

CHEMISTRY

Linda Garmon reports from Washington at the Nineteenth Annual Meeting of the Society of Toxicology

Dickens of the sea: Scombroid toxicity

Somewhere in the tuna, and in other fish of the scombroid family, lurks a mysterious factor that can cause a toxic reaction in persons ingesting the seafood. The reaction — termed scombroid toxicity — is characterized by cardiac palpitations, dizziness, faintness, itching, pulse changes, inability to swallow, a rash, burning of the mouth, abdominal cramps and nausea occurring up to three hours after ingestion of certain scombroid fish. The toxic reaction has been associated with the presence of high levels of certain bacteria in scombroid fish — bacteria that rapidly change the amino acid histidine in the fish to histamine. Now, Sara Henry and colleagues of the Food and Drug Administration have shown that histamine alone does not cause scombroid poisoning: An unknown factor in tuna is also involved.

Henry and co-workers treated beagle dogs to capsulized commercial tuna extracts with or without histamine. Histamine alone also was tested. Only the combination fish extract with histamine caused a significant adverse effect. The FDA researchers suggest, therefore, that scombroid toxicity results from the action of histamine and an unidentified factor in the tuna.

The Center for Disease Control in Atlanta documented between 1975 and 1979 about 250 outbreaks of scombroid toxicity. The syndrome may be under-reported, however, because most victims recover within 48 hours after ingesting the toxic fish. Syndrome outbreaks may be due to ingestion of tuna that was not refrigerated on fishing boats: The histamine-producing bacteria multiply rapidly in higher temperatures.

Caffeine, fentanyl: And they're off

Equine racers who help their horses to win, place and show through illegal administration of drugs continue to frustrate racing commissions: The racers can give their horses drugs in amounts that are effective but too small to be detected by present analytical means. To regulate such drug abuse, commissions need improved analytical techniques, and these can be developed only after the pharmacodynamic — effect and reaction — details of the abused agents are studied.

Now, Eugenie Greene and colleagues of the University of Kentucky at Lexington have studied the effects of caffeine — sometimes used illegally as a doping substance — in race horses. Spontaneous motor activity in response to the drug was measured by the number of left foreleg footsteps taken by the horses in specially designed stalls. Interestingly, caffeine produced only a slight increase in the activity of the horses.

Because previous work had shown that the stimulant methamphetamine potentiated, or intensified, the motor activity induced by fentanyl — another narcotic administered to horses — Greene and co-workers hypothesized that caffeine also might multiply fentanyl's toxicity. Back in the stalls, the theory was confirmed: Caffeine significantly potentiates the motor activity induced by fentanyl in the last 30 minutes of the fentanyl response. Furthermore, potentiation of the fentanyl response peaks four hours after caffeine administration.

Paraquat poisoning: Beware the antidote

It seemed a logical choice when ascorbic acid was selected as an antidote for paraquat — a herbicide — poisoning: Paraquat causes lung damage by generating active oxygen (superoxides) and ascorbate is an active oxygen scavenger.

But Glynn McArn and colleagues of the University of California at Davis found some not-so-logical results when they tested the toxicological effects of paraquat and ascorbate in rats: The ascorbate intensified the toxicity of paraquat. McArn suggests further evaluation of ascorbate-paraquat interaction.

ENVIRONMENT

Oiling the way to a cleaner body

Animals dining on a low-level diet of mineral oil — roughly five percent of their diet by weight — experienced up to a 10-fold increase in the rate at which chlorinated hydrocarbons are naturally eliminated from the body, according to scientists from New Mexico State University and the International Center of Environmental Safety at Holloman Air Force Base. What this means, says Stan Smith of NMSU, is that in the future, livestock contaminated with PCB's (polychlorinated biphenyls) or similar persistent and dangerous chemicals might be cleaned — instead of sacrificed — to halt spread of contamination up the food chain. And, he adds, results suggest that the mineral oil treatment might rid certain fat-seeking chemicals from humans too.

Smith was drawn into these studies by Karl Rozman, a German toxicologist from a Munich-based institute who is currently working out of ICES in Alamogordo. Results of their work, described at a toxicology meeting in Washington this week, reported a three-fold increase in the rate of chlorinated-hydrocarbon elimination by rats and sheep, a 10-fold reduction by rhesus monkeys.

Smith, of NMSU's Range and Animal Science Department, is particularly interested in results of the sheep study because of what it implies about the possibility of saving animals exposed to contaminated feed, as occurred in a PCB spillage episode in Montana last year (SN: 10/6/79, p. 228).

The studies involve deliberate contamination of animals with hexachlorobenzene — an excellent chemical model, Smith claims, for examining effects of slowly degrading pesticides and other chlorinated hydrocarbons, such as PCB's. Movement of the chemical through the body was monitored via radioactive tags.

Speaking of the sheep study, Smith said oil treatment, which lasted six weeks, involved levels so low that there was "no laxative effect at all." What's more, the animal nutritionist says, results indicate the inexpensive cleansing agent interfered with neither food digestion nor weight gain.

Animals may accumulate high levels of poisons without showing signs of toxicity if contamination occurs at chronic low levels. But efforts to quickly flush poisons from the body can induce acute poisoning if chemicals leaving body storage enter the blood at high enough levels. That's what toxicologists feared might happen with the mineral oil treatment. But it didn't. Blood levels of the contaminant never elevated during treatment, nor were there signs that the oil exited into the feces as the chemical had. In fact, Smith says, the oil may be absorbed and metabolized during decontamination.

Radiant cleaners

A team of Japanese scientists have demonstrated a technique for simultaneously removing both nitrous oxides (NO_x) and sulfur oxides (SO_x) in a dry form from caustic industrial-exhaust gases by electron-beam irradiation. Tested for more than a year on emissions from a sintering machine in a steel plant, the 260,000-rad-per-second dose delivered by 600-kilovolt electron beams eliminated better than 95 percent of the SO_x and more than 80 percent of the NO_x, according to a report in the March ENVIRONMENTAL SCIENCE AND TECHNOLOGY.

Irradiating an aerosol of exhaust gases and controlled additions of ammonia produces a white powder that electrostatic precipitators filter from the exhaust gases further downstream; the powder contains the troublesome NO_x and SO_x.

This concept might spell a solution to problems plaguing clean up of particularly dirty and corrosive emissions from the combustion of both heavy oil and coals, say the authors, who represent Ebara Corp. in Kanagawa and the Nippon Steel Corp. in Fukuoka and Tokyo.