prefed possums became averse to the 1080 bait after two exposures, compared with only 55% and 9% of the two prefed groups. Similarly, 90% and 92% of the non-prefed possums were averse to prefeed and brodifacoum baits, respectively, compared with 8% and 14% of the prefed possums. This suggests that pest managers can reduce the risk of 'bait shyness' by prefeeding. A further advantage of prefeeding is that if poison shyness develops, use of an alternative toxin such as brodifacoum in the original bait base may still be successful.


Abstract: Diagnosis of poisoning with strychnine, fluoroacetate, rodenticides, insecticides, ethylene glycol, urea, monensin, salt, lead, arsenic, copper and poisonous plants is summarized. The samples required for chemical analysis are also tabulated.

Munday, B. L. (1978). Marsupial disease. In 'Proceedings No. 36 of a course for Veterinarians (the J.P. Stewart course for 1978). (Sydney University Post Graduate Committee in Veterinary Science: Keywords: lethal dose/1080

Murphy, C. D. Biological fluorination and defluorination in Streptomyces cattleya. 185. 1998. Queen’s University of Belfast (Northern Ireland) Editor.

Ref Type: Thesis/Dissertation

Keywords: defluorination/fluoroacetate/NMR/metabolism/acetate/fluorine/enzyme

Abstract: Little is understood about the mechanism by which fluorinated compounds are biologically formed, although the existence of such natural products was established over 50 years ago. This investigation concerns the biochemical pathways involved in fluoroacetate and -fluorothreonine production by the actinomycete Streptomyces cattleya and the enzymatic defluorination of 4-fluoroglutarate by the same organism. By employing GC/MS and $^{19}$F NMR methodologies it was possible to determine the incorporation of isotopic label into the fluorometabolites after various labelled precursors were incubated with resting cell suspensions. The incorporation of isotopic label from (3-$^{13}$C) -serine was consistent with the metabolism of glycine via serine and pyruvate to the fluorometabolites, as previously suggested and investigations with (2-$^{13}$C) -acetate indicated that pyruvate does not enter the TCA cycle before yielding the carbon substrate for fluorination. Observations from resting cell studies with (R)- and (S)-(1,1-$^{2}$H₂) -glycerol suggested that (a) the carbon substrate for fluorination is closely related to an intermediate of the glycolytic pathway linking glycerol and pyruvate and (b) the mechanism of fluorination probably involves the replacement of phosphate with fluoride. It was tentatively concluded from isotopic dilution experiments and studies with various stable isotope labelled glucose of glyceraldehyde phosphate or glyceraldehyde-3-phosphate (or a close derivative) is the carbon substrate for fluorination. When fluorooacetaldehyde was incubated with resting cell suspensions, it was largely oxidized to fluoroacetate and, more importantly, significant amounts of 4-fluorothreonine were formed, consistent with the hypothesis that fluorooacetaldehyde is the immediate fluorinated precursor of both fluorometabolites. Cell-free extracts of S. cattleya were found to defluorinate 4-fluoroglutarate, a compound that may be formed inside the cell via TCA cycle metabolism of fluorooacetyl CoA and which may act as an analogue of L-glutamate. The defluorinating system does not appear to require a cofactor and partial purification of the cell free extract by anion-exchange chromatography demonstrated that the defluorinating activity could be separated from deaminating activity. Passage of the enzyme through a gel filtration column indicated a molecular weight of $\sim$80,000.

Keywords: fluoroacetate/biosynthesis/metabolism/bacteria/enzyme/occurrence in nature

Abstract: *Streptomyces cattleya* is unusual in that it produces fluoroacetate and 4-fluorothreonine as secondary metabolites. We now report that the isolation of an NAD+-dependent fluoroacetaldehyde dehydrogenase from *S.cattleya* that mediates the oxidation of fluoroacetaldehyde to fluoroacetate. This is the first enzyme to be identified that is directly involved in fluorometabolite biosynthesis. Production of the enzyme begins in late exponential growth and continues into the stationary phase. Measurement of kinetic parameters shows that the enzyme has a high affinity for fluoroacetaldehyde and glycoaldehyde, but not acetaldehyde.


Keywords: biosynthesis/fluoroacetate/bacteria/enzyme

Abstract: Organofluorine compounds are rare in Nature, with only a handful known to be produced by some species of plant and two microorganisms. Consequently, the mechanism of enzymatic carbon-fluorine bond formation is poorly understood. The bacterium *Streptomyces cattleya* biosynthesises fluoroacetate and 4-fluorothreonine as secondary metabolites and is a convenient system to study the biosynthesis and enzymology of fluorometabolite production. Using stable-isotope labelled precursors it has been shown that there is a common intermediate in the biosynthesis of the fluorometabolites, which has recently been identified as fluoroacetaldehyde. Studies with cell-free extracts of *S. cattleya* have identified two enzymes, an aldehyde dehydrogenase and a threonine transaldolase, that are involved in the biotransformation of fluoroacetaldehyde to fluoroacetate and 4-fluorothreonine.


Keywords: ferrets/1080/brodifacoum/pindone/secondary poisoning/poisoning/stomach/rats/birds/invertebrates/possums/field efficacy

Abstract: This study aimed to quantify the changes in numbers and diet of stoats, weasels and ferrets following rat and possum poison operations in two podocarp-hardwood forests between 1989 and 1995. Poison operations were classified according to their success in reducing rat numbers, and if they used an acute toxin (1080) or an anticoagulant (brodifacoum or pindone). Stoat catch rates followed the same seasonal patterns as rat footprint tracking rates, and stoat catch rates were positively correlated with rat catch rates. Rat numbers in spring had no significant relationship with the number of juvenile stoats caught in summer. Stoat catch rates did not vary significantly with poison-operation type over a six month period, but all three successful anticoagulant operations resulted in lower stoat catch rates than did unsuccessful operations. Brodifacoum in bait stations may have lowered stoat numbers by secondary poisoning for the first 2-3 months, but there after there was no apparent effect. The sex ratio of stoats caught varied significantly amongst the poison operations. The fewest females were caught following anticoagulant operations. Stoot stomachs and intestines contained mostly rats, and some birds and mice. Weasels ate mostly mice, while ferrets predominantly ate lagomorphs and invertebrates. Male and female stoats ate similar proportions of rats, but females ate more mice. Both sexes, but particularly females, ate fewer birds in autumn and winter than in spring and summer. Stoats shifted between eating rats and birds, depending on the abundance of rats. Thuis successful rat-poisoning operations resulted in higher bird consumption than unsuccessful ones. Combining the numerical and functional responses of stoats into a ‘bird predation index’ showed that stoats are likely to have the greatest effect on birds after successful 1080 operations. Diet shifts could not be demonstrated in weasels or ferrets because sample sizes were too small for quantitative assessments. The risk of increased predation pressure on birds from diet-shifting by stoats must be balanced against the predation pressure on birds and other ecological impacts of rats and possums from different poison operations.

Abstract: Stoats were monitored by three methods through an aerial 1080 poisoning operation at Waimanoa, Pureora Forest in August 1997. Tracking rates and number of live captures were used as indices of abundance, and radio-transmitters were used to follow individual animals. All 13 stoats with radio-transmitters within the poisoned area died between 2-18 days after the operation. No mustelids were tracked or live-trapped after the operation for three months. Of the radio-tracked stoats that died, rat remains occurred in 67%, passerine birds in 17%, cave weta in 17% and possum in 8%. Residues of 1080 were found in 12 of the 13 dead stoats. Our findings have important implications for the management of threatened species. Stoats are known to be a major factor in the continuing decline of some native birds. Previously, the potential of secondary poisoning to control stoats (and other predators) in New Zealand had focused on the use of anticoagulants, as these compounds persist and can accumulate in predators over a longer period. However, our results suggest that secondary poisoning with an acute toxin can also be highly efficient. This may also have greater public acceptability.


Abstract: Chemical and physical measurements were made on soil samples and leaf material from *Acacia georginae* in order to investigate a number of factors which were considered to be possibly influencing the uptake of fluoride by the plant in the field. No correlation was found between leaf fluoride levels and any of the factors measured. The available evidence suggests that the 100-fold variation in leaf fluoride levels found is not due to variation in soil composition; this conclusion was supported by pot trials using soil from trees with high and low leaf fluoride levels. High leaf fluoride levels (> 10 ppm or air dry material) were found in the filed only where the trees grow over carbonate bedrock (limestone or dolomite); however only a small percentage of the trees in such areas have elevated leaf fluoride levels.


Abstract: Several toxic agents were compared in order to test the effect of various types of illness in producing learned taste aversions. After a 10-min sucrose drinking trial, groups of rats were injected intraperitoneally with lithium chloride or with a strong, near lethal dose of a rodenticide. Strong sucrose aversions were acquired by groups injected with lithium chloride, copper sulfate, sodium fluoroacetate, or red squill, and very weak or no aversions were learned by groups injected with thallium, warfarin cyanide, or strychnine. The results were discussed in terms of onset of symptoms, duration of symptoms, and kinds of physiological effects necessary to produce aversions. It was concluded that the effects of different drugs may be mediated by different physiological systems learned taste aversions


Abstract: mode of action/sodium fluoroacetate/fluoroacetate/metabolism/brain/Krebs cycle

We consider the results to be consistent with a selective inhibition both by sodium fluoroacetate and by exogenous aspartic acid of the tricarboxylic acid cycle in the brain associated with the biosynthesis of glutamine. We suggest that the activity of this pathway may regulate the metabolism of N-acetylaspartate and aspartate.


Abstract: .....We consider the results to be consistent with a selective inhibition both by sodium fluoroacetate and by exogenous aspartic acid of the tricarboxylic acid cycle in the brain associated with the biosynthesis of glutamine. We suggest that the activity of this pathway may regulate the metabolism of N-acetylaspartate and aspartate.


Ref Type: Magazine Article

Keywords: 1080/pest/New Zealand
Abstract: Until a better way of killing noxious pest animals comes along, New Zealand had no alternative but to continue with the widespread use of 1080, according to the New Zealand Veterinary Association.


Keywords: poisoning/dogs/1080/symptoms/convulsions/welfare/treatment/diagnosis

Abstract: From these observations and the cases brought to our clinic, we consider the following symptoms to be characteristic of 1080 poisoning: extreme pain manifested by running and barking, convulsions of the tetanic type with ophisthotonos. Death follows first symptoms in thirteen to thirty minutes. We have had two cases to recover from 1080 poisoning, which in our opinion received only a very small amount of the poison. The health department has discontinued the use of 1080 in our county.


Keywords: biosynthesis/fluoroacetate

Abstract: When both (2R)-[1-2H2]- and (2S)-[1-2H2]-glycerol are incubated with resting cell suspensions of S. cattleya, only the 2R-enantiomer labels the fluoromethyl groups of fluoroacetate and 4-fluorothreonine, with retention of both deuterium atoms, placing metabolic and mechanistic limitations on the process of biological fluorination.


Keywords: citrate/metabolism/excretion/kidney/dogs/persistence in animals


Keywords: sodium fluoroacetate/fluoroacetate/heart/mode of action/cardiac/Krebs cycle/metabolism/poisoning

Abstract: It is not known whether the response of the cardiac tissue is mediated through an interruption of the vagus control or through its own dependence on Krebs cycle metabolism. Myocardial cells in vitro were utilised to examine this question. It is interesting to note that cardiac fibrillation observed in cases of sodium fluoroacetate poisoning in man and animals is also recorded in isolated myocardial cells treated in tissue culture. The absence of nerve tissue in this in vitro preparation indicates that fibrillation results from a direct effect on the myocardial cells.


Keywords: fluorine/fluoroacetamide/mammals/testes/monofluoroacetic acid/citrate/heart/kidney/rats/liver/metabolism/acute toxicity/enzyme

Abstract: N-ethyl-N-(1-naphthyl)monofluoroacetamide (MNFA), a derivative of monofluoroacetic acid, is an effective pesticide with low toxicity for most mammals. The biochemical effect of this compound was investigated. After a single dose the citrate levels rose in the heart of the rat and monkey and in the kidney of the guinea-pig. A chronic toxicity experiment showed that there was an increase in the citrate level only in the testis of rats receiving 10 mg/kg/day of MNFA for 180 days and a decrease in the level in the liver and kidney as compared with animals receiving a single dose. The lack of toxicity associated with chronic administration may be due to accelerated detoxication (sic) in the liver and kidney as a consequence of metabolism in the animal body. The hydrolysis on MNFA by liver homogenates was closely related to the acute toxicity. The enzyme activity in the guinea-pig was about 35 times that of the rat or mouse. The product of the hydrolysis of MNFA by liver homogenates of guinea-pigs, rats and mice was N-methyl-1-naphthylamine. The LD50 of MNFA, a N-CH3 compound of NFA, was 3.1 times that of NFA, and the amount hydrolysed after 30 minutes incubation was about one-fifth.

Norbury, G. L. The use of 1080 to control feral goats in Western Australia. Agriculture Protection Board of Western Australia. 1992.
Ref Type: Report
Keywords: 1080/goats
Abstract: The minimum conc. of 1080 to kill 100% of goats was estimated from yard trials to be 7 mg of 1080 per litre of water. This equates to a dose of 1.4 mg/kg. There appeared to be minimal suffering from poisoning.

If precautions are not taken to prevent non-target species from drinking, Zebra Finches, Budgerigars and some Galahs will be at risk of poisoning. Other bird species are resistant to 1080 at the poisoning rates required to kill goats. When inverted sheet metal guttering was applied to the edges of poisoned troughs, birds could not perch safely when attempting to drink. Provided an alternative watering trough was available, birds rarely drank from the poisoned troughs. Some kangaroos will also be at risk from poisoning unless poison is removed at the recommended time of 1200 hr.

It is technically feasible to selectively poison feral goats with 1080 provided the appropriate safeguards are adopted to protect non-target species. Six guidelines are recommended for goat poisoning campaigns.

Ref Type: Report
Keywords: 1080/ground control/regulatory toxicology/livestock protection collar/legislation/USA

Keywords: treatment/1080/sodium fluoroacetate/antidote

Keywords: non-target species/invertebrates/1080/birds/mammals/secondary poisoning
Abstract: Compound 1080 is widely used in New Zealand for the control of wild animals. The tendency of 1080 to poison non-target birds and mammals is recognised, but its effects on invertebrates have gone mostly unnoticed. At least 9 invertebrate orders are prone to 1080 poisoning. Invertebrates have been observed eating baits, and their habitats are contaminated by residues leaching from baits, and from animal by-products and carcasses. Poisoned insects leaching from baits, and from animal by-products and carcasses. Poisoned insects provide a means of secondary poisoning for insectivores. Therefore 1080 should not be used where susceptible invertebrate species or rare insectivores are found.

Keywords: fluoroacetate/rats/sodium fluoroacetate/temperature/citric acid/mode of action
Abstract: It was found in mice and rats that an intraperitoneal injection of sodium fluoroacetate in sublethal doses of 2.5 to 7.5 mg/kg produces a sharp decrease in the resting vales of carbon dioxide output and oxygen consumption within 60 to 90 minutes after application. In mice, the values of respiratory exchange decrease within 2 to 5 hours following the injection of sodium fluoroacetate to a mere 15 to 20 per cent of the initial values. The decrease of respiratory exchange coincides with the decrease of rectal temperature and falls into the period when citric acid accumulates in the body tissues and when the sensitivity of the organism to irradiation occurs. The results are interpreted in favour of the hypothesis on the importance of the level of metabolic processes in the organism for its sensitivity to irradiation.

Keywords: fluoroacetate/metabolism/mode of action
Abstract: A quantitative study of the radioprotective effect of sodium fluoroacetate (FAc) in white mice of H-strain, 9-12 weeks old was made. The results of the experiment showed that FAc administered intraperitoneally 3 hours before irradiation in the amount of 7.5 mg/kg increases the average LD 50(30) values from 648 R (controls) to 998 R (protected). A comparison of the obtained results with data on the radioprotective effect of cysteine, cysteamine, AET, serotonin and hypoxia indicates that the radioprotective effect of FAc is not statistically different from the effect of these compounds. The protective effect of FAc, however, requires much smaller doses (50-75 u moles/kg). At the same time, the
duration of protection after FAc administration is much longer, lasting roughly from 30 minutes to 7 hours after the application of the substance, with maximum protection between the first and second hour.


**Keywords:** temperature/fluoroacetate/acconitase/fluorocitrate/enzyme/Krebs cycle

**Abstract:** Fluorocitrate formed by lethal synthesis from injected fluoroacetate blocks the enzyme aconitase and hence the course of Krebs cycle reactions. This is manifested in a temporary decrease in respiratory exchange and body temperature. In male strain H mice given doses of 2.5 and 5 mg/kg, respiratory exchange recovered and returned to the initial level 24-72 hours after the injection. On administering a second FAc injection at different intervals after the first, a further and greater decrease in respiratory exchange and body temperature was found. Actinomycin D and cycloheximide prolonged the recovery period. This means that the observed recovery of respiratory exchange and body temperature are an expression of renewed aconitase activity and that the block of the enzyme is followed not by an adequate compensatory by-pass reaction, but by the induction of new aconitase molecules.


**Keywords:** fluorocitrate/aconitase/biochemistry/heart/kidney/liver/enzyme/sodium fluoroacetate/fluorocitrate

**Abstract:** In experiments with heart, kidney and liver homogenates from male strain H mice (aged nine weeks), it was found that the addition of synthetic sodium fluorocitrate to organ homogenates in vitro raised the in vitro resistance of aconitase to inactivation during storage of crude extract of the enzyme at low temperatures, in the same way as fluorocitrate formed in the organs in vivo by Peter's lethal synthesis from injected sodium fluorooacetate (FAc). Raised resistance of aconitase to heat denaturation at 50, 55, 60 and 65 degrees celcius was likewise demonstrated in homogeates or organs removed at 2 hours after the i.p. injection of a radioprotective dose of FAc (50 u mol/kg). The results support the authors hypothesis that the presence of the FCTR molecule, bound to the aconitase molecule "protects" the enzyme against natural inactivation during storage at low temperatures and raises its resistance to heat denaturation.


**Keywords:** deer/non-target species/1080/aerial control


**Ref Type:** Report

**Keywords:** deer/aerial control


**Keywords:** deer/poisoning/possums/New Zealand/brushtail possum/baits/sodium monofluoroacetate/monofluoroacetate/1080/Tb

**Abstract:** Incidental kills of deer during aerial-1080 poisoning of brushtail possums (*Trichosurus vulpecula*) using baits containing sodium monofluoroacetate (1080) causes widespread hunter opposition to this control method. We document the deaths of a large number of fallow deer (*Dama dama*) after aerial-1080 poisoning in the Blue Mountains, Otago. Three deer fitted with radio collars all died during the poisoning. Eight randomly located "search cells" (25-57 ha) were each searched twice. One pig (*Sus scrofa*), 53 deer, 58 possum, and 20 bird (three native) carcasses were found. Deer-carcass density varied widely between cells (2.2-38.6/km²), reflecting differences in deer density but apparently also the amount of ground cover. The total number of deer killed was estimated using Lincoln indices. More fawns were killed than larger adult deer. Comparison with historical harvest data suggested that between two-thirds and three-quarters of the deer present had been killed. This unintended by-kill will have reduced deer impacts on native plants and the risk of Tb spread or persistence in deer. However, such incidental benefits may not offset the
increased indirect "social" costs likely to arise from increased hunter opposition to use of aerial-1080 poisoning.

Keywords: poisoning/livestock/cardiac/fluoroacetate/occurrence in nature
Abstract: This review covers 60 spp. of plants which are potential sources of poisoning to livestock in Nigeria. The plants are listed, with a little information on each, under the toxic constituents, as follows: cyanogenetic glycosides, cardiac glycosides, alkaloids, fluoroacetate, oxalates, saponins, miscellaneous and unknown toxic constituents. Also included are some spp. which cause mechanical injury, through sharp awns, burrs, spines or thorns, or cause ulcers or hair balls in the digestive tract

Keywords: acute toxicity/toxicity/rabbits/goats/convulsions/liver/kidney/spleen/heart/monofluoroacetate/occurrence in nature
Abstract: Acute toxicity of the leaves and extracts of *Dichapetalum barteri* for mice, rabbits and goats was investigated. Consumption of 0.5 g/kg and 2.2 g/kg body weight of dried leaves was lethal to rabbits and goats, respectively, within 4 h. Plants collected in the dry season were more toxic than those collected during the wet season. Clinical signs observed were initial depression followed by restlessness, convulsions, and death. The main lesions observed were acute vasculitis and congestion of the liver, lung, kidney, spleen as well as extensive oedema and congestion of the myocardium. The water extract of the leaves was lethal to mice at 2.0 g/kg, to rabbits at 0.1 g/kg and toxic to isolated rabbit heart at 2 mg/ml of Locke's solution. Monofluoroacetate was detected in the plant material and is probably the toxic principle of *D. barteri*

Ref Type: Report
Keywords: poisons/poison/brodifacoum/cyanide/possums/1080/welfare/poisoning/cholecalciferol
Abstract: (outcomes) In summary, cyanide caused mild abnormal breathing in 52% of the poisoned possums and convulsion occurred in all animals after they had become unconscious. For 1080 there is potential welfare compromise for 9.5 hours following poisoning. A small percentage of possums poisoned with 1080 had mild to moderate retching, most became uncoordinated and then all had mild to moderate tremors or spasms. The main welfare concern with phosphorus is the congestion is the congestion of the gastric mucosa, which was linked to the adoption of a crouching posture. This was probably associated with some mild pain and lasted for 10 h until possums became prostrate. Cholecalciferol caused mineralisation in the organs of 67% of possums and lung damage in 59% of the animals. Seventy-one percent of possums had abnormal breathing for 1.5 days before death. They did not eat for 7 days, on average, and 21% lost more than 30% of their bodyweight. Finally, brodifacoum caused widespread haemorrhages of varying severity in all animals. The welfare consequences depended on the site and severity of the haemorrhages, which makes it difficult to generalise the welfare impact of this poison. Nevertheless, all animals had at least one severe haemorrhage in an area that would cause or contribute to pain, distress or weakness. In addition, in order to describe a refined humane end-point for efficacy testing, we determined that the behaviour shown by most possums across all poisons was a prolonged period of prostration or lying, on the side, back or belly. We have defined prolonged in this case as a continuous 2 hours or more. If this refined end-point (prolonged period of prostration), had been used there would have been a significant reduction, of several hours, in the period of suffering for many animals tested.

Keywords: 1080/mode of action/humans/sodium monofluoroacetate/monofluoroacetate
Abstract: Details are given of the characteristics, mode of action, persistence in the environment, suitability, usage in New South Wales and risk to humans of sodium monofluoroacetate [sodium fluoroacetate] (known as 1080), which is used widely to control vertebrate pests in Australia
Keywords: pigs/1080/symptoms/non-target species/efficacy  
Abstract: We examined vomiting by feral pigs after 1080 intoxication and tested the effectiveness of metoclopramide in suppressing emesis. Most pigs vomited repeatedly after 1080 intoxication. At the doses tested (1.4 and 16 mg/kg) metoclopramide did not reduce the frequency of vomiting, but decreased the proportion of a pig's 1080 dose that was ejected by decreasing the amount of vomitus produced. Because of wide individual variability in response, and the small sample size, there was no significant effect of metoclopramide on mortality. Overall mortality was lower than expected. Vomitus varied widely in mass, 1080 concentration and 1080 content. Typical levels of 1080 in vomitus would be hazardous to a number of nontarget species and peak levels hazardous to most. Other feral pigs are unlikely to be poisoned by consuming vomitus.

Ref Type: Conference Proceeding  
Keywords: residues/pigs/warfarin/1080/distribution/liver  
Abstract: We measured the distribution and persistence of warfarin and 1080 in the tissues of captive feral pigs offered toxins in wheat in a choice experiment. Compound 1080 was found in low levels in all tissues tested except fat. Warfarin was concentrated in the liver of poisoned animals. Liver levels of warfarin were well correlated with levels in other tissues. Liver may be a useful tissue for asaay for diagnostic purposes.  
Both toxins declined to very low levels over time, with no evidence of persistence. Samples obtained from pigs in the field had extremely high warfarin levels, indicating cumulation with repeated dosing.

Keywords: high-performance liquid chromatography/acute toxicity/mammals/1080/sodium monofluoroacetate/pigs  
Abstract: The toxicity of sodium monofluoroacetate (1080) to captive feral pigs was compared in wheat and pellet bait. Mortality following 4-34 mg 1080 kg^-1 was significantly higher among pigs receiving 1080 in wheat bait (60%, 24/40) than in pellet bait (28% 11/40, x^2 = 7.31, 1 d.f., P< .005). There were no significant differences between pigs receiving each bait type in terms of time until vomiting began, frequency, mass of vomitus produced. or in time until death. The amount and concentration of 1080 in vomitus and the proportion of 1080 dose ejected were unrelated to bait type. Surviving pigs produced vomitus with a greater 1080 concentration but smaller mass than those that died. Bait type is an important determinant of the toxicity of 1080 to captive feral pigs and should be closely evaluated before specific bait types are used in the field.

Keywords: acute toxicity/monofluoroacetate/1080/pigs/symptoms  
Abstract: The toxicity of sodium fluoroacetate (1080) to captive feral pigs was assessed over a range of doses (1.50 - 21.3 mg/kg) administered orally in wheat bait to 80 animals. Calculated LD50 dose was 4.11 mg/kg (95% fiducial limits 3.02 - 5.34 mg/kg) and LD90 was 11.25 mg/kg (8.05 - 21.69 mg/kg). The incidence (985) and frequency of vomiting were high. Frequency of vomiting was unrelated to log10 dose, although time until vomiting began and time until death had a significant negative association with log10 dose. Medina latency was 49 minutes and median time until death was 244 minutes. Sex and bodyweight had no effect on frequency of vomiting, time until death or prognosis. Feral pigs were much less sensitive to 1080 under these test conditions than those in earlier studies.

Keywords: sodium monofluoroacetate/monofluoroacetate/1080/pigs/stomach/baits  
Abstract: Post-mortem investigations of 207 feral pigs poisoned in the field were conducted to assess the influence on 1080 dose of bait type, site, sex, bodyweight and distance from bait stations. The stomachs of most (126/207) pigs contained only bait material. Bait type significantly affected intake and 1080 dose,
with pellet intake greater than cereal baits. Sex and bodyweight also influenced intake: females ingested significantly larger 1080 doses than males; and larger pigs tended to consume more bait in absolute terms but lower doses of 1080 (mg kg⁻¹). Average intake of 1080 varied widely at different locations. Pigs that died close to bait stations had higher 1080 doses but smaller proportions of bait in their stomach contents than those that died away from bait stations.


Abstract: There are no data on the potential for 1080 used for pest control to cause delayed deaths or impaired productivity in livestock following multiple, sub-lethal doses. Recent losses of late-gestation ewes exposed to weathered 1080 baits has also led to speculation that pregnant ewes may be unusually sensitive to the toxin. To address these data gaps, groups of 20 Perendale ewes, non-pregnant or pregnant with twins, were administered either a single (0.25 mg/kg) or multiple oral doses (0.05 mg/kg over 3 consecutive days) of a 1080 cereal pellet. The highest mortality occurred in the single does groups (pregnant 45%, non-pregnant 21%) compared to the multiple doses groups (pregnant 35%, non-pregnant 0%). There was no mortality in the control group of pregnant ewes. Log-linear modelling showed highly significant treatment effects (P<0.0003) and differences (P=0.045) in acute mortality rates between pregnant (40%) and non-pregnant ewes (10%), which was linked to increase bioavailability. There were no differences in the incidence of metabolic diseases, lambing percentages, lamb survival, or growth rates between dosed and undosed pregnant ewes. This study demonstrated that extra care should be taken to avoid exposure to pregnant ewes to even small bait fragments, but also provides further evidence that there are no long term health effects in animals that survive accidental 1080 poisoning.


Abstract: Objectives: To develop alternative poisons to 1080 for the effective and humane control of possums, by determining the palatability and efficacy of a zinc phosphide cereal bait to possums; determining the palatability and efficacy of a cholecalciferol gel bait to possums; determining the efficacy and cost-effectiveness of these new zinc phosphide and cholecalciferol baits for possums control, in field trials. Conclusions: Zinc phosphide cereal bait Zinc phosphide is an effective toxicant in cereal baits for possums. It is uniformly lethal to animals ingesting only 3 g of bait containing 2% active ingredient. Many possums apparently detect the odour and/or taste of zinc phosphide, and reject the bait in spite of efforts to mask the toxicant. About 40% of captive animals offered the best cereal bait formulation in two-choice trials did not ingest a lethal dose. Zinc phosphide-coated grain bits developed for rodent control are not appropriate for possums. Cholecalciferol gel bait The cholecalciferol gel bait is palatable and effective in pen trials with captive possums. There is no difference in efficacy of formulations containing from 0.66% and 1.0% cholecalciferol. The LD₅₀ for possums for cholecalciferol in the gel matrix is < 12mg/kg, which is similar to LD₅₀ values obtained with current formulations of Campaign cholecalciferol cereal bait. Cholecalciferol gel was at least as effective as prefed 1080 pellets in replicated field trials. The most likely cause was the poor kills in these trials was the abundance of natural foods in the summer and possums' consequent disinterest in artificial baits.


Abstract: The current experiment aimed to determine the proportion of wild-caught from previously poisoned and non-poisoned populations that developed aversions to 1080 baits. In addition, we aimed to identify the bait characteristics mediating the ongoing aversions. In an initial test, animals from areas previously exposed to a 1080 control-operation avoided 1080 baits (60-80%), whereas few naïve animals (0-20%) avoided these baits. The baits comprised a green-dyed, cinnamon-lured cereal loaded with 0.08% 1080. As a result of the exposure to the toxic baits, over 80% of the naïve animals subsequently developed aversions to those baits. Sixty-nine of these averse animals were allocated to on of 16 bait-treatment groups...
in a factorial design balanced for population, age, sex and bodyweight. Each bait was characterised by one of four factors a) presence or absence of 1080 b) presence or absence of green dye c) lure type (cinnamon or orange) and d) bait type (No.7 or carrot). The presence or absence of 1080 or green dye did not influence the degree of bait avoidance. Lure type had a significant effect on consumption, with 53% of possums avoiding an orange bait compared with 73% for cinnamon baits. Bait type also has a significant effect on avoidance rates, with carrot baits being avoided by 42% of possums compared with 83% for No. 7 baits. Changing the bait type would appear to hold the greatest promise for overcoming aversion by possums to cereal baits.


Ref Type: Report
Keywords: 1080/blood/urine/carrot/humans/analysis/occupational exposure
Abstract: In those areas where either the Workplace Exposure Standard has been exceeded, or a Level 3 exposure has been found, standard procedures need to be reviewed and more rigorously enforced. We recommend further immediate monitoring, at the factories and aerial carrot operation sites, to ensure that improvements in procedures do reduce the 1080 exposure risk.

The exposure level of workers involved in laying 1080 paste bait needs to be determined (i.e. determine if detectable levels of 1080 are present in urine samples).

A goal should be no measurable biological exposure (Level 1), which can be achieved by encouraging the use of work practices (e.g. foot pedal taps, face masks, clean gloves) that can be shown to minimise risk of worker exposure to 1080.

A representative sample of staff working with 1080 should be monitored at least annually to ensure continual minimal risk of exposure.

The risk to worker health needs to be assessed by comparing measured daily exposures with acceptable maximum doses for chronic exposure derived from ongoing animal dietary exposure studies.

The health of highly exposed 1080 workers should be monitored through occupational physicians or an epidemiological investigation.

A human health risk assessment should be undertaken that includes hazard identification, dose-response relationship and risk characterisation (acute and chronic).

These unique data should be published in a peer-reviewed clinical toxicology journal to demonstrate the recognition of these risks by our pest control industry.


Ref Type: Conference Proceeding
Keywords: poisons/wildlife/possums/poisoning/cyanide/1080/cholecalciferol/brodifacoum/behaviour/poison/welfare/time to death
Abstract: Wildlife managers have the responsibility to use the most humane methods available for pest control. However, data have not been available to identify practices that meet these expectations. We have assessed the behavioural, biochemical and pathological changes in caged possums following poisoning with cyanide, 1080, phosphorus, cholecalciferol or brodifacoum. The mean time until death, mean duration of illness, and the type and prevalence of changes in behaviour differed between poisons. On average death occurred 18 minutes after cyanide, 11.5 hours after 1080, 18 hours after phosphorus, 9 days after cholecalciferol and 20 days after brodifacoum poisoning. Main behavioural changes included:

incoordination and unconsciousness within 7 minutes after cyanide poisoning; retching during an 8-hour illness period after 1080; restlessness and a crouching posture for 16 hours after phosphorus; inappetance and listlessness for 47 days after death after cholecalciferol; and listlessness and abnormal postures for 6 days before death after brodifacoum poisoning. Cyanide is therefore the most preferred poison from a welfare perspective. Phosphorus and brodifacoum appear less humane than 1080, cholecalciferol, or cyanide.

Abstract: • 'False' positives through contamination need to be conclusively eliminated, by increased diligence during sampling (e.g., monitored washing before all sampling) in the future.
• The source of worker exposure needs to be identified and then isolated through (i) engineering controls (e.g., splash guards) and (ii) more rigorous use of Personal Protective Equipment (e.g., glove liners, or to continually wear a clean face mask).
• The three exposure levels used to describe the results in this study must not be considered as classified hazard levels. A Biological Exposure Index for future routine monitoring will be developed by the Occupational Safety and Health Service.
• Work practices that can be shown, by biological monitoring, to adequately protect workers need to be determined.
• Further immediate biological monitoring at more aerial carrot operation sites is required to ensure that changes in procedures and practices do reduce the 1080 exposure risk to acceptable levels.
• Once these levels are achieved, annual or biannual biomonitoring of a representative sample of all 1080 workers to ensure continual good practice and minimal risks of exposure should be enforced.


