Biomedicine

New weapon against Kaposi's sarcoma

Researchers studying Kaposi's sarcoma (KS) may have found a promising new weapon against this cancer, which strikes many people with the AIDS virus (HIV).

Robert C. Gallo of the National Cancer Institute in Bethesda, Md., reports that a compound called SP-PG (sulfated polysaccharide-peptidoglycan), isolated from the outer wall of *Arthrobacter* bacteria, reverses the growth of KS tumors more effectively and safely than present chemotherapy treatments. His findings appear in the March 13 SCIENCE.

Once restricted mainly to elderly Jewish or Mediterranean men and to people, such as transplant recipients, using drugs that suppress the immune system, Kaposi's sarcoma has become epidemic among people infected with HIV.

The disease causes swollen, purple-colored tumors to appear on the skin, created by the cancer's feeding techniques. To grow, KS tumor cells tap into the surrounding blood by sprouting a thick network of blood vessels. The disease also causes nearby vessels to leak, bathing the tumor in blood.

In laboratory experiments conducted at the National Cancer Institute and at Daiichi Pharmaceutical Co., Ltd., in Tokyo, researchers tested SP-PG on cultured KS cells and on KS-like tumors in mice. They found that SP-PG blocked tumor growth more effectively than any of three current drug treatments – interferon-A, suramin and pentosan polysulfate. In addition, SP-PG proved less toxic to the mice than the other drugs. Gallo points out, however, that the SP-PG mice were observed for only six days following the experiment.

SP-PG starves the KS tumor by destroying its vascular supply lines and by mending leaky blood vessels. Gallo speculates that SP-PG may prove useful against other cancers that feed like KS. SP-PG has not yet been tested in humans.

Something fishy about frozen livers

The same proteins that keep cold-water fish from freezing may extend the life of donor organs awaiting transplantation, says Boris Rubinsky, a biomedical engineer at the University of California, Berkeley.

On March 11, Rubinsky told a U.C.-Berkeley Industrial Liaison Program Conference that he and his co-workers added proteins from the Newfoundland ocean pout to "the worst possible preserving solution" and used this mixture to keep a rat liver frozen for 24 hours without causing severe damage. Livers receiving the fish proteins functioned three times better than livers not receiving the proteins, he says.

Cold temperatures damage cells by impairing their ability to maintain a proper ion balance, says Rubinsky. Normally, cells maintain this balance by pumping ions in and out through holes called ion channels. However, as temperatures reach the freezing point, the pumping slows, eventually allowing a lethal amount of ions to build up inside.

Current preserving solutions attempt to maintain an ion balance as temperatures drop by mimicking the cell's internal chemical composition. However, since chemical changes occur constantly inside the cell, no solution can perfectly match this internal mixture, says Rubinsky.

Although researchers discovered two decades ago that certain proteins inside fish – dubbed "antifreeze" proteins – keep them from freezing, little is known about how these compounds work. However, in a follow-up to his liver experiment, Rubinsky and his co-workers uncovered a possible solution to the mystery.

The researchers found that antifreeze proteins plug ion channels when the temperature drops, allowing the cell to maintain its proper ion balance. This explains how the frozen rat liver stayed so healthy, says Rubinsky. The finding appears in the March AMERICAN JOURNAL OF PHYSIOLOGY.

Physics

In search of the elusive top quark

Of the six quarks and six leptons postulated in the standard model of particle physics as the constituents of matter – ordinary and otherwise – only the top quark and the tau neutrino remain unobserved. Researchers working with the CDF detector at Fermilab's Tevatron collider in Batavia, Ill., now conclude that the top quark, if it exists, most likely has a mass greater than 91 billion electron-volts (91 GeV). They see no evidence in their searches to date of a top quark in any of the billions of observed collisions between protons and their antimatter counterparts. The 268 members of the CDF collaboration report the new lower limit on the top quark's mass in the Jan. 27 PHYSICAL REVIEW LETTERS.

By observing the numerous ways in which a particle known as the Z° can decay into other particles, another huge group of researchers working at the Large Electron-Positron collider at the European Center for Particle Physics in Geneva, Switzerland, has tentatively set an upper limit of roughly 190 GeV on the top quark's mass. If its mass proves less than about 170 GeV, the Fermilab team may have a chance of catching a glimpse of this elusive particle by 1994.

Theorists agree that the top quark must exist for the standard model of particle physics to remain viable. The theory requires that quarks come in pairs, and only the bottom quark has no partner so far. "The fact that they come in pairs is an integral part of the theory," Fermilab's John E. Huth said at the American Association for the Advancement of Science's annual meeting, held last month in Chicago. "If you were to find just one quark, with the other one missing, the whole theory falls apart."

At the same time, the standard model in no way specifies what mass the top or any other quark should have. The bottom quark, heaviest of the known quarks, has an experimentally determined mass of about 4.5 GeV, nearly five times that of a proton. The newly established lower limit on the top quark's mass appears to set it apart from the others. "Although we don't have a good [theoretical] understanding of what any of the masses of the fundamental constituents are," says Chris Quigg, also of Fermilab, "the top is now so much heavier than any of the others. . . . It may be the special key to the masses of the other particles."

"Finding the top quark and measuring its mass are important," he adds. "The mass of the top quark is a crucial unmeasured parameter of the standard model."

Sounds to ring around

Light of a single wavelength passing through a convex lens sitting on a glass plate produces a distinctive pattern of dark and bright rings centered at the point where lens and plate touch. Such a pattern, known as Newton's rings, results when light reflected from the plate interferes with light reflected from the lens surface. At certain viewing angles, the commingled light waves cancel each other, creating a dark ring. At other angles, they reinforce each other, producing a bright ring.

David K. Hsu and Vinay Dayal, engineers at Iowa State University in Ames, now report observing Newton's rings created by high-frequency sound waves. They first noted the presence of wavy light and dark contours in ultrasonic scans of two riveted, adhesively bonded aluminum plates. Further tests revealed that the concentric rings observed around the tightened fasteners were caused by the interference of sound waves reflected from the two adjacent inner surfaces of the aluminum plates.

"The ability to interpret the interference fringes would help the quantitative evaluation of adhesively bonded aircraft structures," the researchers conclude in the March 9 APPLIED PHYSICS LETTERS.