CHEMISTRY

Shellfish toxin chemically prepared

Saxitoxin, a poison extracted from shellfish, is one of the most toxic nonprotein substances known. It has a very specific action on the central nervous system. For the first time it has now been totally synthesized in a Harvard chemistry laboratory.

The chemists began their synthesis from scratch, in this case, an easily available 2-ringed compound called methyl 2-oxo-4-phthalimidobutyrate. They used 13 steps to construct another ring and attach the appropriate side groups, all in the correct three-dimensional configuration. The procedure took two years, but Yoshito Kishi estimates they could do it again in less than two months. Kishi and co-workers Hideo Tanino, Tadashi Nakata and Takushi Kaneko ended up with about 3 milligrams of saxitoxin, an amorphous solid.

Kishi admits that purifying the toxin from shellfish is still much cheaper than synthesizing it. However, synthetic saxitoxin may have important research uses. Neurophysiologists are interested in the poison because it selectively prevents critical changes in the nerve membranes' permeability to sodium ions. Researchers would like to be able to chemically manipulate the toxin, for example, label it with radioactive carbon to locate the cell membrane molecules that bind it.

The report of saxitoxin synthesis, published in the April 13 issue of the JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, is one of many papers this year dedicated to Harvard organic chemist Robert B. Woodward by former students to commemorate his 60th birthday.

Magnet pull on chemistry unexplained

The rug has been tugged from under the only good explanation of how a magnetic field might influence chemical reactions. For five years the predominant theory has been thermodynamic—a strong magnetic field should speed a reaction if the reactants are relatively nonmagnetic and the products are strongly magnetic. That hypothesis was based on one reaction, reduction of an iron compound (Fe_3O_4) to metallic iron.

Chemists at Texas A and M University have now used an independent technique to confirm that earlier observation. But Marvin W. Rowe, Steven M. Lake and Robert Fanick went a step further. They reduced another nonmagnetic compound (FeO) to metallic iron. Contrary to their expectations, this reaction was slowed by the magnetic field, they report in the April 14 NATURE. At present the researchers have no new explanation to offer.

Toxic reflections on an oil spill

Don't let the sun shine on oil spills, at least not until they have been chemically treated. Researchers at the Stroud Water Research Center of the Academy of Natural Sciences in Philadelphia beamed bright summer levels of ultraviolet light at number 2 fuel oil in a simulated environment. The oil degraded to compounds highly toxic to bakers' yeast, an organism similar in cellular organization to many forms of aquatic life. Toxicity reached a maximum within 24 hours. "It is likely that peroxides and acidic materials were responsible for much of the phototoxicity," Richard Larson, Laura L. Hunt and David W. Blankenship report in the May issue of ENVIRONMENTAL SCIENCE AND TECHNOLOGY.

If oil spills can't be kept in the dark, the researchers propose another solution. A mild reducing agent called thiacyclohexane markedly reduces the toxic effects if it is applied during the first 24 hours of the oil's exposure to light. "It is conceivable that similar compounds could be used in the field to mitigate the environmental impact of spills of refined oil," they say.

ZOOLOGY

Female fish produce mates when needed

Certain species of coral reef fish have a capability that is, to say the least, intriguing. They function first as one sex and later as another. Scientists that study the behavior of such sequentially hermaphroditic fish have previously noticed that in the species in which individuals first function as females and then as males, dominant males can control production of other males by aggressive dominance over females.

Now, in different kinds of fish, exactly the opposite case has been observed. Two scientists report that in two hermaphroditic species in which the individuals function first as males and then as females, the females control production of females by aggressive dominance over males.

This behavior was found in the anemone fish, *Amphiron*, a widely distributed coral-reef fish that lives in symbiosis with several kinds of sea anemones. The work, the result of 38 months of field studies at Eilat, Israel, on the Red Sea, and at Aldabra, in the Indian Ocean, is in the April 28 NATURE by Hans and Simone Fricke of the Max Planck Institute in West Germany and of the Steinitz Marine Laboratory at Eilat.

The anemone fish, the Frickes showed, are born as males and females both but during growth undergo functional male, then female phases. The typical social unit consists of a large female, a single smaller male and some subadults. Occasionally groups are larger, but the average group size is restricted to no more than two adults by the dimensions of the host anemones.

They have shown that the largest and oldest individual of a group is always female and dominates the male, the subadults and the juveniles. Subadult males are attacked by both sexes. The largest male prevents other males from spawning. This intergroup social pressure determines the gonadal development of the victims of the aggression. Their testes are smaller and less mature. They are "psychophysiologically castrated."

The Frickes demonstrated the dominant female's control over sex reversal by a series of experiments. In one, when the dominant female was removed from an aquarium group of five anemone fish, the largest male changed sex to female in less than 63 days. In a field experiment, when the female was removed from each of 24 pairs of anemone fish, 18 of the males turned into females. The first of these females laid eggs within 26 days. In another experiment, different sized males were forcibly placed on empty anemones. The largest and most dominant males always changed to females.

"This study," they conclude, "demonstrates socially controlled sex change by aggressive dominance. Females control the procreation of other females. They restrict the size of the breeding population and actively suppress males which are likely candidates for future females. . . . Functional mates are produced whenever they are needed."

The head 'eyes' of the weevil

The heads of many kinds of weevils appear to be part of a newly discovered receptor system sensitive only to long-wavelength light. All or part of the head capsule of these insects acts as an optical filter, transmitting far-red and near-infrared radiation to the tissues beneath, entomologist John R. Meyer, now at North Carolina State University, reports in the April 29 SCIENCE. He says receptors sensitive to this portion of the spectrum are virtually unknown among arthropods.

Meyer first discovered the head filter in the alfalfa weevil, but apparently almost all other weevil species, including the cotton-boll weevil, have it also. He has shown that the alfalfa weevil uses this head sensor in conjunction with its eyes to detect living alfalfa, which strongly reflects infrared.