Keywords: occurrence in nature/fluoride/fluoroacetate
Abstract: Monofluoroacetate occurs in young leaves and seed of *Dichapetalum braunii* Engl. & K. Krause from southeast Tanzania at concentrations of 7200 and 8000 ppm, respectively, on a dry weight basis. This is the highest level so far reported from a plant source. The fluoride and monofluoroacetate (MFA) concentrations in this species are compared with those of six other *Dichapetalum* spp. collected from the same locality in Tanzania. The seeds of *D. braunii*, unlike *D. toxicarium*, so not contain any w-fluorinated fatty acids.


Keywords: metabolism/occurrence in nature
Abstract: It is now more than 50 years since the first fluorinated natural product was identified. In that time only about a dozen fluorinated natural products have been isolated, the last one over a decade ago. Very little is known about the mechanism of biological fluorination although significant progress has been made in elucidating the pathway by which biosynthesis of fluoroacetate and 4-fluorothreonine occurs in the bacterium Streptomyces cattleya. In this article we review the fluorinated natural products and the current status of our understanding of fluorometabolite biosynthesis.


Keywords: analysis/biosynthesis/fluoroacetate/bacteria/enzyme/fluoride
Abstract: A sensitive method for the configurational analysis of (R)- and (S)-[H-2(1)]-fluoroacetic acid has been developed using H-2{H-1}-NMR in a chiral liquid crystalline solvent. This has enabled biosynthetic experiments to be conducted which reveal stereochemical details on biological fluorination occurring during the biosynthesis of fluoroacetate and 4-fluorothreonine in the bacterium Streptomyces cattleya. In particular, feeding experiments to S. cattleya with isotopically labeled (1R, 2R)- and (1S, 2R)-[1-H-2(1)]-glycerol 3d and 3e and [2,3-H-2(4)]-Succinate 4a gave rise to samples of enantiomerically enriched [2-H-2(1)]-fluoroacetates 1a. The predominant enantiomer resulting from each experiment suggests that the stereochemical course of biological fluorination takes place with an overall retention of configuration between a glycolytic intermediate and fluoroacetate 1. Consequently, this outcome suggests that the stereochemical course of the recently
identified fluorinase enzyme which mediates a reaction between fluoride ion and S-adenosyl-L-methionine (SAM), occurs with an inversion of configuration.

Ref Type: Report
Keywords: 1080/soil/inhibition/urine/possums/lethal dose
Abstract: The lowest-observed-effect concentration (LOEC) of 1080 on lettuce seedlings was 7 mg/kg dry weight soil, at which the time to emergence significantly increased. A significant decrease in seedling shoot growth also occurred. A median effective concentration (EC_{50}) value of 10 mg 1080/kg dry weight soil was derived for lettuce shoot growth. Lettuce seedlings appeared to be relatively more sensitive to 1080 soil concentrations than oat seedlings, for which LOEC and EC_{50} values were 22 and 42 mg/kg dry soil weight, respectively.

No 1080-related inhibition of soil nitrate production was found. The addition of possum urine to soils enhanced basal nitrate production, probably by supplying soil microbes with an easily convertible source of nitrogen (N) as nitrate (NH). The urine from possums that had received a lethal dose of 1080 caused a 15% reduction in substrate-induced nitrate production compared with that in soils spiked with control urine. However, in terms of ecotoxicological hazard, this reduction was considered neither statistically nor biologically significant.

Ref Type: Report
Keywords: 1080/soil/residues/invertebrates/toxicity
Abstract: • No mortality or growth changes were observed in earthworms after a 28-day exposure to any of the soil concentrations of 1080 tested.
• The NOEC, LOEC and EC_{50} for *Eisenia fetida* exposed to 1080 in a chronic test were 50, 100 and 160 mg/kg, respectively, for juvenile production, and 50, 100 and 90 mg/kg, respectively, for cocoon production.
• Residues of 1080 in soil were reduced after 28 days to <0.01% of initial concentrations.
• Whole earthworm tissue 1080 residues at the conclusion of the chronic exposure were either close to, or below, the analytical method limit of detection (0.01 mg/kg).

Conclusions
• Data on earthworm reproduction suggests that 1080 triggers the threshold for a substance with ecotoxic (terrestrial invertebrate ecotoxicity) properties and may therefore be classified as a category 9.2D substance under the HSNO Act (1996) for this property.

Keywords: occurrence in nature

Keywords: occurrence in nature


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Abstract: Sodium monofluoroacetate (1080) is a toxin used throughout New Zealand for the control of possums *Trichosurus vulpecula*. Its rate of degradation was measured in stream water in aquaria in the presence and absence of the endemic aquatic plant *Myriophyllum triphyllum* together has a significant effect on 1080 degradation rate, with concentrations decreasing below detectable levels in 1 day at 23°C and 3 days at 7°C. *M. triphyllum* is therefore capable of playing a significant role in 1080 degradation, but 1080 introduced into the environment at colder times of the year is likely to take longer to degrade than if introduced in warmer temperatures.


Keywords: persistence in water/1080/sodium fluoroacetate/temperature/sodium monofluoroacetate/monofluoroacetate/degradation/fluoroacetate

Abstract: The influence of temperatures of 21 and 11°C on the biodegradation of sodium monofluoroacetate [sodium fluoroacetate] in water and in *Elodea canadensis* was studied in the laboratory, using stream water and plant material collected from the field in New Zealand. Conc of the rodenticide remained relatively constant in deionised water at both temperatures but decreased with time in stream water. Degradation was more rapid in the stream water at 21 than at 11°C. *Elodea canadensis* was considered to play a mediating role in the degradation of sodium fluoroacetate.


Ref Type: Conference Proceeding

Keywords: sodium monofluoroacetate/monofluoroacetate/1080/bait shyness/possums/carrot/poisoning/field efficacy

Abstract: Bait-shyness was investigated in wild possums by comparing the consumption of diced carrot with the consumption of non-toxic cereal bait before and after the population had been poisoned with the same cereal bait containing 0.04% sodium monofluoroacetate (1080). Before poisoning, 64% of the total bait consumed was cereal, whereas after the poisoning cereal bait consumption declined to 3-4%. To determine whether any individual component of the cereal bait cues possum avoindance, the consumption of plain cereal bait, cereal bait with green dye and cereal bait with cinnamon lure were also measured. Possums remained shy of the cereal bait even when the dye and lure were absent. Ways to overcome bait shyness are discussed in light of these new findings.


Keywords: persistence in plants/1080/rabbits/secondary poisoning

Abstract: In New Zealand, large-scale control of introduced possums (*Trichosurus vulpecula*) and rabbits (*Oryctolagus cuniculus*) is based on aerial application of baits containing the toxin sodium monofluoroacetate (1080). The high solubility of 1080 has caused concerns about the environment effects of 1080 leaching from baits to soil and waterways (Livingstone 1994). Sodium monofluoroacetate which has leached into soil may be absorbed by plants (Atzert 1971; Rammel and Fleming 1978). Cabbage (*Brassica oleracea capitata*) has been shown to systemically accumulate 1080 through its roots, and subsequently become toxic to aphids (Negerborn 1959). Herbivores may be at risk of secondary poisoning if they consume plants which have taken up 1080 that has leached from bait. Depending on the period of time 1080 persists within plant tissues, plants could remain toxic to herbivores after the risk of primary poisoning had gone, i.e., after baits had degraded and become non-toxic. We have investigated the potential risks of 1080 poisoning to herbivorous species by determining the uptake and persistence of 1080 in two plant species, the native New Zealand broadleaf (*Griselinia littoralis*), a dicotyledon, and perennial ryegrass (*Lolium perenne*), a monocotyledon.


Keywords: field efficacy/1080/bait shyness/monofluoroacetate/poisoning
Abstract: Bait shyness is a significant threat to the sustainable control of vertebrate pests. New Zealand’s foremost vertebrate pest is the introduced brushtail possum (Trichosurus vulpecula). Bait shyness was identified in two wild possum populations by comparing the consumption of two non-toxic bait types before and after each population was presented with one of the bait types containing the toxin sodium monofluoroacetate (1080). Before poisoning, approximately 60% of total bait consumption was of the type which 1080 was later presented in, whereas after poisoning this bait type made up only 2-4% of total consumption. This shyness persisted for at least 11 weeks in one of the populations. No individual component (bait base, cinnamon lure or green dye) of the toxic bait could be isolated as the primary cue eliciting bait shyness as the response. Possible means of overcoming bait shyness are discussed in light of these findings.


Ref Type: Report
Keywords: 1080/baits/humans/aerial control/poisoning/pest/Tb/persistence in plants

Abstract: (Conclusions) 1080 can move out of Wanganui No. 7 baits when the baits are applied in the field. There is no evidence that either pikopiko or karamuramu contain endogenous 1080. There was no evidence of pikopiko plants taking up 1080 that has elached out of baits. Karamuramu plants will take up 1080, however based on this experiment only a very small proportion (0.0004%) of the original 1080 present in baits is likely to be seen in the leaves and the shoots. The highest 1080 concentration measured in the karamuramu was 5 ppb, in leaf material 7 days after bait placement. 1080 did not persist, plants containing 1080 reduced levels to zero after 25 days. At the highest measured concentration of 5 ppb, a person would need to consume 28 tonnes of this material to receive an LD50. There is negligible risk of humans being poisoned by consuming plants that have taken up 1080 from baits during an aerial control operation.

(Recommendations) The poisoning of humans by consuming pikopiko or karamuramu plants after aerial application of 1080 should not be considered as a significant risk. Consideration should be made for Maori groups to adopt a withholding period of 30 days after the aerial application of 1080, during which plants from within the 1080 application area are not used for rongoa (medicinal) purposes. Support should be given to further collaborative research projects involving Maori groups, as this allows these groups to play an informed role in considering the acceptability of 1080 as a vertebrate pest control technique, thus potentially strengthening efforts to reduce Tb vector numbers.


Keywords: persistence in animals/birds/mammals/analysis/1080/sodium fluoroacetate/muscle/heart/kidney/liver/gut/temperature


Keywords: fluoroacetate/mammals/tolerance/occurrence in nature/marsupials


Keywords: fluoroacetate/tolerance/mammals/marsupials

Abstract: The toxin fluoroacetate occurs naturally in many south-western Australia species of the legume genera *Gastrolobium* and *Oxylobium*. No fluoroacetate-bearing species are known from south-eastern Australia. Herbivores have evolved a high level of genetic tolerance to this toxin; this has persisted in some mammalian herbivores whose range now extends beyond the range of the toxic plants. Other species of mammals have acquired tolerance since extending their range into south-western Australia. This tolerance can be used as a genetic marker to identify the geographic origin and trace the subsequent spread of herbivorous mammals in southern Australia. In this paper, this marker has been used to clarify the recent evolutionary history of the western grey kangaroo, the tammer wallaby and the bush rat.

Australian wildlife research 9, 125-134.
Keywords: field efficacy/target species/bait degradation/1080/pindone/rabbits

Keywords: acute toxicity/mammals/possums/1080/non-target species/lethal dose
Abstract: The susceptibilities of mice Mus musculus, guinea-pigs Cavia porcellus and brushtail possums Trichosurus vulpecula to sodium monofluoroacetate (compound 1080) were determined at various ambient temperatures in the range 4-33EC. Toxicity was greater at both ends of the range than in the middle. In mice the LD50 at 24EC was five times that at 12.2EC, in guinea-pigs the LD50 at 17EC was twice that at 4EC, in possums the LD50 at 23.5EC was two and a half times that at 10.5EC. It is important to consider these differences when assessing the efficacy of 1080 for pest control, and potential hazards to non-target species in situations where such temperature ranges may be commonly expected.

Keywords: treatment/sodium fluoroacetate/lethal dose
Abstract: Pathogenesis in fluoroacetate poisoning is multifactorial. Biochemically it is characterized by lethal synthesis of fluorocitrate, causing hypocalcemia, and energy deficiency through blockade of the TCA cycle. Calcium gluconate (CaG) was chosen to antagonize hypocalcemia, while sodium alpha kelogluterate (NaKG) and sodium succinate (NaSuc) were selected as potential antidotes to revive the TCA cycle. Effectiveness of each of these antidotes individually and in certain combinations was tested in mice exposed to lethal doses (15 mg/kg ip) of sodium fluoroacetate (NaFAC). Antidotal treatments were administered at 15 min, 4 h, 10 h, 24 h, and 36 h after NaFAC. All 3 of the antidotes alone, as well as a combination of CaG with NaKG, were ineffective in reducing morality in mice after NaFAC. On the other hand, a combination of CaG (130 mg/kg) with NaSuc (240 mg/kg) was effective if the 2 solutions were either injected at separate sites or mixed in the same syringe just prior to injections. Similar solutions, if mixed for 24 h or longer before administrations, were ineffective. Increasing the dose of NaSuc to 360 or 480 mg/kg with CaG (130 mg/kg) was unrewarding. These results indicate that CaG in combination with 240 mg NaSuc/kg offer a promising therapy modality in NaFAC intoxication. Additional studies involving biochemical parameters and other species are needed to confirm the efficacy and mechanism(s) of action of this combination.

Keywords: non-target species/mammals/1080/poisoning/livestock/withholding period/target species/carrot/welfare
Abstract: It appears that compound 1080 is relatively humane and efficient and its use by approved operators ensures that it is relatively target species specific. The operators usually advise that livestock and pet animals should be withheld from the poisoned areas for at least 8 weeks and preferably until at least 10 cm of rain has fallen. In low rainfall areas, it may be appropriate to extend the withholding time until laboratory testing of weathered bait indicates that it is safe to restock. Extra precautions should be taken before livestock are allowed to graze airstrips from which 1080 carrot has been flown.

Keywords: fluoroacetate/fungus/resistance/acetate/analysis/enzyme
Abstract: Sixty-two mutants of the filamentous fungus Neurospora crassa were isolated on the basis of resistance to the antimetabolite fluoroacetate. Of these, 14 were unable to use acetate as sole carbon source (acetate non-utilizers, acu) and were the subject of further genetic and biochemical analysis. These mutants fell into four complementation groups, three of which did not complement any known acu mutants. Mutants of complementation group 3 failed to complement acu-8, demonstrated similar phenotypic properties and provided to be closely linked (less than 2% recombination) but not allelic. Representatives of groups 2 and 4 were mapped to independent loci; the single representative of group 1 could not be mapped. The four complementation groups were therefore designated as genes acu-10 to acu-13, respectively.

All
the mutants demonstrated normal acetate-induced expression of acetyl-CoA synthetase and the unique enzymes of the glyoxylate cycle and gluconeogenesis. The nature of these mutations is therefore quite different to those reported for other fungal species. Mutant acu-11 was unable to fix labelled acetate, indicating the loss of an initial transport function; partial enzyme lesions were observed for acu-12 (acetyl-CoA hydrolase) and acu-13 (acetate-inducible NAD+-specific malate dehydrogenase).


Keywords: persistence in water

Abstract: A method is described for the determination of trace amounts of sodium monofluoroacetate (MFA-Na) in water. MFA-Na was converted to the dichloroanilide derivative in a water sample acidified with hydrochloric acid by using N,N'-dl-cyclohexylcarbodiimide (DCC) and 2,4-dichloroanilide (DCA) and the derivative was extracted from the sample water and cleaned up by the silica gel column chromatography. The derivative was quantified by gas chromatography with electron capture detection (GC-ECD). The limit of detection was 0.0006 ug/mL, with a 50-mL water sample. The recoveries from environmental waters spiked at concentrations of 0.005-0.01 ug/mL were 93-97% with less than 4% relative standard deviation.


Keywords: persistence in soil/sodium monofluoroacetate/monofluoroacetate/soil

Abstract: A method is described for the determination of trace amounts of sodium monofluoroacetate (MFA-Na) in soil and biological samples. Soil samples were sonicated with distilled water in the presence of basic magnesium carbonate. Biological samples were extracted with distilled water by sonication and the extracts were coagulated by addition of equal volumes of alcohol and centrifuged. MFA-Na in each sample solution was absorbed on Dowex 1-X8 anion-exchanged resin and eluted with 2% (w/v) sodium chloride. The eluate was acidified with hydrochloric acid and treated with 2,4-dichloroaniline and N,N'-dicyclohexylcarbodiimide. The dichloroanilide derivative of MFA-Na was extracted with ethyl acetate and quantified by gas chromatography with electron-capture detection and gas chromatography-mass spectrometry. The detection limits were 0.0015 and 0.003 ug/g in 20 g of soil and 10 g of biological sample, respectively.


Keywords: honey/invertebrates/lethal dose/stomach/poisons/1080

Abstract: A description is given of laboratory tests designed to study the effect upon honey bees of pesticides acting as stomach and dry contact poisons. Methods are also given for measuring direct spray and fumigant action. Compound 1080 is highly toxic to bees as a stomach poison.


Keywords: persistence in soil/persistence in water/1080

Abstract: Sodium monofluoroacetate (1080) was added to streamwater at a rate of 0.1 mg l-1 in an aquarium, and 3-8 mg (representing typical baits) was added to small cores of soil in the laboratory, and the concentration of 1080 in solution measured with time. For the streamwater at 21EC, biodegradation was complete within 2-6 days; in the soils biodegradation took longer, and increased with temperature and moisture content. In laboratory experiments 1080 was found to be leached through soils but at three field sites no 1080 was detected in groundwater after aerial application of baits. Surface waters as well as groundwaters were monitored after four possum-control operations and one rabbit-control operation between 1990 and 1993. No 1080 was detected in the water after three of the possum-control operations. Extremely small, but variable, traces (<0.0003 mg l-1 (ppm)) were found in some samples from the fourth operation in Taranaki but these could have arisen from contamination of the outside of some containers. After an aerial application of carrot baits for rabbit-control in central Otago, 1080 was present in measurable but extremely low concentrations (0.0003 and 0.0006 mg l-1) in two samples of streamwater.
both taken with 24 hours of the application, probably as a result of baits falling into streams. The amount of 1080 used per has is extremely low (less than 15 g) and if any 1080 is not degraded because of low biological activity (e.g., at low temperature) it will be diluted by soil water and streamwater to very low concentrations.


Keywords: persistence in soil/1080/non-target species

Abstract: Sodium monofluoroacetate (Compound 1080) is used in New Zealand for the control of animals such as rabbit and the brush-tail possum. Since more than one tonne of this pesticide is applied annually in New Zealand a clear understanding of possible risks to the environment is essential. Research has been conducted on the toxicity of 1080 to a number of target and non-target species (Atzert 1971; Rammel and Flemming 1978; Eason et al. 1993). Work on biodegradation of 1080 has shown that it is defluorinated both by organisms which have been isolated from soil (Walker and Bong 1981; Wong et al. 1991) and within soils themselves (David and Gardiner 1966; Parfitt et al. 1994). In Australia where fluoroacetate occurs naturally in 41 plant species from two genera of Leguminosae at concentrations of from <100 mg/kg to in excess of 6000 mg/kg (Twigg 1994), biodegradation of fluoroacetate takes place in soils and none has been detected in waters (D. R. King, Agricultural Protection Board of Western Australia; pers. comm).

To our knowledge no studies have been conducted on the leaching of 1080 through soil. Peters (1975) speculated that 1080 is absorbed by soil and is not leached but this appears to have been based on the mistaken assumption that 1080 could be absorbed on cation-exchange sites in soils; fluoroacetate, however, is an anion and it cannot be held on cation-exchange sites. Therefore it may possibly be held on anion-exchange sites which occur on hydrous iron oxides, hydrous aluminium oxides and the clay mineral allophane. Since fluoroacetate, like chloride and nitrate, is a large monovalent ion, we suggest that fluoroacetate has a low preference for adsorption on soil minerals and that traces which are not removed by biodegradation may be leached through soils.

Here we report on the adsorption of 1080 by soil samples with large amounts of hydrous oxides, including samples of Andisols formed from volcanic ash and which contain allophane. We also investigate the possibility that traces of 1080 may be leached through soils.


Ref Type: Conference Proceeding
Keywords: fluoroacetate/1080/baits/analysis


Ref Type: Conference Proceeding
Keywords: sodium fluoroacetate/fluoroacetate/foxes/baits


Keywords: ground control/field efficacy/target species/poisoning/1080/baits/goats/herbivores


Keywords: baits/sodium monofluoroacetate/monofluoroacetate/1080/bait degradation

Abstract: Feral goats have been controlled in New Zealand by treating leaves of favoured food plants with he poison sodium monofluoroacetate (compound 1080) in a suitable carrier, enter carbopol gel or petrolatum grease. Both carriers caused baits to absciss and the rate of abscission increased when 1080 was included. Toxic petrolatum was three times less phytotoxic than carbopol and retained 1080 for much longer (carbopol lost most of its toxin after 200 mm of rain). Abscessed petrolatum-treated leaves retained their toxicity for at least a year.

Keywords: diagnosis/treatment/pathology/1080/humans/kidney

Abstract: A rabbiter who was repeatedly exposed to sodium monofluoroacetate (compound 1080) developed renal failure and evidence of other organ damage. This is believed to be the first report of chronic sodium monofluoroacetate intoxication occurring in man.

Parton, K., Bruere, A. N., and Chambers, J. P. (2001). Veterinary Clinical Toxicology. (Foundation for Continuing Education of the N.Z. Veterinary Association: Massey University, Palmerston North, New Zealand.)

Keywords: symptoms/poisoning/treatment/mode of action/1080


Ref Type: Magazine Article

Keywords: treatment/antidote/1080/poisoning/sodium monofluoroacetate/monofluoroacetate/dogs/convulsions/poison

Abstract: Until an effective antidote is licensed for use in domestic animals, veterinarians must use their professional judgement and skills in the treatment of animals poisoned by 1080. IN the past, glycerol monoacetate (GMA) was used to treat people and animals but GMA had a short shelf life and is no longer available. Alternatively, acetamide treatment appears to be effective in the treatment of dogs as reported by john McLaren in *Vetscript* March 1999. Because many practices do not have a ready supply of acetamide available for poisonings, symptomatic treatment of convulsions and metabolic acidosis arising from 1080 ingestion may require anaesthesia and fluids containing sodium bicarbonate. Of importance in all cases of poisoning, the use of decontamination to prevent absorption and eliminate the poison is often the key to success. An emetic may be indicated before clinical signs appear to reduce the amount of poison available for absorption. The use of activated charcoal with sorbitol binds to, and aids, the elimination of 1080 in the intestinal tract.


Keywords: fluorocitrate/Krebs cycle/symptoms/brain

Abstract: Fluorocitrate (FC) an inhibitor of the Krebs cycle that acts by blocking aconitase, the enzyme which catalyzes the conversion of citrate to isocitrate, exerts potent neurobiological effects. Injected intracerebrally in rat, FC (5 - 10 ug) causes lethargy followed by convulsive seizures and death. When injected intrathetically in cat, FC (10 - 30 ug) produces a spinal status epilepticus featuring clonic-tonic seizures of hindlimbs and trunk after a latent period of 1-2 hour.


Keywords: metabolism/cats/fluorocitrate


Keywords: fluorocitrate/treatment/brain/metabolism/inhibition

Abstract: In order to study the role of glutamine from glial cells for the synthesis of transmitter amino acids, the effect of the gliotoxic substance fluorocitrate on amino acid release from slices was investigated. In vivo treatment with 1 nmol fluorocitrate reduced the Ca\(^{2+}\) dependent K\(^{-}\) evoked release of endogenous glutamate and GABA from the slices, whereas the glutamine efflux decreased and alanine efflux increased. The K\(^{-}\) evoked release of [\(^{3}H\)]D-aspartate increased during fluorocitrate treatment. The latter is consistent with an inhibited uptake of D-aspartate into glial cells. Incubation of striatal slices with fluorocitrate (0.1 mM) decreased the glutamine efflux and increased the alanine efflux. Similar to the in vivo condition, fluorocitrate increased the K\(^{-}\) evoked [\(^{3}H\)]D-aspartate release, but the K\(^{-}\) evoked release of endogenous glutamate and GABA increased rather than decreased. The ratio between the K\(^{-}\) evoked release of exogenous D-aspartate to endogenous glutamate increased in both cases. The results suggest an important role of glial cells in the synthesis and inactivation of transmitter amino acids.

Keywords: enzyme/soil/resistance/analysis

Abstract: Most organic compounds are degraded in nature either by chemical interactions or by the enzymes of microorganisms distributed widely in soils and waters; but some are not. Alexander (1965) has used the term "recalcitrant" to characterize the compounds that can resist inactivation and biodegradation, and accumulate in nature as a consequence. Within the past decade, certain of the components of commercial detergents were found to be recalcitrant in this sense and were replaced by the manufacturers in the formulation of products sold in the United States. Synthetic surfactants largely susceptible to microbial attack are now used, and this problem has been eased without diminishing the quality of the product.

Today, organic herbicides and insecticides are the most troublesome of the persistent organic compounds routinely broadcast in nature.

It is tempting to speak of these lingering substances as unqualified nuisances, but attitudes toward pesticides must necessarily be ambivalent. It is certain, for example, that employment of DDT and other pesticides has resulted in more effective disease control and greatly increased agricultural productivity. The resistance of these compounds to biodegradation and their adverse effects on the environment have typically come to light only after some years of just such extensive and effective use. The unintentional, and originally unexpected, persistence of many of these agents and their progressive concentration in organisms in successive trophic levels must now be cause for growing alarm. Once perceived, hazards as clear as these should be regarded as danger signals that place us on guard against future offenses.


Keywords: 1080/sodium monofluoroacetate/monofluoroacetate/carrot/aerial control/possums

Abstract: Fluctuations in density patterns of opossum populations were studied by fecal pellet counts, along the North Bank of the Taramakau catchment from 1970-1977. The study area contained 2 major vegetation associations, rata (Podocarpus hallii)/kamahi forest and red beech (Nothofagus fusca) forest. Variations in density patterns over the years indicated that peak population numbers in the beech forests were approximately half those in the rata/kamahi forests. The upper transitional forests above both major forest types reached similar peak densities. Canopy defoliation was studied by aerial photography in 1960 and in 1973. Within 13 yr over 40% of the canopy in these protection forests was defoliated. This large-scale defoliation coincided with a build-up and peaking of the opossum population. In the winter of 1974 the whole area was poisoned by air with 1080 (sodium monofluoroacetate) impregnated carrot. Approximately 85% of the opossum population was removed by this operation. The greatest decline in pellet densities was recorded in the lower and mid-forest strata.


Keywords: possums/poisoning/field efficacy/aerial control

Abstract: Brushtail possums began colonising a rata/kamahi forest in the Taramakau catchment, Westland about 1950 and by 1973 had caused widespread conspicuous forest canopy defoliation. They were poisoning in one block of this forest in 1970, at about the time they reached peak density, and again in 1974. In an adjacent block they were poisoning in 1974 only. A survey of forest canopy condition in 1985 showed that, in the block poisoned at peak density, 21% of the basal area of palatable trees had died, compared with 47% in the block where poisoning was deferred for 4 years. This suggested that control at or before populations attain peak density is critically important for limiting canopy mortality. After the 1974 poisoning, possum numbers in both blocks recovered to within 20% of their pre-control levels in 10 years, indicating that control should be carried out at about decade intervals. Defoliation indices and species condition patterns showed that canopy dieback was least evident on relatively unpalatable trees. Of the palatable trees, kamahi was in best overall condition with least canopy dieback, followed by cedar, southern rata and Hall's totara.
Keywords: acute toxicity/mode of action/treatment/pathology/metabolism

Keywords: fluorocitrate/citrate/metabolism/dogs/biochemistry/excretion/persistence in animals
Abstract: The renal handling of calcium and citrate was studied in dogs after the administration of fluorocitrate. The drug produced a significant increase in urinary calcium and citrate excretion. Net renal secretion of citrate occurred during the infusion of fluorocitrate since citrate clearances exceeded the glomerular filtration rate.

Ref Type: Thesis/Dissertation
Keywords: 1080/non-target species/amphibian

Ref Type: Report
Keywords: 1080/systemic toxicity

Ref Type: Report
Abstract: On the basis of an overseas tour of study an insight is conveyed into the complexity of regulating vertebrate wildlife populations by lethal chemical control alone. In the United States, the pendulum of public opinion has swung away entirely from this type of control. This has led to a drastic revision of research-into-control priorities. The use of acutely lethal compounds has been severely restricted. In Europe and Japan, this situation has long been established fact.
Abroad major changes are in the offing in which the trend of research-into-control is toward integrated manipulation of pest populations by bio-chemical means. This trend takes into account the influence of biological attractants and deterrents (pheromones), and the decrease of birth rates by means of reproduction inhibitors (chemosterilants).
With respect to research-into-control in the New Zealand situation, fruitful contact has been made with Japan to augment Compound 1080 with other organo-fluorine derivatives. It is envisaged that these derivatives will impose secondary hazards of lesser consequence than hitherto possible.

Keywords: product chemistry/ion chromatography/fluorine/analysis
Abstract: A rapid and accurate method is described to determine toxic organofluorine residues in biological materials. Sample preparation is minimal. The sample is degraded by oxygen combustion and the liberated inorganic fluoride determined by ion-specific electrode.

Keywords: persistence in animals/non-target species/legislation/cost-benefit
Abstract: With growing emphasis on environmental impacts, the control of vertebrate pest populations by lethal chemicals is examined in the light of some overseas and local situations. The current philosophy embodied in legislation and policy of developed countries abroad is that a compound should be proven safe, rather than be found by use and experience not to be harmful. Such a level of scientific certainty is so unreasonable that, functionally, it may never be achieved. Such a concept of safety ignores dosage/response relationships and takes no account of the need or benefits. Given the multiple values of a situation and the ultimate problem of not having all the answers (and sometimes not even being aware of the appropriate
questions), it is not surprising that issues spill over from one problem to another. In such a situation the charge of bias as active prejudice must be clearly distinguished from bias inferring a certain set of presuppositions. New chemicals will undergo much more intensive scrutiny than those already approved, as criteria previously ignored, not identified, or not considered significant are developed and applied. The ramifications of environmental policies and attitudes overseas are discussed particularly in relation to future developments of chemical tools in the New Zealand situation. It may be that, by the time all the options have been thoroughly assessed, some will have quietly slipped away.


**Keywords:** persistence in soil/persistence in water/sodium fluoroacetate/1080

**Abstract:** Predictive and conceptual models are used to examine the contamination, toxicology, and residues of sodium fluoroacetate (Compound 1080) in relation to its application in vertebrate pest control programmes on forest and pastoral lands.

As a pesticide, the toxin appears to be neither mobile nor persistent. Exceedingly slender opportunities exist therefore for significant contamination of susceptible components of the environment.


**Keywords:** 1080/poisoning/analysis/humans

**Abstract:** Letter to the editor in response to article by Parkin, McGiven and Bailey in 9 February 1977 issue of New Zealand Medical Journal.

Peters, J. A. and Fredric, B. J. Susceptibility of the brushtail possum (Trichosurus vulpecula) to sodium fluoroacetate (Compound 1080 or SFA). 1983.

**Ref Type:** Unpublished Work

**Keywords:** sodium fluoroacetate/fluoroacetate/1080/aversion/carrot/lethal dose/possums

**Abstract:** The susceptibilities to sodium fluoroacetate of 10 regional possum populations in captivity are determined by acute and chronic dose experiments. Circadian rhythms and desynchronisation (capture stress) have major influences on susceptibility. The relationships between susceptibility and bait acceptance are examined. Toxic anorexia (loss of appetite) induced by sub-lethal doses inhibits further bait-seeking, and smell and taste aversion diminishes bait-eating when the toxic load in bait is high. Susceptibility determined under experimental conditions in captivity is not significantly from susceptibility measured in a wild population. The varying susceptibilities in regional populations are considered in the light of field control operations. A general toxic load of 6 mg SFA/ carrot bait is recommended, but specific toxic loads determined for individual regional populations may often be more effective.


**Ref Type:** Unpublished Work

**Keywords:** 1080/lethal dose/efficacy


**Keywords:** mode of action/acute toxicity/metabolism

**Abstract:** It has been suggested that the toxicity of fluoroacetate is due to the enzyme synthesis of a fluorotricarboxylic acid, which 'jams' the tricarboxylic acid cycle at the citrate stage. This communication presents the proof of this hypothesis. The inhibitory substance for citrate metabolism synthesized by enzymie action from fluoroacetate has been isolated as a compound in crystalline form of great potency. Under The conditions of test it inhibits The disappearance of approximately 300 times its weight of citric acid in 30 min. The final isolation involved a separation from citric acid by The use of ion-exchange resin, and fractional extraction with ether. It is a monofluorotricarboxylic acid, as shown by its migration on a paper chromatogram, by its fluorine content (estimated spectrochemically), and by its titration curve. It does not give the colour reaction with sodium sulphide for penta-bromacetone produced from citric acid by The usual methods. It gives an infra-red band which may be expected from a C-F bond. By a process of exclusion, it is considered to be a fluorocitric acid; a final decision must await synthesis.
Abstract: As the spectra of the enzymically synthesized compound show no bands which cannot be accounted for by the bands seen with the synthetic fluorocitric acid together with bands expected from traces of barium salts, the compound made enzymically must be actually monofluorocitric acid; it has approximately twice the activity of the synthetic specimen.


