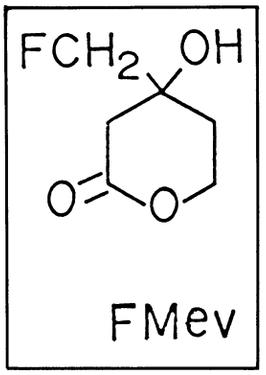
CHEMISTRY

Linda Garmon and Julie Ann Miller report from Las Vegas, Nev., at the meeting of the American Chemical Society

Moth control: Block juvenile hormone



Chemical analogs to an insect's juvenile hormone have provided successful control of selected insect species. An attractive extension of that approach is to impede insect production of the hormone, say Gary B. Quistad and colleagues at Zoecon Corp. in Palo Alto, Calif. Impaired production of juvenile hormone shortens the larval stage of an insect's life, which is usually the period that produces maximal damage to plants. In addition, the deficiency often produces miniature pupae that do not develop into adults.

Similarities in biosynthesis of insect juvenile hormone and of cholesterol suggested to Quistad that compounds that inhibit cholesterol production might also limit juvenile hormone synthesis. He now reports that fluorinated mevalonate (FMev) does inhibit juvenile hormone production in a variety of moth species. Larvae treated with FMev develop intense black pigment, begin burrowing behavior prematurely and often develop into nonviable miniature pupae or larvae-pupae intermediates. These effects can be circumvented by concurrent application of an active juvenile hormone analog.

Insects other than the lepidopteran species, which include moths, were not affected by FMev at the doses that inhibit juvenile hormone synthesis in moths. The compound, however, has toxic effects at higher concentrations in a wide range of insect species. Those "nonspecific" effects may be due to metabolic conversion of FMev to the toxic chemical fluoracetate, according to Quistad.

"The activity of FMev by itself is not sufficiently high even on lepidopteran pests for commercial exploitation," Quistad says. Nevertheless, he believes that it will be a valuable tool for studying insect physiology and that its novel mode of action, inhibition of juvenile hormone biosynthesis, will foster new selective insect control agents.

New mushroom method

A process for cultivating commercial mushrooms that conserves fuel, space, time and materials is reported by a U.S. Department of Agriculture scientist. Ralph H. Kurtzman Jr. of the Western Regional Research Center in Berkeley, Calif., says that modern fermentation technology, like that used to produce antibiotics, can shorten preparation of mushroom "compost" from three weeks to less than a day. The new method decreases loss of original material from 50 to 10 percent, Kurtzman says.

Traditionally, compost for mushrooms has been meticulously prepared, starting with straw and horse manure and other nutrient supplements. The compost must be turned with heavy machinery several times as it lies outside for at least a week. Then it is moved indoors for an additional week of treatment with steam and forced air. Control of the process is difficult, and it sometimes fails.

The new method uses a "liquid compost" of water and such supplements as beet molasses, cotton seed meal, urea and other common chemicals. Microorganisms are grown in that liquid, which is then poured over straw, corncobs or other cellulose-containing wastes. When the straw has cooled, mushrooms are planted and they grow just as mushrooms grow in a traditional compost. "However, since less of the material is lost in preparing the 'compost,' there is more food for the mushrooms to grow on, so many more mushrooms will be harvested," Kurtzman says.

Superstick brain chemicals

Improvements on the human brain are difficult to come by, but chemists, with their skills in constructing intricate molecules, are creating new chemicals that are an improvement, at least for experimental and medicinal purposes, on natural brain substances. Each of the new compounds binds to the specific receptor structures in the brain. Compounds that bind more strongly than the natural substance are useful to identify specific receptors and have potential as a long-lasting drug.

Dopamine is a natural brain substance that carries signals between nerve cells. A shortage of dopamine results in Parkinson's disease; an excess has been associated with some types of schizophrenia. John L. Neumeyer and Say-Jong Law at Northeastern University and collaborators at Harvard Medical School and University of Bradford in England have synthesized a chemical that binds to the dopamine receptor very strongly, because it makes a covalent bond. Neumeyer says that chemical, N-chloroethylnorapomorphine, could help explain the basis for Parkinson's disease and schizophrenia and might become a long-lasting drug for schizophrenia.

In a different line of investigation using the same general strategy, Philip S. Portoghese and colleagues at the University of Minnesota have created chemicals that bind to opiate receptors in the brain. Like Neumeyer's dopamine antagonist, the opiate analogs bind covalently (by alkylation) to specific receptors. Work with a series of such opiate analogs has verified that there are distinct types of opiate receptors. Portoghese says that from a practical viewpoint, such opiate compounds might be of clinical value as "ultra-long-acting" antagonists to narcotics.

Hoppy talk

Here's to good beer; the hop is kind of special. And agricultural chemists Val E. Peacock and Max L. Deinzer of Oregon State University in Corvallis are discovering why hops—the dried ripe cones of a rough twining vine—make a difference in beer flavor. The researchers are identifying the compounds that are responsible for the "hoppy aroma" that certain hop varieties impart to beer. "Hop breeders can then use this information to develop new hop varieties that will grow well in the United States—most of the traditional 'aroma hops' are European varieties that do not grow well in North America—and still have good aroma characteristics," the researchers report.

Peacock and Deinzer recognize two types of aroma that various hops impart to beer: a floral aroma that is common in American hops and a classical "noble" aroma most often from expensive imported European hops. The chemists easily traced the floral aroma to three compounds — linalool, geraniol and geranyl isobutyrate. But, "the spicy-herbal hop aroma has been much more elusive to us and other investigators," they report. Taste panel data, though, indicate that the compound humulenol II probably has a "noble" influence on hop aroma.

Perfume oil: Out with the bad

It's a savory example of selective chemistry: Canadian researchers have designed a polymer (plastic) material that removes the allergens from plant extracts used in perfumes without disturbing the desirable scent components. The plastic, P-CH_2-CH_2-NH_2 (P = polystyrene gel), acts as a "chemical sponge," sopping up compounds known to cause contact dermatitis — an inflammation of the skin caused by contact with various substances — Jean M. J. Fréchet and colleagues of the University of Ottawa in Ontario report. Their research paves the way for the design of other polymers to remove toxic substances from different environmental sources.