Cancer protection from fruits and veggies

Two nutrients in fresh fruits and vegetables may help prevent a precancerous colon condition, according to a new report. A second study adds to evidence that diets rich in such foods help guard against colorectal cancer, a disease that will kill 57,000 Americans this year.

The first study supports previous research suggesting that colon cancers arise when there is a reduction in a biochemical process called methylation – the addition of methyl side groups to a cell's DNA. Other studies suggest that insufficient methylation activates cancer-causing genes. To accomplish methylation, cells need plenty of folate, a substance abundant in fresh fruits and leafy vegetables. The essential amino acid methionine, a constituent of high-protein foods such as fish, chicken, and dairy products, is also needed during methylation.

Epidemiologist Edward Giovannucci of the Harvard Medical School in Boston and his colleagues report that diets low in folate and methionine may elevate the risk of developing polyps in the colon and rectum.

The Boston researchers sent questionnaires to women participating in the Nurses' Health Study and men enrolled in the Health Professionals Study. The team asked detailed questions about diet and the use of vitamin supplements. They then homed in on men and women who had undergone colonoscopy or sigmoidoscopy, procedures that allow physicians to look at the lining of the rectum and intestine. As it turned out, 564 of the 15,984 women and 331 of the 9,940 men had colon or rectal polyps.

A statistical analysis revealed that study participants with diets rich in folate had the lowest incidence of such polyps. That association held true even when the epidemiologists adjusted for factors that increase the risk of developing colorectal polyps. People who took folate supplements enjoyed even greater protection than those who ate a folate-abundant diet, Giovannucci says.

The researchers also discovered that people who consumed at least two alcoholic drinks per day were 85 percent more likely than nondrinkers to develop colorectal polyps. Alcohol blocks DNA methylation; thus it may be even more important for people who imbibe alcohol to eat plenty of fruits and vegetables, Giovannucci adds.

In the second report, Robert S. Sandler of the University of North Carolina at Chapel Hill and his colleagues confirm earlier studies suggesting that diets rich in fruits and vegetables protect against precancerous colorectal polyps. Although Sandler and his co-workers didn't study folate and methionine specifically, their findings are consistent with those of the Harvard study. Both studies appear in the June 2 JOURNAL OF THE NATIONAL CANCER INSTITUTE.

Despite the increasing list of health benefits ascribed to vitamins and certain nutrients, many researchers advise against taking supplements containing these compounds (SN: 5/22/93, p.327). Public health expert Gladys Block of the University of California, Berkeley, argues that it is time to reconsider that cautious approach.

"There can be no disagreement that people should eat a balanced diet rich in fruits, vegetables, and whole grains," she writes in an editorial in the same issue of the journal. "But people are not eating enough of these foods and are unlikely to do so in the foreseeable future," she notes.

"Our data suggest that there may be a benefit to multivitamin supplements," Giovannucci agrees, noting that most multivitamin pills contain folate. Still, neither of the studies rules out the notion that fresh fruits and vegetables contain some as-yet-unheralded substance that protects against colon cancer. "Our primary recommendation is to eat plenty of fruits and vegetables," he adds.

– K.A. Fackelmann

Synthetic path to new transplant drugs

Scientists have finally succeeded in synthesizing rapamycin, a complex chemical first isolated 20 years ago from a soil fungus found on Easter Island. In recent years, researchers have eyed the substance's potential as a drug that would suppress the body's urge to reject a transplanted organ or tissue. The ability to make the molecule using the techniques of organic chemistry – rather than having to rely on microorganisms – may usher in a new class of immunosuppressant drugs, writes a group of chemists in the May 19 JOURNAL OF THE AMERICAN CHEMICAL SOCIETY.

Over the past decade, transplant success rates have risen, thanks largely to cyclosporin, another immunosuppressant drug obtained from a fungus. Cyclosporin, however, can cause serious side effects, such as hypertension and kidney and liver damage, so scientists have been eager to find an alternative. Researchers at the pharmaceutical company Wyeth-Ayerst in Princeton, N.J., have begun clinical trials of rapamycin. At present, they produce the drug by fermentation, a process that involves culturing large batches of the fungus.