Abstract: A new method has been worked out for testing the activity of fluorocitrate on soluble aconitase. In this a cruder enzyme preparation is used taken to an intermediate stage of fractionation which does not require reactivation with ferrous salts and cysteine.

Abstract: Grass seedlings exposed to inorganic fluoride solutions do not take up appreciable amounts of fluoride until concentrations of more than 1.0 mM (19 ppm) are used. No formation of organic fluoride has been found even with exposure to 15.75 mM fluoride, indicating that there is no formation of fluoroacetate or similar compounds.

Abstract: We could not therefor demonstrate an effect of fluoroacetate in vitro, and conclude that any synthesis of fluorocitrate must be very slight if it occurs at all.

Abstract: When working with homogenates of Acacia georginae in an attempt to trace the pathway of fluoroacetate synthesis, we found that there was a loss of fluoride, and we extended our experiments to some other plants to study this effect. This communication describes experiments which have led us to believe that plants can convert fluoride, possibly in part, to a volatile form.

Peters, R A. (1967). Experiments upon the biochemistry of the synthesis of fluoroacetate in the Australian Georginae and their significance. Revue roumaine de Biochimie 4, 79-91. Keywords: biochemistry/fluoroacetate

Abstract: We have now found that some extracts of fluorosed bones from cattle contained small amounts of fluorocitric acid, which have been identified by their capacity for inhibiting aconitase and by gas liquid chromatography.

Peters, R A. and Shorthouse, M. (1970). Aconitate hydratase. Some new observations with especial relation to its use as a test system for fluorocitrate, together with studies on the electrophoretic separation of components of the crude enzyme. Biochimica et biophysica acta 220, 569-579. Keywords: fluorocitrate/enzyme/aconitase/analysis/biochemistry
Abstract: Preparations ofaconitate hydratase from pig heart, purified to the first ethanol stage have been studied, and evidence supporting the existence of two centres has been confirmed; wide variations in the ratio of the isocitrate hydro-lase to that of the citrate hydro-lase have been found. Additive effects occur on the enzymatic action when one of the substrates is added to the other, both additions being at $v_{\text{max}}$. Fluorocitrate never inhibits these mixed enzymes completely.

Keywords: metabolism/persistence in plants/occurrence in nature/biosynthesis/defluorination

Abstract: Monofluorocarbon acids can be formed from inorganic fluoride by single cell cultures of *Acacia georgiana* and tea. Fluorocitrate is also present in small amounts in commercial specimens of tea and oatmeal. The significance of these observations is discussed, especially in relation to the toxic plants.

Keywords: fluoride/biosynthesis/persistence in plants


Keywords: occurrence in nature/metabolism/mode of action

Keywords: metabolism/acute toxicity/fluorocitrate/rats

Keywords: fluoroacetate/poisoning/treatment/sodium fluoroacetate/metabolism/enzyme

Keywords: mode of action/occurrence in nature/metabolism/biochemistry

Keywords: fluoroacetate/poisoning/fluorocitrate/monoacetin

Keywords: acute toxicity/mammals/fluoroacetate/fluorocitrate/rats

Keywords: product chemistry/mode of action/occurrence in nature/fluoroacetate/fluorocitrate/chemistry/biochemistry

Keywords: diagnosis/occupational exposure/fluoroacetate/poisoning

Keywords: acute toxicity/aerial control/aquatic species/bait degradation/birds/cats/deer/field efficacy/ground control/invertebrates/mammals/non-target species/occurrence in nature/persistence in
Abstract: This investigation has confirmed the magnitude of the threat posed by possums, which should not be underestimated. New Zealand's native biota and natural values are at risk from the damaging effects of possums and, although the incidence of bovine TB may not have serious financial effects on individual farmers, it could significantly affect the New Zealand economy. Ongoing possum control over more than a third of New Zealand, using current techniques, will be essential until there is a breakthrough in the search for new methods of control.


Keywords: sodium fluoroacetate/fluoroacetate/1080


Keywords: metabolism/fluoroacetate/liver

Abstract: Monofluoroacetic acid is found to be efficiently utilized as a substrate for the biosynthesis of fluorine-containing nonsaponifiable lipids by a cell-free preparation of rat liver.


Keywords: mammals/acute toxicity/treatment/fluoroacetamide


Keywords: fluoroacetamide


Ref Type: Report

Keywords: non-target species/birds/invertebrates/1080/possums

Abstract: An aerial 1080 poison operation for possums at Waipoua Forest in spring 1990 applied cereal pellets lured with cinnamon. Numbers of brown kiwi, moreporks, fernbirds, kokako and common diurnal birds were monitored before, during and after the operation, while small numbers of insects and kauri snails were tested for 1080 uptake. Of the birds only blackbird and tomtit showed possible declines after the poisoning. Although some kiwi had consumed non-toxic baits, no 1080 related deaths were detected following the poison operation. Low concentrations of 1080 were found in the insects, but none of the kauri snails had detectable levels of 1080.


Keywords: monofluoroacetic acid/citrate/citric acid/metabolism/mode of action/persistence in plants

Abstract: After sufficiently long influence of 10mM/l monofluoroacetic acid (MFA) (pH 4.5), the oxygen consumption in segments of seedling roots is nearly completely blocked. By addition of citrate and citric acid measurements it was found that MFA probably exerts the same effect on pea roots as known for animal tissues. 1 mMol MFA has no effect. If no substrate is offered during the MFA action, oxygen consumption is less hampered than at presence of sucrose. Roots cultivated in vitro behave similar to seedling roots; their O2 consumption is not as much suppressed by MFA. Addition of 2.10-8 molar 2,4-dichlorophenoxyacetic acid (2,4-D) to the nutrient solution does not induce considerable changes in the sensitivity of O2 consumption of roots against MFA. After 6 hours of MFA action all segments contained less dry matter than the controls. They were the smaller the stronger O2 uptake had been blocked, which fact is explained to be the result of suppressed uptake of substrate. From the experiment it is concluded that in 3 days old seedling roots most of the O2 consumption is combined with dehydration in acid-metabolism and that there is no difference in dehydration-type between the root segments of meristems. elongation and differentiation
zones. When substrate is lacking even small amounts of substances not being decomposed via isocitric acid, probably proteins are oxidised.


Keywords: field efficacy/ground control/rabbits/poisoning

Abstract: Four 4-acre enclosures were kept stocked with rabbits and used to compare, under different seasonal conditions, the effectiveness of bait, chiefly carrot poisoned at concentrations of 0.01%, 0.02% or the usual field strength of 0.04% of sodium fluoroacetate.


Keywords: fluoroacetate/tolerance/marsupials

Abstract: Morphometric analyses of cranial and body measurements from western grey kangaroos were undertaken as a possible means of determining the taxonomic status of the described forms. The kangaroos were assigned arbitrarily to one of four geographic groups, those from Kangaroo Island (*Macropus fuliginosus fuliginosus*) and three from the mainland, comprising animals taken from the western (*Macropus fuliginosus ocydromus*) and eastern *Macropus fuliginosus melanops* extremities of their distribution together with an intermediate geographic group. Four types of analysis - analysis of variance, canonical variate analysis, principal component analysis and discriminant function analysis - were utilised and their outcome assessed. Earlier findings based on diverse criteria such as aspects of reproductive cycles, distribution of red-cell lactate dehydrogenase types, and responses to ingestion of fluoroacetate, revealed that *M.f.fuliginosus* was quite distinct from *M.f.melanops* on the adjacent mainland and to a lesser extent from *M.f.ocydromus* in Western Australia. The present results confirm these levels of affinity and suggest that western grey kangaroos comprise at least two principal subspecific forms, a uniform group, *M.f.fuliginosus*, from Kangaroo Island and a composite group on the mainland that intergrades clinally in its morphological traits along a longitudinal (west-east) gradient. *M.f.melanops* Gould is the senior name for the mainland complex.


Keywords: sodium monofluoroacetate/monofluoroacetate/mode of action/persistence in plants

Abstract: The author has studied the evolution of protoplasmic streaming in barley root hairs treated with sodium monofluoroacetate (MFA), in three experimental variants. In the first variant, the treatment with a 10-²M solution of MFA for 60 minutes was followed by a 30 minute washing with buffer solution and by treatment with a 10-⁴M solution of ATP for 30 minutes. The results obtained indicate that the exogenous ATP added after the removal of the MFA has increased the speed of protoplasmic streaming. In the second variant the root hairs were treated simultaneously with MFA (10-²M) and ATP (10-⁴M) for 120 minutes. The combined treatment resulted in strong inhibition of protoplasmic streaming. In the third variant, administration of MFA in 10-²M concentration for 60 minutes was followed by washing with buffer solution for 30 minutes and by addition of LiCl (10⁻⁵M) for 30 minutes. The results show that LiCl was not able to remove completely the modification caused by MFA in the protoplasmic structure. The author has drawn the conclusion based on the experimental data that MFA decreases the speed of protoplasmic streaming by inhibiting respiration and by increasing the viscosity of protoplasm.


Keywords: pathology/analysis/fluoroacetate


Keywords: citric acid/fluoroacetate/citrate/Krebs cycle/metabolism

Abstract: Previous investigations have indicated that tumor tissues are deficient in enzymes which oxidise
pyruvate via the Krebs citric acid cycle. The work of Buffa and Peters offered a means for testing the ability of tumor to produce citrate in vivo, since oxidation of citric acid is prevented and the compound accumulates following injections of sodium fluoroacetate.


Abstract: This report describes results from the first two years of a three-year programme to determine whether the costs and benefits of aerial 1080 possum control operations to North Island robins (*Petroica australis longipes*), North Island tomtits (*Petroica macrocephala toitoi*) and moreporks (*Ninox novaeseelandiae*) in Pureora Forest Park. Prior to this study, the five-minute count technique had been used to quantify mortality of forest passerines during aerial possum control operations. During this study robins were individually colour-banded, and moreporks radio tagged at both treatment and non-treatment study areas. The poison operation took place in mid-September 1996 (carrot baits, 15 kg/ha, 1080 0.08% ww). An audit after the operation indicated that only 9.9% wastage (chaff) by weight was produced, rather than the expected c. 20%. This suggests that the other 50% of the expected chaff was not screened out and so was made toxic and distributed with the baits. No possums were trapped in the treatment area during October and December 1996. Rodent population indices from foot-print tracking tunnels indicated the rat population (known to be mainly *Rattus rattus*) had declined markedly in the treatment area (95% in June 1996 to 5% in October 1996) following the poison operation, and indices remained low (5-10%) during the robin nesting season (October - February). Twelve (54.5%) of the 22 banded robins in the treatment area disappeared during the fortnight immediately following the poison operation, but none of 24 in the non-treatment area. All three robins found dead following the operation tested positive for 1080. In the treatment area, nesting success (72%, n=18 nests) was much greater than in the non-treatment area (11%, n=35 nests; 0.4, n=14 pairs). The high nesting success in the treatment area resulted in the number of robins present just before the start of the next nesting season (August 1997) being 36, a 28.6% increase in the number present prior to the poison operation. In contrast, teh numbers present in the non-treatment area remained much the same., in September 1996 as compared with 33 in August 1997. All five tomtits, including two banded birds, that were regularly fed in the treatment area disappeared immediately after the poisoning operation. No tomtits were monitored in the non-treatment area. One of six radio-tagged moreporks (16.7%) in the treatment area was found dead during the poison operation and tested positive for 1080. The single radio-tagged morepork in teh non-treatment area was alive several months afterwards.


Keywords: field efficacy/non-target species/birds/1080/treatment/possums


Ref Type: Report
Keywords: 1080

Keywords: 1080/birds/treatment/poison/carrot/baits/possums/rats/predators/non-target species

Abstract: To measure the costs and benefits of an aerial 1080 possum control operation to kereru and kaka in Whirinaki Forest Park, individuals of both species were radio-tagged from October 1998 to June 2002. We monitored birds in one treatment and one non-treatment study area to compare toxin-related mortality, nesting success and survival. The poison operation involved the spreading of non-toxic carrot baits on 1 May 2000, and the toxic baits on 17/18 May 2000. Possums and rats were moderately abundant in both study areas prior to the poison operation, but afterwards few possums and rats remained in the treatment area. All radio-tagged kaka and kereru in the treatment area survived the poison operation. No radio-tagged keraeru and too few radio-tagged kaka bred in either study area during the 2000/01 nesting season to show whether reduced possum and rat populations would enable the birds to nest more successfully. A reduction in possum and rat densities in the non-treatment area (and an increase in densities in the treatment area) during 2001/02 meant that during the second nesting season after the poison operation, possum and rat densities were similar in the two study areas. The nesting effort and success of kaka and kereru is described for each of four nesting seasons, with the main cause of nesting failure for both species being predation. While no radio-tagged adult male kaka died during the study, 6 females did, giving them a mean life expectancy of 9.5 years. In contrast, radio-tagged adult kereru suffered high mortality, resulting in a mean life expectancy of just 1.5 years. Predation by introduced mammalian predators was the main cause of mortality of kaka eggs, chicks, fledglings and adult females, and of kereru eggs, chicks, fledglings and adults. Effective control of introduced mammalian predators, including control by aerial 1080 operations, just before mast fruiting events that invariably promote prolific kaka and kereru breeding, should benefit these bird populations.


Keywords: invertebrates/USA/poison/fluoroacetate/fluorocitrate

Abstract: Unlike invertebrates, phytophagous insects lack the capacity for de novo synthesis of the steroid nucleus and rely on C28 and C29 phytosterols as sources for C26 cholesterol. The authors report on recent work in the USA to exploit the phytosterol dealkylation pathway to release, in vivo, the latent poison fluoroacetate, which undergoes 'lethal synthesis' to fluorocitrate. Four 29-fluorophytosterols were prepared in diastereometrically pure form by total synthesis from stigmasterol, and 1 was prepared from 24-oxocholesterol. The recrystallised 29-fluorosterols were dissolved in dichloromethane and applied as a coating to wheat germ in the artificial diet of larvae of Manduca sexta (Joh.). Control larvae received either 50 p.p.m. stigmasterol or no additional sterols. First-instar larvae were kept on the diet from the 7th day (test day 0) after egg collection at 26 deg C, RH 65% and LD 17:7. All 5 29-fluorophytosterols significantly impaired larval growth and development. The doses affording 50% reduction in maximum larval weight, survival to test day 21 and pupation were 110, 300 and 150 p.p.m., respectively for 29-fluorositosterol, <1, 4, and <1 for 29-fluorostigmasterol, 26, 48 and 31 for 29-fluorofucosterol. The results are discussed, and evidence is provided to support the presumed metabolic steps. The 29-fluorosterols are referred to as 'pro-insecticides'


Keywords: metabolism/invertebrates/fluorocitrate

Abstract: A novel pro-insectide, 29-fluorostigmasterol, is proposed to cause mortality of fluoroacetate during side chain dealkylation. The 29-H-labelled substance was fed to third instar tobacco hornworms (Manduca sexta) and erythro-2-fluoro-[2-H]-citrate was isolated in 0.012% yield by ion-exchange, silica gel and reverse-phase chromatography of the tricarboxylic acid, trimethyl ester and trimethyl ester benzoate, respectively. The less toxic 29-fluoro-[29-H]sitosterol did not provide sufficient labelled fluorocitrate to allow isolation while a more toxic 16-H-labelled 16-fluorofatty acid gave nearly 1% conversion to labelled fluorocitrate. This is the first direct chemical evidence for the fate of the two carbons removed during phytosterol dealkylation in an insect. It is also the first use of labelled fluorocitrate as an in vivo metabolite of these precursors.

Keywords: fluorine/fluorocitrate/fluoroacetate/inhibition/acetate/fluoride/invertebrates
Abstract: Substitution of fluorine for hydrogen in essential sterols, juvenile hormones and pheromones can lead to materials that interfere with insect growth, development or communication, in novel and potentially useful ways. In this paper, examples drawn from work in these areas are used to illustrate fluorocitrate generation via dealkylation of 29-fluorophytosterols; fluoroacetate release by beta-oxidation of fatty alcohols and acids; inhibition of juvenile hormone esterase by trifluoromethyl ketones; inhibition of antennal esterases that hydrolyse acetate pheromones; and sensory disruption by acyl fluorides that mimic aldehyde pheromones.

Ref Type: Abstract
Abstract: Acacia georginae, a plant native to Australia, is known to contain monofluoroacetic acid. We have shown that this compound is synthesised when seedlings of Acacia georginae are grown axenically and supplied with sodium fluoride. The metabolism of monofluoroacetic acid was studied in Acacia georginae, peanut (Arachis hypogaea L.), castor bean (Ricinus communis L.), and Pinto bean (Phaseolus vulgaris). When 2-14C-fluoroacetate was supplied to seedlings of the above four plants, it was demonstrated that the radioactive carbon is evolved as 14CO2 and incorporated into various water-soluble and lipid fractions. Evolution of 14CO2 from germinated seeds of the four plants was studied on a time-course basis. Incorporation of radioactivity and fluorine into lipids was studied by means of thin-layer chromatography, gas chromatography and mass spectrometry. Results indicate that Acacia and other plants can metabolise monofluoroacetic acid and cleave the carbon-fluorine bond. The data obtained are not consistent with the generally accepted scheme of fluoroacetate utilisation and toxicity in animals and a hypothesis is presented to explain the metabolism of fluoroacetate in plants. The synthesis of several fluoroorganic compounds is suggested and the metabolic reactions leading to such syntheses are discussed.

Ref Type: Abstract
Abstract: The metabolism of 2-14C-sodium fluoroacetate was studied in Acacia georginae, peanut, castor bean and Pinto bean. When this compound was supplied to sterile seedlings of the four plants, 14CO2 was evolved and 14C was incorporated into water-soluble fractions and lipids. Results indicate that the plants studied contained an enzyme system capable of cleaving the carbon-fluorine bond.

Ref Type: Abstract
Abstract: Experiments were carried out to 1) confirm the germinating peanut seeds contain enzymes which split the carbon-fluorine bond of fluoroacetic acid and 20 determine if fluoroacetic acid can be metabolized by fluoroacetic acid in Acacia georginae. About 15 per cent of the fluoroacetic acid supplied to germinating peanut seeds as sodium fluoroacetate was found in the inorganic form in the seedlings or in the incubation medium after 48 hours. Only 2 to 5 per cent was detected after incubation of boiled seeds. The gas chromatographic pattern of fatty acids control and fluoroacetate-treated Acacia seeds was the same and analysis of each peak by mass spectrometry provided no evidence for the presence of a fluorine atom attached to the fatty acids.

Ref Type: Abstract
Keywords: fluoroacetate/poisoning/humans

Ref Type: Report
Abstract: A range of soil bacteria is capable of using 1080 as their sole carbon source. Both soils and isolation techniques raised a number of different isolates. The descriptions and ID-kit results indicate that the isolates belong to a range of species. Some of the isolates with similar results might belong to the same species. For the true identification of the isolates the amplified 16S gene should be sequenced. Due to the
inability of the majority of natural microorganisms to grow under artificial conditions the obtained collection of isolates is not a good representation of all 1080 degrading bacteria in soil. With the primers used in this study it could not be shown that any of the isolates contained a gene similar to dehH1 in Moraxella. Results from PCRs with the 16S and dehalogenase primers indicate that inhibitory substances were present in both soil samples as well as in the enrichment culture of soil B (Manawatu).


Keywords: monofluoroacetate/heart/rabbits/cardiac/mammals/acute toxicity/bacteria/poison/sublethal effects/chronic poisoning

Abstract: Considerable variation in susceptibility to potassium monofluoroacetate has been found to exist among various species of laboratory animals. The compound is not affected by actively fermenting ruminal flora nor does its presence affect such fermentation. Direct observations on the heart of rabbits and sheep injected with this compound have proved it to be a heart poison probably affecting the cardiac conducting mechanism thus leading to partial or complete heart block.


Keywords: poisoning/fluoroacetate/humans


Keywords: 1080/poisoning/fluorine/urine/humans


Keywords: acute toxicity/aerial control/aquatic species/bait degradation/birds/cats/deer/diagnosis/field efficacy/ground control/invertebrates/mammals/metabolism/mode of action/non-target species/occurrence in nature/pathology/persistence in animals/persistence in plants/persistence in soil/persistence in water/poossums/product chemistry/rabbits/secondary poisoning/target species/treatment/welfare/1080

Abstract: Preparation of this book grew out of the need to provide a ready reference source for the answers to many of the questions that were being asked about the use of 1080 in New Zealand. Much of the information on 1080 was scattered throughout a variety of publications and unpublished reports. This book is an attempt to present, in a readily digestible form, the available information as it applies to the New Zealand situation.


Keywords: diagnosis/treatment/1080

Abstract: Therapy using glycerol monoacetate, as is used for humans, has been applied to dogs. Observation of circulating acetate levels indicated that GMA doses of more that 100mg/kg are required.


Keywords: metabolism/non-target species/persistence in animals/1080/lethal dose

Abstract: Forty sheep were dosed orally with compound 1080 (sodium monofluoroacetate) at or near the lethal dose rate and then sacrificed 2 to 32 hours after dosing to determine the 1080 residues in the muscle and liver. Compound 1080 concentrations in the muscle from sheep dosed at 200 u g/kg reached a maximum of about 110 ppb in 4 hours and decayed exponentially thereafter with a half-life of about 12 hours. In liver, the maximum concentration of about 40 ppb was found at 2 hours with an exponential decay thereafter and half-life of about 3 hours. The data imply that 1080 should be undetectable (less than 3 ppb) in meat from any sheep which inadvertently consumed 1080 more than 5 days pre-slaughter.
Keywords: humans/1080/poisoning/kidney

Keywords: product chemistry

Keywords: product chemistry

Keywords: 1080/lethal dose/rabbits/resistance/tolerance

Abstract: Rabbits in Australia are developing resistance to a widely used poison, raising fears that the authorities are losing their battle to control the invaders. It's the first time a small mammal other than mice has become resistant to the pesticide, and serves as a warning to countries such as New Zealand that use huge quantities of it.

In some areas of the outback there are as many as 3000 rabbits per square kilometre, giving conservationists and farmers alike a major headache. Attempts to wipe out the animals using lethal viruses have proved only partially successful. Last week, *New Scientist* revealed that researchers are now developing a virus they hope will make the pests sterile.

But the most widely used control measure remains the poison sodium fluoroacetate - better known as 1080. The chemical is deployed against mammal pests in various countries, but New Zealand accounts for 90 per cent of its use, mainly to control ppossums introduced from Australia.

The poison is particularly useful in Australia because fluoroacetate is produced as a natural defence by several Australian plant species. So while rabbits are vulnerable to it, it does little damage to native plant-eating mammals, which are up to 100 times less likely to succumb.

But Laurie Twigg at the Department of Agriculture for Western Australian in Perth and his team have found that three rabbit populations repeatedly exposed to 1080 are becoming resistant to it. By comparing results from a similar study in 1979, they found that more than double to amount of poison is now needed to kill the same number of animals (*Journal of Applied Ecology*, vol 39, p 549).

"I was surprised that we would find resistance in 25 years," Twigg says. "We would advocate alternating the use of 1080 with other control measures," he says. James Randerson

Keywords: pigs/1080/sodium monofluoroacetate/monofluoroacetate/baits/rabbits/stomach/secondary poisoning/poisoning/lethal dose/field efficacy

Abstract: Wild pigs (Sus scrofa) in Australia annually cause damage worth 73.3 million dollars (Australian) to the agricultural and pastoral industry. Since 1971, Compound 1080 (sodium monofluoroacetate) has been used in New South Wales to control wild pigs. The recorded LD50 for pigs is <1.0 and 0.4 mg/kg body weight, respectively, for adult and young pigs. Wild pigs poisoned by carrot baits placed for European rabbits have been observed to leave trails of vomitus containing carrot and the food contents fo their stomachs. Vomiting (emesis) induced by the ingestion of 1080 has not previously been reported in pigs. The objective of this study was to prevent 1080-induced vomiting of target animals to avoid secondary poisoning of non-target animals. The present trial was undertaken to document the incidence of vomiting induced by lethal doses of 1080 in wild pigs and to test the effectiveness of the antiemetic compound metoclopramide (Maxolon) in preventing 1080-induced vomiting.

Analytical Chemists 64, 19-24.
Keywords: liquid chromatography/diagnosis/sodium fluoroacetate/1080
Abstract: A sensitive high pressure liquid chromatographic method was developed for the determination of sodium fluoroacetate (compound 1080) in canine gastric content. The procedure involves extraction of 1080 with water, methyl, ethyl ketone, and dilute base, followed by sample cleanup using octadecylsilane bonded phase cartridges and derivatization in ethyl acetate solution with O-p-nitrobenzyl-N-N'-di-isopropylisourea (PNBDI). The compound was chromatographed on a 10 um silica column, and ultraviolet absorbance at 254 and 280 nm was measured. Recovery was greater than 95% for standard 1080 and in the 70 - 90% range for spike samples (1-50 ppm).

Keywords: brain/fluorocitrate
Abstract: Striatal catechol-O-methyltransferase (COMT), monoamine oxidase B (MAO-B; an astroglial enzyme), alkaline phosphodiesterase I (PDE; a microglia/macrophage marker) and tyrosine hydroxylase (TH; catecholaminergic neuron marker) activities were analysed biochemically 1-3 days after infusion of fluorocitrate, an astrocyte damaging agent. Astrocytes, microglia and neurons were stained immunohistochemically with specific antibodies (against glial fibrillary acidic protein, OX-42 and TH, respectively) and with COMT antiserum. Three days after fluorocitrate infusion the activity of MAO-B was reduced, whereas COMT and PDE activities were increased. The elevation of COMT immunoreactively co-localized to microglial cells, but not to astrocytes. In conclusion, this is the first report indicating that microglia contains COMT activity which may be increased in pathological conditions.

Keywords: enzyme/fluoroacetate/inhibition/metabolism
Abstract: The esterase-catalyzed enantioselective hydrolysis of the fluoroacetate of pantolactone leads to fluoroacetic acid, a toxic compound which inhibits the growth of esterase-producing yeast; this forms the basis of an ee-assay.

Reid, K. A. Biochemical studies of fluoroacetate and 4-fluorothreonine biosynthesis in Streptomyces cattleya. 201. 1994. Queen's University of Belfast (Northern Ireland) Editor.
Ref Type: Thesis/Dissertation
Keywords: fluoroacetate/biosynthesis/flouride/NMR/metabolism/bacteria
Abstract: The production of fluoroacetic acid and 4-fluorothreonine in batch culture by the actinomycete Streptomyces cattleya NRRL 8057 was examined on a chemically defined medium containing 2 mM fluoride using GC-MS and $sp{19}$F NMR spectroscopy techniques. Fluoride uptake by cells did not begin until growth had ceased and closely reflected fluorometabolite levels found in culture supernatants. 4-Fluorothreonine was detected prior to fluoroacetate and was present at higher concentrations throughout incubation, although levels of both compounds stabilised at about 0.75 mM after approximately three weeks. 4-Fluorothreonine was purified from batch cultures of S. cattleya by column chromatography. Another amino acid, 3-ethynylserine, copurified with the fluorocompound, and was also isolated. Several hypotheses for the biosynthesis of fluoroacetate and 4-fluorothreonine were investigated by feeding possible precursors and biosynthetic intermediates to resting cells. Only D- homoserine had a significant effect on the amounts and relative proportions of the metabolites formed, stimulating 4-fluorothreonine production by over 20%. Such studies also indicated that neither of the fluorometabolites produced is derived by metabolism of the other. The incorporation of $sp{14}$S-label into fluoroacetate from L-(U-$sp{14}$S) threonine by resting cells was in the range 1-3% and compared favourably with those from both (U-$sp{14}$S) glycerol and D-(U-$sp{14}$S) glucose. However, the highest incorporation from all the radiolabelled possible precursors examined was from (1,2-$sp{14}$S) glycolate, in the range 2-5%. It is concluded that the fluorinated secondary metabolites elaborated by S. cattleya are derived either by two entirely separate biosynthetic pathways, or from a common fluorinated intermediate. The most plausible hypothesis from present data involves 4-fluorothreonine formation from the phosphate ester of homoserine or threonine, mediated by pyridoxal phosphate. Twenty five other Streptomyces spp. were examined for their ability to incorporate inorganic fluoride into fluorometabolites. In over half the species examined, a
significant uptake of fluoride (0.2-0.3 mM) was observed, but no fluorometabolites were detected in culture supernatants by $sp{19}$F NMR spectroscopy.


Keywords: biosynthesis/bacteria/fluoroacetate/NMR/fluoride

Abstract: The biosynthesis of organofluorine compounds by *Streptomyces cattleya* NRRL 8057 was examined using $sp{19}$F NMR spectroscopy. The organism produced 1.2 mM fluoroacetate and 0.5 mM 4-fluorothreonine as secondary metabolites when cultured for 28 days on a chemically defined medium containing 2 mM fluoride.


Keywords: biosynthesis/fluoroacetate/bacteria


Keywords: diagnosis/treatment/sodium fluoroacetate/humans

Abstract: We observed a case of poisoning with sodium fluoroacetate, and extremely lethal rodenticide that has had relatively strict controls placed on its use. The case was unusual in the very long time the rodenticide had been present in the home, the mild nature of the poisoning, and the remarkably delayed onset of serious central nervous system symptoms. It demonstrates the need for even stronger control on the use of sodium fluoroacetate.


Keywords: analysis/monofluoroacetate

Abstract: Haloacetates in various environmental compartments can be determined by gas chromatography-negative-ion chemical-ionization mass spectrometry after derivatization with l-pentafluorophenyl diazoethane. Detection limits in absolute amounts per injection are between 0.01 fg (chlorodifluoroacetate) and 80 fg (monofluoroacetate). Sampling of haloacetates in urban air was performed by means of cylindrical denuders coated with alkalized glycerol. The haloacetates detected are trifluoro-, monochloro-, dichloro-, trichloro-, monobromo-, and dibromoacetate. The concentrations in ambient air fluctuate strongly, e.g. between 20 and 3000 pg/m^3^ for TFA. Haloacetates are also found in river waters and tree foliage. A major problem is interference from contamination with trifluoro- and trichloroacetate.


Keywords: inhibition/metabolism/amphibian/fluoroacetate

Abstract: The effects of the metabolic inhibitors 2-deoxy-d-glucose and monofluoroacetate on intracellular ion concentrations and Na transport were investigated in the isolated frog skin epithelium of *Rana pipiens*. Ion concentrations were determined in thin freeze-dried cryosections using energy dispersive X-ray microanalysis. Metabolic inhibition was compared to direct inhibition of the Na pump by ouabain. At similar rates of transepithelial transport, inhibition of the Na pump always resulted in much more pronounced Na concentration increase than metabolic inhibition. The result suggests that the apical Na influx is under effective metabolic control. Downregulation of the Na influx during impaired cellular energy metabolism may be a means by which transporting epithelial cells avoid potentially damaging derangements of intracellular ion composition.


Keywords: fumigant/sodium fluoroacetate/fluoroacetate/field efficacy/mammals
Abstract: Pocket gophers (of several genera), which live underground and construct extensive galleries in cane fields, damage more than 60,000 acres/year in the major cane producing regions of Mexico. Primitive control methods include trapping, shooting, extermination with CO2 and flooding of galleries. Commercial fumigants that have been or are currently in use include Cyanogas, methyl bromide and aluminium phospide. The best and most economical control is obtained with pieces of cane soaked with sodium fluoroacetate and placed at gallery entrances.


Keywords: cats/field efficacy


Keywords: fluorocitrate/brain/metabolism/treatment

Abstract: Experimental energy-deprivation syndromes are known to have toxic effects on brain astrocytes *in vivo* (Cavanagh, *Toxicology*, 49, 131-136, 1988). Some of these toxins are proposed to act on astrocytes alone (fluorocitrate) whilst others are associated with changes in the permeability of the BBB (1,3-dinitrobenzene). Fluorocitrate has been shown to alter metabolism in glial cells and this is proposed to be its main site of action (Hassel *et al.*, *J Neurochem* 62, 2187-2194, 1994). In contrast, 1,3-dinitrobenzene has been shown to alter BBB permeability in vivo (Romero *et al.*, *Neuropath Appl Neurobiol*, 17, 495-508, 1991). The RBE4 cell line (Durieu-Trautmann *et al.*, *J Cell Physiol*, 155, 104-111, 1993) has proved to be a useful *in vitro* model of the BBB. It has been reported that a marginal F-actin distribution is required to maintain the tightness of the tight junctions in brain endothelial cells (Rubin *et al.*, *J Cell Biol*, 115, 1725-1735, 1991). In this study, the effects of fluorocitrate and 1,3-dinitrobenzene on permeability of RBE4 cell monolayers grown on filters was measured and correlated with changes in the metabolism, and F-actin cytoskeleton in the cells. Treatment of RBE4 cells with fluorocitrate and 1,3-dinitrobenzene leads to a decrease in F-actin distribution at the cell margin and a reduction in the F-actin content of the cells at concentrations >0.5 mM. Fluorocitrate significantly reduced and 1,3-dinitrobenzene significantly increased the glucose consumption and lactate production of the RBE4 cells. Fluorocitrate (0.1 to 1 mM) had no significant effect on RBE4 cell monolayer permeability measured by FITC-dextran or 14C-sucrose. However, 1,3-dinitrobenzene (0.5 mM) significantly increased the permeability of RBE4 cell monolayers. These results show that whilst both fluorocitrate and 1,3-dinitrobenzene have significant effects on the RBE4 cell F-actin cytoskeleton and cellular metabolism, only 1,3-dinitrobenzene treatment produces increases in endothelial cell monolayer permeability. These data demonstrate that profound toxic effects on endothelial cell structure and metabolism do not necessarily indicate changes in monolayer permeability.


