Biomedicine

Diane Edwards reports from Daytona Beach, Fla., at the American Cancer Society's 30th annual science writers' seminar.

Berry good and nutty anticancer agent?

A basket of fruits and nuts may be both a gracious hospitality gift and a tasty cancer preventive, say scientists from the Medical College of Ohio in Toledo. A substance called ellagic acid — found in fruits like strawberries and in Brazil nuts — scavenges carcinogenic chemicals and prevents normal cells from becoming cancerous, says Gary D. Stoner. He and his co-workers are studying its effects on carcinogenesis caused by different chemicals.

Among the cancer-causing agents included in the study were polycyclic aromatic hydrocarbons (PAHs) found in tobacco smoke and auto exhaust, nitrosamines found in tobacco smoke and foods, and aflatoxins found in certain foods such as stored nuts. Assays using cultures of mouse and human lung tissue showed that ellagic acid reduced DNA damage caused by PAHs, for example, by 45 to 70 percent, says Stoner. He says ellagic acid, which is a member of the phenol chemical group, also inhibits the formation of PAH-induced lung cancer in mice. The researchers observed similar inhibition against aflatoxins and nitrosamines tested in the same system.

Stoner says the group is considering large epidemiologic studies in China, where people living in certain valleys have high rates of cancer that some researchers think are related to the nitrosamine-containing chemicals used to pickle food (SN: 9/5/87, p.148). By providing ellagic acid in the diet, the scientists hope to reduce the cancer's incidence. Despite the promising results in the present study, however, Stoner emphasizes that ellagic acid can be used only as a preventive, because it has to be added to the system just before or during carcinogen exposure. But Stoner says he does not necessarily recommend that diners drink wine (grapes are another source of ellagic acid) when eating nitrosamine-laced overcooked meat, because of the possible dangers of ethanol.

Although the researchers have yet to define the exact mechanism of cancer inhibition, they suspect that the ellagic acid competes for DNA receptors that are also used by the carcinogens. Because purified ellagic acid has difficulty crossing intestinal walls, the group is tinkering with its structure to improve its absorption into the body. The substance, which apparently is bound to glucose in nature, may be more easily absorbed in its natural state, says Stoner.

Cells haywire in electromagnetic field?

Electromagnetic fields may interfere with the electrical chit-chat between cells in the body — and cooperate with carcinogens to disrupt normal regulation of cell growth and promote cancer development, says W. Ross Adey of Loma Linda (Calif.) University. By studying the way cells "whisper together" using electrical messages, Adey and his co-workers are trying to explain why some studies link certain types of cancer to electromagnetic exposure (SN: 2/14/87, p.107). Because the signals passed between cells are essential for regulating cell growth, altering these signals may result in the out-of-control growth of cancer, says Adey.

Across the thin membranes surrounding cells is an electrical gradient called the membrane potential. With a strength of about 0.1 volt (the equivalent of 200,000 volts per inch), the membrane potential acts as an electrical barrier against the outward and inward flow of signals. Receptors on cell surfaces are thus needed to facilitate message transfer across membranes. In addition, says Adey, the "little fluid gutters" between cells have their own electrical gradients. Based on his own studies and those of other researchers, Adey concludes that these electrical gradients may be changed by certain powerline and microwave fields. The negatively charged surface receptors that permit day-to-day signal transfer are sensitive to minute changes in both electrical and chemical signals, says Adey.

Changes caused by electromagnetic fields are not themselves the first step in cancer, says Adey, who uses the standard initiation-promotion model of cancer to explain how the fields and chemical carcinogens may work together. He says that carcinogens probably serve as initiators by damaging cellular DNA, but that disorganized cell growth in tumor formation is prompted by later events — which include exposure to electromagnetic fields. According to Adey, the Loma Linda research takes a different approach to cancer formation by studying "atomic rather than molecular levels of tissue organization, and physical rather than chemical processes."

Recycling bone marrow transplantation

Traditionally, a patient's sibling has been the donor of choice for a bone marrow transplant, reducing the chance of adverse immune reactions in the recipient. But with the size of an average U.S. family decreasing, health officials worry that locating a well-matched donor is like finding a shrinking needle in an ever-enlarging haystack. Thus, researchers are remodeling bone marrow transplantation techniques so less-well-matched donors, or even the recipients themselves, can supply the necessary cells. Included in those studies are two that use specialized equipment to isolate needed cells from those that cause immune reactions.

Scientists at the University of Nebraska College of Medicine in Omaha are using the recipient's own blood, rather than the usual bone marrow from the hip bone, to supply the "primitive" stem cells that differentiate into the various types of blood cells. Autologous (where the recipient is the donor) bone marrow transplants have been used for about a decade in some cancer patients to minimize chemotherapy's devastating effect on blood cell counts. But cancer or irradiation therapy in the pelvic area, along with discomfort associated with marrow punctures, make the blood an attractive alternative.

In a recently completed study, Anne Kessinger and her colleagues treated 26 patients undergoing chemotherapy with autologous stem cells. Twenty-five quickly showed bone marrow recovery (one patient died of other causes two days after transplant). Using a centrifuge that separates cells on the basis of weight, the researchers had collected the medium-sized stem cells and returned the remaining blood to the patient. To obtain sufficient numbers of cells, six or seven daily four-hour collection sessions are necessary, says Kessinger. In addition to the time involved, another factor that must be considered is the possible transfer of cancer cells with the stem cells in those cancers that are easily spread through the bloodstream. The next step, she says, is to expand the technology so anyone can donate stem cells.

At Johns Hopkins University in Baltimore, Albert D. Donnenberg uses a method called counterflow centrifugal elutriation (CCE) to remove lymphocytes from bone marrow. Lymphocytes are white blood cells responsible for immune reactions, which can be dangerous in graft-versus-host (GVH) disease seen in bone marrow transplants but beneficial when the donor's immunity against infection is transferred to the immune-compromised transplant recipient. In a preliminary study of 32 patients, the Hopkins group removed nearly all lymphocytes from donor bone marrow before transplant. The result, says Donnenberg, was a significant reduction in GVH cases. To optimize the phenomenon of immunity transfer, the scientists also started a separate study in which the donor is injected with an antigen one week prior to marrow collection to boost immunity against specific infection. The recipient is injected with the same antigen (tetanus and diphtheria toxoids have been used thus far) on the day of transplantation.