The new synthesis technique will not replace the current production method, but it will enable scientists to develop chemical relatives of rapamycin, says K.C. Nicolaou, leader of a research team at the University of California, San Diego, and the Scripps Research Institute in La Jolla, Calif. Indeed, he and his colleagues are now aiming to make improved versions of rapamycin that will resist quick degradation in the body.

To synthesize rapamycin – a 31-carbon ring structure – the scientists first constructed an open chain of 29 carbons. The chain had the same variety and placement of highly sensitive side groups as rapamycin. They then closed the ring using a process called "stitching cyclization," in which a two-carbon fragment containing reactive tin groups forms a bridge between the ends of the chain. The group obtained a "modest" yield of 28 percent, "quite satisfying" considering the molecule's complexity, says Nicolaou.

New versions of rapamycin with different side groups will help scientists probe the mechanisms of immunosuppression, says Nicolaou. "We're hoping to use the analogs that we create with this chemistry to increase our knowledge about how these kinds of drugs interact with the immune system," he says.

– K.F. Schmidt

Hubble observations back merger theory

Galaxies come in various shapes, including fuzzy footballs, elongated smears, hazy pinwheels, and glowing whirlpools. In the 1920s, astronomer Edwin Hubble resolved some of the confusion by classifying galaxies as either spiral (disk-like and compact) or elliptical (egg-shaped and diffuse). But the fundamental question remains: Why do galaxies look so different?

In recent decades, some astronomers have argued that spirals can merge to form larger, elliptical galaxies. Now, images from the Hubble space telescope provide some of the strongest evidence to date for the merger theory.

Astronomer Bradley C. Whitmore of the Space Telescope Science Institute in Baltimore and colleagues peered into the core of the elliptical galaxy NGC 7252, already suspected to be the product of a merger between two spiral galaxies, and saw something strange and unexpected. "Just for one terrible moment I thought, 'Oh my God, I gave them the wrong coordinates!'" Whitmore recalls.

Fortunately, Whitmore had indeed pointed Hubble in the right direction. And to his surprise, the telescope images revealed a pinwheel-shaped whorl of gas and stars in the galaxy's center. This

NASA/Whitmore, Schweizer, Leitherer, Borne, Robert

Hubble space telescope image shows mini-spiral structure and dozens of hot, young star clusters in the heart of the elliptical galaxy NGC 7252.

"mini-spiral," as Whitmore calls it, measures 1/20 of the diameter of NGC 7252 and, in an unprecedented twist, rotates counter to the rest of the galaxy.

The astronomers also found at least 40 tightly packed, spherical knots of stars, called globular clusters, speckling the galaxy's central pinwheel. These young, blue clusters, previously detected with ground-based instruments but not seen clearly until now, provide a key piece of evidence for the merger theory. The clusters appear to be 50 to 500 million years old – too young to have originated in the parental spiral galaxies. Thus, the clusters must have formed in the merger itself, says Whitmore.

About a billion years ago, Whitmore explains, two spiral galaxies had a fateful encounter where NGC 7252 now lies, some 300 million light-years from Earth in the constellation Aquarius. As the spinning galaxies merged, a powerful gravitational tug-of-war ensued among their billions of stars, tearing the spirals apart. Currents of gas streamed into the center of the merging mass, creating the swirling mini-spiral in the core of NGC 7252. This inrush of gas also created millions of stars, which gravitated together in dense clusters.

The new observations, says Jon A. Holtzman of Lowell Observatory in Flagstaff, Ariz., will help resolve the main objection to the merger theory: that ellipticals contain more clusters than expected from the simple addition of spiral galaxies. The Hubble images suggest that cluster birth may be a *consequence* of the merger process, says Holtzman, who has conducted similar research on the elliptical galaxy NGC 1275 (SN: 1/25/92, p.52).

Holtzman cautions, however, that "one case does not an entire theory prove." Both he and Whitmore emphasize that more work is needed to explain the physics of how new clusters form in mergers. Astronomers must also find more examples of the phenomenon. Only then might they agree that spiral mergers account for some elliptical galaxies. *– D. Pendick*

New radiation belt spotted around Earth

A joint U.S.-German satellite launched last year has identified a belt of radiation around Earth that holds an unusual collection of matter from outside the solar system. The discovery of these exotic ions trapped in orbit provides an opportunity to study the environment beyond our solar system without having to leave Earth's own backyard, say space scientists who announced the findings last week in Baltimore at a meeting of the American Geophysical Union.