Keywords: non-target species/birds/1080/possums/secondary poisoning/invertebrates/sodium monofluoroacetate/monofluoroacetate/baits/carrot/poisoning


Keywords: metabolism/biochemistry/enzyme/inhibition

Abstract: A preparation of gently disrupted rat liver mitochondria which shows exposed and easily sedimented Krebs tricarboxylic acid cycle enzyme activities has been characterised further. Results indicate that the Krebs tricarboxylic acid cycle exists as a sequential complex of enzymes, a metabolon, *in situ*.


Keywords: poisoning/rabbits

Abstract: Telemetry was used to determine the patterns of mortality of rabbits, *Oryctolagus cuniculus* (L.), day by day following laying of poisoned bait in the field. Four poisoning methods were studied: 'conventional' 1080 (sodium monofluoroacetate) in oat bait, 'conventional' 1080 in carrot bait, pindone (2-
pivalyl-1,3-indandione) in oat bait, and 'one-shot' 1080 (0.25%, 1%, and 4%) were compared. The relative merits of the various poisoning techniques are discussed.


Keywords: sodium monofluoroacetate/monofluoroacetate/1080/toxicity/humans

Abstract: The highly toxic sodium monofluoroacetate (SMFA) was banned as a rodenticide in the U.S. in 1972. We report the first case of intentional ingestion in this country in over 15 y. A 47-y-old male was brought to the emergency room status post tonic clonic seizure. At 34 h post ingestion, he responded only to noxious stimuli and at 48 h, he was unresponsive to painful stimuli, was intubated and placed on a ventilator. Over the following 3 d, he was became minimally responsive to external stimuli with bouts of agitation and hypertension. Two days later he was discharged with no evidence of neurologic sequelae. We report this patient to increase awareness of SMFA toxicity, and its ability to cause anion gap metabolic acidosis.


Keywords: predators/1080/mammals/field efficacy/USA

Abstract: Coyote populations have been greatly reduced during the past several years in many of the western states. Trapping data from seven localities in the plains and deserts of Wyoming, Colorado and New Mexico suggest that in these areas where control has been vigorously conducted coyotes are now about one-fourth as numerous as they were a decade ago. predator control work by the Fish and Wildlife Service, particularly the employment of 1080 stations, has been largely responsible for his reduction. During the same period, and in teh same areas, populations of bobcats, skunks, badgers and raccoons have greatly increased. This may be due, at least in part, to less commercial trapping. Some of these mammals have been accidentally poisoned or otherwise killed in control operations, but not in sufficient numbers to prevent sizable population increases.


Keywords: acute toxicity/1080/livestock

Abstract: The LD50's and 95 percent confidence limits for sodium monofluoroacetate (1080) were 0.393 (0.247-0.625) mg/kg for Hereford cows 0.221 (0.149-0.327) mg/kg for Hereford steer and heifer calves. This high susceptibility demonstrates the importance of using safe techniques when applying 1080 grain baits for rodent control.


Ref Type: Thesis/Dissertation

Keywords: occurrence in nature


Keywords: metabolism/sodium fluoroacetate/fluroacetate/cyanide/inhibition/citric acid/invertebrates

Abstract: Investigation of pathways of carbohydrate metabolism showed that adult Schistosomatium douthitti appear to depend on glycolysis to a marked degree. The worms were also capable of aerobic metabolism. Histochemical studies demonstrated the existence of the TCA cycle and a cytochrome system. The presence or absence of glucose in the incubation medium had no effect on O2 consumption. Reduction of O2 tension had a severe effect on motility. Oxygen uptake was completely inhibited by tartar emetic and partially inhibited by sodium fluoroacetate and sodium cyanide. Inhibition by sodium fluoroacetate was partially counteracted by citric acid in the medium. Adults showed an oxygen debt following anaerobic incubation. A maximum of 52% of the glucose consumed under aerobic conditions was excreted as lactic acid. Under anaerobic conditions the amount of lactic acid increased. Acids other than lactic acid were also released. It is indicated that although glycolysis is the major pathway, 2 additional aerobic pathways also exist, one which is cyanide sensitive and the other cyanide insensitive.

Keywords: monofluoroacetate/fluoroacetate/fluorocitrate/inhibition/aconitase/rodents/metabolism

Abstract: At concentrations up to 2mM, fluoracetate stimulates gluconeogenesis from L-lactate, possibly by activating pyruvate dehydrogenase. At high concentrations, fluoracetate becomes weakly inhibitory, probably because of fluorocitrate inhibition of mitochondrial aconitase. This inhibition becomes considerably more pronounced when NH-3 is present together with lactate. Difluoroacetate stimulates gluconeogenesis from lactate and increases pyruvate dehydrogenase flux.


Keywords: enzyme/biochemistry/citrate

Abstract: The interaction of a novel fluorinated analogue of citrate, 3-fluoro-3-deoxycitrate (3-fluorocitrate) with the four known citrate-processing enzymes is described in this report. Three of the citrate-processing enzymes, citrate synthase, ATP citrate lyase and citrate lyase, catalyze reversible aldol-type condensations. The fate of 3-fluorocitrate with each enzyme is uniquely related to their mechanisms of action. For citrate synthase, 3-fluorocitrate is a competitive inhibitor. 3-fluorocitrate is a substrate for the carboxylate activation half-reaction catalyzed by ATP citrate lyase and induces a net ATPase action during conversion to 3-fluorocitryl-S-coenzyme A. Because of the unusual mechanism of citrate cleavage catalysed by bacterial citrate lyase, 3-fluorocitrate is a mechanism-based inhibitor, acting at two points during turnover of the acetyl enzyme. The fourth citrate-processing enzyme, aconitase, does turn over 3-fluorocitrate catalytically. This enzyme, catalyzing a dehydration and rehydration of citrate, also catalyzes the elimination of HF from 3-fluorocitrate, yielding cis-aconitate and fluoride.


Keywords: citrate/biochemistry/enzyme/fluorocitrate

Abstract: Bacterial citrate lyase catalytically cleaves the carbon skeleton of the naturally occurring fluorocitrate isomer (-)-erythro-2-fluorocitrate (2R, 3R) with the same regiospecificity as with citrate cleavage.


Ref Type: Conference Proceeding

Keywords: sodium monofluoroacetate/monofluoroacetate/1080/possums/field efficacy/bait shyness


Keywords: field efficacy/possums/1080/sodium monofluoroacetate/monofluoroacetate/aversion/bait shyness/efficacy

Abstract: Shyness to sodium monofluoroacetate (1080) in cereal bait can persist in sub-lethally poisoned possum (Trichosurus vulpecula) populations for at least 2 years. We investigated the use of non-toxic cereal 'prefeed' and 'postfeed' as ways of inhibiting and overcoming such shyness. The postfeed result was also compared with changing to a non-cereal, gel-based 1080 bait. Prefeeding had a significant effect on the number of possums that became 'bait shy' following an approximate LD20 1080 dose, with 97% of non-prefed possums developing an aversion to 1080 cereal bait compared with only 22% of prefed possums. In contrast, postfeeding with cereal was relatively ineffective in reducing the number of 1080 bait-shy possums, with mortality of these possums being 30% compared with 0% of non-postfed possums. In contrast, the gel 1080 bait killed 64% of 1080 cereal bait-shy possums. These results suggest that 1080 bait shyness can be markedly reduced by prefeeding non-toxic bait to possums prior to each control operation. However, this may not be the most cost-effective control option, given the observed efficacy of follow-up baiting with 1080 gel.

Keywords: 1080/possums/bees/efficacy/treatment/New Zealand

Abstract: A new 1080 paste (PTP) was developed by Pest-Tech Ltd. and then evaluated in a series of comparative trials with Pestoff possum paste (POP). The research indicated that PTP was significantly more palatable to captive possums than POP following 57 h of exposure to 'hot' conditions (hot conditions were 30°C for 6 h followed by 18 h at 13°C on a 24 h cycle).

Acceptance by bees was low with significantly less PTP than POP removed by forager bees over a 30 h period. In the field, the control efficacy of both pastes was high (89%-94% kill), with no significant differences between treatments. Based on these results, it is recommend that PTP is registered for possum control in New Zealand.


Ref Type: Report

Keywords: sodium monofluoroacetate/monofluoroacetate/1080/possums

Abstract: RS5 most preferred bait; manipulating prefeeding and cinnamon conc.


Ref Type: Conference Proceeding

Keywords: 1080


Keywords: citric acid/sodium monofluoroacetate/monofluoroacetate

Abstract: The addition of increasing levels of Mn2+, Fe3+, Zn2+, Co2+, Cu2+, Ca2+, sodium monofluoroacetate and methanol during citric acid surface fermentation of spent grain liquor by *Aspergillus niger* (ATCC 9142) was investigated. For spent grain liquor the addition of 51 ppb Mn2+, 5 ppb Fe3+, 75 ppb Zn2+ and 4% (v/v) methanol caused a 4.9, 1.9, 10.9 and 16.8% increase in citric acid yield respectively. In all other fermentations the yield of citric acid was decreased whereas the biomass production in some cases was increased.


Keywords: field efficacy/ground control/target species/rabbits


Keywords: field efficacy/target species/rabbits/baits


Keywords: rabbits/field efficacy/ground control/poisoning/baits/bait shyness


Keywords: metabolism/mode of action/rabbits/sodium fluoroacetate

Abstract: Caged wild rabbits *Oryctolagus cuniculus* (L.), were fed sublethal doses of sodium fluoroacetate ("1080") at different levels and at different intervals. Results show that in some circumstances "1080" can accumulate and cause death and that its elimination from the rabbit is a slow process.

Keywords: sodium fluoroacetate/fluoroacetate/1080/poisoning/pathology/treatment/metabolism/cats/fluorocitrate/enzyme/citrate

Abstract: Fluoroacetate, which is an inhibitor of the tricarboxilic acid cycle, is widely used as a rodenticide. Fluoroacetate is converted in the body to fluorocitrate, which is an inhibitor of the enzyme aconitate hydrase. As a result, energy production goes down, and citrate accumulates. As citrate is a potent chelator of calcium ion, we postulate that ionized calcium concentration in the blood would drop. Fluoroacetate, 0.03 mmol/kg, was injected iv into anesthetized cats. Ionized calcium concentration in anaerobically drawn arterial blood samples was measured with an ion-exchange electrode. Samples were taken immediately before and 40 min after poisoning, after which the animals were either used as controls (six cats) or treated with an infusion of iv CaCl2 (another 6 cats), so as to restore ionized calcium levels to normal values. Forty minutes after fluoroacetate injection, the ionized calcium levels fell by an average of 27.2%, from 1.09 ± 0.07 to 0.79 ± 0.14 mM. There was a corresponding prolongation of the QTc interval of the ECG (r = 0.82). Treatment with CaCl2 significantly prolonged the life of the treated animals as compared to the control animals (p=0.0016 by the Mann-Whitney rank sum test). Our findings suggest that reduced levels of ionized calcium play an important role in the pathogenesis of fluoroacetate poisoning. The reduced levels of Ca²⁺ are an adequate explanation for the toxic effects of fluoroacetate, and may be the missing link between the biochemistry of the poisoning and the clinical manifestations.


Keywords: poisoning/fluoroacetate/humans

S J Zindel and D B Padmanabhan for Appellant and J C Pike for Crown. The Queen vs. Quaid Hutchinson. 7-7-2003. Court of Appeal of New Zealand. [5] The decision to make the aerial drop of 1080 was made in early 2001. In or about March 2001, exercising powers under the Resource Management Act 1991, the Tasman District Council [the Council] granted resource consents, on a nonnotified basis, for the Department of Conservation to apply 1080 to the area by helicopter drop. Mr Hutchinson ascertained (some time in mid March 2001) that a non-notified consent had been granted. Mr Hutchinson was a member of the Golden Bay 1080 Action Group. He had been involved with that Group in opposing the use of 1080 since November 2000.

[6] Eight or nine officers employed by the Department of Conservation stayed at a bach in proximity to the Bait Bin on the evening of 26 August 2001. At about 2.05am on 27 August 2001, one of the officers heard a noise coming from the vicinity of the Bait Bin. He went to ascertain the source of the noise. Using his torch he could see the door of the Bait Bin was open. He called for assistance from the other officers.

[7] On closer inspection, it became clear that bags of bait had been slashed open and diesel oil poured over the 1080 pellets. A crow bar was outside the door to the Bait Bin, on the grass. The two padlocks, which had been removed from the door, were lying outside.

[8] Subsequently, Mr Hutchinson was apprehended. He was charged with burglary and wilful destruction or damage of the 1080 poison on or about 27 August 2001. Mr Hutchinson did not dispute that he was the person responsible for breaking into the Bait Bin and destroying the 1080 pellets.

[9] Nevertheless, Mr Hutchinson entered pleas of not guilty to both charges. Trial by jury was elected. Following a trial on 16 and 17 January 2003 in the District Court at Nelson, the jury returned verdicts of guilty on both counts.

[10] Mr Hutchinson appeals against conviction on both counts. In the event that he is unsuccessful in his appeal against conviction, there is no appeal against the monetary penalty imposed by way of sentence.

Ref Type: Case

Keywords: 1080


Keywords: poisoning/sodium fluoroacetate/fluoroacetate/persistence in water

Abstract: After rodenticide (sodium fluoroacetate preparation) was spread on forest regions by hand at
the rate of 2kg/ha to prevent the forest from rat-injuries, it was investigated in the course of 5 months if the river water near the forest is contaminated by the rodenticide. Sodium fluoroacetate, however, was not detected at all in the river in this investigation.


Keywords: fluoroacetate/metabolism/brain

Abstract: When the slice of rat brain was perfused with a solution containing fluoroacetate (1 or 10 mM), a selective inhibitor of glial metabolism, cytochromes shifted to oxidized levels. The amplitude of evoked potentials tended to decline by a low dose (1 mM) and significantly decreased by a high dose (10 mM) of fluoroacetate. Oxygen consumption of the slice was dose-relatedly lowered by fluoroacetate.


Keywords: fluoroacetate/citrate/metabolism/plasma/blood/pathology

Abstract: The effects of fluoroacetate on ameloblasts were studied in the rat incisor. Fluoroacetate is an inhibitor of tricarboxylic acid cycle and accumulation of citrate occurred in the animal tissue due to fluoroacetate administration. Fluoroacetate injection caused severe morphologic changes in the ameloblasts. The most prominent change was observed in the mitochondria. Reduction of the mitochondrial matrix density was the earliest change followed by varying degrees of matrix swelling. Loss of the matrix granules and disintegration of the cristae were also observed. The difference in the mitochondrial activities in regard to the citrate metabolism was found between the matrix formation stage and the maturation stage in the ameloblasts. Extensive dilatation of the rough-surfaced endoplasmic reticulum and grossly enlarged vacuoles were found mainly in the early maturation stage at 12 and 24 h after fluoroacetate administration. These abnormally large vacuoles seemed to be caused by the water stored within the endoplasmic reticulum cisternae. Accumulation of plasma citrate and decrease of ionized Ca concentration in the whole blood were observed in the fluoroacetate treated group. Fluoroacetate may have caused the lowering of the function of the ameloblasts through the suppression of cell energy production. The secretion of the matrix and calcification of the enamel may have been inhibited.


Ref Type: Report

Keywords: dermal/inhalation/risk assessment/soil/wildlife/regulatory toxicology

Abstract: Executive Summary:

The process of evaluating ecological risks of environmental contaminants comprises two tiers. The first tier is a screening assessment where concentrations of contaminants in the environment are compared to no observed adverse effects level (NOAEL)-based toxicological benchmarks that represent concentrations of chemicals in environmental media (water, sediment, soil, food, etc.); these concentrations are presumed to be nonhazardous to the surrounding biota. The second tier is a baseline cosmological risk assessment where toxicological benchmarks are one of several lines of evidence used to support or refute the presence of ecological effects.

This report presents NOAEL- and lowest observed adverse effects level (LOAEL)-based toxicological benchmarks for assessment of effects of 85 chemicals on 9 representative mammalian wildlife species or 11 avian wildlife species. The chemicals are some of those that occur at U.S. Department of Energy waste sites; the wildlife species were chosen because they are widely distributed and provide a representative range of body sizes and diets. Further descriptions of the chosen wildlife species and chemicals are also provided in this report. The NOAEL-based benchmarks represent values believed to be nonhazardous for the listed wildlife species; LOAEL-based benchmarks represent threshold levels at which adverse effects are likely to become evident. These benchmarks consider contaminant exposure through oral ingestion of contaminated media; however, exposure through inhalation and/or direct dermal exposure are not considered in this report.


**Keywords:** biosynthesis/fluoride/NMR/fluoroacetate/bacteria

**Abstract:** An antimetabolite, THX, was isolated from fermentation broths of the thienamycin producer, Streptomyces cattleya, when the organism was grown in the presence of a fluorine-containing substrate. THX was subsequently identified as one of the four possible stereoisomers of 4-fluorothreonine. Inorganic fluoride or any one of a number of organofluorine compounds can be used as precursors of 4-fluorothreonine. In addition, 19F NMR has provided evidence that the organism synthesizes fluoroacetate under the same fermentation conditions. The in vitro antibacterial spectrum of 4-fluorothreonine is also presented.


**Keywords:** acute toxicity/product chemistry/fluoroacetate


**Keywords:** foxes/predators/sodium fluoroacetate/fluoroacetate/poisoning/rabbits/goats/pigs/rodents

**Abstract:** The red fox (*Vulpes vulpes*) was introduced into Victoria in 1871, and subsequently spread to all parts of Australia except the tropical north and Tasmania. As predators, they are a threat to native species, such as rock wallabies, bettongs and numbskulls. Their biology is reviewed and strategic management of foxes at local and regional levels is discussed. Sodium fluoroacetate has been for poisoning foxes in Australia. For den fumigation, hydrogen phosphide is preferred to chloropicrin. Sensitive habitats have been protected by fox-proof fencing. Recreational fox hunting, as practised in Australia, has had little effect on fox populations. Detailed information on the extent of predation by foxes, and the need for controlling them in specific areas is needed. Other publications in the "Managing vertebrate pests" series have dealt with feral horses, rabbits, feral goats, feral pigs and rodents.


**Keywords:** bait degradation/1080/treatment


**Keywords:** non-target species/metabolism-mode of action/1080/fluorocitrate

**Abstract:** This paper reviews toxicological research involving fluorocitrate, the toxic metabolite of sodium monofluoroacetate (fluorocetate), which is the active ingredient in the pesticide Compound 1080. Many toxicological studies have been done with fluorocetate and the results obtained are actually due to the fluorocitrate because it has been definitely proved that, from a biochemical perspective, fluorocetate is not toxic but fluorocitrate is. The classical explanation of the toxic action of fluorocitrate is that it inhibits the enzyme aconitase in the tricarboxylic acid cycle. Deactivation of aconitase results in decreased energy production by cells and ultimately death of the organism. However, the more recent explanation of fluorocitrate's mode of action is that it binds with mito-chondrial protein with prevents transport of citrate and its utilization by cells for energy production. metabolism studies indicate that only small amounts, perhaps less than 3% of fluorocitrate is formed from fluorocetate. From the limited number of acute and chronic studies conducted with fluorocitrate it does not appear to be as potent as fluorocetate by either the oral or parenteral routes of administration. This decreased level of toxicity is though to be due to the larger molecular weight of fluorocitrate which would not be as readily absorbed by tissues. Central nervous system toxic manifestations (i.e., tremors, convulsions) are characteristic in animals poisoned with fluorocetate. From the limited number of acute and chronic studies conducted with fluorocitrate it does not appear to be as potent as fluorocetate by either the oral or parenteral routes of administration. This decreased level of toxicity is though to be due to the larger molecular weight of fluorocitrate which would not be as readily absorbed by tissues. Central nervous system toxic manifestations (i.e., tremors, convulsions) are characteristic in animals poisoned with fluorocetate. Fluorocitrate administered directly into the brain was found to be 100 times more toxic than fluorocetate. The accumulation of citrate in organs is characteristic of fluorocitrate poisoning; from a quantitative point of view the liver is less affected than the brain, heart, kidney, or spleen. Fluorocitrate causes extensive kidney damage, but the tests are most sensitive to sublethal doses. Testicular damage may be either reversible or irreversible, depending upon the dose. Several plants have the ability to metabolize both fluorocetate and fluorocitrate from either inorganic or atmospheric fluoride.

Savarie, P. J. and Schafer, Jr. Biodeterioration of warfarin, sodium monofluoroacetate (1080), 4-aminopyridine and 3-chloro-4-methylbenzenamine in terrestrial vertebrate pests. Barry, S. and Houghton,
Ref Type: Conference Proceeding
Keywords: persistence in animals/secondary poisoning/metabolism/sodium monofluoroacetate/1080/warfarin/predators/fluorocitrate
Abstract: Warfarin, an anticoagulant rodenticide, is a racemic mixture of two isomers, R-warfarin and S-warfarin. Metabolites of warfarin are 6-, 7-, 8- and 4'-hydroxywarfarin. The major metabolic product of R-warfarin is 7-hydroxywarfarin and the major metabolic products of S-warfarin are 7- and 4'-hydroxywarfarin. The latter possesses one-fourth the anticoagulant activity of warfarin but the other metabolites are inactive. Scavenging mammalian predators can be poisoned by consuming animals killed by warfarin. Tissue residues of 1080, an acute rodenticide and predacide, can also poison mammalian predators although less than 3% of 1080 is converted to the toxic metabolite, fluorocitrate. The major unidentified metabolite of 1080 is nontoxic. 1080 is also metabolised into amino acids, fatty acids and cholesterol.

Ref Type: Conference Proceeding
Keywords: dogs/1080/sodium monofluoroacetate/monofluoroacetate/baits/secondary poisoning/poisoning/ferrets

Keywords: liver/heart/aconitase/biochemistry/fluorocitrate

Keywords: fluoroacetate/1080/sodium fluoroacetate/birds/lethal dose/heart/liver/poisoning/brain/kidney/pathology/diagnosis/symptoms
Abstract: Sodium fluoroacetate is extremely toxic to California quail. Although insufficient birds were available to make an accurate determination of the minimum lethal dose, it was found to lie between 1 and 5 mg/kg of body weight. Death due to a minimal lethal dose of sodium fluoroacetate occurs in about three hours in California quail. The birds first become inactive, standing stationary with fluffed wings and finally assuming a prone position in a comatose state. Death is preceded by a convulsive fluttering of the tail feathers of several seconds' duration. Upon autopsy, the only obvious gross pathological changes are hyperemia of the heart and liver, with extreme fragility of the liver. The general histopathological picture of sodium fluoroacetate poisoning in quail is hyperemia of the brain, liver, lungs, heart and kidney. The heart is further characterised by fatty infiltration and focal areas of interstitial hemorrhages and the liver by sinusoidal engorgement and severe diffuse fatty degeneration. Although pathological changes were produced in quail by sodium fluoroacetate, the lack of specificity precludes pathology as a means of diagnosis for 1080 poisoning.

Keywords: metabolism/mammals/mode of action/rabbits/fluorocitrate/fluoroacetate/persistence in animals/rodents/pigs
Abstract: When living mice were poisoned with (2-14C) fluoroacetic acid, no detectable amounts of fluorocitric acid were found in the organism. Similarly, no fluorocitric acid was found in homogenates of organs of rats, guinea pigs, rabbits and pigs after incubation, with radioactive fluoroacetic acid. However, several amino acids were formed, as can be shown by electrophoresis followed by identification reactions. Two of these are acidic amino acids and behave similarly to fluorocitric acid in paper chromatography.
When pig liver in incubated with unlabelled fluorocitric acid, the information of an amino acid can be demonstrated by a single electrophoresis. 1 mg of this amino acid was purified and contained 9.3% fluorine.


Keywords: teratogenicity/1080


Keywords: foxes/secondary poisoning/persistence in animals/USA/1080/sodium monofluoroacetate/monofluoroacetate/strychnine/zinc phosphide/rats/predators

Abstract: Acute oral LD₅₀ₙₙₙₙₙ to the kit fox (Vulpes macrotis) were determined to be 0.22 mg/kg for compound 1080 (sodium monofluoroacetate), 0.75 mg/kg for strychnine alkaloid and 93 mg/kg for zinc phosphide. One fox died within hours when fed a kangaroo rat (Dipodomys spp.) killed by 0.74 mg of 1080 or 12.8 mg of strychnine, amounts one rat might consume in field baiting programs. However, foxes survived repeated feedings of kangaroo rats each killed by 480 mg of zinc phosphide, equivalent to 3 times the LD₅₀ for a fox and some 29 times the amount one rat might consume in bait.


Keywords: sodium fluoroacetate/fluoroacetate/1080/poisoning/symptoms/herbivores/convulsions/livestock

Abstract: This is a report of losses apparently due to a new product, about which little information is available concerning it's toxicity to farm animals. The following observations in cattle are similar to those reported in sheep.


Keywords: acute toxicity/heart/mammals/non-target species/pathology

Abstract: Fluoroacetate was dosed per stomach tube to 17 Merino sheep at the rate of 0.05 - 1.0 mg/kg/day. The clinical signs, haemodynamic changes, chemical pathology and pathology of acute, subacute and chronically intoxicated cases are described. Tetanic convulsions were seen in acutely intoxicated animals and in them respiratory failure, occurring concomitantly with cardiac failure, may have been the cause of death. Subacute intoxication resulted in less conspicuous clinical signs when the sheep were at rest, but they developed apparent nervous signs of being handled, and later tended to lie down. Chronically intoxicated animals were only mildly affected. At levels of intoxication changes in the chemical pathological parameters were wither absent or were mild and transient. The microscopic lesions in the hearts of acutely intoxicated sheep included degeneration as well as necrosis of individual or small groups of myocardial fibers. In the subacutely and chronically intoxicated animals the multifocal myocardial lesions were more widespread and in various stages of development or resolution.


Keywords: temperature/bacteria/fluoroacetate/inhibition

Abstract: The in situ temperature of the profundal sediment of Lake Constance is constant at 4°C. Methanogenic bacteria could not be detected at 6°C by the most probable number technique using acetate and H₂/CO₂ as methanogenic substrates. Instead homoacetogenic bacteria were detected on H₂/CO₂. At a higher temperature of 20°C however methanogenic bacteria were found. However CH₄ production was observed at both 4°C and 20°C. production of CH₄ was inhibited by chloroform and fluoroacetate and the accumulation of intermediary metabolites was measured.


Keywords: monofluoroacetate/1080/pigs/birds/acute toxicity/symptoms/poisoning/lethal dose/chronic
poisoning
Abstract: The toxicity of sodium monofluoroacetate has been determined for swine and chickens. The characteristic symptoms and lesions have been described for both species. Swine are particularly susceptible to poisoning by this agent. The minimum lethal dose is much less than that reported for the common Norway rat or the horse. Chickens can tolerate slightly larger doses than swine and are slightly more resistant to this type of poisoning than the common rat or the horse. Repeated sublethal doses to chickens show its cumulative effects.

Keywords: acute toxicity/aerial control/aquatic species/bait degradation/birds/cats/deer/diagnosis/field efficacy/ground control/invertebrates/mammals/metabolism/mode of action/non-target species/occurrence in nature/pathology/persistence in animals/persistence in plants/persistence in soil/persistence in water/possums/product chemistry/rabbits/regulatory toxicology/secondary poisoning/target species/treatment/welfare/1080
Abstract: This workshop was convened by the Royal Society of New Zealand in conjunction with Manaaki Whenua - Landcare Research. It brought together 70 scientists and other delegates from wildlife management, animal welfare, and conservation backgrounds from Australia, south Africa, the United States, and New Zealand. The purpose of the workshop was to review and discuss historical and recent research findings, and to identify gaps in our present knowledge. The need for substantial scientific data to provide the foundation for resolving conflicts between 1080 use for environmental protection, and terrestrial wildlife and human resource values was recognised as the principal issue of the meeting.
[Note : Many of the papers from the workshop are indexed separately.]

Keywords: occurrence in nature/chemistry/fluoroacetate
Abstract: Little is known about the chemistry of most species of the genus Acacia, although the genus is quite large and widespread in the warm subarid and and portions of the world. As presently defined, Acacia is a cosmopolitan genus containing in excess of 1350 species. Taxonomic relationships and identification of Acacia species are difficult; new studies of the genus confirm that Acacia is an agglomeration of at least five discrete groups. The major elements of this 'genus' are the groups now recognized as the subgenus Acacia, the genus Faidherbia, the subgenus 'Aculeiferum', relatives of Acacia coulteri, Bentham's series Filicinae, the subgenus Phyllodineae, and possibly others, each with somewhat distinct chemistry. A number of secondary metabolites have been reported from various Acacia species including amines and...
alkaloids, cyanogenic glycosides, cyclitols, fatty acids and seed oils, fluoroacetate, gums, nonprotein amino acids, terpenes (including essential oils, diterpenes, phytosterol and triterpene genins and saponins), hydrolyzable tannins, flavonoids and condensed tannins. The most evident and best known are polysaccharides (gums) and complex phenolic substances (condensed tannins).


Abstract: Fluoroacetate, which is an inhibitor of the tricarboxylic acid cycle, is widely used as a rodenticide. In the body fluoroacetate is converted to fluorocitrate, which is an inhibitor of aconitate hydrase. Energy production decreases and citrate accumulates. As citrate is a potent chelator of Ca-2+ the drop in Ca-2+ concentration in the blood was studied. Fluoroacetate, 0.03 mmol/kg, was injected i.v. into anesthetized cats. Ca-2+ concentration in anaerobically drawn arterial blood samples was measured with an ion-exchange electrode. Samples were taken immediately before and 40 min after poisoning. The animals were then used as controls (6) or treated with an infusion of i.v. CaCl-2 (6) to restore Ca-2+ levels to normal values. After fluoroacetate injection (40 min), Ca-2+ levels fell by an average of 27.2%, from 1.09 ± 0.07 to 0.79 ± 0.14 mM. There was a corresponding prolongation of QTc interval of the ECG (r = 0.82).

Treatment with CaCl-2 significantly prolonged life of treated animals compared to control animals (P < 0.001 by the Mann-Whitney rank sum test). Reduced levels of Ca-2+ apparently play an important role in the pathogenesis of fluoroacetate poisoning. Reduced levels of Ca-2+ explain the toxic effects of fluoroacetate and may be the missing link between biochemistry of poisoning and clinical manifestations.


Abstract: Sodium monofluoroacetate (Compound 1080) has been widely used around the world as a vertebrate pest control agent. Following ingestion of 1080 there is a latent period, during which the compound is metabolised into a toxic form, before the onset of symptoms. The timing of this period varies significantly between species as does the median lethal dose. Traditionally different species have also been classified into groups depending on the primary organ system involved in 1080 toxicosis (cardiac, nervous, or mixed signs/symptoms). However, general acceptance of this method of classification has obscured the fact that several signs of fluoroacetate poisoning are common to most vertebrate species. This paper reviews five decades of literature on the signs/symptoms of fluoracetate poisoning in vertebrates and concludes that there is little justification for the division of animals poisoned by fluoracetate into symptomatic groups.


Abstract: Fluoroacetate (FA), an inhibitor of aconitase, is known to lower the intracellular level of adenosine triphosphate (ATP), which recently has been suggested to be a possible determinant of the form of cell death, apoptosis or necrosis. To investigate which form of germ cell death occurs in FR-induced testicular toxicity, adult Sprague Dawley rats were given a single oral dose of FA (0.5 or 1.0 mg/kg) and euthanized at 3, 6, 12, 24, 48, and 72 h thereafter. Germ cell degeneration was histologically first found in early round spermatids at stage I and in spermatogonia at stages II-IV of seminiferous tubules 6 and 12 h, respectively, after dosing. Degenerating spermatogonia exhibited characteristic features of apoptosis as demonstrated by both electron microscopy and in situ terminal deoxynucleotidyl transferase-mediated dUTP nick end labeling (TUNEL), whereas spermatids did not. At the 24 and 48 h time points, degenerating spermatids were continually present and subsequently formed multinucleated giant cells.
while the number of degenerating spermatogonia and TUNEL-labeled spermatogonia was drastically
and/or significantly decreased compared to those from the control group, indicating that spontaneous male
germ cell apoptosis is inhibited. Coincident with these morphological changes, DNA laddering on gel
electrophoresis was apparent only 12 h after dosing. The results demonstrate that FA induces either
apoptosis or necrosis of male germ cells in the early stage after dosing and subsequently inhibits
spontaneous apoptosis.

Wildlife Diseases* 11, 534-536.
Keywords: fluoroacetamide/1081/poisoning/birds
Abstract: An outbreak of poisoning in four greylag geese (*Anser anser*) and 35-45 teal (*Anas crecca*) is
described. Laboratory findings led to the conclusion that a wheat bait containing the rodenticide
fluoroacetamide (1081) caused the poisoning. Circumstantial evidence incriminated fluoroacetamide as the
cause of death in white-fronted geese (*Anser albiifrons*), mallards (*Anas platyrhynchos*), and chukars
(*Alectoris chukar*).

