Twist of orange, lavender oil stop cancer

A compound in the fragrant oil found in orange peels has now joined a growing list of substances under study for their ability to stop cancer before it starts.

Called limonene, the ringed, 10-carbon orange oil compound can reduce and prevent human breast cancer tumors in mice, says Michael N. Gould of the University of Wisconsin-Madison. A similar oil compound – originally derived from lavender plants – has proved five to 10 times as potent as limonene and seems less irritating to the digestive system, he reported last week in Orlando, Fla., at the annual meeting of the American Association for Cancer Research.

At that meeting, several researchers described their progress in finding and assessing substances like limonene. Their studies reflect an increased interest in and emphasis on "chemoprevention" – the use of specific chemical agents, not just better diets – to stop cancer before it has a chance to take hold.

"We're showing we can develop drugs to prevent the development of cancer," says Michael B. Sporn of the National Cancer Institute in Bethesda, Md.

In their work, Gould and his colleagues fed mice a diet containing 2 percent perillyl alcohol, the lavender compound. Tumors disappeared in 60 percent of the animals and shrank in an additional 20 percent, they report. Mice with these tumors, even after treatment for cancer, typically develop one or more new tumors within a few months, Gould says. But he and his colleagues observed almost no additional tumors in mice on the perillyl alcohol diet. These results parallel earlier findings in mice on diets with 5 percent limonene, he adds.

In mice, enzymes break the compounds down into metabolites that exert several effects, Gould explains. First they stimulate the production of enzymes that help break down carcinogens.

Then these substances sidetrack proteins produced as the result of cancer-stimulating genes called oncogenes. To cause rapid cell growth, these proteins must acquire a carbon chain that enables them to move to a new home along the inner edge of the cell membrane. The new chemopreventive agents block the addition of the carbon chain, Gould says.

The metabolites also slow the construction of a particular enzyme in the cancer cells' mitochondria, thereby reducing the amount of energy the cells produce. In addition, they increase the levels of a substance called transforming growth factor-beta, which inhibits the growth of breast cancer cells.

In studies of six people who took limonene, Gould found that humans also produce these metabolites, which presumably will have similar effects. But he is just beginning to assess whether limonene fights cancer in people.

Tests in humans have begun, however, for another plant-derived chemopreventive compound, this one from soybeans (SN: 3/28/87, p.206). In February, Ann R. Kennedy and her colleagues at the University of Pennsylvania School of Medicine in Philadelphia began administering this substance, called Bowman-Birk inhibitor, to 24 people with precancerous patches in their mouths.

The study participants gargle and swallow mouthwash containing the inhibitor, consuming an amount equivalent to that in the typical Japanese diet, says Kennedy. She expects to finish this trial by fall.

Because so few precancerous spots actually turn into malignant oral tumors, and because this transformation can take many years, Kennedy also is seeking faster ways to determine the effectiveness of the inhibitor. Like other scientists, she hopes to find intermediate biochemical indications of impending cancer that she can monitor during these chemoprevention trials.

To thwart cervical cancer, researchers at the Arizona Cancer Center in Tucson have developed a different way of delivering chemopreventive drugs: via vaginal sponges similar to those used for contraception. The sponges release a synthetic relative of vitamin A. The drug signals skin and other kinds of epithelial cells to stop dividing and become specialized.

About 300 women who had developed precancerous cells, or dysplasia, in the cervix used these sponges for four days at the beginning of the study and again for four days at three and six months. Half of the women were given sponges containing the drug, and half were not. Examinations of the women's cervical tissue over 15 months, sometimes longer, revealed that precancerous spots disappeared in significantly more women with moderate dysplasia who took the drug than in similar women who did not. However, no such significant difference appeared in cases of more severe dysplasia, says Frank L. Meyskens Jr., now at the University of California, Irvine. *– E. Pennisi*

Forwarding information via controlled chaos

By repeatedly pressing a key to complete an electrical circuit, a telegraph operator can generate a string of electrical pulses to convey a message. But that's not the only way to transmit encoded or digital information. Researchers have now proposed an alternative strategy that involves gingerly "nudging" the erratically fluctuating, or chaotic, electrical output of a certain type of circuit into an appropriate pattern of voltage and current variations.

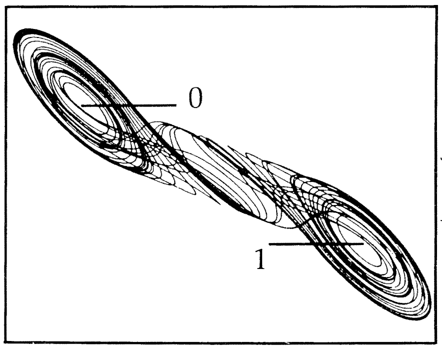
"We're trying to use chaos itself to send a message," says Celso Grebogi of the University of Maryland at College Park.

Normally, engineers go to a lot of trouble to ensure that microwave generators and other oscillators used for producing information-carrying signals operate at predictable frequencies. The novel idea of precisely controlling a circuit's chaotic output to produce a given signal (SN: 9/5/92, p.156) may allow them to operate conventional signal generators at much higher powers than is now possible.

"You could have an extremely high-power microwave transmitter that would be very simple," says Scott Hayes of the U.S. Army Research Laboratory in Adelphi, Md. "And you could control it using a tiny microelectronic chip."

Grebogi, Hayes, and Maryland's Edward Ott describe their idea in the May 17 PHYSICAL REVIEW LETTERS.

To test the feasibility of their concept, Hayes and his co-workers used a computer to simulate the behavior of a simple electrical circuit that produces a fluctuating signal. The researchers characterize the circuit's erratic behavior by plotting a sequence of points, each one having coordinates representing the current flowing through one circuit component and the voltages across two other components. This sequence of points traces out a "trajectory" that winds around to create a distinctive looping pattern with two lobes (see diagram).



Hayes *et al.*/PHYS. REV. LETT.

This geometric form mathematically represents irregular current and voltage fluctuations in a certain type of electrical circuit.

As the oscillator operates, this trajectory swings from lobe to lobe, circulating one or more times within a lobe before shifting to the other. By designating one lobe as 0 and the other as 1, the researchers can capture the trajectory's wanderings as a sequence of binary digits.

Then, by slightly adjusting one of the circuit voltages, Hayes and his colleagues can force the circuit's complicated oscillations into the particular pattern that corresponds to a message's binary digits. *– I. Peterson*