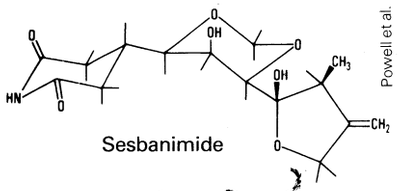
Chemistry

Linda Garmon reports from Seattle at the meeting of the American Chemical Society

Back-to-nature chemistry

Nature is the most important laboratory for natural-product chemists — scientists who try to isolate potential drugs, pesticides and other useful substances from plant and animal sources. In some cases, these substances already have been used as folk remedies. At a special symposium on such natural-product chemistry, the following work was reported:

• Within the seeds of a poisonous plant called rattlebrush lies a cancer inhibitor, Richard G. Powell and colleagues of the U.S. Department of Agriculture in Peoria, Ill., have discovered. The isolated substance has been dubbed "sesbanimide" for *Sesbania drummondii,* the Latin name of the poisonous plant, which grows in sandy soils in seven southern and southeastern states.



Sesbanimide

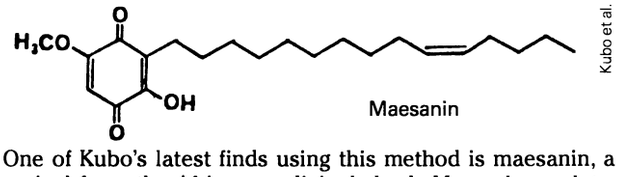
Rattlebrush

In National Cancer Institute tests, mice that received 0.01 milligram of this poisonous plant extract per kilogram of body weight survived leukemia 1.71 times as long as control mice. In addition, sesbanimide has been shown to inhibit the growth of human carcinoma cells in laboratory cultures.

With its three chemical rings, this anticancer substance structurally resembles antibiotics that are produced by common soil bacteria. Therefore, the USDA scientists are not certain whether sesbanimide is actually produced by the rattlebrush or by microorganisms associated with the plant. The chemical does differ structurally from antibiotics, though, in that its three rings are linked by single bonds. Usually, the rings of natural products share a common side.

Sesbanimide is just one of about a dozen potentially useful natural products Powell and his group have isolated from plant seeds. Earlier, for example, they isolated a group of cancer inhibitors, harringtonines, from a plumyew tree that grows in China. The ability of a member of that harringtonine chemical class to fight various cancers now is being tested in human trials under the direction of Peter O'Dwyer of the National Cancer Institute.

• Success in unraveling the natural-product chemistry of East Africa depends in part on finding a "Bwana Mganga," a village medicine man, and earning his trust, says Isao Kubo of the University of California at Berkeley. In revealing certain medicine-man secrets — such as which barks and leaves are used as specific treatments — the Bwana Mganga provides important leads on which plants deserve to be taken back home to the laboratory for further analyses, Kubo explains.



Maesanin

One of Kubo's latest finds using this method is maesanin, a chemical from the African medicinal shrub *Maesa lanceolata.* Kubo had learned that medicine men boil the shrub to make a tea that natives drink to prevent cholera, a disease caused by drinking bacteria-contaminated water. So he and his colleagues began testing the antibacterial activity of various extracts taken from the shrub's orange berries. Eventually, they discovered the active component to be maesanin, a chemical structurally similar to vitamin K. Mice treated with single low doses of maesanin (5 milligrams per kilogram) were protected from normally lethal infections of the bacteria *Escherichia coli.* Kubo reported. The chemical may prove to be a model for new antibiotics, he said.

Seedling 'garlic breath' repels deer

The same malodorous gas that the human body exudes after a garlic meal is eaten has proved effective in preventing deer from feeding on tree seedlings.

Garlic contains a rather large amount of the chemical selenium. People who have eaten garlic eliminate that chemical from the body by converting it to the volatile substance dimethyl selenide, which then escapes as a gas. David I. Gustafson and colleagues of the University of Washington in Seattle have demonstrated that this same gas can be used as a deer repellant to reduce browse (graze) damage to Douglas-fir seedlings — a problem that costs several million dollars each year in Washington and Oregon alone. Scientists long have known that certain plant species already contain selenium and that such foliage is avoided by deer, Gustafson reported. "Thus it was our plan to convert Douglas-fir seedlings into ... similarly malodorous plant[s]," he said.

To give Douglas-fir seedlings "garlic breath," Gustafson and associates designed a small slow-release, selenium-containing tablet to be placed in or near the seedling planting holes. The tablet is dissolved by rainfall, absorbed through the roots and then eliminated from the tree needles as dimethyl selenide. Use of tablets that result in selenium foliar concentrations of 100 parts per million (ppm) has been shown to reduce deer browse damage to seedlings by 80 percent and to have no measurable effect on tree growth rate, Gustafson reported. Tablets that lead to greater selenium concentrations, however, were found to be toxic to the seedlings.

The major advantage of this repellant system over conventional methods, such as the placement of plastic tubing around the seedlings, is "its potential for long-term protection — approximately three years with one treatment," Gustafson said. "This is precisely the time required for tree seedlings to attain a height at which they are no longer vulnerable to browse damage." Gustafson said the deer repellant tablet could be on the market within a year.

Fruit-of-the-vine sweetener discovered

Japanese researchers have unlocked the secret behind the sweet fragrance of Sauterne, Rhine, Moselle and Tokay wines. That secret, Masahiro Masuda and colleagues of the Central Research Institute of Suntory Ltd. in Osaka have discovered, is relatively large concentrations of the component chemical sotolon, which also is the main flavor compound in molasses.

The sweet wines Masuda studied belong to a class called "botrytised wines." These are produced from grapes on which the mold *Botrytis cinerea* grows and causes the fruit to lose some of its liquid and therefore to concentrate its sweetness. "The conditions in special districts in France, Germany and Hungary are especially suited to the growth of this noble rot," Masuda reported. By contrast, the rainy weather during the harvest season in Japan often causes the grapes to "rot undesirably." Nonetheless, the Japanese team has developed a special cultivation program in order to produce these wines in vineyards near Mt. Fuji. Masuda reported that he hopes the recent discovery of the key role concentrated sotolon plays in the flavor of the botrytised wines will enable the team to further improve its wine production technique.