**Keywords:**
poisoning/fluoroacetate/diagnosis/symptoms/metabolism/citrate/CNS/monoacetin/inhalation/humans

**Abstract:** Fluoroacetic salts belong to the most toxic chemicals. They are used for various purposes, and form stable compounds in some plants. A case of poisoning with ethyl fluoroacetate is presented in detail. Diagnostic problems and therapy which failed due to the late diagnosis and dramatic progress in the symptoms of poisoning are also discussed. Fluoroacetic ion alone is non-toxic but in vivo forms fluorotricarboxylic acid, which blocks cellular metabolism at the citrate stage. Symptoms occur with a delay but lethal synthesis of fluorotricarboxylic acid leads to the irreversible cellular dysfunction, especially in CNS and circulatory system. Poisoning may be treated with monocetin and acetamide. An emphasis is on health hazards resulting from the exposure to fluoroacetate and necessity to observe strictly safety regulations


**Keywords:** metabolism/sodium fluoroacetate/fluoroacetate


**Keywords:** citrate/metabolism/citric acid/inhibition/fluorocitrate/biochemistry

**Abstract:** The rate of intracellular metabolism of citrate plays a major role in determining the amount of citrate excreted in the urine. Fractional excretion of citrate can be increased either by increasing intracellular citrate synthesis from precursors or by inhibiting mitochondrial citrate metabolism. Increased excretion secondary to increased synthesis of citrate occurs when citric acid cycle precursors such as malate or succinate are infused. Increased excretion resulting from inhibition of citrate metabolism occurs when malonate, maleate or fluorocitrate is administered. Systemic acid-base changes cause striking changes in citrate clearance and metabolism.


**Keywords:** non-target species/mammals/baits/1080/marsupials/predators


**Keywords:** inhalation/toxicity/rats/convulsions/liver/kidney

**Abstract:** One of the most potent rodenticides is 2-fluoroacetamide (2-FA). Toxicity of this chemical is well documented. However, its inhalation toxicity data is not available in the literature. Hence, acute inhalation toxicity study was carried out by exposing male and female rats to aerosols of 2-FA at different concentrations for 4 h in a dynamically operated whole body inhalation exposure chamber. During and after the inhalation exposure the rats were less active, and showed mild tremors and convulsions. At higher concentrations the rats died after 2-3 days. The estimated 4-h LC50 for male and female rats was 136.6 and 144.5 mg/m^3 respectively. Exposure to 0.7 LC50 for 4 h duration showed an increase in the liver weight of male and female rats 7 days after exposure. Various haematological and biochemical variables determined were within the normal limits. However, histological findings showed injured lung as indicated by desquamation and necrosis of the epithelium of the respiratory tract. Marked hypertrophy of hepatocytes displaying strong acidophilic granulated cytoplasm was observed. Focal dilatation of renal proximal tubules in kidney with cytoplasmic vacuolation, and irregularly placed pyknotic nuclei were seen. The present study shows that 2-FA is a highly toxic chemical through the inhalation route based on the LC50 value. Consequently necessary precautions should be taken during its handling.


**Keywords:** treatment/metabolism/pathology/1080/defluorination/fluoride/urine/kidney/reproductive effects/bone/fluoroacetate/rats/sodium monofluoroacetate/monofluoroacetate/excretion/inhibition/Krebs
cycle/citrate/testes

Abstract: Rats given 5 ppm F as FAc (equivalent to 26 ppm of NaFAc) in drinking water for approximately 4 months deposited as much fluoride in the skeletal system as did rats receiving 5 ppm F as NaF in the water. Little evidence could be found for the presence of organically bound fluoride in bone after ingesting FAc, though an appreciable proportion of skeletal fluoride deposited when NaF was ingested was shown not to respond to the fluoride ion electrode. The daily urinary excretion of total fluoride after FAc was somewhat greater than after NaF; about two thirds of this fluoride responded to the electrode, whereas more than 90% of the total fluoride after NaF was ionic in nature. The data are interpreted as showing that the rat is capable of splitting the C-F bond in FAc and/or in its fluoride-containing metabolites, with subsequent skeletal storage and renal excretion of the released fluoride ion. The chronic administration of this low level of FAc caused an early but temporary retardation of growth. The Krebs cycle was interfered with, as evidence by increased concentrations of citrate in kidney and urine. At termination of the experiment, histological examination of the testes showed that FAc had induced severe damage characterised by massive disorganisation of the tubules, nearly total loss of functional cells, absence of sperm and damage to the Sertoli cells.


Keywords: invertebrates/pathology/fluoroacetate/developmental toxicity


Keywords: fluoroacetate/monofluoroacetate/bacteria/resistance/metabolism

Abstract: Mutants of *methanosarcina barkeri* 227 resistant to fluoroacetate were isolated from monofluoroacetate-treated cultures. Mutant strain FAr9 was 100 times more resistant to monofluoroacetate than the wild-type strain and was deficient in carbon uptake and CH4 and CO2 production from methyl-labeled acetate. Methanol was assimilated at increased levels.


Keywords: metabolism/defluorination/enzyme/liver/temperature

Abstract: The liberation of free fluoride ion from fluoroacetate (FAc) proceeds as an enzyme-catalyzed dehalogenation reaction in the soluble fractions of several organs of the CFW Swiss mouse. Liver contained the highest FAc defluorinating activity. The enzyme activity in other organs decreased in the order kidney > lung > heart > testes. No activity was detected in the brain. Experiments were designed to characterize and identify the enzyme species responsible for FAc metabolism in liver. Enzyme activity was dependent on the concentration of glutathione (GSH) in the assay mixture, with maximal activity occurring above 5mM. The dehalogenation of FAc had an apparent Km of 7.0 mM when measured in the presence of a saturating concentration of GSH. An increase in the pH of the assay mixture enhanced fluoride release in both phosphate and borate buffer. The defluorination activity was reduced to negligible levels when stored for 24 h at 4EC. The addition of either GSH, dithiothreitol, or 2-mercaptoethanol increased stability, with the latter providing protection for greater than 150 h at a concentration of 15mM. DEAE anion-exchange chromatography separated the defluorinating activity from 90% of the soluble GSH S-transferase activity measure with 1-chloro-2,4-dinitrobenzene. FAc deluorination activity did not bind to a GSH affinity column which selectively separates it from a group of anionic GSH S-transferases. The GSH-dependent enzyme which dehalogenates FAc has unique properties and can be separated from the liver GSH S-transferases previously described in the literature.


Keywords: liver/enzyme/defluorination/rodents/fluoride/metabolism

Abstract: Fluoroacetate-specific defluorinase, an enzyme which catalyzes the release of fluoride ion from the rodenticide fluoroacetate, has been purified 347-fold from mouse liver cytosol and shown to be distinct from multiple cationic and anionic glutathione S-transferase isozymes. The evidence presented suggests
that fluoroacetate-specific defluorinase and glutathione S-transference activities are catalyzed by separate proteins present in the cytosol of mouse liver.


Ref Type: Abstract

Keywords: liver/fluoroacetate/enzyme/biochemistry/metabolism

Abstract: An hepatic defluorinase which specifically catalyses the liberation of fluoride ion from the rodenticide fluoroacetate has been isolated and characterised by biochemical and immunological techniques.


Keywords: fluorocitrate/citrate/bacteria/metabolism/Krebs cycle/aconitate

Abstract: Spontaneous and Tn10 induced fluorocitrate resistant mutants were isolated and characterized. These mutants were unable to grow on either cis-aconitate or DL-isocitrate but were still able to grow slowly on sodium citrate and normally on potassium or potassium-plus-sodium citrate. These mutants were defective in both citrate transport and citrate binding to periplasmic proteins. Tn10 insertion mutants were unable to produce immunologically detectable amounts of the citrate inducible periplasmic C protein previously shown to bind tricarboxylates.

Using a series of tct::Tn10 directed Hfrs the tct locus was accurately positioned at 59 units between srlA and pheA, but was not cotransducible with either gene. In the absence of P22 mediated cotransduction with 16 adjacent chromosomal markers the srlA and tct loci were bridged by using a series of tct flanking Tn10 insertions, and by newly isolated and characterized naldB mutants. In addition the hyd and recA loci were located establishing the gene order in this region of the chromosome as: pheA tct naldB recA srlA hyd cys. Nitrosoguanidine derived tricarboxylate mutations (Imai 1975) were also mapped within the tct locus.


Keywords: inhibition/sodium fluoroacetate/fluoroacetate/fungus

Abstract: Respiration was stimulated by galactose, arabinose and fructose in R. solani and by lactose, xylose and glucose in C. capsici. Most of the amino acids tested stimulated respiration but L-tyrosine and DL-threonine in C. capsici and beta-alanine in R. solani were inhibitory. Metabolic inhibitors showed adverse effects on fungal respiration with the exception of methylene blue and Na malonate in R. solani. Inhibitory effects were less pronounced in R. solani than in C. capsici. Respiratory inhibition by sodium fluoroacetate suggests the presence of a functional TCA cycle in both pathogens.


Keywords: metabolism/persistence in animals/mode of action/citrate/liver/kidney/fluoroacetate/poisoning

Abstract: The citrate content of rat liver changes little when normal rats are starved, when starved rats are re-fed with various diets and when normal animals are made diabetic with alloxan. The citrate content of rat kidney changes little on starvation, but it doubles on induction of diabetes. Fluoroacetate poisoning has relatively little effect on the citrate content of liver under a variety of conditions except that normal female rats show a 2.4-fold increase. Fluoroacetate poisoning leads to increases in the citrate content of kidney under all conditions. The relevance of these observations to the regulation of fatty acid synthesis is discussed. The acteic anhydride-pyridine method and the pentobromocetone method for the estimation of citrate are compared.


Keywords: metabolism/pathology/sodium fluoroacetate/treatment/reproductive effects/developmental toxicity/teratogenicity
Abstract: The effect of various concentrations of 2-deoxy-d-glucose (2DG) and sodium fluoroacetate (SFA) on the QO2 of day-11 and 12 rat embryos was studied in vitro. The dose-response curves - % inhibition versus log concentration - were linear for 2DG between 500 uM and 50 mM; day 11 rat embryos showed a higher rate of inhibition than day-12 embryos and adult kidney tissue. The inhibitory effect of SFA on the embryonic QO2 in vitro was significantly lower than on adult kidney tissue slices. These in vitro effects are in agreement with recent investigations on the energy metabolism of rat embryos that revealed a change from glycolysis to an oxidative, respiratory metabolism during organogenesis. The administration of a single dose of 2DG and SFA to pregnant rats at day 9 or 10 of pregnancy significantly reduced the QO2 and dry weight of the embryos at day 11, where as both parameters were unchanged at day 12. The same treatment was nonteratogenic, which is in contrast to the findings of other investigators.


Keywords: analysis/serum/blood/stomach/kidney

Abstract: A new and in part automated headspace solid-phase microextraction method for quantitative determination of the highly toxic rodenticide fluoroacetic acid (FAA) in serum and other biological samples has been developed. FAA and deuterated acetic acid (internal standard) were extracted from acidified samples by a StableFlex divinylbenzene-Carboxen on polydimethylsiloxane fibre. The acids were derivatised on the fibre in-situ with 1-pyrenyl diazomethane and detected using gas chromatography-mass spectrometry with electron impact ionisation and selected ion monitoring. The calibration curve for FAA in serum was linear over the range from 0.02 to 5 mug/ml, with limits of detection and quantification of 0.02 and 0.07 mug/ml, respectively. The method was also tested with spiked whole blood, urine, stomach contents and kidney samples. It was sufficiently reliable, reproducible and sensitive for use in routine forensic toxicology applications.


Keywords: non-target species/possums/aerial control/ground control


Ref Type: Report

Keywords: baits/persistence in invertebrates/invertebrates/aerial control


Keywords: non-target species/birds/1080/poisoning


Keywords: non-target species/birds/1080

Abstract: The brushtail Possum Trichosurus vulpecula, a herbivorous Australian marsupial, is a serious pest of forest and farmland in New Zealand. Possum numbers are periodically controlled, mainly by aerial distribution of baits containing Compound 1080, ground based trapping, or cyanide poisoning. Poisoning with 1080 kills more non-target birds per hectare than commercial trapping or cyanide poisoning, but is also potentially more beneficial to bird populations because it causes a greater reduction in Possum populations, and hence a greater improvement in the condition of the habitat. There is no evidence that Possum control operations have any detrimental effects on populations survival of the more common bird species present in Possum areas.
Keywords: field efficacy/invertebrates/monofluoroacetate/1080/wasps

Keywords: ground control/field efficacy/invertebrates/wasps

Keywords: baits/honey/poison/1080/sodium monofluoroacetate/monofluoroacetate
Abstract: Baits typically consist of fresh fish or meat. Sugar-based baits are unsuitable because they are attractive to honey bees. Until recently, a slow-acting organochlorine poison called mirex was mixed with baits. This has now been withdrawn from the market but a replacement has not yet been found. At the request of the former New Zealand Forest Service and Department of Conservation, the Forest Research Institute has tested the effectiveness of compound 1080 (sodium monofluoroacetate) as an alternative poison for the control of wasps in areas of high public use.

Keywords: non-target species/birds/possums/baits
Abstract: Baits may be made less acceptable to birds by increasing the strength or slowing the release of cinnamon, or by using a more repellent flavour. Because baits may always be acceptable to some birds, wildlife managers need to know the chances of wild rare birds feeding on baits before approving poisoning operations in areas where they occur.

Keywords: non-target species/invertebrates/birds/1080
Abstract: The impacts on non-target species of 70 aerial 1080-poisoning operation or trials for brushtail possum control in New Zealand between 1978 and 1993 are reviewed> Dead birds were reported from 15 operations on trials; 34 blackbirds were reported from 15 operations or trials; 34 blackbirds, 15 tomtits, 14 chaffinches, nine whiteheads, four moreporks, three fantails, one grey warbler, on robin, one tui and one magpie. Significantly more birds were found dead after operations using carrot baits than after operations using cereal-based baits. Selected bird populations of common, adequately monitored bird species. However, less common bird species (e.g. kiwi, kaka, kakariki, and kokako) have been inadequately monitored , at least for some bait types. Bats, lizards and frogs have not been monitored in any 1080 poisoning operations, and none have been reported killed by 1080. Selected invertebrate populations were monitored in five 1080 poisoning operations. No impact was detected on populations of weta in Waipoua Forest, a range of invertebrate species on Rongitoto Island, predatory insects in Mapara Reserve, or ground-dwelling invertebrates in Puketi Forest and Titirangi Reserve.

Keywords: non-target species/invertebrates/1080
Abstract: Impacts on non-target ground-dwelling invertebrate populations of two aerial 1080-poisonings operations using cereal-based baits for brushtail possum control were monitored in Puketi Forest and Titirangi Scenic Reserve. Invertebrates were collected in 100 pitfall traps in paired poison and non-poison areas. Bait density within 2m of traps in poison areas was measured on the day of poisoning. The traps were open continuously an were emptied monthly twice before poisoning at Puketi, four times before poisoning at Titirangi, and 12 time after poisoning at both sites. Trapped invertebrates were sorted into orders and/or families. Preliminary analysis of counts from five traps in Puketi, 10 traps in Titirangi, and...
10 traps in each non-poison area did not reveal any impact of the 1080 poisoning operations on populations of Acari, Amphipoda, Araneae, three families of Coleoptera, other Coleoptera, Collembola, Diplopoda, Formicidae. Pulmonata and Rhaphidophoridae.

Ref Type: Report
Keywords: non-target species/invertebrates/birds/1080/possums
Abstract: Sodium monofluoroacetate (1080) is used by the Department of Conservation (in cereal-based baits) and by Regional Councils (in carrot and cereal-based baits) during aerial poisoning operation for control of possums (Trichosurus vulpecula) in New Zealand. The impacts of these operations on non-target species of birds, bats, lizards, frogs and invertebrates are reviewed, and priorities for further research are recommended. A Research Co-ordinating Group should be established to implement these recommendations.

Keywords: non-target species/birds/possums
Abstract: An effective bird repellent is required to prevent bird species in New Zealand from eating baits used for the control on introduced mammalian pests, such as brushtail possums and Norway rats. In a dose-response study, cinnamamide mixed into cereal based baits at concentrations of 0.1% and 0.25% (wt/wt) did not significantly reduce bait consumption by captive weka, but 0.5% cinnamamide reduced bait consumption by 83%. Addition of 0.5% cinnamamide to the surface of carrot baits reduced bait consumption by captive kea by 89%, and eastern rosellas by 80% in one trial and 85% in a subsequent trial. Birds exhibited both direct taste repellency and learned taste aversion to cinnamamide. A surface coating of 0.5% cinnamamide on carrot baits did not significantly reduce bait consumption by captive possums, but as little as 0.25% cinnamamide mixed into cereal-based baits reduced bait consumption by captive Norway rates by 53%. These results indicate that 0.5% cinnamamide added to baits could greatly reduce the risks to birds during rodent control operations.

Keywords: non-target species/invertebrates/possums
Abstract: This study was initiated in response to concerns that vertebrate pest control operations in New Zealand may be having deleterious impacts on invertebrate populations and, secondarily, on insectivorous non-target vertebrate populations. Invertebrates feeding on non-toxic baits of the types used for vertebrate pest control were collected and identified. The bait types were diced carrots and three types of cereal-based baits (No.7, RS5, and AgTech). The study was conducted in two rata/kamahi dominated forests (Bell Hill Scenic Reserve and Kopara Forest, West Coast), in July and September 1996. The most common species found on baits was the ant Huberia brouni (Hymenoptera: Formicidae). Other common taxa were Orthoptera (at least eight species of weta including Zealandosandrus aff. gracilis, Gymnoplectron sp., and Pleioplectrion sp.), Coleoptera (at least nine species of beetles including Saphobius nitidulus, Nestrius sp., and Phrynixus sp.), Dermaptera (at least one species of the earwig Parisolabis sp.), Opiliones (at least three species of harvestmen), and Acarina (at least three species of mites). The ants and weta were found predominately on cereal-based baits, and the beetles, earwigs, harvestmen, and mites predominantly on carrot baits. More invertebrates were found on carrot and RS5 cereal-based baits than on the other two bait types, and more on baits at night than during the day. Fewer invertebrates were found on cinnamon-flavoured baits (used for 1080-poisoning of possums) than on plain baits (used for brodifacoum-poisoning of rodents). The number of species and number of individual invertebrates found on baits were a small proportion of the number likely to be present in the forest litter. We predict that vertebrate pest control operations are unlikely to have any long term deleterious impacts on invertebrate populations. This prediction should be tested by monitoring populations of invertebrate species, found to eat baits, during vertebrate pest control operations.

Ref Type: Report
Keywords: non-target species/invertebrates/birds/secondary poisoning/1080/lethal dose
Abstract: Objective: To determine whether insectivorous birds could die as a result of secondary 1080-poisoning, based on the amount of toxin ingested by invertebrates and the number of invertebrates that an insectivorous bird would need to ingest to receive a lethal dose of 1080.

Conclusion: The risk of secondary 1080-poisoning to insectivorous birds is related to the amount of 1080 required to kill the birds and the amount of 1080 that the birds ingest from invertebrates that have eaten bait; Based on published LD50s and the amounts of 1080 measured in invertebrates after 1080-poisoning operations, secondary 1080-poisoning of insectivorous birds is theoretically possible; However, the circumstantial evidence available suggests that direct poisoning of insectivorous birds from eating baits is more likely than secondary poisoning from eating invertebrates that have eaten baits.

Keywords: field efficacy/ground control/predators/1080

Ref Type: Magazine Article
Keywords: 1080/poisoning/baits/poison/invertebrates
Abstract: Weta are potentially at risk from 1080 poisoning for possum control as several species have been observed eating toxic baits. Also some weta collected alive after 1080-poisoning operations have contained residues of 1080. To date, weta populations that have been monitored in poison baited areas have not been affected by the toxin. These results are open to challenge, however, because the methods used to monitor impacts have not included individually marked weta. For example, one study recorded weta calls heard at night and another the number of weta caught in pitfall traps.

To confirm the risk to weta (or not), Eric Spurr and Peter Berben monitored individually marked weta occupying artificial refuges before and after simulated aerial 1080-poisoning (i.e. baits spread by hand). To do this, they set up 10 randomly located artificial refuges (Fig. 1) in each of 20 plots spaced at least 50m apart on a north-facing ridge in Tararua Forest Park in August 1999. From October onwards, the refuges were checked monthly for occupancy by weta and other invertebrates, and any tree weta present were individually marked with coloured paint. In August 2000, 10 of the plots, chosen at random, were sown by hand with 1080 bait at 5 kg/ha. The bait was green-dyed, cinnamon-lured, Wanganui No.7 cereal-based bait containing 1500 ppm (0.15%) 1080. The remaining 10 plots were not baited. The artificial refuges were checked for occupancy by weta and other invertebrates a week after bait application, and then again at monthly intervals for the next 4 months.

Keywords: birds/1080/strychnine/alphachloralose/fenthion/DRC-1339
Abstract: Chemicals used to control bird populations when they cause damage to crops, stock-food, buildings and other structures, and when they are ahzards at places suchas airports, public parks, golf courses and rubbish dumps. They include lethal toxicants (avidcides) and stressing agents, and nonlethal immobilizing agents, repellents and reproductive inhibitors. Lethal methods of control attempt tor educe bird numbers, whereas nonlethal control methods generally attempt to modify bird behaviour without causing mortality as a means of reducing damage.

Keywords: pest/invertebrates/baits/1080/New Zealand/lethal dose/poisoning/residues/non-target species
Abstract: Artificial refuges and mark-recapture techniques were used to monitor the non-target impacts of hand-broadcast applications (simulating aerial application) of Wanganui No. 7 cereal-based baits containing 0.15% (1500 ug/g) 1080 on populations of weta and other invertebrates in Tararua Forest Park, North Island, New Zealand. Wellington tree weta (Hemideina crassidens) and a cave weta (Isoplectron sp.)
were the only species of weta that occupied the refuges. Flatworms, slugs, spiders, harvestmen, amphipods, millipedes, centipedes, cockroaches and beetles also occupied the refuges. Invertebrate numbers in the refuges were monitored for 12 months before and 4 months after bait application on 22 August 2000. Bait application had no significant impact on the numbers of either species of weta, or on slugs, spiders and cockroaches, the most numerous other invertebrates occupying the refuges. Bait application also had no effect on the number of individually marked tree weta resighted in the refuges. Few weta or other invertebrates were observed on baits at night. The concentration of 1080 in a cave weta collected alive from a bait, and a tree weta collected alive from outside an artificial refuge was less than 10% of the average lethal dose. The results indicate that 1080 poisoning for vertebrate pest control is unlikely to have any negative impact on populations of weta or the other invertebrates monitored.

Keywords: citrate/metabolism/enzyme
Abstract: Citrate has always occupied an important position in metabolism and several recent observations have added new dimensions to its role in living processes. A significant observation was that of Brady and Gurin who found that the rate of fatty acid synthesis by a crude soluble enzyme system was greatly stimulated by citrate. This observation eventually led to the recognition of three metabolic functions for citrate in addition to its role in the Krebs cycle and ATP production: a source of reducing power, a source of acetyl groups for biosynthetic pathways and a controlling (activating or inhibiting) substance for a number of enzymes.

Keywords: fluoroacetate/baits/fluoride/analysis
Abstract: A simple screening test, based on the reaction of the fluoride ion with the ion-selective fluoride electrode, has been developed for fluoroacetate in baits and biological samples. Positive results have been obtained in diagnostic cases. The method is not specific for fluoroacetate, but other fluoride-containing compounds are not likely to be present in the extract. Positive responses to the test should be confirmed as fluoroacetate by another method, such as the official AOAC method or by gas chromatography-mass spectrometry.

Keywords: product chemistry
Keywords: mode of action/product chemistry/fluorocitrate/aconitase
Keywords: bait degradation/rabbits/deer/possums/sodium monofluoroacetate/zinc phosphide/withholding period
Abstract: The rate of removal of sodium fluoroacetate (1080) from chopped carrot treated with the poison at a rate of 1/2 lb or 1 lb per ton and then exposed to weather has been studied. The rainfall pattern is an important factor in the weathering of poisoned rabbit baits but it is not possible to lay down specific rules about the time that domestic stock should be kept off recently-poisoned areas. The trials showed that the baits became harmless to stock more quickly when that carrot was cut thin and when the amount of 1080 recommended for rabbits i.e. 1/2 lb per ton of carrot, was not exceeded. When opossums or deer are to be poisoned in areas that are not to be restocked with domestic animals larger pieces of carrot and high levels of 1080 i.e. 2 lb per ton are indicated. in order that baits should remain toxic for as long as possible.

Keywords: bait degradation/field efficacy/sodium monofluoroacetate/monofluoroacetate/baits/carrot
Ref Type: Report
Keywords: 1080

Keywords: fluoroacetamide/testes/reproductive effects

Keywords: fluorine
Abstract: Natural fluorine concentrations are reported in the skeletons of birds, fish, small mammals, cattle and sheep, sampled in the Bluff area of New Zealand. Expressed on a bone-ash basis the values obtained were: 142-8050 ppm for nine species of birds; 100-4554 ppm for six species of fish; 13-357 ppm for six species of shellfish; 184-278 ppm for opossums and rabbit; and 19-1469 ppm for cattle and sheep. Comparisons with published data indicate that the natural levels of fluorine in the fauna of the Bluff area are, in general, similar to levels found elsewhere in the world.

Keywords: mode of action/persistence in animals/fluoroacetate/brain/heart/blood/rodents/symptoms/citrate/Krebs cycle
Abstract: Treatment of rats with fluoroacetate resulted in two phases of behaviour (i) a sedated phase followed by (ii) a tonic extensor convulsive phase. The levels of various labile metabolites such as citric acid, lactic acid, ammonia, free glucose and glycogen, were measures at these two phases in heart, brain and blood. In heart the citric acid level rose in both of the phases, however in the brain the level of this metabolite fell at the convulsion following an initial rise during the sedative phase. This alteration in the citrate content of brain could have profound effects on the tricarboxylic acid cycle as a whole and also on the level of compounds, such as GABA, related to the cycle. The implications of such alterations on the overall behavioural patterns are discussed.

Keywords: 1080/wallaby
Abstract: In the past two decades there had been considerable conflict concerning social, economic and environmental aspects of plantations in Victoria. The issues have included: the change of land use from agriculture to forestry; the use of 1080 to control browsing animals and vermin; aerial application of herbicides; perceived human health hazard from plantation disease such as Pine Needle Blight; and recently, the implications of genetic engineering in plantation forestry. These concerns have been fought as single issues in some cases and collectively in others in a wide range of forums. In some instances strident opposition has resulted in direct action to halt plantation works. Conflict about use of 1080 in plantation development in Gippsland (in southern Victoria) provides a useful case study of the way in which a single issue can impact on the public perception of plantations and influence plantation management practices. Initial responses to these concerns included ‘do nothing’, communication to the relevant groups rationale for the plantation program, and the use of scientific facts to dispel arguments about specific environmental impacts. This approach met with limited success. In 1986, public participation was engaged seriously in the broad debate on plantations for the first time by way of a Plantation Impact Study initiated by government. This and subsequent forestry inquiries have failed, however, to deliver universal support for plantation forestry. Such a goal is probably unrealistic given that the basis for conflict is continually changing in response to changes in socio-economic factors and scientific knowledge. Lessons have been learned, however, by all parties involved in the debate on these issues and a number of principles are generally agreed as a means of moving forward: identify and understand issues early; research issues and make relevant knowledge available; adopt the concept of informed consent; develop a framework for
genuine public participation; and make a sincere commitment to participate with the public in resolving questions about the risks and benefits of plantation forestry.


Abstract: From the results of experiments conducted upon thirty-two rabbits it appears (a) that the continuous ingestion of leaves or underground stems of gifblaar does not induce the development of tolerance to this plant; and (b) that the active principle of gifblaar has cumulative effects, that is, it is inactivated in the body or excreted at a very slow rate. It is also possible that repeated small doses of the plant may cause progressive damage to organs of vital importance (heart) and that the sum total of these consecutive and progressive lesions is sufficient to cause death in spite of the fact that the active principle has been partly or completely excreted.

There also was a certain amount of evidence that some animals became sensitized to the effects of the plant, unless we accept that these animals possessed an idiosyncrasy to gifblaar.


Abstract: During the course of investigations into the toxicology of aliphatic fluorocompounds, it was noted that trifluoroethanol (TFE) produced testicular damage in the rat. Fluoroacetate (FAc) is already recognised as a testicular poison, and it seemed worthwhile to compare effects of this nature produced by each compound. Previous work in our laboratory showed that 20 ppm of FAc in drinking water decreased the testis weight, elevated citrate concentration in the testis and produced early signs of seminiferous epithelial damage and involved both spermatocytes and spermatids. Early signs of regeneration were evident by 7 days post-treatment, but this was not complete at 21 days. New information from a breeding experiment extend these morphological observations through a 10 week post treatment period. Also, reproductive performance was impaired after 1 week post treatment, completely inhibited 3 to 6 weeks post treatment and improved thereafter, being near normal when the experiment was terminated after 12 weeks. No unusual incidence of gross abnormalities was seen in the fetus taken 11 days post-conception. The 2-hour LC50 for male rats inhaling TFE was 4850 ppm (deaths were recorded at 24 hours post exposure). Damage to spermatocytes, spermatagonia and Sertoli cells were observed at 400 ppm for 2 hour, the lowest concentration used in the LC50 determination and persisted for at least 86 hours post exposure. Single doses of 50 mg TFE/kg of injected ip induced similar testicular damage through 7 days postinjection. TFE was not defluorinated in vitro by a rat liver fraction capable of defluorinating FAc. TFE appears to differ somewhat from FAc in that a former compound affects spermatogonia whereas FAc does not.


Abstract: Rats receiving 20, 6.6 or 2.2 p.p.m. sodium fluoroacetate in the drinking water were killed daily during the 7 day treatment and at more widely spaced intervals in the succeeding 21 days. Testicular weight and ATP concentrations decreased in rats receiving 20 or 6 p.p.m fluoroacetate, while citrate concentrations were elevated and morphological damage was seen in the tests of all the treated rats. Initial cellular changes common to the three treatment groups included altered appearance and decreased numbers of spermatids, and formation of spermatid and spermatocyte giant cells. At the two higher concentrations, damage progressed to marked seminiferous tubule atrophy. Regeneration of the seminiferous tubules was complete by 7 days after treatment, in the rats given 2 p.p.m but regeneration was not complete by Day 21 after treatment in those receiving the higher doses. Spermatogenesis was abnormal in some instances.
during the regeneration period in these groups. The findings are consistent with impaired energy production via blockage of the Krebs cycle, and subsequent impairment of carbohydrate metabolism through the Embden-Meyerhof pathway.

Ref Type: Report
Keywords: 1080/persistence in water/invertebrates/aquatic species/aerial control
Abstract: Streams, sediment and aquatic invertebrate samples were monitored in following an aerial drop in Haupiri State Forest. No 1080 was detected in any of the water samples collected. No major changes to the invertebrate communities was observed, except for a decrease in the total number of taxa collected in some streams five days after the 1080 drop. There was also a slight decline in the number of EPT taxa collected 5 days after the drop. Such decreases were not evident in the control site. However, both taxonomic richness and the number of EPT taxa found in streams 14 days after the drop were generally higher than those observed before the drop. It is thought that these changes most likely reflect effects of a small-scale flood event that occurred prior to the 1080 drop.

