Pregnancy-hormone therapy blocks cancer

If pregnancies early in adulthood reduce a woman's lifelong risk of developing breast cancer, could short-term hormonal treatments that simulate aspects of pregnancy do the same thing? A new study on rats suggests that the answer is yes.

This finding fuels hope that scientists can develop a means to reduce women's risk of breast cancer. Among malignancies in women, it's the second-leading cause of death.

Satyabrata Nandi of the University of California, Berkeley and his coworkers administered a potent carcinogen to 7-week-old female rats, a common procedure used to study cancer risk. Two weeks later, they treated each animal with one of several agents that cause a maturation, or differentiation, of breast structures known as terminal end buds.

The agents mimic changes during pregnancy when those end buds transform into milk-producing lobules. Untransformed buds are believed to be especially vulnerable to carcinogens (SN: 8/5/95, p. 92).

In one experiment, the researchers stimulated the lobule development with an injection of the drug perphenazine. In others, they implanted capsules that dispensed the hormones estrogen, progesterone, or both in a range of doses for 3 weeks—the gestation period of these animals. The implants increased blood hormone concentrations to those that occur in various phases of pregnancy.

In groups of rats getting no treatment, 90 to 100 percent of the carcinogen-exposed animals developed breast cancer within 9 months. The big surprise, Nandi's group reports in the March 2 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, is that despite triggering a similar maturation of the end buds, the drug and hormones offered vastly different levels of protection.

Perphenazine cut the 9-month cancer incidence to just under 75 percent, while breast-cancer rates in animals receiving the pair of hormones plummeted to between 4 and 11 percent. "What that told us," Nandi says, "is that [end-bud] differentiation is probably not the reason for protection against breast cancer following pregnancy." This had been the leading hypothesis.

The hormonal duo proved effective even when delivered several weeks before the carcinogen exposure. It also worked when its estrogen component was small—matching in some of the lower blood concentrations measured during gestation, though still exceeding those that occur outside of pregnancy. Even cutting the rats' therapy to a single week, the equivalent of treating women for just 3 months, didn't reduce long-term protection.

Estrogen-only therapy worked less well, allowing 38 percent of the rats to develop cancer, and treatment with progesterone alone actually spurred the disease. Not only did all rats on the progesterone regimen get cancer, but each developed more tumors than did the carcinogen-exposed rats that were denied any treatment.

Though he is not yet sure how estrogen protects, Nandi told SCIENCE NEWS that "we think the predominant effect is going to be at the brain and pituitary-gland level." These organs may trigger the secretion of hormones that reduce the number of cellular receptors in breast tissue for hormones such as estrogen. The presence of fewer receptors for estrogen would reduce the breast's response to this hormone, which can fuel cancer growth.

Investigating hormonal simulation of pregnancy to reduce breast-cancer risk "is something that had to be done," says epidemiologist Malcolm C. Pike of the University of Southern California in Los Angeles. Nandi's new data suggesting that short-term therapy might work "is really very exciting," Pike maintains.

The USC researcher has data indicating that intensive treatments with novel contraceptives also block breast cancer (SN: 10/31/92, p. 298), and a start-up company is now making and testing them. Other researchers have developed drugs to selectively limit the effects of hormones in the breast. In the war on this cancer, Pike says, "I'm now very optimistic we're going to win." —*J. Raloff*

Asteroids get solar push toward Earth

When it comes to luring asteroids into the inner solar system, a little nudge goes a long way.

Most asteroids inhabit an elliptical set of tracks, known as the main asteroid belt, between the orbits of Mars and Jupiter. Although unlikely to spell doomsday for Earth, rocks occasionally get flung from the belt onto paths that intersect our planet's orbit. A new study suggests that tiny motions induced by the sun's energy can play a crucial role in sending asteroids on such an inward journey.

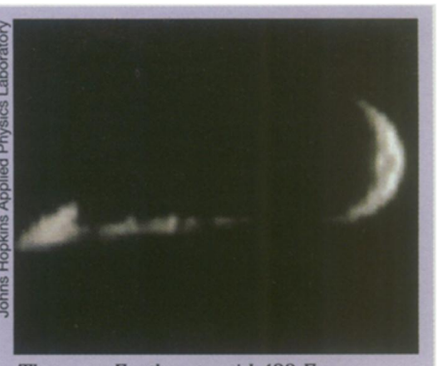
Researchers realized in the 1980s that asteroids occupying certain zones, known as resonances, within the outer part of the main belt are profoundly influenced by Jupiter's gravity. The giant planet's pull can dramatically elongate the orbits of these asteroids, causing their paths to cross those of the inner planets. More recently, scientists have calculated that another set of resonances in the main belt nearer Mars also acts as an escape hatch, ejecting some rocks into the inner solar system.

These special zones are numerous but extremely narrow, making it hard to explain how so many asteroids end up in the inner solar system. In the March 5 SCIENCE, Paolo Farinella of the University of Trieste in Italy and David Vokrouhlicky of Charles University in Prague, Czech Republic, present computer simulations showing a nongravitational effect so tiny it has often been ignored could account for the migration.

Named for the Russian engineer who discovered it a century ago, the Yarkovsky effect results from the way a spinning asteroid absorbs and reradiates solar energy. Because an asteroid's surface gets hotter the longer sunlight falls on it, it does not reradiate energy evenly throughout its day or year.

If different parts of the surface don't reemit radiation equally, the asteroid will receive a net kick in a particular direction, just as a rocket spewing a jet of gas recoils in the opposite direction.

Farinella and Vokrouhlicky calculate that over a period of 10 million to 1 billion years, the typical interval between collisions among such small asteroids, the Yarkovsky effect can shift an orbit by a few million kilometers. This effect is large enough to push a significant number of asteroids with diameters of less than 20 km into resonances that can deliver them into the inner solar system.



Johns Hopkins Applied Physics Laboratory

The near-Earth asteroid 433 Eros.

The smaller the asteroid, the greater the Yarkovsky effect. This could explain why the tiniest members of one family of asteroids, known as the Astrids, have the widest range of orbits, Farinella and Vokrouhlicky note.

"We're learning more and more that small effects [like this] can have important consequences," says Joseph A. Burns of Cornell University. For instance, the Yarkovsky effect may help explain why two classes of asteroid fragments, or meteorites, each with a distinct composition, take very different amounts of time to reach Earth. —*R. Cowen*