BIOLOGY

Julie Ann Miller reports from Washington at the International Symposium on Aging and Cancer

Factors for leukemia control

Blood cells are produced as a gradual specialization of cells. Myeloid leukemia is the result of the disrupted differentiation of progenitor cells into two types of blood cells—granulocytes and macrophages. J. Donald Metcalf of the Royal Melbourne Hospital in Australia now reports that leukemic cells can be controlled by the same hormones that regulate normal blood cell differentiation. The finding offers "an exciting possibility for additional methods for treating patients with leukemia," Metcalf says.

Metcalf has purified several hormones or factors involved in blood cell differentiation. He finds that one is required for proliferation of the cells that give rise to granulocytes and macrophages. He calls the hormone granulocyte-macrophage colony stimulating factor. Looking at cells taken from patients with myeloid leukemia, Metcalf discovered that they are all dependent on that growth factor for every cell division. Suppressing the hormone in patients would not be a useful approach, however, because normal cells require it too.

The growth hormones influence the fate of cells, as well as their reproduction. Metcalf finds that progenitor cells given high concentrations of the primary growth factor become granulocytes, while those given a low concentration develop into macrophages. Some but not all mouse leukemic cells, which do not differentiate by themselves, can be induced to mature by the growth factor.

Recently Metcalf has identified another hormone more effective in promoting differentiation of leukemic cells. This factor, which comes from the serum of mice suffering from infections, induces the differentiation of the progenitors into granulocytes. Metcalf has some evidence that humans produce a similar factor. He believes therapies could be developed in which leukemic patients are stimulated to produce the factor or, once the human form is identified, are given hormones produced by recombinant DNA techniques.

Cancer-aging link: No fault of repair

With age, cells accumulate damage to their genetic material. Is it because the DNA repair systems have broken down? Richard B. Setlow of Brookhaven Laboratory in Upton, N.Y., says that specific deterioration of repair systems does not seem to be responsible. Instead, study of cells grown in the laboratory indicates that all forms of DNA synthesis, including repair, slow down with age. "It looks like the cells just are running out of steam," Setlow says.

The importance of the repair system in preventing skin cancer can be demonstrated by studies of persons with Xeroderma pigmentosa, a genetic disorder in which the repair system is defective. Ultraviolet light from the sun can link adjacent DNA subunits into dimers, and a normal skin cell can repair this damage at a rate of 80,000 dimers per hour, Setlow estimates. He says because the Texas sun at noon, for example, can cause 50,000 dimers per cell per hour, skin cells often operate close to their maximal repair rate. Setlow calculates that normal skin cell repair ability decreases the cancer incidence from ultraviolet radiation by a factor of 10,000. Cells from a person with Xeroderma pigmentosa, however, can repair only 10,000 dimers per hour, and a study of 13 patients revealed an average of 40 skin tumors each, the first tumors appearing between the ages of 5 and 15 years.

Although the effect of radiation on skin cells is striking, Setlow agrees with John Cairns of the Imperial Cancer Research Fund in London (SN: 10/4/80, p. 212) that the same mechanisms may not apply to other malignancies. Setlow concludes, "UV is probably not the proper model [for cancer] except for those people extensively exposed to sunlight."

SPACE SCIENCES

Carbyne 'carriers' for meteorite gases

It was long thought an odd paradox that carbon, the element with the richest chemistry, was known in only two elemental forms — diamond and graphite. In recent years, the number has grown to include another form of each, as well as a form known as lonsdaleite and at least nine members of a family called carbynes (polymorphs containing triply bonded carbon atoms). It has lately been suggested, in fact, that carbynes rather than graphite may be the dominant form of carbon in stellar condensates and interstellar dust. Now a group of researchers has found that carbynes also comprise some of the carbonaceous material holding the traces of noble gas isotopes in the Allende and Murchison meteorities that have been yielding significant results about conditions during and even before the formation of the solar system.

Anomalies in the abundances of these gases are being used by a growing number of scientists in attempts to trace the solar system's early history, investigating, for example, whether material generated in other stars was part of the mixture from which the sun and its planets formed. However, according to E. Greenville Whittaker and Ethel J. Watts of the Aerospace Corp. in California and Roy S. Lewis and Edward Anders of the University of Chicago's Fermi Institute, "to establish the true nature of these gas components, their carriers must be isolated and characterized." The researchers report in the Sept. 26 SCIENCE that they used electron diffraction to determine that the "carriers" in the carbonaceous material of Allende and Murchison include carbynes. The Allende carbynes become thermally unstable at relatively low temperatures, suggesting, says Lewis, they they could not have been heated much during their history, and thus that they probably formed within the solar nebula. The Murchison carbynes, on the other hand, are considerably more stable, consistent with the possibility that they were ejected from red giant stars (which also fits with ideas of the possible origins of the neon and xenon gas anomalies they contain).

Until recently, the idea that some carbynes might form at low temperatures would have been a puzzler. Ryoichi Hayatsu and colleagues from Argonne National Laboratory in Illinois, together with Lewis and Anders, point out in the same issue of SCIENCE that carbynes were known to form only by condensation of carbon vapor at temperatures above 2,600 K or by explosive shocks (such as from meteorite impacts) with pressures greater than 600 kilobars. Hayatsu's group, however, has been able to produce carbynes from carbon monoxide at only 300 K to 400 K, in the presence of a catalyst of chromite. Carbynes were first discovered in the Ries meteorite crater in Germany in 1968, but they were only of the high-temperature variety, due to the impact. Yet the researchers now propose that, in fact, "low-temperature formation by surface catalysis may be the dominant source of carbynes on earth and in meteorites." Further, it may be a major source of interstellar carbynes, as well as of cyanopolyacetylenes, which are given off when low-temperature carbynes are heated and which have been detected in space by radio astronomers.

Mars photo album

A collection of photographs of Mars, taken by the Viking spacecraft during their extended mission and showing the planet's spectacular volcanoes, canyons, craters, channels, dunes, clouds, dust storms and more, has been published by NASA. Called *Images of Mars,* the 8½-by-11-inch book contains 31 captioned black-and-white photos, and is available for $2.25 (specify NASA SP-444) from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. (Do not order from SCIENCE NEWS.)