10 Kyle Street, Riccarton, Christchurch
P O Box 8602, Christchurch, New Zealand
Phone +64-3-348 8987, Fax +64-3-348 5548
www.niwa.co.nz.
Ref Type: Report
Keywords: baits/sodium monofluoroacetate/monofluoroacetate/1080/New Zealand/invertebrates/muscle/gut/analysis/tolerance/predators/secondary poisoning/poisoning/humans
Abstract: The effects of pollard baits containing sodium monofluoroacetate (1080) on New Zealand freshwater crayfish (Paranephrops planifrons) i
This study assessed whether native crayfish (Paranephrops planifrons) consumed 1080 baits in preference to their natural food source of decomposing leaf litter and invertebrates, and determined whether ingestion of such pollard baits resulted in crayfish mortality. It also assessed whether residual 1080 remained in crayfish muscle and gut viscera after exposure of these animals to 1080 baits.
2. The experiment was conducted on the NIWA campus in Christchurch in a "stream simulator", consisting of a 5 m x 1 m long riffle section and 3.5 m long x 3.0 m wide pool (1 m deep) through which clean groundwater water flowed at a rate of 5 l s-1. Water was discharged to the reticulated sewer system to avoid accumulation of 1080 in the simulator. This simulator was divided into an upstream riffle section, and a downstream pool section. Twenty-five cages (15 cm x 50 cm: mesh size 15 mm) were placed in each of these habitat types. Small plastic PVC pipes and large cobbles were also placed in each cage to give the crayfish shelter.
3. Crayfish were collected from streams on the West Coast, and transported to Christchurch. Single crayfish were placed into each cage and left for 1 week to acclimatate, after which time a single 1080 bait (mean weight = 6.4 g) containing c. 0.15% 1080 (i.e., 9.6 mg) was added to 20 of the cages. Non-toxic baits were also added to 5 control cages within each habitat. A further 5 crayfish were kept in separate aquaria for the duration of the experiment to act as a double control. Replicate crayfish were collected at random from both the riffle and pool habitats after 1, 2, 4 and 8 days and frozen pending analysis of residual 1080 in their viscera or tail muscle. The crayfish fed the non-toxic baits, and those placed in the aquaria were also collected after 8 days, frozen and analysed for presence of 1080. Water samples were also collected at regular intervals for analysis of dissolved 1080.
4. Observations of the crayfish over time showed that some had moved the pollard baits into or near their PVC pipes, while others had consumed some baits. The fact that detritus was also present in the cages suggested that pollard baits may represent a more favourable food item to crayfish than detritus. Despite the direct consumption of 1080 baits by crayfish, no mortality
was observed during the study, even after 8 days when the experiment was terminated.
5. Analysis of crayfish viscera and tail muscle confirmed that crayfish had consumed baits. The highest 1080 concentration found in the viscera was 3.3 mg kg-1 of body tissue, while up to 5 mg kg-1 of 1080 was found in the tail muscle. There was no significant difference in concentrations of 1080 in animals placed in either pools or riffles, and 1080 concentrations decreased over time. The highest total concentration of 1080 found within a particular crayfish (7.7 mg kg-1) suggested that c. 80% of a pollard bait had been consumed by this individual, assuming that each bait contained 9.6 mg of 1080.
6. The amount of 1080 found in the tail muscle was significantly related to the amount found within the viscera, suggesting that what each animal consumed was being transferred to muscle tissue. The 1080 body burden of animals collected 2 and 4 days after being exposed to the 1080 baits was related to their body size, suggesting that larger animals consumed more of the baits. The significant decline in 1080 concentration in the muscle tissue between days 4 and 8 suggests that crayfish that consumed sub-lethal doses of 1080 were able to successfully metabolise this compound.
7. Water samples collected from the outlet of the stream simulator for 1080 analysis showed that the highest concentration of 1080 (1.1 µg l-1) occurred after 2 days. No residual 1080 was detected in the water after 8 days.
8. Crayfish that were fed control (non-toxic) baits had no residual 1080 in their viscera or tail muscle, despite being exposed to the very low concentrations of 1080 in the water within the stream simulator. Lack of detectable 1080 in control animals suggests that contaminant loadings in the animals exposed to the toxic baits reflected direct consumption of 1080 pollard baits, and not exposure to water containing traces of 1080.
9. Lack of crayfish mortality may reflect their naturally high tolerance to 1080, or the fact that they were exposed to only 1 pollard bait. It is, however, theoretically possible that crayfish in natural streams could encounter more than 1 pollard bait within their territory, and consume them. Whether consumption of more than 1 bait by an individual is enough to cause mortality is unknown.
10. The main ecological implication of crayfish consuming 1080 baits is the potential for predators becoming susceptible to secondary poisoning. The main predators of crayfish are eels, trout and humans. A theoretical risk may exist to humans if they consume crayfish caught from within operational areas and which still contain a significant body-burden of residual 1080.
11. Such risks could be minimised by changes to operational practices. In operational areas where crayfish are likely to occur, aerial flight plans could be varied to minimise the chances of overflying streams in the latter part of the day, as crayfish are mostly nocturnal feeders. 1080 leach rapidly from pollard baits, so baits that land in streams in the early part of the day would have little residual 1080 left in them after sunset. The risk of crayfish accumulating 1080 from such baits is greatly reduced. Consideration should also be taken to warn the public against harvesting crayfish from streams within any operational areas for a period of time after the cessation of the aerial drop.

Keywords: metabolism/mode of action/aconitase/fluorocitrate/bacteria/inhibition/fluoroacetate
Abstract: Both fluorocitrate and fluoroacetate acted on yeast aconitase as an inducer and a stabilizer of the enzyme. Fluoroacetate appeared to function after conversion to fluorocitrate in the cells. Inhibitors of protein synthesis and terminal respiratory system showed a strong inhibitory effect on the inductive formulation of aconitase. In addition, these fluorocompounds were also found to induce various microbial aconitases.

Keywords: mode of action/metabolism/Krebs cycle/fluorocitrate/fluoroacetate/brain
Abstract: The Krebs cycle inhibitor fluorocitrate (FC) and its precursor fluoroacetate (FA) are taken up in brain preferentially by glia. These compounds are used experimentally to inhibit glial metabolism in situ.
The actions of these agents have been attributed to both the disruption of carbon flux through the Krebs cycle and to impairment of ATP production. We used primary astrocyte cultures to evaluate these two possible modes of action. Astrocyte ATP levels exhibited little or no reduction during incubation with 0.5 mM FC or 25 mM FA. Correspondingly, FC and FA caused less than 30% reductions in glutamate uptake ($P > 0.05$), an important energy-dependent astrocyte function. Carbon flux through the Krebs cycle was assessed by measuring astrocyte glutamine production in the absence of exogenous glutamate or aspartate. Under these conditions, glutamine production was reduced $65 \pm 5\%$ by 0.5 mM FC and $61 \pm 3\%$ by 25 mM FA ($P < 0.01$). In contrast, FC and FA had no effect on glutamine production when 50 mu M glutamate was provided in the media. These findings suggest that the metabolic effects of FC and FA on astrocytes in vivo result from impairment of carbon flux through the Krebs cycle, and not from impairment of oxidative ATP production.

Sweetapple, P. J. (1995). Effectiveness of foliage bait poisoning for deer : development of a plasma marker for deer and a toxic field trial. (Manaaki Whenua - Landcare Research: Lincoln.) Keywords: field efficacy/deer/1080

Abstract: Objectives : To determine whether orally administered iophenoxic acid provides an effective plasma marker for red deer and identify the quantities needed per bait for use in non-toxic bait-acceptance field trials; To determine the percentage of a low-density forest-dwelling deer population killed using toxic foliage baits and the cost of achieving that level of control. Conclusion : Iophenoxic acid is an effective plasma marker for use in red deer bait acceptance trials, with only 0.3 mg/kg required to mark red deer for at least 40 days, and 3-6 mg/kg probably marking red deer for at least 6 months. The plasma marker can be used to determine the number of marked baits eaten by red deer; The cost of baiting forest with 2 baits/ha is likely to be about $6.00/ha, compared with about $20/ha for aerial poisoning. Actual cost will depend on wage rates, accessibility and topography of the poison area, and availability of broadleaf material; At least some deer accept foliage baits even when deer densities are low. Deer did not appear to selectively avoid baited leaves. Because shade-grown broadleaf foliage retains toxic leaves longer than other foliage types and is of similar palatability, it is the best broadleaf foliage type for 1080 foliage baits; The trial did not reduce deer densities in the poison area, but this failure may simply reflect the low concentration of 1080 in the gel. The large number of baits browsed indicate that it is likely that some deer would have been killed had the toxic gel contained 10% 1080.


Abstract: Very little is known about the in vivo behavior of sodium monofluoroacetate (FAc). We have studied the disposition, excretion and metabolism of this compound up to four hours after the intravenous injection of the (18F)-labelled material of mice. There was no tissue specific accumulation of the compound itself, however bone accumulation of (18F) activity was significant. Comparison to (18F)-NaF data and the demonstration of (18F)-fluoride in the blood supported the concept of metabolic defluorination of FAc.

Szerb, J. C. and Issekutz, B. (1987). Increase in the stimulation-induced overflow of glutamate by fluoroacetate, a selective inhibitor of the glial tricarboxylic cycle. *Brain research* 410, 116-120. Keywords: mode of action/brain/Krebs cycle/fluoroacetate

Abstract: Fluoroacetate is known to be taken up selectively by glia, where after forming fluorocitrate, it inhibits the tricarboxylic acid cycle. Since uptake into glia has a major role in the inactivation of synthetically released glutamate, the effect of fluoroacetate on the overflow of glutamate evoked by electrical field stimulation in slices of rat hippocampus was investigated. In agreement with previous reports, 1 mM Fluoroacetate reduced the release and content of glutamine, but increased only slightly the overflow of glutamate induced by stimulation. If, however, 0.5 mM glutamine was added to the superfusion fluid, Fluoroacetate nearly tripled the overflow of glutamate evoked by electrical field stimulation. The large glutamate overflow due to field stimulation in the presence of fluoroacetate was fully Ca2+ -
dependent. Results confirm the major role of glia in the inactivation of glutamate. The absence of such an uptake may contribute to the in vivo convulsive effect of fluoroacetate.


Abstract: Selection of an insecticide-susceptible house fly, Musca domestica L., strain with fluoroacetate produced moderate resistance to fluoroacetate during the first 65 generations of selection. After the 75th generation, resistance increased sharply, reaching 500 µg of fluoroacetate per fly at the 81st generation of selection.

Selection with fluoroacetate for 57 generations caused a 200-fold increase in DDT-resistance. After further selection, this high level dropped gradually to 8-fold only. An 8000-fold increase in resistance to dieldrin was observed after 25 generations of selection with fluoroacetate. During the next 20 generations this high level of dieldrin resistance declined considerably.

When selection with fluoroacetate was discontinued after the 17th generation, the levels of DDT and dieldrin resistance were maintained for another 40 generations. Later on they declined, while always remaining above those of the corresponding strain, selected continuously with fluoroacetate.

No resistance developed to the organophosphorus insecticides parathion, malathion, and trichlorfon.


Abstract: Two cases are reported of severe acute fluoroacetamide poisoning in man, with successful treatment of the life-threatening cardiac arrhythmias by the administration of calcium chloride. The arrhythmias were preceded by prolongation of the QT interval in the ECG. Calcium chloride therapy restored to normal the markedly prolonged QT interval.


Abstract: As a part of our work on synthetic studies of chiral monofluoro compounds and molecular design of efficient reagents for optical purity determination, we focused on novel alpha, alpha-disubstituted alpha-fluoroacetic acids (8a-d) (R-1 = Me, Ph; R-2 = C tbd CPh, Me, Bu). The ethyl esters (13a-d) were prepared by introduction of alkyl groups into the appropriate alpha-keto acids (9a,b) followed by fluorination of the corresponding hydroxy-esters (12a-d) with diethylaminosulfur trifluoride (DAST). For comparison with Mosher's reagent (2-methoxy-2-trifluoromethylphenylacetic acid, (MTPA)), the ethyl esters (13a-d) were converted into three representative diastereoisomers, (14a-d), (15a-d), and (16a-d), and 19F-nuclear magnetic resonance (19F-NMR) chemical shift differences between pairs of diastereoisomers (DELTA-delta) were obtained. These alpha, alpha-disubstituted alpha-fluoroacetate derivatives have much larger DELTA-delta values than the corresponding derivatives of MTPA, which strongly indicates that the acids (8a-d) can potentially be better reagents for ee determination than MTPA. The influence on the DELTA-
delta values of the steric effects which arise upon introduction of the two substituents (R-1 and R-2) on the fluorine-bearing chiral center is also discussed


Abstract: Streptomyces cattleya produces fluoroacetate and 4-fluorothreonine from inorganic fluoride added to the culture broth. We have shown by F-19 nuclear magnetic resonance (NMR) spectrometry that fluoroacetate is accumulated first in the culture broth and that accumulation of 4-fluorothreonine is next. To show precursors of the carbon skeleton of fluoroacetate, we carried out tracer experiments with various C-14- and C-13-labeled compounds. Radioactivity of [U-C-14]glucose, [U-C-14]glycerol, [U-C-14]serine, and [U-C-14]beta-hydroxypyruvate was incorporated into fluoroacetate to an extent of 0.2 to 0.4%, whereas [3-C-14]pyruvate, [2,3-C-14]succinate, and [U-C-14]aspartate were less efficiently incorporated (0.04 to 0.08%). The addition of [2-C-13]glycerol to the mycelium suspension of Streptomyces cattleya caused exclusive enrichment of the carboxyl carbon of fluoroacetate with C-13; about 40% of carboxyl carbon of fluoroacetate was labeled with C-13. We studied the radioactivity incorporation of [3-C-14], [U-C-14], and [1-C-14]beta-hydroxypyruvates to show that C-2 and C-3 of beta-hydroxypyruvate are exclusively converted to the carbon skeleton of fluoroacetate. These results suggest that the carbon skeleton of fluoroacetate derives from C-1 and C-2 of glycerol through beta-hydroxypyruvate, whose hydroxyl group is eventually replaced by fluoride.


Abstract: Streptomyces cattleya NRRL 8057 produces monofluoroacetate and 4-fluorothreonine from inorganic fluoride. Mutants blocked in fluorometabolite production were prepared by chemical mutagenesis, and cosynthesis experiments with these blocked mutants were carried out by suspending cells of one blocked mutant in the supernatant broth of another blocked mutant. The harvest age of the cells, pH of the buffer, potassium fluoride concentration and glycerol supplementation were optimized for the monofluoroacetate production by a resting-cell suspension of S. cattleya. Successful cosynthesis with pairs of the mutants characterized four distinctive blocked sites in the order N-82, N-44, N-43 and N-47. Additional preparation of blocked mutants by UV irradiation and their cosynthesis assay confirmed that U-303, U-304, U-400 and U-500 were blocked in later steps than N-47. O'Hagan et al. recently proposed that fluoroacetaldehyde, the hypothetical precursor of monofluoroacetate and 4-fluorothreonine, derives from 5'-fluoro-5-deoxyadenosine, the first fluorinated metabolite synthesized from S-adenosyl-L-methionine and inorganic fluoride by the novel enzyme 'fluorinase'. We were able to detect fluorinase activity in crude extracts of wild type and N-47 mutant strains, but not in the other mutant strains whose blocked steps flanked that of N-47.


Abstract: The adsorption removal of benzalkonium chloride disinfectant by granular activated carbon is discussed. The adsorption isotherm of benzalkonium chloride was expressed by the Freundlich equation. A significant correlation was found between the amount of benzalkonium chloride adsorbed in less than 1000 ppm of equilibrium concentration and the micropore volume of activated carbon. As for the adsorption rate, a change in intraparticle diffusiveness was found with increasing adsorption ratio. No significant correlation between the value of intraparticle diffusiveness and the properties of activated carbon was found. It was concluded that the micropore volume of activated carbon was the dominant factor in the adsorption removal of benzalkonium chloride by granular activated carbon.


Abstract: Fermentative production of citric acid from methanol by an isolated yeast, *Candida* sp. Y-1, was
investigated using a medium containing fluoroacetate, a potential inhibitor of aconitase. Culture conditions were optimized, and the results showed that efficient production of citric acid required several factors; (1) the optimum concentration of fluoroacetate, (2) an addition of yeast extract with corn steep liquor, (3) a low nitrogen source concentration, and (4) strictly aerobic conditions. We then isolated a fluoroacetate-resistant mutant strain MA92 with threefold higher citric acid productivity than the wild strain. This mutant strain had lower aconitase activity than the wild strain and produced 4.6 g/l citric acid from methanol after 4 days of culture.

Ref Type: Magazine Article
Keywords: possums/poison/1080/anti-1080

Keywords: fluoroacetate/mode of action/inhibition/aconitase/metabolism
Abstract: In summary, there is a parallel between the observed effects of fluoroacetate reported in this paper and the metabolic actions of insulin. Both agents lower cAMP, decrease lipolysis and lipolytic production, accelerate glucose transport, activate pyruvate dehydrogenase, and increase lipogenesis. However, there are certain quantitative differences observed between the effects of these agents such as the fluoroacetate-induced inhibition of aconitase and pyruvate dehydrogenase kinase and the insulin-induced activation of a low Km phosphodiesterase. However, where the actions are similar, it is tempting to speculate that a primary event such as the reduction in cAMP could be responsible for the anabolic pattern of glucose metabolism observed.

Keywords: metabolism/fluoroacetamide/NMR/treatment/fluoroacetate/kidney/excretion/flouride/fluorocitrate/mode of action
Abstract: Fluoroacetate administered intraperitoneally (ip) to rats and mice is defluorinated to give fluoride ion evident in urine and kidney by 19F NMR. The use of (2-13C)-,(1,2-13C)- and (1,2-14C) fluoroacetate, prepared from isotopically labeled glycine, combined with 13C NMR as TLC radioautography, respectively, reveals a complex mixture of urinary metabolites including S-(carboxymethyl) conjugate complex in rats and mice and sulfoxidation products thereof in rats. Direct 13C NMR examination of the bile following treatment with (2-13C) fluoroacetate shows the presence of S-(carboxymethyl) glutathione or a related conjugate and an O-conjugate of fluoroacetate. Incubation of (13C) fluoroacetate with rat and mouse liver cytosol involves formation of S- ((13C) carboxymethyl) glutathione and fluoride ion. Fluoroacetate is also detected by 19F NMR examination of fluoroacetate incubations with mouse liver cytosol. Fluoroacetamide administered ip to rats and mice yields urinary fluoride ion formed via fluoroacetate which is liberated on hydrolysis by and organophosphate-sensitive amidase. 19F NMR chemical shifts of other metabolites of Fluoroacetamide are consistent with fluoroacetohydroxamic acid in the liver of mice and Fluorocitrate in the urine of rats. Fluoroethanol gives urinary fluoroacetate and fluoride ion in rats and mice is converted to fluoroacetaldehyde by mouse and rat liver microsomes (-) and (+)-erythro-fluorocitrate administered ip rats yield mostly the parent compounds in urine at 6 h with increasing amounts of fluoride ion thereafter 19F NMR establishes that rat and mouse liver cytosol defluorinate (-) but not (+)-erythro-Fluorocitrate and pig heart aconitase also defluorinates (-) erythro-fluorocitrate. Metabolic defluorination of fluoroacetate and its progenitors, fluoroacetamide and fluoroethanol, is therefore attributable to both conjugation of fluoroacetate with glutathione and conversion to (-) erythro-fluorocitrate which is both an inhibitor of and a substrate for aconitase. 13C NMR spectra of urine of rats and mice poisoned with fluoroacetate or (-) erythro fluorocitrate show elevated citrate and glucose and diminished urea consistent with disruption in the tricarboxylic acid cycle and ammonia metabolism.

Abstract: Conclusions from this study are that it is unlikely that anyone would suffer adversely from consuming a normal cooked portion of SMFA-killed duck meat. More information about the kinetics of SMFA in man would be needed to determine levels of this substance when poisonings occur to achieve a better understanding and management of human toxicity.

Keywords: non-target species/birds/1080/poisoning/humans/secondary poisoning/residues

Abstract: The effect of fluorocitrate on oxidative reactions and energy production systems of rat liver mitochondria has been studied. It was shown that oxidation of endogeneous substrates and malate with pyruvate as well as the phosphorylation of the added ADP were inhibited by fluorocitrate. Inhibition of oxygen consumption by fluorocitrate induced the efflux of Ca2+ ions from mitochondria and a decrease in the Ca2+-accumulating capacity. The effect of fluorocitrate on Ca2+ transport in mitochondria is due to activation of the Ca-efflux pathway in those sensitive to Ruthenium red.

Keywords: fluorocitrate/liver/inhibition

Abstract: The adsorption characteristics of paraquat and diquat onto activated carbon in vitro were discussed for the primary treatment of acute poisoning by accidental, suicidal or homicidal ingestion of paraquat containing herbicides. Paraquat was adsorbed onto activated carbon more abundantly and more rapidly in physiological saline solution than that in artificial gastric juice and distilled water. Most suitable solvent for paraquat removal by activated carbon was physiological saline solution (0.9% sodium chloride solution). No significant correlation was observed between the ability of paraquat removal and the properties of adsorbent. Paraquat was preferentially adsorbed onto activated carbon in the mixed solution. The adsorption abilities by activated carbon (the removal ratio, the amount adsorbed and the adsorption rate) for paraquat were larger than those for diquat, and it was enhanced by added sodium chloride and added magnesium sulfate. Enhancing effect for adsorption removal was proportional to the saline concentration. As addition of salts into carbon suspension enhanced the adsorption ability, it will contribute to the effective treatment of acute poisoning.

Keywords: liver/citrate/fluoroacetate

Abstract: Control of brushtail possums (Trichosurus vulpecula) using baits containing sodium fluoroacetate was investigated in New Zealand during April 1992, December 1993 and February 1994. Populations were reduced to similar levels to those achieved with aerial application, provided the possums were fed non-toxic cereal baits before treatment. Compared with aerial treatment, the amount of pesticide used was reduced by more than 90%.

Keywords: field efficacy/possums/1080/sodium fluoroacetate/treatment

Abstract: Possum control in native forest is essential to reduce damage to native flora and fauna, so the development of more efficient control methods is a high priority. We investigated methods to improve control efficiency using toxic baits to fed from bait stations. Results showed that by using the recommended bait station spacing grid of 150-m, and baits containing 0.15% 1080, a mean possum kill of
83% could be achieved after 3 weeks of prefeeding with non-toxic baits. With no prefeeding a mean kill of 68% was achieved. Prefeeding gave 70% increase in the amount of 1080 baits taken from the bait stations. Prefeeding also resulted in 95% of the 1080 baits being taken from the bait stations on the first night of baiting. With no prefeeding 1080 baits were taken gradually over a 50 day baiting period with increased the likelihood of baits decaying and becoming less palatable. When Talon followed 1080 baiting, there was no further reduction in possum numbers but rat numbers were reduced a further 23%. More research needs to be conducted to improve cost-efficiency and to monitor non-target and environmental effects when feed toxic baits from bait stations.

Keywords: fluoroacetamide/fluoride/analysis
Abstract: FCH2CO2H and FCH2CONH2 residues are extd. from the plant material and the ext. is subjected to chromatography on a silica gel column, which removes fluorides and fluosilicates. The acids are detd. as F, which is released by fusion with CaO. To det. FCH2CONH2 in plant exts., the ext. is treated with the anion exchange resin De-acidite FF to remove inorg. and org. F-contg. plant constituents, and FCH2CONH2 is detd. as F. With a 100-g. sample, 1 p.p.m. can be assayed with an accuracy of 13% and 0.1p.p.m. with an accuracy of 50%

Ref Type: Report
Keywords: 1080/pigs/dogs/foxes
pentafluorobenzyl bromide. Quantitation is performed using a gas chromatograph equipped with an electron-capture detector. A standardised statistical protocol is used to validate a screening level 0.2 µg compound 1080/g soil. Difluoroacetic, trifluoroacetic and naturally-occurring formic acids do not interfere with the determination. The recovery for compound 1080 was 40% from soil fortified to 0.2 µg/g soil.


Keywords: persistence in soil/defluorination/bacteria

Abstract: Monofluoroacetate (FA) is well known as a toxic substance and has been used as an insecticide: C-F linkage of which is very stable. Bacteria, capable of being grown in a defined salt medium containing FA as a sole source of carbon, have been isolated from soil. It has been found that the defluorination of FA involved an enzyme which catalyzes the conversion of FA to glycolate and fluoride ions and that the enzyme was induced when bacteria were grown in a defined salt medium containing FA as a sole source of carbon. The activity of defluorination was fairly stable and strong in this organism.


Keywords: treatment/1080

Abstract: 1. Sodium acetate and ethanol acted synergistically to antagonize 1080 poisoning in mice. The LD50 of 1080 for mice (17.0 mgm/kgm. subcutaneously) was raised 4.6 times by immediate treatment with sodium acetate, 3.1 times by ethanol, and 12.7 times by a combination of these substances.

2. The beneficial effect of the acetate-ethanol treatment decreased rapidly with increasing time after the administration of 1080 in mice.

3. The oral LD50 of 1080 in dogs was 0.066 mgm/kgm. and the LD100 was 0.08 to 0.12 mgm/kgm.

4. In treating 1080 poisoned dogs, ethanol and acetate had some antidotal effect when administered immediately after the 1080 but these agents were of no value as adjuncts to treatment with barbiturates when this treatment was started 30 minutes after poisoning.

5. By the use of barbiturate therapy and by starting treatment 0.5 or 3 hours after poisoning, 100 per cent of dogs poisoned with approximately 2 x LD50 of 1080 were saved. When treatment was started 0.5 or 3 hours after oral poisoning with approximately 4 x LD50, 80 or 17 per cent of dogs, respectively, were saved. No dogs survived when barbiturate treatment was instituted 0.5 hour after oral poisoning with approximately 6 x LD50.


Keywords: diagnosis/mode of action/pathology/metabolism/brain/humans/treatment/welfare/symptoms

Abstract: A previously healthy 15 year old female attempted suicide by SMFA-ingestion. The case reported developed an acute brain syndrome, including cerebellar signs, shortly after the ingestion of sodium monofluoroacetate. After insidious improvement of the clinical symptoms, the patient remained with an "end-stage" cerebellar ataxia for 18 months following the acute intoxication. The development of brain atrophy, proven by computed tomography, is considered to represent a direct influence of sodium monofluoroacetate on the brain and to reflect the unique disturbances in cellular metabolism of glucose.


Ref Type: Report

Keywords: persistence in water/fluoride/degradation


Ref Type: Report

Keywords: 1080/fluoroacetate/fluorocitrate/mammals/monofluoroacetate/reproductive effects/sodium fluoroacetate/sodium monofluoroacetate

Abstract: Sodium fluorooacetate (1080) and its active metabolite fluorocitrate were tested to determine
whether they can mimic the sex steroid 17β-oestradiol (E2) by binding to the oestrogen receptor (ER). This work was carried out by
Landcare Research/ CENTOX, Lincoln for the Animal Health Board in September and October 2002. ER preparations were isolated from sheep uterine tissue and
used in a competitive receptor-binding assay to determine the relative affinity of a variety of compounds for the ER. The assay is based on the ability of competitor
molecules to displace radiolabelled E2 from the ER. The assay was validated by generating displacement curves for the natural oestrogen E2, nonylphenol (a known environmental oestrogen), tamoxifen (an anti-oestrogen drug), o,p’-DDT (an oestrogenic pesticide), and the androgen testosterone. The results showed that the ER
preparations used met the requirements for validation. The known oestrogenic pesticide o,p’-DDT showed significant displacement of E2 while neither 1080 (sodium monofluoroacetate) nor its active metabolite (fluorocitrate) had any effect on ER binding. Neither 1080 nor fluorocitrate are likely to promote oestrogenic or anti-
oestrogenic effects by binding to a mammalian ER, therefore both compounds are unlikely to act as EDCs through this specific mechanism.

Ref Type: Abstract
Abstract: Concerns were raised over the possibility that sodium fluoroacetate (1080) and its active metabolite fluorocitrate could cause endocrine disruption. Both compounds were tested to determine whether they could interfere with the sex steroid 17β-oestradiol (E2) by binding to the oestrogen receptor (ER), which is one of the most studied endocrine disruption mechanism. ER preparations were isolated from sheep uterine tissue and used in a competitive receptor-binding assay to determine the relative affinity of a variety of compounds for the ER. The assay is based on the ability of competitor molecules to displace radiolabelled E2 from the ER. The assay was validated by generating displacement curves for the natural oestrogen E2, nonylphenol (a known environmental oestrogen), tamoxifen (an anti-oestrogen drug), o,p’-DDT (an oestrogenic pesticide), and the androgen testosterone. The results showed that the ER preparations used met the requirements for a validated assay. The known oestrogenic pesticide o,p’-DDT showed significant displacement of E2 while neither 1080 nor its active metabolite fluorocitrate had any effect on ER binding. The data strongly suggest that neither 1080 nor fluorocitrate are likely to promote oestrogenic or anti-oestrogenic effects by directly binding to a mammalian ER. Therefore it is highly improbable that both compounds can act as EDCs through this specific mechanism. However, in order to provide a more complete evaluation, further screening tests based on higher levels of cellular organisation are required.

Keywords: sodium monofluoroacetate/monofluoroacetate/1080/fluorocitrate/assay/reproductive effects
Abstract: Sodium monofluoroacetate (1080), a vertebrate pesticide used in New Zealand, and its metabolite fluorocitrate were tested to determine whether the pesticide could promote an estrogenic response by binding to a mammalian estrogen receptor (ER). ER preparations were isolated from sheep uterine tissue and used in a competitive binding assay. The assay was validated by generating displacement curves for the natural estrogen (E2) and known environmental estrogens like o,p’-DDT and 4-nonylphenol. The known estrogenic pesticide o,p’-DDT showed significant displacement of E2 while neither 1080 nor its active metabolite fluorocitrate had any effect on ER binding. Sodium monofluoroacetate and fluorocitrate are unlikely to promote estrogenic or anti-estrogenic effects by binding to the ER.

Ref Type: Report
Keywords: sodium monofluoroacetate/monofluoroacetate/1080/fluorocitrate/New Zealand/fish/brain/assay
Abstract: Objectives

To determine, using an in vitro test system established in New Zealand, whether 1080 and fluorocitrate bind to fish brain androgen receptors.
To determine, using an in vitro test system (Inserm, Montpellier, France), whether 1080 and fluorocitrate bind or block the actions of natural hormones at human androgen receptors.

Methods

The androgenicity of 1080 and fluorocitrate was tested using a fish AR binding assay. Additional assays were conducted using a mammalian-based system.
A reporter gene assay system incorporating the human AR was used to determine whether 1080 and fluorocitrate bind to the AR or block the actions of testosterone.

Results

Neither 1080 nor fluorocitrate showed androgenic activity in the rainbow trout AR competitive binding assay. In reporter gene assays using the human AR, neither 1080 nor fluorocitrate showed androgenic or anti-androgenic activity.

In reporter gene assays using the human oestrogen receptor α (ERα), neither 1080 nor fluorocitrate showed oestrogenic or anti-oestrogenic activity.

Conclusions

Neither 1080 nor fluorocitrate are likely to promote androgenic or anti-androgenic effects by binding to a fish or the human AR. Therefore, both compounds are unlikely to act as endocrine-disrupting chemicals through these specific mechanisms.

Both compounds did not interact with the human ERα, supporting the results of earlier work with a sheep ER assay.

Recommendations

These results should be considered by the Environmental Risk Management Authority (ERMA New Zealand) as part of the formal reassessment of 1080.


Abstract: Two morphological types of brushtail possum were introduced to New Zealand: smaller, grey possums from mainland southeastern Australia and larger, black possums from Tasmania. Analysis of patterns of allozyme variation and allele frequencies of present-day possum populations in New Zealand and southeastern Australia indicates that populations comprised predominantly of balck possums remain genetically similar to possums in Tasmania, whereas predominantly grey populations are genetically closer to Victorian and New South Wales possums. The distribution of possums in New Zealand can be accounted for at least partly by selection of stock types with respect to climate. genetic differences between populations may have important implications for the control of possums, because Tasmanian possums have a greater resistance than mainland southeastern Australian possums to 1080 poison (sodium monofluoroacetate), which is commonly used to control possums in New Zealand.


Abstract: Parallel in vivo and in vitro determinations of the adsorption characteristics of activated charcoal were carried out with three drugs having a different pKa: aspirin, salicylamide, and phenylpropanolamine. In vitro adsorption isotherms at pH1 and 8.2 and the effect of increasing pH on drug desorption characteristics suggested that, as these drugs pass from stomach to intestine, the in vivo adsorption of : (a) aspirin will be reversed significantly due to change in pH, (b) salicylamide will be decreased only slightly except for possible competitive effects of normal intestinal contents,and (c) phenylpropanolamine may be increased slightly unless intestinal content exerts a displacing effect. Absorption studies in human volunteers yielded results that are consistent with these predictions and that demonstrate the effect of dose and mode of charcoal administration on the efficacy of this adsorbent. These studies suggest that it may be possible to make reasonable predictions concerning the relative antidotal effectiveness of activated charcoal in man on the basis of appropriate in vitro adsorption studies.
Ref Type: Conference Proceeding
Keywords: defluorination
Abstract: Fluoroacetate is highly toxic to a wide range of animals, including non-target species. The species difference in sensitivity to fluoroacetate remains without an explanation. In mammals, detoxification of fluoroacetate by defluoriantion occurs mainly in the liver by fluoroacetate-specific defluorinase. This enzyme is thought to be a unique glutathione-S-transferase, but the mechanism of this glutathione dependent reaction is still unclear. To understand the species differences in sensitivity to fluoroacetate, subcelluluar fractionation of livers from Wistar Rats, Bal b/c mice and brushtail possums was performed. Defluorination was measured by fluoride ion determination in vitor based on fluoride release after incubation, using sodium fluoroacetate as the substrate. The result showed; 1) defluorination activity based on protein content was the highest in the cytosolic fraction of all species. The mitochondrial and microsomal fractions both had minimal activity. 2) The subcellualr distribution of defluorinationactivity in the liver of male rats showed the nuclear, mitochondria, microsomes and cytosol presented 33.2%, 0.6%, 1.3% and 50.8% respectively of the defluorination activity in the homogenate. 3) The comparison between male and female of rats and mice suggested that there was increasing defluorination activity in females. However, only the cytosolic fraction of female rats had significantly higher  activity than male rats. 4) Comparison of defluorination activity in the three species showed that rats and possums had a relatively lower activity in cytosol, but higher activity in mitochondria and microsomes compared with mice. The rank order of defluorination activity in the mitochondrial fraction in the three species is possum> rat>mouse. This study suggested that the defluorination of fluoroacetate is mainly localised in cytosolic fraction of the liver. Female animals presented a higher defluorination activity tendency. The role of mitochondia in defluorination of fluoroacetate requires further investigation.

Ref Type: Report
Keywords: lethal dose/ferrets/1080

Keywords: acute toxicity/birds/non-target species

Keywords: developmental toxicity/toxicity/sodium monofluoroacetate/monofluoroacetate/1080/rats

Ref Type: Report
Keywords: fluoroacetate/invertebrates/occurrence in nature
Abstract: Little is known about the influence of fluoroacetate-bearing seed upon the selection of seed by harvesting ants. The response of ants to seed containing fluoroacetate, which were placed out in artificial depots in a Eucalyptus wandoo open woodland, suggested that the presence of this substance had very little effect upon the seed selection of harvesting ants. Of the total seed offered, 44.3 % was removed in 24 hours. The principal ant species observed taking seed were Camponotus sp. J.D.M.183, Melophorus sp. J.D.M. 117, Meranoplus sp. J.D.M. 400, Monomorium sp. 1 (ANIC) and Rhytidoponera sp. J.D.M. 121. Small numbers of Gastrolobium microcarpum (fluoroacetate producing) seed were recovered form two of five extracted ant nests.