"What's exciting about this is that it's a sample of matter from a place that we'd like to be able to study. We'll be able to do it because it's right here," says Jay R. Cummings, a member of the satellite team and a space physicist at the California Institute of Technology in Pasadena.

The new information comes from measurements made by the Solar, Anomalous, and Magnetospheric Particle Explorer (SAMPEX), the first of a trio of small, quickly built satellites that NASA hopes will bypass the normally plodding process that can take a decade from planning to launch. SAMPEX circles the Earth at an altitude of 600 kilometers.

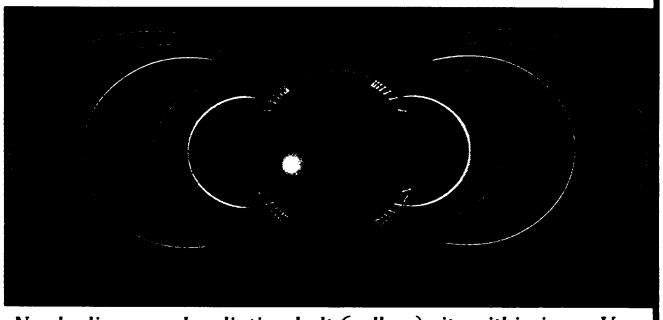
The radiation belt identified by SAMPEX joins two others that were discovered in 1958 by physicist James A. Van Allen of the University of Iowa in Iowa City. All three belts hold electrically charged particles that have become trapped by Earth's magnetic field. The outer Van Allen belt contains mostly energetic electrons, while the inner Van Allen holds mostly fast-moving protons. The newly discovered belt resides within the inner Van Allen belt and stores energetic ions of oxygen, nitrogen, and neon, says SAMPEX scientist Richard A. Mewaldt of Caltech.

The scientists believe this collection of ions is a trapped form of so-called anomalous cosmic rays. Unusual because of their composition and charge, such rays are born in a complex process that starts outside the solar system in the interstellar medium, which contains debris from supernovas, remnants of the Big Bang, and other matter.

As our solar system moves through the interstellar medium, the flow of protons emanating from the sun pushes aside any charged particles. But this solar wind does not affect neutral elements, which can slip into the solar system. As the elements drift toward the sun, solar radiation bombards them, stripping one electron from each and forming ions. These ions feel the push of the solar wind and are carried to the edge of the solar system. There they hit a magnetic shock wave that energizes them and forms the anomalous cosmic rays, some of which head toward Earth.

In 1977, J. Bernard Blake and Lynn T. Friesen of The Aerospace Corporation in El Segundo, Calif., proposed that such anomalous cosmic rays could become trapped in Earth's magnetic field if they passed close enough to hit atmospheric particles and lose all of their electrons. Once stripped, the ions would fly between magnetic poles, spiraling around the magnetic field lines.

Data collected in the late 1980s by Soviet COSMOS satellites first detected signs of such cosmic rays trapped in a radiation belt around Earth. But those measurements could not identify the precise location of the belt or much of its contents, says Cummings.



NASA

Newly discovered radiation belt (yellow) sits within inner Van Allen belt (blue). Outer Van Allen belt shown in purple.

To its discoverers, the band of trapped cosmic rays represents a third radiation belt. But because the original Van Allen belts contain different types of particles, Van Allen himself thinks the trapped cosmic rays are one group within that inner radiation belt, he told SCIENCE NEWS. Others argue that the trapped ions constitute a new belt because they come from a different location. Many of the other belt constituents hail from Earth itself.

Beyond that nominal issue, space scientists say the discovery of trapped cosmic rays in a belt around Earth offers a unique chance to obtain samples of matter from beyond the confines of our immediate stellar environment. That's important because almost everything else within the solar system is related, having condensed from the same cloud of gas and dust 4.65 billion years ago. Says Blake, who predicted the existence of a new radiation belt, "One would like to get samples of material from elsewhere. Well, cosmic rays are messengers from a distance."

– R. Monastersky