Marrow culture aids in cancer prediction

Surgeons have no sure means of knowing whether some cancer cells from a breast tumor they have removed may already have spread to a distant site. So, in deciding whether to embark on a course of postsurgical chemotherapy, they must rely upon indirect clues to judge the chances of recurrence, including cancer severity and the presence or absence of estrogen receptors on the tumor cells.

Now researchers say they've developed the first direct test for detecting cancer cells that have spread to bone marrow. Their technique, if validated in further studies, should help identify women at low risk of recurrence and may save some women from unpleasant chemotherapy regimens.

William P. Vaughan, J. Graham Sharp and their colleagues at the University of Nebraska Medical Center in Omaha cultured bone marrow cells taken from 28 women with breast cancer. The women were candidates for an experimental breast cancer therapy involving intensive, whole-body radiation treatments that wipe out hidden cancer cells. Since the treatment also kills marrow cells, surgeons first remove some marrow, then reinfuse it after radiation therapy ends — a procedure called autologous marrow transplantation. Using special stains, they scrutinize the extracted marrow for cancer cells. If any appear, the doctor may "purge" the malignant cells with drugs before reinfusing the patient.

The Nebraska researchers plated marrow cells in a culture medium. Within a few weeks they saw cancerous growths in more than half of the specimens that had appeared normal under conventional staining techniques. In follow-up periods ranging from six to 38 months, eight of the 16 culture-positive women suffered relapses. In contrast, only one with a negative culture relapsed, the team reported last week at the annual meeting of the American Society of Clinical Oncology in Washington, D.C.

"It's a very important observation," says oncologist Bruce D. Cheson of the National Cancer Institute in Bethesda, Md. Autologous marrow transplants among breast cancer patients are "going gangbusters," he says, with hundreds performed per year despite a relative shortage of data regarding the technique's ultimate benefits. Physicians would value any test that helps predict cancer outcomes and treatment requirements, Cheson says.

"This is the first technique for actual detection of small numbers of malignant cells at a distant site," Vaughan says. He estimates that the method can detect a single cancer cell in a sample of 10,000 cells — far better than a pathologist could do looking at a stained slide under a microscope. *— R. Weiss*

Intense winter lightning zaps Gulf Stream

Meteorologists, like most people, tend to view lightning and thunderstorms as summertime phenomena powered by the sun's warming influence on the land surface. To their surprise, atmospheric scientists have discovered intense *winter* lightning over the warm waters of the Gulf Stream.

During early 1986, a network of lightning detectors recorded a high number of cloud-to-ground flashes off the coast of the Carolinas, reports Richard E. Orville of the State University of New York at Albany. Over a two-month period in winter, one ocean region experienced an average of seven flashes per 10 square kilometers. For comparison, it typically takes an entire year for an area of similar size in upstate New York to accumulate the same number of flashes, Orville notes in the May GEOPHYSICAL RESEARCH LETTERS.

His work combines data from the detection network with information gathered during a 1986 experiment studying winter storms that develop off the East Coast. Orville found the most lightning-intense regions about 250 to 300 km offshore in the vicinity of the warmest sea-surface temperatures (about 20°C). The lightning activity spread across the width of the Gulf Stream.

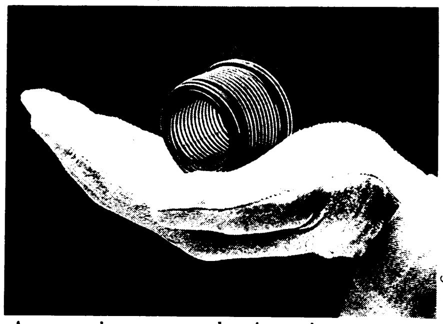
Until the 1986 winter storm experiment, scientists did not realize that warm water could generate strong convection of air currents, much like the convection driven by the sun-baked land surface during summer, according to Peter V. Hobbs of the University of Washington in Seattle. In retrospect, Hobbs says, it makes sense that the heat from the Gulf Stream could cause air to rise and thereby trigger thunderstorms and lightning.

Other ocean areas with warm currents may also experience winter lightning, and these regions could pose a hazard to passing aircraft and ships, says Hobbs.

Violent thunderstorms over the Gulf Stream may account for nautical legends about the area, Hobbs adds. "Going back to the days of sailing ships, the region off Cape Hatteras [N.C.] has been known as a graveyard for ships," he says. *— R. Monastersky*

Coiling a ceramic superconductor

Stretched end to end, the superconducting wire in the coil shown below spans 30 feet. Though it can carry only a tenth of the current needed for building practical electrical motors, it represents a step toward such devices, says ceramics engineer Stephen E. Dorris, who helped develop the wire at Argonne (Ill.) National Laboratory. Reaching lengths of up to 50 feet, the Argonne wires may be the longest superconducting strands around, he asserts. Already, Reliance Electric Co. in Cleveland has used one of these coils in a small, experimental motor, with which the company hopes to study technical challenges to building larger superconducting motors for use by the electric utility industry.



Argonne

Argonne's superconducting wire.

"Efficiency losses in a superconducting motor are less than half those in a conventional motor," notes research manager James S. Edmonds of the Electric Power Research Institute in Palo Alto, Calif., which funds the work.

Unlike coils made with copper and other normally conductive metals, which pose varying degrees of energy-sapping resistance to electrical current, the superconducting coils can carry current with no resistance whatsoever so long as they are held at liquid nitrogen temperatures (77 kelvins). The Argonne researchers made their coil out of the superconducting ceramic yttrium-barium-copper-oxide, also known as "1-2-3." The process involves mixing 1-2-3 powder with some acrylic resin and strength-giving silver and extruding the malleable mixture into a wire, which then gets a coating of "2-1-1" powder — 2 parts yttrium and 1 each of barium and the oxide. The scientists wind the preparation into a coil and then heat it. The heat treatment burns off the acrylic while sintering the 1-2-3 powder into a continuous coil and the 2-1-1 into a green-colored insulating coat.

"We used the 2-1-1 modification as an insulator because other materials interfered with the chemical properties of the superconducting wire when the coil was fired in a furnace," explains Argonne's Roger Poeppel. *— I. Amato*