Keywords: metabolism/sodium fluoroacetate/1080/persistence in animals/defluorination/liver
Abstract: Administration of 100 mg sodium fluoroacetate (compound 1080) per kilogram body weight to *T. rugosa* resulted in a 3.4-fold increase in plasma citrate levels 48 h after dosing while administration of 3 mg sodium fluoroacetate per kilogram body weight to *R. norvegicus* produced a fivefold increase in plasma citrate levels within 4 h. Administration of 300 mg sodium fluoroacetate per kilogram body weight reduced the oxygen consumption of the skink by between 2.5 and 11% while in the rat, 2 mg sodium fluoroacetate per kilogram body weight reduced oxygen consumption by between 28 and 57%. Aconitate hydratase activity in extracts of liver acetone powders from *T. rugosa* was less inhibited by (-)erythrofluorocitrate (Ki: 0.065 mM) than that in extracts derived from *R. norvegicus* (Ki: 0.026 mM). The rate of defluorination of fluoroacetate in erythrocytes and in extracts of liver acetone powders of *T. rugosa* was 8- and 4.5-fold greater, respectively, than that found in similar preparations from *R. norvegicus*. A rapid rate of defluorination together with a low reliance on aerobic respiration favoured detoxification of fluoroacetate in *T. rugosa* rather than its conversion into fluorocitrate. Though defluorination in this species helped to minimize the immediate effects of fluoroacetate on aerobic respiration, it resulted in rapid depletion of liver glutathione levels.


Keywords: acute toxicity/non-target species/mode of action/pathology/sodium fluoroacetate/1080/reproductive effects/plasma/blood/chronic poisoning/fluoroacetate

Abstract: 1. Administration of multiple or single doses of sodium fluoroacetate (1080) to male *Tiliqua rugosa* caused a decrease in plasma testosterone concentration.
2. A single dose of 100 or 250 mg 1080 kg^{-1} body weight decreased plasma testosterone by 52%. However, 25 mg kg^{-1} had little apparent effect on testosterone levels. When lizards were given the multiple dose equivalent of these doses over 12 days at 3 day intervals, the effect was much less dramatic with plasma testosterone concentration steadily declining over 15 days for the two higher doses.
3. There was a suggestion of degeneration of seminiferous tubules in some individuals.


Keywords: non-target species/birds/metabolism/persistence in animals/1080

Abstract: Compared with most other birds, the emu, *Dromaius novaehollandiae* Vieillot, has unusually high tolerance to fluoroacetate (1080). The LD50 for emus with evolutionary exposure to fluoroacetate bearing vegetation in the southwest of Western Australia was 102 mg of 1080 per kilogram. This tolerance appears to result from: the substantial capacity of emus to detoxify fluoroacetate by defluorination; the limited conversion of fluoroacetate into fluorocitrate; and/or their possession of an aconitate hydratase which is relatively insensitive to fluorocitrate.


Keywords: tolerance/fluoroacetate/birds/occurrence in nature/citrate

Abstract: Increases in plasma citrate concentration in response to dosing with sodium fluoroacetate were shown to reflect the sensitivity to fluoroacetate intoxication of birds with similar metabolic rates and phylogenetic affinities. *Platycercus icterotis* and *Purpureicephalus spurius* are indigenous to the south-west of Western Australia where fluoroacetate-bearing vegetation is abundant and they were more tolerant to fluoroacetate than *Barnardius zonarius*, *Polytelis anthopeplus* and *Cacatua roseicapilla* whose distributions include areas outside the range of the toxic plants. *Streptopelia senegalensis* and the Barbary dove (*Streptopelia* sp.) have had little or no exposure to naturally occurring fluoroacetate and were much more sensitive to fluoroacetate poisoning than were *Phaps chalcoptera* and *Ocyphaps lophotes*, regardless to the extent of exposure of the latter species to the toxic plants. *Phaps chalcoptera*, *Ocyphaps lophotes*, *Anas superciliosa* and *Chenonetta jubata* in eastern Australia are not exposed to fluoroacetate-bearing vegetation, but had tolerances similar to that of their conspecifics in the south-west of Western Australia. The level of tolerance to fluoroacetate appears dependent upon the length of evolutionary exposure to the toxic plants, and the degree of mobility in each species.

Keywords: metabolism/fluoroacetate/liver/defluorination/fluorocitrate/tolerance

Abstract: Populations of *Tiliqua rugosa* which coexist with fluoroacetate bearing vegetation were much less sensitive to fluoroacetate intoxication than were conspecifics not exposed to the toxic plants. However, the biochemical mechanisms responsible for this toxicity differential were not ascertained. Liver acetone powder preparations from both conspecifics were similar in their abilities to detoxify fluoroacetate by defluorination, and to convert fluoroacetate to fluorocitrate. The aconitate hydratase in these preparations was also similarly inhibited by (-)erythro-fluorocitrate. These findings, and other possibilities which could be responsible for the toxicity differential are discussed.


Keywords: fluoroacetate/invertebrates/lethal dose/1080

Abstract: The sensitivity of fluoroacetate (1080) of three species of lepidopteran and one species of hymenopteran larvae, which coexist with fluoroacetate-bearing vegetation in Western Australia, was determined. Larvae of *Perga dorsalis* (hymenopteran) and *Mnesampela privata* feed mainly on eucalypts and were very sensitive to the toxin with LD$_{50}$ values of 1.05 and 3.88 mg 1080 kg$^{-1}$ respectively. *Spilosoma* sp. has a cosmopolitan diet and was moderately tolerant to fluoroacetate (LD$_{50}$ 42.73 mg 1080 kg$^{-1}$). However, larvae of *Ochrogaster lunifer*, which when collected were feeding on fluoroacetate-bearing *Gastrolobium microcarpum*, were extremely tolerant to the toxin (LD$_{50}$ c. 150 mg 1080 kg$^{-1}$). This suggests that co-evolution has occurred between tolerant insects and the toxic plants.


Keywords: tolerance/fluoroacetate


Keywords: fluoroacetate/occurrence in nature/tolerance/mammals/non-target species

Abstract: Fluoroacetate is a highly toxic compound which is produced by three genera of plants in parts of south west and northern Australia, particularly the south west corner of Western Australia. Native animals in these regions have coexisted with this toxic vegetation for at least several thousand years, and many species have developed a marked tolerance to fluoroacetate. Factors influencing their level of tolerance, the possible causal mechanisms, and the implications to fauna management are discussed.


Keywords: metabolism/acute toxicity/occurrence in nature/1080/mammals/birds

Abstract: In parts of Australia, plant species of the genus Gastrolobium, can produce considerable quantities of fluoroacetate (2,000 mg kg$^{-1}$ in leaves) as a chemically mediated defence strategy against herbivory. The concentration of fluoroacetate in these plants varies between species, region, soil type, and season. By necessity, animal populations have coexisted with this fluoroacetate bearing vegetation for at least several thousand years. Consequently, they have developed varying degrees of tolerance to this potent toxin which depends upon their dietary and habitat specialisation, the size of their home range, the degree of mobility exhibited by each species, and the length of evolutionary exposure to the toxic vegetation. Dietary studies indicate that animals are able to discriminate between the highly toxic and less toxic plant species. Fluoroacetate-tolerance has developed in insects, reptiles, mammals, and birds with herbivores > omnivores > carnivores. It is also retained by animal populations even when they become isolate from the toxic vegetation for 7,000 to 10,000 y.

Development of tolerance to fluoroacetate by animals has evolved on at least three continents where
indigenous plants are known to produce fluoroacetate. However, the biochemical mechanisms responsible for the tolerance are poorly understood. As fluoroacetate can cause a reduction in animal fertility, and in levels of reduced glutathione in the liver necessary for detoxification, it is argued that both the acute and chronic effects of fluoroacetate poisoning are equally important selection pressures for the development of tolerance to fluoroacetate.

Tolerance to fluoroacetate (1080) in native Australian animals enhances the target specificity of 1080 poison during control programs directed at introduced vertebrate pests. Baiting with 1080 also plays an important role in protecting native Australian flora and fauna from the effect of predation and competition generated by introduced predators and herbivores.


Keywords: occurrence in nature/tolerance/fluoroacetate/mammals/marsupials

Abstract: In south-western Australia, 39 species of indigenous plants from the genus Gastrolobium produce fluoroacetate (1080 poison - a highly toxic vertebrate pesticide) as a chemically-mediated defence against being eaten. Many species of native animals have therefore co-existed with this toxic vegetation for several thousand years and, as a consequence, have developed varying degrees of tolerance to fluoroacetate. This article summarises our current understanding of this natural biological 'arms race'.


Keywords: occurrence in nature

Abstract: A note suggesting that the concentrations of fluoroacetate found in plants which naturally produce fluoroacetate will vary according to time of year, particular plant part tested, species examined, and ability of the species to reproduce fluoroacetate. The presence or absence of fluoroacetate should therefore not be taken as a reliable indicator of the genetic relationship of these plants, at least not until all the potential candidates, which are likely to contain fluoroacetate, have been adequately assessed.


Keywords: metabolism/persistence in plants/occurrence in nature

Abstract: Gas chromatography confirmed the relatively high concentrations of fluoroacetate found in toxic Gastrolobiums, a genus of indigenous Australia plants. Fluoroacetate concentration in these plants ranged from 0.1 to 3875 ug/g (ppm) dry weight, with young leaves and flowers containing the highest concentrations. However, there as considerable intrastand variation between individual plants of at least two species with coefficients of variation ranging from 94% to 129%. Despite the high concentrations of fluoroacetate in many species, only one of nine soil samples collected from beneath these plants contained fluoroacetate. None of the 16 water samples collected from nearby streams catchments dams contained fluoroacetate. This suggest that fluoroacetate does not persist in this environment. Fluoroacetate was also found in the genus Nemcia, and very low levels of fluoroacetate (ng/g) were detected in the foodstuffs, tea and guar gum. The latter indicates that other plant species my produce biologically insignificant amounts of fluoroacetate.


Keywords: occurrence in nature/fluoroacetate

Abstract: The degree to which physical defence mechanisms are present in toxic species of Gastrolobium was compared with the known fluoroacetate (the toxic principle) concentrations of these plants using both histological leaf sections prepared from fresh leaves (4 species), and a variety of visual external traits measured from herbarium specimens (28 species). There was a strong negative correlation between the presence of physical deterrents (e.g. area of fibres, number and length of spines) and the fluoroacetate concentration of each species. This suggests that, with respect to their leaves, individual species have established a compromise between producing physical grazing deterrents and the adoption of chemically mediated antiharbore strategies.

Keywords: occurrence in nature

Abstract: Fluoroacetate was found in *Gastrolobium brevipes* and some other Australian species. Its presence suggests that some native animals in central Australia are likely to have developed a degree of tolerance to the toxin.


Keywords: bait degradation/1080/cats/non-target species


Keywords: tolerance/fluoroacetate/bacteria/1080/livestock/poisoning/GMO/occurrence in nature

Abstract: It is with some concern that we have been following a research programme aimed at developing non-specific genetically modified ruminal bacteria capable of detoxifying fluoroacetate (Compound 1080) to protect domestic livestock from fluoroacetate poisoning. The main thrust of this research programme is the prevention of cattle losses in the Georgina Basin in the Northern Territory and Queensland where the toxic plant Gidgee *Acacia georginae* occurs. Although rarely mentioned in formal reports of this work, 1080 is an important vertebrate pesticide that is widely used throughout Australia and New Zealand. It is the first defence against a number of pest species that impact on agricultural production and conservation efforts in both countries. The main concerns about this work relate to the potential lack of target specificity of these modified microorganisms, and also, if released, their potential impact on conservation biology. We raise these questions now because the Genetic Manipulation Advisory Council has been approached for approval to conduct field trials in Western Australia using the modified bacteria. We believe the perceived advantages and disadvantages of these modified organisms need informed debate before such approval, or any general release of these modified rumen bacteria could be considered.


Keywords: metabolism/persistence in soil/1080


Keywords: 1080/foxes/baits/bait degradation/birds/non-target species/reptiles

Abstract: The longevity of 1080 in egg-baits (4.5 mg 1080 per egg) used for fox control was monitored at the Corackerup Nature Reserve, Western Australia. Irrespective of season, most egg baits (94%) were found to retain sufficient 1080 to be theoretically lethal to all foxes for at least 42 days, and 75% of baits contained an LD50 of 1080 at Day 63. Exponential decay curves also predicted that these baits would remain toxic to most foxes for up to 32 weeks, depending upon environmental conditions. Sealing the injection hole with wax, or using sterile techniques to prepare some egg-baits, appeared to have little effect on the longevity of 1080 in these baits compared with that of unsealed eggs. Bait take, and identification of those species taking baits were monitored over 12 days at 216 permanent bait stations in the reserve. Track plots were present for 3-6 days on 83 of these stations in spring and summer but not in winter. In spring and summer, of those species likely to take bait, goannas were the most frequent visitors to the track plots and they were also responsible for most of the baits taken at this time (59% and 90% of baits taken). Foxes accounted for 27% (spring), 8% (summer) and 75% (winter) of the egg-baits taken. No egg-baist were taken by goannas in winter, but the overall bait take was also low at this time (28 of 211 baits laid, 13%). Overall bait take after 12 days in spring and summer was 64% (135 of 211) and 68% (145 of 212) of baits laid. Except for goannas, birds and other non-target species (eg bob-tail skink) took relatively few baits in any season.


Keywords: rabbits/field efficacy/efficacy/1080/pindone/non-target species/birds/resistance
Abstract: The acceptability of four different bait station designs (drum, slab, tyre, corrugated iron) to rabbits was tested in the field using unpoisoned oat bait. The drum (200 L, cut longitudinally) and the raised concrete slab (60 X 60 cm) designs were the most acceptable to rabbits. The raised tyre design was unacceptable, and this was supported by later field efficacy trials that compared the drum and tyre designs using 1080 One-shot oats. The efficacy of three of these designs (drum, slab, tyre) against 'urban' rabbits was assessed more fully using pindone oat bait. The tyre stations were again found to have little impact on rabbit numbers. With the exception of one drum site where pindone bait stations were totally ineffective, the proportional reductions in rabbit numbers for the remaining sites were similar between the drum (69%, n = 3) and slab (70%, n = 5) designs. However, the slab design provided much easier access to bait by non-target species (particularly birds), and we therefore recommend that the drum design would be the best bait station for controlling rabbits. The overall proportional reduction in rabbit numbers achieved with pindone bait stations was 48% (range 0-80%, n = 13), which is less than that usually achieved during broadacare control programs with pindone (60-90%). In addition, these kills took 30-60 days to achieve, and as rabbit damage still occurred over this period, the use of pindone bait stations did not always result in damage mitigation or, ultimately, an economic benefit. Some potential problems associated with the use of pindone bait stations, such as the possibility of the development of 'resistance' to pindone bait and the risk to non-target species, are also discussed. The combined use of track counts and a 'digs' index proved a reliable indicator of changes in rabbit abundance.


Keywords: 1080/efficacy/lethal dose/poison/rabbits/resistance/rodents/toxicity/wildlife

Abstract: Toxicant-resistance is a potential, or very real, problem with many pest-control programmes worldwide. However, apart from rodents, pesticide-resistance has not been well documented in vertebrates. We assessed the potential impact of developing resistance to 1080 in rabbit populations with differing levels of historical exposure to 1080-baiting programmes in south-western Australia. The sensitivity to 1080 of three out of the four populations of rabbits examined had decreased significantly since Australian rabbits were last tested over 25 years ago. The lethal dose values (LD50) for these populations, as determined from formal toxicity trials, ranged from 0.744 to 1.019 mg pure 1080/kg, and were significantly greater (P<0.05) than the previously reported values for Australian rabbits (LD50 range 0.34 to 0.46 mg pure 1080/kg). The LD50 value for the fourth population (0.584 mg pure 1080/kg), which has had the least exposure to 1080, did not differ from those reported previously (P>0.05). The lethal dose values (LD99) for four rabbit populations tested ranged from 1.181 to 1.666 mg pure 1080/kg, and suggested that, theoretically, all rabbits should be killed during routine baiting campaigns provided that there is no loss of active ingredient from the bait. In reality, the efficacy of 1080 poison bait laid in trails for controlling free-ranging rabbits was reduced in those populations where rabbits had decreased sensitivity to 1080. Mean reductions in rabbit numbers 7-9 days after trail baiting of resistant and sensitive populations ranged from 51.2% to 65.2%, and from 76.4% and 76.5% respectively. These findings suggest that genetic resistance to 1080 is developing in at least some populations of Australian rabbits. This has world-wide implications for agricultural protection and wildlife conservation programmes that rely on a 1080-baiting strategy for reducing the impact of vertebrate pests.


Keywords: sodium fluoroacetate/fluoroacetate/1080/rodents/rodent/tolerance/lethal dose

Abstract: The sensitivity to fluoroacetate (1080) of a number of species of rodents and dasyurids with and without evolutionary exposure to fluoroacetate-bearing vegetation was determined. Rattus fuscipes, and species of Pseudomys from populations with exposure to this vegetation, were particularly tolerant to fluoroacetate. However, the level of tolerance varied among the different populations of each species, depending on the degree to which the toxic plants were present in their microhabitat. The tolerance of the F1 offspring of sensitive R. fuscipes (South Australia) crossed with tolerant conspecifics from Western Australia was mid-range between those of the parental populations. The sensitivity of introduced R. rattus and Mus domesticus from areas with fluoroacetate-producing plants in Western Australia was similar to that reported elsewhere for these rodents. This suggests that their relatively short coexistence with the toxic
plants has had little obvious impact on their level of sensitivity to fluoroacetate. The dibbler, Parantechinus apicalis, which coexists with the toxic vegetation, was exceptionally tolerant for a native carnivore/insectivore (LD50 similar to 35 mg 1080 kg(-1)). In contrast, however, Phascogale tapoatafa from southern Western Australia was more sensitive to 1080 than was expected, with an estimated LD50 of 7 mg 1080 kg(-1). Although the level of tolerance to fluoroacetate was seen to vary depending on the level of exposure of each species/ population to fluoroacetate-bearing vegetation, our findings provide further evidence of the evolutionary impact that fluoroacetate-producing plants appear to have had on the genetic composition of indigenous Australian fauna.

Keywords: cats

Keywords: fluoroacetate/inhibition/bone
Abstract: The effect of fluoroacetate (FA) on the physiological distal drift of the rat molar was investigated in this study. FA produced a dose-dependent inhibition of the bone formation ratio on the modeling side. The total number of osteoclast population on the remodeling side decreased with the increase of the dose of FA, but not dose-dependently. Therefore, the physiological distal drift seemed to be inhibited by the FA injections and the rate of the distal drift seemed to be not proportional to the total number of osteoclasts on the remodeling side. Among the osteoclast population, the number of multinucleated cells in contact with the bone surface (on-bone multinucleated osteoclasts) decreased considerably when the physiological distal drift was inhibited by the FA injections. The availability of the change in the number of the on-bone multinucleated osteoclasts as a marker of the degree of bone resorption was also discussed

Keywords: citrate/enzyme/fluorocitrate/behaviour/Krebs cycle/biochemistry
Abstract: The mechanism of citrate activation of acetyl coenzyme A carboxylase has been investigated. Several chelating agents cannot substitute for citrate in the activation of this enzyme. The activation of the enzyme by citrate is not blocked by either trans-aconitate or fluorocitrate. Fluorocitrate activates the enzyme to the same extent as citrate.
Sucrose gradient centrifugation studies indicate that the enzyme has a sedimentation coefficient ($s_{20,w}$) of approximately 18.8 S. When the enzyme is incubated with citrate under the conditions that activate the enzyme, and then centrifuged in medium containing citrate, it sediments much faster. The approximate $s_{20,w}$ value of the citrate-treated carboxylase is 43 S. Centrifugation of control carboxylase in the presence of citrate did not give rise to the new, rapidly sedimenting peak. Centrifugation of citrate-treated carboxylase in the absence of citrate gave rise to a series of peaks, none of which was in the usual location of the citrate-treated enzyme. The change in sedimentation behaviour is quite specific as to the Krebs cycle compounds that can cause it to occur. Nonspecific protein does not sediment with the citrate-treated carboxylase.
Further studies on the activation process have shown that activation by citrate does not occur at 0º, that the rate of activation at 30º is dependent upon the concentration of the enzyme, and that activation is rapidly reversible upon dilution of citrate.

Keywords: sodium fluoroacetate/fluoroacetate/cyanide
Abstract: 1. Using isolated Rat duodenum previously decalcified, the authors had compared the effect of various metabolic inhibitors on the increase of tonus brought about by addition of calcium ions. Conversely, the same inhibitors had been assayed on the fall of tonus following the decalcification of the same organ.
4. Sodium fluoroacetate (2.0 µmol/l) and 2,4-DNP (0.27 µmol/l) induced sensitization of the organ only in case of high doses of Ca$^{2+}$ (0.45 mmol/l).
5. Sodium cyanide, sodium malonate and sodium fluoroacetate hindered the fall of tonus following the decalcification of the organ.


Keywords: fluoroacetate/resistance

Abstract: We employed two genes in constructing yeast expression cassettes for dominant, selectable markers. The *Saccharomyces cerevisiae* gene *SFA1*, encoding formaldehyde dehydrogenase, was placed under the control of the *GPD1* promoter and *CYC1* terminator. The *Moraxella* sp. strain B gene *dehH1*, encoding fluoroacetate dehalogenase, was placed under the control of both the *GPD1* and *CYC1* promoters. With these constructs it was possible to select directly for yeast strains resistant to either formaldehyde or fluoroacetate. Both selective agents are completely metabolized and inexpensive, making them very useful in the pursuit of yeast gene functions and for industrial applications. An additional advantage of the formaldehyde dehydrogenase marker is that it is an *S. cerevisiae* gene, thus allowing 'all yeast' constructs.


Keywords: poisoning/livestock/poison/fluoroacetate/fluorocitrate/Krebs cycle/heart/rabbits/antidote/occurrence in nature

Abstract: In Njala, Sierra Leone, N'Dama cattle died or became ill. In the dry season when grass was scarce, they had eaten the palatable young leaves of Dichapetalum toxicarum. The plant is used as rat poison and has fluoro-fatty acids that are oxidised in the body to fluoroacetate and converted enzymically to fluorocitrate, which upsets the Krebs cycle in heart cells. Clinical and postmortem signs are described; similar signs were found in calves and rabbits given the leaves. Antidotes are being studied


Keywords: occurrence in nature/analysis

Abstract: A method is described for the extraction and determination of nanogram amounts of the highly toxic fluoroacetic acid in plant samples. The acid is extracted by ammonia solution and purified by repeated other extractions. The fluoroacetate is then transferred to dichloromethane by using tetrahexylammonium as counter-ion, and finally derivatized by pentafluorobenzyl bromide. The determination is completed by capillary gas chromatography and single-ion monitoring mass spectrometry. Small amounts of fluoroacetate were found in many plant samples, including tea. The limit of detection was about 0.005 Fg g⁻¹, The reproducibility about ±9% and The recovery of added fluoroacetate 89 ± 6%.


Keywords: occurrence in nature/fluoroacetate

Abstract: The toxicity of guar gum, derived from the Indian leguminous plant *Cyamopsis tetragonolobus*, is thought to be due to a globulin which can be denaturated and made non-toxic. Another very toxic compound, fluoroacetic acid, has been detected at a low level in raw samples of guar gum (0.07-1.42 microgram fluoroacetic acid/g). A sample of a guar-gum pharmaceutical formulation contained only 0.08 ppm fluoroacetate. One exceptionally high value of 9.5 micrograms/g was found in a guar-gum powder. The low concentrations of fluoroacetate found in guar gum dispel any considerations about possible health risks associated with fluoroacetate during the prolonged use of guar gum at the recommended doses.


Keywords: fluoroacetate/occurrence in nature

Keywords: temperature/poisoning/1080/baits/sodium monofluoroacetate/monofluoroacetate/treatment/field efficacy

Abstract: Kill rates estimated after aerial broadcast of cereal baits containing sodium monofluoroacetate (1080) to control brushtail possum (*Trichosurus vulpecula*) populations in New Zealand varied from 61-100% in 48 operations between 1994 and 1999. Possum mortality was not related to size of treated area, toxin concentration, bait sowing rate or year of operation. We tested the hypothesis that ambient temperature influenced operational outcome using temperature measurements from meteorological recording stations (local scale) and latitude (regional scale) nearest to application sites. Field temperatures ranged from 3.0 - 17.4°C, and both temperature and latitude contributed significantly to a regression model for predicting possum kill rates. Highest estimated kill rates were observed during winter and at southern latitudes, consistent with previous laboratory studies of 1080 toxicity at warm and cool temperatures. Modeling showed populations that were reduced by more than 90% returned to 95% of initial density after 14.5 years, while sites with a kill rate of 70% needed only 9 years to reach 95% of initial density. During 9 years following an operation, simulated average possum densities were over 2 times greater in forests that experienced a 70% kill. Shorter intervals between control operations led to lower average densities for given kill rates in simulated populations. Therefore, we recommend that managers limit their operations to months with the coldest average temperatures and consider varying treatment intervals to remedy the ecological effects of low possum mortality after some operations.


Keywords: fluoride/metabolism/monofluoroacetic acid/monofluoroacetate/livestock/occurrence in nature

Abstract: Samples of the toxic plant D. toxicarium were collected from a 20-km2 area at Njala, and analysed. No free monofluoroacetic acid was detected in the leaves, but the monofluoroacetate ion (MFA) was present. MFA concentration was highest in leaves adnate to the flowers (1100 ppm on a fresh tissue basis), young leaves (450) and young stems (270), was lowest in the wet season and highest in the hot, dry season. D. toxicarium, however, was toxic to livestock throughout the year. The fluoride ion was an intermediate in the synthesis of MFA and it was concluded that D. toxicarium had an unusual ability to withdraw fluoride from a low fluoride environment


Keywords: livestock/goats/dogs/rabbits/occurrence in nature/mode of action/symptoms/antidote

Abstract: When the Voortrekkers crossed the Transvaal in the 1830s they found that their cattle died after eating the leaves of a particular, small, green-leaved plant. This plant was given the Afrikaans name gifblaar-poison leaf. Its botanical name is *Dichapetalum cymosum*. Since that time many cattle have been poisoned by this plant, which is also highly toxic to goats, sheep, horses, donkeys, dogs, rabbits and guinea-pigs. Apart from *D. cymosum*, there are at least twelve other poisonous species of the genus *Dichapetalum*. These are found in West, South-West, East and South Africa. The genus is, however, widespread throughout the tropics, more than 200 species being known. The toxicity or otherwise of most of these species has not yet been determined.


Keywords: defluorination/monofluoroacetate/occurrence in nature/biosynthesis/persistence in plants


Keywords: fluorocitrate/inhibition/aconitase/fluoride/metabolism

Abstract: Fluoride ion is released nearly stoichiometrically when (-)-erythro-fluorocitrate is incubated with aconitase. The release of F- parallels the loss in activity and could arise from direct displacement of F- by a base on the enzyme or from dehydration to fluoro-cis-aconitate and attack of an enzymic base to release F-. Aconitase inactivated by 14C-fluorocitrate does not retain radioactivity when passed through G-50 Sephadex or precipitated by ammonium sulfate. Full enzymic activity can be regained after either of these
treatments by activation by cysteine or ferrous salts. These data are consistent with the report of fluorocitrate being a competitive (and non-competitive) inhibitor of aconitase (Villafranca, J.J. 1972 Intra-Science Chem. Rept. 6 (4), 1-11) which rapidly inactivates the enzyme. This inactivated enzyme may be a very labile covalent complex, a very tight complex between enzyme and fluoro-cis-aconitate or a tight complex between a defluorinated derivative of fluorocitrate.


Abstract: Fluorocitrate was injected in the vitreum of rats in order to define the experimental conditions for a temporary impairment of Muller cell metabolism in the retina. Injection of 16 nmol of fluorocitrate appeared to fulfil this requirement since this dose resulted in a large decrease in retinal endogenous glutamine and a smaller decrease in glutamate within 6 hr of administration. The reversible nature of the effect was attested by a substantial recovery of the retinal levels of the two amino acids within 24 hr of injection. In vitro experiments of carbon incorporation from different substrates, carried out with retinas dissected from eyes previously injected with fluorocitrate, were consistent with a metabolic impairment of glial cells, since carbon incorporation from [14C]acetate into glutamine was almost completely abolished in the fluorocitrate-treated retinas. Electron microscopic examination in fluorocitrate-poisoned retinas demonstrated essentially selective ultrastructural alterations of Muller cells at times corresponding to their maximal metabolic impairment. Since Muller cells are by far the largest glial population of the rat retina, common astrocytes being only scattered in the nerve fibre layer, the present experimental model may be used to study the role of Muller cells in the metabolism of retinal neurotransmitters.


Abstract: The deleterious effect of chlorofluorocarbons on stratospheric ozone has led to international cooperation to end their use. The search for acceptable alternatives has focused on hydrofluorocarbons (HFCs) or hydrochlorofluorocarbons (HCFCs) which are attractive because they have relatively short atmospheric residence times. HFCs and HCFCs are attacked by tropospheric hydroxyl radicals, leading to the formation of trifluoroacetate (TFA). Most of the atmospheric TFA is deposited at the Earths surface, where it is thought to be highly resistant to bacterial attack. Therefore, use of HFCs and HCFCs may lead to an accumulation of TFA in soils, where it could prove to be toxic or inhibitory to plants and soil microbial communities. Although little is known about the toxicity of TFA, monofluoroacetate, which occurs at low levels in some plants and which is susceptible to slow attack by aerobic soil microbes, is known to be acutely toxic. Here we report that TFA can be rapidly degraded microbially under anoxic and oxic conditions. These results imply that significant microbial sinks exist in nature for the elimination of TFA from the environment. We also show thatoxic degradation of TFA leads to the formation of fluoroform, a potential ozone-depleting compound with a much longer atmospheric lifetime than the parent compounds.


Ref Type: Conference Proceeding

Abstract: This is a "state of the art" document prepared by the Predator Task Group, American Society for Testing and Materials (ASTM) Subcommittee E35.17, as a consensus guideline for the use of Compound 1080 in wild canid control. Toxicology, storage, handling, bait formulations and preparation of baits are discussed. Bait placement, exposure period, disposal, human safety factors and environmental impact are also treated. Toxicity data and a reference list also are included.

**Keywords**: fluoride

**Abstract**: A number of fungi capable of releasing F- from insoluble fluorides *in vitro*, were isolated from F- polluted soils. All isolates were capable of releasing F- from cryolite (Na₃AlF₆) and fluorspar (CaF₂) *in vitro*, a process which was associated with an increase in medium pH. *Fusarium culmorum* and a *Penicillium* sp. also released F- from MgF₂, *in vitro*, and the *Penicillium* sp. was able to release the ion from AlF₃. Neither species grew in the presence of LiF₃, or MnF₂. Culture variables influencing the release of F- by fungi are reported. The *Penicillium* sp. was also able to release F- from cryolite when growing in autoclaved soils, but like *Fusarium merismoides*, it was incapable of releasing F- from fluorspar under these conditions. Implications of release of F- from insoluble fluorides on the toxicology of the element in soils, and the possibility of using fungi to remove F- from industrial raw materials are commented upon.


**Keywords**: blood/convulsions/fluoride/humans/poison/stomach

**Abstract**: 1. Acute intoxication with fluoride compounds through accidental exposure, homicides and suicides, is not uncommon. Epidemics of rather serious proportions have been caused by mistaking fluoride compounds for baking soda, flour, sugar, etc.

2. There are wide variations in response to fluoride intake, depending on such factors as the particular fluoride compound involved, the animal species and on various biological conditions in humans. Inorganic fluorides, especially NaF and Na₂SiF₆, are more frequently involved in acute intoxication than organic compounds. HF, H₂SiF₆ and particulate NaF are mostly responsible for acute intoxication from air contamination.

3. Three autopsied cases of intoxication with NaF are reported, namely two homicides and one accidental case.

4. Clinical, autopsy and laboratory findings of acute fluoride intoxication are sparse and inconsistent. Hemorrhagic gastritis, tetaniiform convulsions, hypoglycemia and hyperfluoruria are the principal clinical findings. There are no pathognomonic changes at autopsy. Corrosive lesions in the upper intestinal tract, congestion and hyperemia in other vital organs are usually encountered. Changes suggestive of corrosion have been reported in the respiratory tract in intoxication from airborne fluoride.

5. Therapy should be directed toward removal of the poison from the stomach and intestinal tract; toward retarding its absorption into the blood stream; toward countering calcium deprivation in the blood.

6. A description of the topical effect of fluoride and of allergic reactions is presented.


**Keywords**: regulatory toxicology/legislation/1080


**Keywords**: persistence in soil/metabolism/fluoroacetamide/bacteria/defluorination/enzyme/temperature

**Abstract**: Enzymes (haloacetate halidohyrolases) capable of cleaving the C-F bond of fluoroacetate and some other organofluorine compounds have been isolated and partially purified from a soil pseudomonad and from the common soil fungus *Fusarium Solami*. Both enzymes readily released F- from monofluoroacetate and fluoroacetamide but were without effect on a wide range of other organic F-compounds. The enzymes also cleaved the C-Cl and C-Br bonds in mono-chloroacetate and mono-bromoacetate. Inorganic F- acted as a competitive inhibitor of the enzymes. The molecular weights both enzymes were about 62,000. This the properties of the halidohyrolases from both organisms were similar in many respects by the bacterial enzyme was more stable at 55EC and exhibited an unusual difference in temperature coefficient (q10 value) over its higher (30-55EC) and lower (15-30EC) temperature ranges.


**Keywords**: persistence in soil/1080

**Abstract**: Using simple enrichment culture techniques micro-organisms capable of detoxifying monofluoroacetate by removal of F-have been found in many and diverse samples of local soils. Species of *Pseudomonas* and *fusarium* were found to be capable of growth on fluoroacetate as sole source of carbon whilst several other organisms display defluorinating activity if supplied with a supplementary carbon
source for growth. It was concluded that fluoroacetate had a relatively short biological half life in most NZ soils.


Keywords: acute toxicity/mammals/birds/sodium fluoroacetate/fluoroacetate/1080


Keywords: metabolism/fluoroacetate/persistence in plants


Keywords: metabolism/persistence in invertebrates/invertebrates/fluorocitrate/fluoroacetate/citrate

Abstract: A comparison was made of the major excretory products when adult *Haemonchus contortus* worms were incubated with D-[U-14C] glucose under aerobic and anaerobic conditions. Catabolites measured were propan-1-ol, acetate, n-proprionate and CO2 and the only major difference was that nearly twice as much CO2 both in terms of quantity and radioactivity was excreted under aerobic than anaerobic conditions. The worms were also much more physically active under aerobic conditions. When worms were incubated under aerobic conditions with increasing amounts of fluoroacetate their CO2 production was progressively reduced to the anaerobic level. Their movement and their ability to clump together was also progressively reduced. After aerobic incubation with fluoroacetate and D-[U-14C] glucose the quantity and radioactivity of citrate within worms increased greatly. When worms were similarly incubated anaerobically no increase in citrate occurred and the worms appeared physically unaffected. When worms were incubated aerobically with fluoro[1-14C] they produced radioactive fluorocitrate.


Keywords: metabolism/persistence in plants

Abstract: A short note on investigation of the metabolism of fluoroacetate in lettuce plants - results reported in later paperby same authors.


Keywords: metabolism/persistence in plants

Abstract: 1. Whole lettuce plants were incubated with (1) (1-14C) acetate (2) fluoroacetate followed by (1-14C) acetate, (3) fluoro(1-14C)acetate, (4) fluoro(2-14C)acetate or (5) s-carboxy(14C)methylgulathione. 2. Fluoroacetate did not affect the expiration of 14CO2 from (1-14C)acetate and only a small amount of 14Co2 was produced from either fluoro (1-14C)-acetate or fluoro (2-14C)acetate in 43 h. 3. Fluoroacetate at 50 mg/kg wet wt. doubled the plant citrate concentration after 43h incubation, and depending on the age and size of the plant 50-100% of the compound was metabolized. 4. With both fluoro (1-14C)acetate and fluoro (2-14C)acetate all the radioactivity except that in the CO2 was found in the water-soluble acid fraction. About 2% was in fluorocitrate and the remainder, apart from unchanged fluoroacetate was in a number of compounds devoid of fluorine but containing nitrogen and sulphur. These were peptide-like and could be separated by chromatography on an amino acid analyser. 5. Identical compounds were obtained from the spontaneous reaction between iodo (2-14C)acetate and glutathione, the major product being S-carboxy-methylglutathione. 6. S-Carboxymethylcysteine was also isolated and its mass spectrum compared with a commercial sample. 7. Reaction rates of all the monohaloacetates with glutathione were studied at pH7 at 25EC. No reaction was observed with fluoroacetate. 8. The metabolism of fluoroacetate by lettuce is discussed in relation to that of aliphatic and aromatic halogen compounds, including fluoroacetate, by mammalian liver and to the metabolism of fluoroacetate by different plant reported by other workers.


Keywords: defluorination/fluoroacetate/metabolism

Abstract: It appears that lettuce can remove fluorine from fluoroacetate in much the same way that animals remove halogens from some halogenated aliphatic compounds (Thomson *et al.*, 1963). Unlike fluoropyruvate, fluoroacetate does not react directly with cysteine or glutathione; a catalyst such as an enzyme is required.
Ref Type: Report
Keywords: 1080/humans/sublethal effects
Abstract: In September last year we reported on the medical finding of Parkinson's disease as a result of exposure to 2,4-D in Northland. In November, the mainstream media published the results of a laboratory study linking the disease to rotenone, more commonly known as Derris Dust. There is a gathering body of evidence and worldwide concern that exposure to pesticides might be an important triggering factor in the development of this devastating and irreversible condition of the nervous system. We take a closer look at the problem.

Keywords: 1080/New Zealand/sodium monofluoroacetate/monofluoroacetate/pest/poison/temperature
Abstract: Sodium monofluoroacetate (1080) is used for large-scale pest control operations in New Zealand to control the introduced marsupial brush tailed possum. Wide-scale opposition to the use of 1080 had grown in recent years with the development of a substantial "anti 1080" lobby. Concerns for public health and effects on non-target animals among critics of 1080 have prompted the Environmental Risk Management Authority to undertake an official review of this pesticide. In anticipation of this regulatory review an evaluation of the peer-reviewed scientific literature was conducted on the risks associated with the use of 1080, in order to ascertain the degree to which regulations of 1080 reflect current scientific knowledge of the toxicology of this poison. Key areas of concern revealed in the literature include evidence that 1080 could have endocrine disrupting capabilities and that it is relatively slow to break down to low temperature when microbial activity is low. These two issues are yet to be fully resolved through further research and represent significant gaps in current knowledge. If regulations are to take full account of current science on 1080 they will need to acknowledge and reflect what is known, the gaps in this knowledge, and the risks associated with this uncertainty. Recommendations include further targeted research to fill gaps in current knowledge, regulatory precaution until such research is completed, and explorations of alternative methods to be used either in conjunction with, or instead of this toxin.

Ref Type: Magazine Article
Abstract: Refers to monitoring of forest after possum control in Taranaki and Wanganui.

Keywords: 1080/poisoning/baits/poison/non-target species/birds
Abstract: This study aimed to estimate the level of mortality of North Island tomtits (Petroica macrocephala toitoi) during an aerial 1080 possum poisoning operation in Tongariro Forest, New Zealand, and to evaluate transect-based alternatives to banding for monitoring tomtit populations. The operation used 12 g toxic (1080 at 0.15% weight/weight) cereal baits sown at 3 kg/ha. Transects were established at three neighbouring sites; two within the 1080 poison area, and one outside. The re-sighting of 14 out of 15 banded male tomtits at one site within the 1080 operation indicated that mortality was low. This was backed up by results from a before-after-control-impact (BACI) design to analyse density estimates from distance sampling along transects. We analysed the change in counts of territorial males before and after the operation based on the same transect surveys. This also showed little impact of poisoning on tomtits, and indicated that loss rates greater than 8.4% due to 1080 were incompatible with the data (95% one-sided confidence bound). Counts of territorial males gave a much tighter confidence bound than the banding or distance sampling results. Of the techniques applied, the counting of territorial males appears to have the most promise for providing high-precision estimates of short-term impacts, by taking full advantage of the territorial habits of male tomtits in spring. However, distance sampling shows potential for providing the basis for longer-term monitoring of tomtit populations. The transect-based approaches involved substantially fewer resources than banding for estimating short-term impacts, and offer a considerably less-intensive means of longer-term monitoring of tomtits.

Keywords: occurrence in nature


Keywords: bait degradation/1080/rabbits

Abstract: The effect of rainfall, dew and soil moisture on the losses of pindone (2-pivalyl-1,3 indandione) and 1080 (sodium monofluoroacetate) from vacuum-impregnated oat grains used for rabbit control are described. 1080 is lost much faster than pindone. The practical significance of these results is discussed.


Keywords: acute toxicity/mammals/rabbits


Keywords: acute toxicity/mode of action/mammals/occurrence in nature/pathology/poisoning/fluoroacetate/heart/sublethal effects

Abstract: A fatal disease of cattle and sheep which has come to be known as Georgina River poisoning or gidyea poisoning has been known to occur in the region of the Georgina River basin in the eastern Northern Territory and western Queensland since the early days of settlement. Bell et al (1955) have described the history and distribution of the disease in Queensland and established that it is due to the ingestion of the pods and leaves of the gidyea tree *Acacia georgina*. Barnes (1958) described the disease in the Northern Territory and confirmed that is can be produced by experimental feeding of the leaves and pods of the gidyea tree. Neither author described in detail the pathology and histopathology. Subsequent investigations in the Northern Territory and Queensland have revealed that the toxic principle of the gidyea tree is the fluoroacetate ion (Murray, McConnell and Whittem 1961; Oelrichs and McEwan 1961).

This paper presents details of the phyto-chemical investigation carried out in the Northern territory and an account of the histopathology of Georgina River poisoning as established by the study of a considerable number of natural and experimental cases in cattle and sheep. The lesions of experimental fluoroacetate poisoning in sheep and guinea pigs are also described.


Keywords: acute toxicity/diagnosis/1080

Abstract: Numerous cases of suspect accidental poisoning of livestock with sodium monofluoroacetate (1080) occur in New Zealand every year. Veterinarians are often called upon to perform postmortem examinations and collect samples to confirm the cause of death. Inadequate or inappropriate sample collection, handling or analysis significantly weakens the livestock owner's ability to prove liability and obtain compensation for losses from the Regional Council or other authority involved in the pest control operation. This article outlines the correct procedures for sample collection and handling to establish a diagnosis of 1080 toxicosis in livestock.


Ref Type: Report

Keywords: 1080/brain/heart/mammals/sublethal effects/developmental toxicity/gut/livestock

Abstract: Ewes that survived a single exposure to 1080 did not experience any adverse long-term effects. Over 2 years, including two lambing cycles, 1080-exposed (n=21) and control ewes did not differ in the following indices of health and productivity; incidence of infectious of metabolic disease, chronic organ damage, mortality, general condition / live weight, fleece weight, lambing percentage, lamb birth weight, lamb survival and growth rate. Contrary to preliminary findings that indicated no evidence of 1080-induced
lesions 14 days after exposure (Miekle et al 1996), detailed histopathological examination of heart sections using special stains revealed scattered foci of fibrous tissue in cardiac muscle more than 2 years after the single 1080 dose. These lesions may represent scarring resulting from toxin-induced damage to heart tissue. The clinical significance of these lesions is uncertain, but is likely to be minor given the lack of evidence for any adverse effects over a 2-year period. From a diagnostic perspective, this type of lesion is rather non-specific and could result from other toxic or non-toxic insults causing damage to heart muscle. Finding similar lesions in animals suspected of exposure to 1080 would strengthen the case for toxicosis, but their presence or absence could not be considered definitive proof.


Abstract: Objectives: To improve veterinary treatment of non-target animals exposed to 1080 by: Determining the efficacy of anion exchange resins and other potential 1080 absorbents to decrease toxin uptake and reduce mortality in orally dosed rats; Determining the efficacy of specific glutamate antagonists, GABA (gamma amino butyric acid) agonists, and other neurotransmitter modulators to reduce the severity of seizures and increase the survival of rats exposed to 1080; Determining the efficacy of the best binding agent to reduce 1080 uptake, and the effectiveness of peritoneal dialysis to enhance elimination of the toxin in anaesthetised dogs dosed with 1080.

Conclusions: Although both Carbosorb and colestipol were effective at binding 1080 in vitro, and colestipol reduced 1080 serum concentration by 50% during the first 4 h after exposure in a previous study (Wickstorm et al. 1998, unpublished), neither compound appears able to reduce absorption sufficiently to affect survival in rats given a high dose of 1080, even when a large amount of absorbent is given immediately after dosing; Oral administration of a mixture of centrally acting, neurotransmitter modulating agents appears to provide significant protection from the lethal effects of 1080 in rats given an LD50 dose of the toxin. The margin of safety with this mixture of potent compounds is rather small, since treatment at 2-4 times the therapeutic dose actually contributed to mortality in 1080-exposed rats, by excessive depression of the central nervous system or reduction/disruption of baseline transmission levels required to maintain homeostasis; Unlike the results seen in rats in a previous study (Wickerstorm et al. 1998, unpublished), administration of colestipol to anaesthetised dogs immediately after oral 1080 dosing does not appear to significantly inhibit toxin absorption from the gastrointestinal tract; Peritoneal dialysis is not effective at reducing 1080 blood concentrations in orally dosed dogs, even though substantial amounts of toxin can be removed from circulation in the dialysate.


Abstract: The effects of fluoroacetate (FAC) on suspensions of isolated rat kidney tubules were investigated. FAC inhibited gluconeogenesis from lactate, pyruvate, fructose, dihydroxyacetone, α−ketoglutarate and succinate. The gluconeogenesis from pyruvate, ketoglutarate and lactate was less sensitive to FAC than that from other substrates. FAC also caused a decrease in oxygen consumption, hydroxybutyrate to acetoacetate ratio, α−ketoglutarate, ATP and total adenine nucleotide content; the citrate content was increased. Addition of α−ketoglutarate, 5 mmol/l, caused a reversal of gluconeogenesis inhibition, an increase in ATP content and a delay in citrate accumulation in isolated rat kidney tubules incubated with FAC.

Wienhaus, H. (1973). The responses of different grapevine organs to the application of metabolic inhibitors and uncouplers during the ripening stage. Viitis 12, 105-118.

Abstract: Six respiratory inhibitors were applied to the berries and other plant parts. Sodium fluoroacetate decreased berry weight, reducing sugar and K contents, but increased titratable acidity and Ca content; it also caused stalk necrosis. Malonic acid promoted fruit sugar accumulation, lowered acidity, and did not affect weight. Sodium fluoride induced fruit skin discoloration and curtailed the rise in berry weight and sugar accumulation. After treatment with CCP (carbonyl cyanide m-chlorophenylhydrzone) berry weight,
reducing sugars, titratable acidity, K and Ca all increased. Sodium azide and dl-glyceraldehyde had no effect.

Ref Type: Report
Keywords: poison/1080

Keywords: sodium fluoroacetate/fluoroacetate/poisoning/humans/symptoms/welfare/treatment/1080/inhalation
Abstract: During the weighing [of 1080 powder], a small quantity of poison was blown into the writer's face and some of it was inhaled. A tart, sourish taste was shortly thereafter noted, followed almost immediately by a tingling sensation around the corners of the mouth and in the nasal passages. Becoming alarmed, medical assistance was sought. Soon the entire face had become numb, and the tingling sensation was rapidly entering the arms and legs. This was followed by spasmodic contractions of the voluntary muscles, gradual loss of speech, and within 2 and 1/2 hours after inhaling the powder as noted above, unconsciousness. No actual pain was noted during the entire onset.

Keywords: poisoning/treatment/sodium monofluoroacetate/monofluoroacetate/1080/rabbits
Abstract: An experiment compared effectiveness, cost and cost-efficiency of factorial combinations of the four commonly used methods of rabbit control on grazing properties in the Southern Tablelands of eastern Australia. Sixteen different treatment combinations were applied to 32 sites. The treatments comprised initial control, applied over four months, followed by repeated maintenance control on half the replicates, applied after intervals of 2, 6 and 12 months. Initial control comprised no treatment, or poisoning (P) with sodium monofluoroacetate (1080), or warren-ripping (R), or chloropicrin pressure fumigation (F), or combinations of these (P+R, P+F, R+F, P+R+F). Maintenance control consisted of phosphine-diffusion fumigation (M). Indices of rabbit abundance were compared one month before treatments were implemented. Treatment effects were assessed one month after completion of the initial control, and one and 5-6 months after the three maintenance controls, and additionally nine months after the second maintenance control. Control combinations that were highly effective and cost-efficient included both warren-ripping and maintenance treatment; poisoning prior to warren-ripping, or fumigating subsequently, or both, improved effectiveness and cost-efficiency. Warren-ripping interacted positively with one or more subsequent fumigations, improving effectiveness and cost-efficiency non-additively. Control combinations that excluded warren-ripping were ineffective and cost-inefficient, and one combination interacted negatively. Single treatments of poisoning or fumigation were cost-inefficient, allowing rabbits to recolonise rapidly to densities higher than original. Only multiple combination treatments or repeated applications were highly effective and cost-efficient; single applications of any method were inefficient and costly. The most effective and cost-efficient combination comprised the maximum six applications including ripping and maintenance treatment, namely P+R+F+M. The high effort and expenditure on the initial control resulted in high effectiveness and cost-efficiency, which maintenance control sustained at low cost. Maintenance treatments sustained or achieved effective control of rabbits; the cost of maintenance treatments halved on each repetition. [References: 28]

Ref Type: Conference Proceeding
Keywords: welfare/rabbits/sodium fluoroacetate/fluoroacetate/poisoning/poison/1080/lethal dose/convulsions/cardiac
Abstract: The effect of 1080 on a rabbit is dose dependent. A lethal dose results in a period of weakness, not attended by evidence of pain, which precedes unconsciousness. Convulsions occur only after the rabbit loses consciousness and is insensible to pain. The convulsions are due to barin anoxia resulting from acute
cardiac failure and circulatory collapse. Poisoning with sublethal doses often results in anorexia but rabbits recover fully within 24-48 hours. Killing rabbits with 1080 does not contravene the spirit of the Prevention to Cruelty to Animals Act 1986 because there is no evidence that its use causes pain.


Abstract: In global markets New Zealand is in the business of pampering the palates of the prosperous. Our sophisticated markets, in east and west, are demanding ever-higher quality in foods and fibres, both in the product and in the environment in which they are produced. The market scene of the 1990s will be influenced more strongly by concerns for personal health, the environment in general and concerns for nature in terms of animal welfare.

For New Zealand, these factors mean that our clean, green image must be substantive. Perceptions of "quality" will be governed as much by the way we manage, and are seen to manage, our natural and man-made environments, as by scientific evidence of safety of inputs or product quality.

Parallel to these trends is a growing disenchantment in influential sectors of western society, with what science and modern medicine has provided, there is a rising level of environmental awareness. These trends are expressed in many ways: debates on the benefits of bio-technology; the increase in medical ethics committees; and "phobic" responses to perceived chemical risks, e.g. Alar on apples. These societal trends are having an impact on public perceptions of the seriousness of pests and the risks associated with various control methods. One of the few studies of perceptions of pest risks in New Zealand revealed that rabbits and possums were considered "serious" or "very serious" pests by 93% and 90%, respectively, of 1,000 respondents. However, only 44-45% considered 1080 a suitable or very suitable control method.

Biological control, via disease, was slightly more acceptable (46-49%), while shooting was favoured by 68-69%. This highlights one of the great needs of pest research: study of the societal values threatened by pests or the control methods. For too long, pest researchers and controllers have focused on pest damage (impacts) and control efficacy and safety. The future use of 1080 in New Zealand is now critically dependent on establishing consensus on:

(a) What values possums and rabbits threaten;
(b) What are the ways (including 1080) of protecting or enhancing these values;
(c) What are the risks associated with each of the "ways".

This will require a significant increase in risk perception and societal values research. On-going refinement of the understanding of 1080 chemistry and bio-impacts will do little to allay societal concerns. Future emphasis must be on understanding the values bases from which such concerns arise and on developing strategies to address the concerns, while reducing pest and market risks.


Abstract: These results suggest that although the initial effect of fluoroacetate is to give rise to fluorocitrate, the secondary inhibition of phosphofructokinase by the accumulated citrate is actually lethal since it deprives the cell of pyruvate which would eventually overcome the inhibition of aconitase.


Abstract: mode of action/fluoroacetate/metabolism/heart/citrate/enzyme


Keywords: citric acid/metabolism/citrate
Keywords: 1080/New Zealand/baits/poison
Abstract: Research is reported on case studies in six localities throughout New Zealand where the Department of Conservation (DOC) and communities have engaged in consultation processes on possum control and aerial spreading of 1080-poisoned baits. Information from DOC staff and community groups and individuals was obtained by interviews and focus group discussions. The report provides an overview of the consultation and information-sharing process used in each case study. Key factors discussed that can influence community consultation processes (aside from the methods and tools adopted) included: differing perceptions of what 'consultation' meant; the approach and attitude of DOC staff; risk perceptions of aerial spreading of 1080 poison; community impressions of different organisations and contractors involved; differing structures and social contexts of communities; and media involvement. The various processes and methods used by staff when undertaking community consultation and information sharing over aerial 1080 are assessed. The report also highlights key considerations for staff who are involved in community consultation processes. Consultation should be part of a wider relationship-building process with communities, but the need to clearly define what DOC is consulting on in any operation is emphasised.

Keywords: metabolism/fluoroacetate/bacteria/persistence in water/inhibition
Abstract: Lake Mendota sediments and the immediate overlying water column were studied to better understand the metabolism of methanogenic precursors H2/CO2 and acetate in nature. Air and nitrate addition inhibited CH4 formation and stimulated CO2 production, whereas fluoroacetate addition totally inhibited acetate metabolism.

Wolfe, G. W. Subchronic toxicity study in rats with sodium fluoroacetate. HLA Study No. 2399-118, -505. 7-12-1998.
Ref Type: Report
Keywords: rats/sodium fluoroacetate/fluoroacetate/heart/testes/reproductive effects/chemistry/fluorocitrate/spleen/pathology/brain
Abstract: The test material, sodium fluoroacetate (RN62-74-8) was administered by oral gavage to Sprague-Dawley rats (20 animals/sex/group), to evaluate its subchronic toxicity. The rats received 0.05, 0.20 and 0.50 mg/kg/day sodium fluoroacetate (Groups 2 to 4 respectively) in deionized water for 13 weeks. The controls (Group 1) received deionized water only. Criteria evaluated included mortality, clinical signs, body weights, total food consumption, ophthalmologic examinations, hematology, clinical chemistry, organ weights, organ-to-body weight ratios, gross- and histopathology. No treatment-related findings were noted in survival, clinical observations, mean body weights, body weight gains, total food consumption, ophthalmological examinations, or hematology and clinical chemistry findings, except for fluorocitrate results. Fluorocitrate levels were significantly increased at Week 4 in group 4 males and Groups 3 and 4 females and at Week 13 in Groups 3 and 4 of both sexes. Treatment-related findings were noted in absolute and/or relative organ weights of the heart, testes/epididymides, and spleen. Absolute and relative heart weights were significantly increased in Group 4 males and Group 3 and 4 females. Absolute spleen weights were significantly decreased in Group 4 males. Significant decreases in absolute and relative testes/epididymides weights in Groups 3 and 4 males were accompanied by corresponding findings in gross and microscopic pathology. At necropsy, testes/epididymides were noted as small. Microscopic examination of the tissues revealed compound-related findings in the testes and epididymides and the mid and high-dose (Groups 3 and 4) rats. Testicular changes consisted of bilateral hypospermatogenesis with fusion bodies in the seminiferous tubules. Changes in the epididymides consisted of immature/abnormal sperm forms and hypospermatogenesis with reduced numbers of sperm forms in the epididymal ducts. Testes and epididymides from low-dose rats showed no evidence of compound-related effects. No treatment-related effects were observed in the other tissues of the males or in any of the tissues of the females. The findings of this study indicated that the no-observed-effect-level (NOEL) for sodium fluoroacetate, when given orally to Sprague-Dawley rats for 13 weeks, was 0.05 mg/kg/day.

Ref Type: Magazine Article
Keywords: 1080/bait degradation/persistence in soil/non-target species/foxes/soil/degradation

Abstract: Over the last few years there has been an increasing awareness of the need for fox control in Australia to protect native species of fauna from excessive levels of predation and possible extinction. Compound 1080, a poison impregnated into various types of baits has been used to control foxes by the department of Conservation and Land Management and the Agriculture Protection Board in Western Australia. Studies on the degradation of compound 1080 in bait materials and Western Australian soils, conducted by Dr. Dee Wong, Lecturer in the School of Medical Technology at the University, have provided vital information on long term environmental hazards.


Abstract: Soils from four sites, two with and two without previous exposure to sodium monofluoroacetate (1080), in Western Australia were investigated to determine whether they contained microorganisms capable of defluorinating 1080. Most samples from these four sites showed microbial defluorination activity. A number of species of bacteria and fungi were isolated: Aspergillus fumigatus, Fusarium oxysporum, Pseudomonas acidovorans, Pseudomonas fluorescens 1, an unidentified Pseudomonas sp., Penicillium purpurescens and Penicillium restrictum. These seven microorganisms could defluorinate 1080 when grown in a 1080 solution, which was the sole carbon source, and also in autoclaved soil. The amount of defluorination varied with different species of microorganisms, ranging from 2 to 85% in soil and from 2 to 89% in 1080 solutions. A time-course experiment showed that some indigenous soil microflora were able to defluorinate over 50% and up to 87% of the 1080 within 5-9 days in soil with a moisture content of about 10% when kept at 28°C (day) and 15°C (night). Soils from four other arid or semiarid sites were also investigated for the presence of thermophilic microorganisms with 1080 defluorinating ability; no thermophilic microorganisms were isolated.


Abstract: The optimal temperature for 1080 defluorination varied with different microorganisms and with different organic carbon sources. On agar, all seven isolates grew best in the temperature range of 28-30°C. The highest rate of 1080 defluorination in soil for all isolates occurred with fluctuating temperatures (minimum = 11°C, maximum = 24°C) and at soil moisture contents of 8-15%, while the lowest rates occurred at a soil moisture content of 30%. The defluorination rate of 1080 when it was present at the sole carbon source decreased as the inoculum size increased. In soil the rate of reduction in 1080 defluorination was not directly proportional to the microbial inoculum size and the rate varied with different microorganisms. Some microorganisms had their highest rate of defluorination activity at a low inoculum density (105 cells/ml in 1080 solution and 107 cells/ml in soil).

Keywords: bioassay/bait degradation/1080/sodium fluoroacetate


Ref Type: Pamphlet

Keywords: 1080


Ref Type: Report

Keywords: sodium fluoroacetate/fluoroacetate


Ref Type: Report

Keywords: 1080/persistence in plants/persistence in water/degradation

Abstract: 1080 in the presence of aquatic weed reduced in concentration depending on the amount of weed present. There was no observed reduction of 1080 in the presence of shredded carrot. Neither cellulose nor glass fibre filter material showed any effect on 1080 concentration in water.


Keywords: 1080/sodium monofluoroacetate/monofluoroacetate/poisoning/invertebrates/baits/soil/non-target species/persistence in plants/persistence in soil

Abstract: The risk of environmental contamination by 1080 from bait dust during possum control operations was assessed after three such operations. This research was prompted by the lack of data on the potential risk of poisoning invertebrates in leaf litter by 1080 from bait dust. Cereal baits containing 0.15% 1080 were aerially applied and samples of bait dust (from application of bait), plants, leaf litter, soil, and water (from within and up to 1000 m outside the treatment areas) were collected prior to and up to 30 days after bait application. A maximum concentration of 25.2 µg 1080 m⁻² was detected in bait dust (from dust collectors) within the control zone immediately after aerial application of 1080 baits. Lower concentrations of 1080 were found outside the treatment areas indicating relatively little drift of bait dust. There were detectable short-term 1080 residues in water, plant, leaf litter, and soil samples after two of the three baiting operations. However, the residues were very low indicating only minor contamination by 1080. Using the maximum concentration of 1080 found in leaf litter, and literature LD₅₀ values for invertebrates, these results indicate that 1080 derived from bait fragments and bait dust does not pose a significant risk of poisoning to resident leaf litter invertebrates. However, the presence of 1080 baits on the ground may still pose a risk to those invertebrates in close proximity to these baits.


Ref Type: Conference Proceeding


Ref Type: Pamphlet

Keywords: 1080/livestock/poison/poisoning/rats/treatment/persistence in water

Abstract: Water quality is to be monitored during 1080 poisoning operations to determine whether or not 1080 is present at undesirable concentrations in the natural waters of the poison treatment area. This is of particular concern where drinking water for domestic purposes or for livestock is drawn from catchments in or adjacent to these areas. As a result of recent research findings on the teratogenicity (effects on unborn offspring) of 1080 in rats (Eason et al. unpublished contract report 1998), the Ministry of Health has issued
guidelines recommending that water should not be used for drinking until tests show that the concentration of 1080 is below 2 parts per billion. This value was taken from the Ministry's approach to priority determinands in drinking water. The Drinking Water Standards for New Zealand require that, whenever a determinand is present at more than 50 percent of the maximum acceptable value (MAV), additional sampling is carried out until it has been established that its concentration does not exceed the MAV. The figure of 2ppb is an approximation to 50 percent of the provisional MAV of 5ppb.

An intensive water-monitoring programme after a poisoning operation enables any water contamination to be detected and public concerns answered, provided due attention is given to site selection, timing, and the care and handling of samples.

This sampling protocol has been prepared for Department of Conservation, regional council and district council pest control managers who need to undertake water monitoring, or Medical Officer of Health (MOH) who is involved in assessing the need for sampling. It provides information on water sampling, handling, transport, contact names, and the costs involved. Samples are received and analysed by the Toxicology Laboratory of Landcare Research, Lincoln. Advice on the establishment of a sampling strategy may be obtained from Environmental science and Research Ltd (ESR).


Ref Type: Report
Keywords: 1080/metabolism/secondary poisoning/poisoning/humans/persistence in plants/persistence in water
Abstract: The half-life of 1080 in solutions containing E.canadensis concentrations of 0.33 to 133 mg/mL ranged from 18.8 to 2.5 h respectively. The presence or absence of artificial light did not appear to affect the rate of elimination of 1080 from solutions containing plant material. E. canadensis absorbed 1080 from the solution to reach a maximum of 2.5 µg/kg after 2h. This concentration slowly decreased to below the method detection limit (2 µg/kg) after 24h.

The elimination rate of 1080 from low-concentration solutions is influenced by the amount of living aquatic plant material present. The metabolism of 1080 by plant material is not affected by the presence or absence of artificial light. The rate of loss of 1080 from solution due to plant material is relatively slow below 15ºC, but becomes more rapid above 20ºC. There is a very low theoretical risk of acute secondary poisoning of humans and animals consuming aquatic plants contaminated with 1080 through exposure to low concentrations in water.


Keywords: aconitase/resistance/fluoroacetate/citrate/temperature
Abstract: Two independent Chinese hamster ovary cell lines have been isolated in cell culture which exhibit resistance to the cytotoxic effects of fluorocitrate. Although the oxidation of citrate by wild type cell suspensions was markedly inhibited by 1 mM fluorocitrate drug-resistant cells oxidized citrate at approximately normal rates in the presence of the drug. The aconitase activity from the resistant cells was less sensitive to the inhibitory action of fluorocitrate in vitro and showed altered heat stability properties when tested in heat inactivation experiments at 3 different temperatures. These results are consistent with the view that the resistant cell lines contain a structural gene mutation.


Keywords: antidote/poisoning/treatment
Abstract: Adsorption of phenobarbital from simulated intestinal and gastric fluids by two activated charcoals was studied. Adsorption isotherm data were analyzed by the linearized Langmuir equation and by nonlinear least-squares regression employing both Langmuir and Freundlich models. These analyses indicated differences in the capacities of the two charcoals for phenobarbital which could not be completely explained by surface-area considerations.

Keywords: antidote/poisoning/treatment

Abstract: The molecular modeling program SYBYL was used to simulate the adsorption of various barbiturates by an activated charcoal surface. The compounds barbituric acid (BA), barbital (B), phenobarbital (PB), mephobarbital (M), and primidone (Pr) were modeled, and their structures were energetically minimized. These structures agreed with literature reports for the conformations of these molecules in dimethyl sulfoxide-d$_6$, methanol-d$_4$, and chloroform-d. The activated charcoal surface was modeled using graphitic crystallites which had either no oxygen-containing functional group, a C-OH functional group, or a C=O functional group. The presence of the C-O (presumably C-OH) and C=O functional states on activated charcoal surfaces had been previously determined by X-ray photoelectron spectroscopy. It was assumed that the crystallite was locally flat. Upon docking, conformational changes were observed for barbital, phenobarbital, mephobarbital, and primidone. Estimates for the heat of adsorption ranged from -62.3 kJ/mol for barbituric acid to -91.1 kJ/mol for mephobarbital on the hydroxylated surface. Allowance for the heat of desorption of the required number of water molecules from the surface, also determined by SYBYL, gave heat of displacement values of -19.4 kJ/mol for barbituric acid and -32.6 kJ/mol for mephobarbital. These values compared well to the heat of displacement values obtained by isoperibol calorimetry, which were -20.3 kJ/mol for barbituric acid and -31.6 kJ/mol for mephobarbital. Previous laboratory studies had demonstrated the greater importance of the C-O functional state for barbiturate adsorption compared to the C=O functional state. The computer-modeled system predicted the same result.


glycogenolysis by 50-90%. Fluoroacetate treatment inhibited mixed function oxidation in the perfused liver by about 50% without affecting p-nitroanisole O-demethylation by isolated microsomes. Fluorocitrate at concentrations up to 50 uM did not inhibit microsomal p-nitroanisole O-demethylation \textit{in vitro}. These data support the hypothesis that mixed-function oxidation in intact hepatocytes is dependent upon reducing equivalents generated via the citric acid cycle.