RNA tumor viruses show action at a distance

Most cancer-causing retroviruses cause tumors in one of two ways: They carry a tumor-inducing "oncogene" into the cell they infect, or they insert their genetic message into the host cell DNA near genes that then become abnormally activated and make the cell malignant. But two retroviruses, human T-cell lymphotropic viruses (HTLV) types I and II, can turn a cell malignant regardless of where they set down, and they don't appear to carry a conventional oncogene.

William A. Haseltine and his colleagues at Harvard Medical School in Boston and the National Cancer Institute (NCI) in Bethesda, Md., report in the July 27 SCIENCE that they've discovered a gene regulation system in HTLV I and II never before seen in retroviruses. They say it could explain how these HTLVs cause cancer and other diseases. (Retroviruses contain RNA, and not DNA, as their genetic material.)

Three subtypes of HTLV are known: Types I and II cause leukemias and lymphomas of T cells, a white blood cell that orchestrates the body's cell-mediated defense against invaders. Type III is thought to cause AIDS (Acquired Immune Deficiency Syndrome) (SN: 5/28/84, p. 260).

Haseltine believes HTLV I and II make use of a mechanism for controlling genes called "*trans*-activitation," in which a viral gene makes a protein that affects the expression of other, perhaps distant genes. In HTLV-infected cells, where the system has been seen in action, the suspect protein is known to increase viral replication and may also activate cellular genes that control the infected T cell's growth, thereby turning it cancerous, Haseltine's group hypothesizes.

A comparison of the nucleotide sequences of HTLV I and II turned up a 1,000-base segment that is nearly identical in the two viruses and which the researchers believe is the gene that encodes this activity-boosting protein. Flossie Wong-Staal at NCI says there is now evidence for a similar sequence in the AIDS agent HTLV III, and Haseltine says that bovine leukemia virus "has the same setup. All of those together," he says, "add up to a nice picture."

A precedent for this RNA virus system occurs in certain DNA tumor viruses that make a protein which activates some of their own genes and at the same time switches on some genes in the cells they infect. While the suspected *trans*-acting protein seen in HTLV-infected cells hasn't yet been shown to activate genes known to control cell reproduction, the infection does switch on two T-cell genes of unknown function, Wong-Staal says.

The protein thought to be the culprit — it's the right size and is found only in HTLV-infected cells — is "not difficult to purify," says Wong-Staal, "but to make it in large enough amounts for study is a problem," she notes. At least three laboratories are trying to coax genetically engineered cells to produce the protein in quantity.

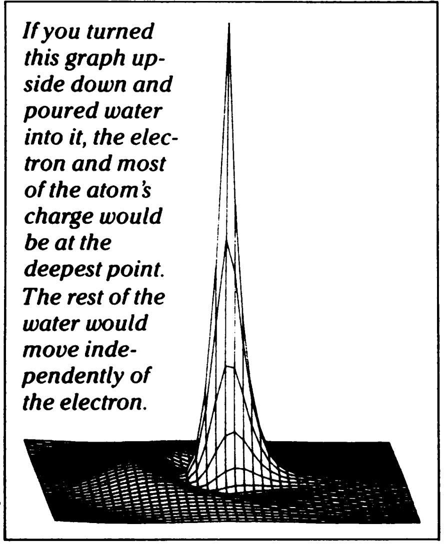
Among the researcher's immediate goals is to discover whether the *trans*-acting protein binds directly with the genes it influences and what its target sequences are. If HTLV does cause cancer, and perhaps AIDS, by the *trans*-activation system, therapies that exploit this mechanism might be devised. One idea is to genetically engineer a gene that codes for a poison in such a way that when it's put into cells, it is switched on only by HTLV's *trans*-acting protein, and thus would only kill cells in which HTLV was present and active, Haseltine says.

— G. Morse

First portrayal of hydrogen birth

A North Carolina physicist has produced the first portrait of a hydrogen atom at its moment of birth, data which should shed light on details of other atom collisions, such as those occurring during thermonuclear fusion.

"It's a complete picture of the hydrogen atom. We not only know where the electron is, but also how it moves, how the charge actually flows," says John S. Risley, of North Carolina State University in Raleigh. "It doesn't look like you normally think of an atom. The hydrogen atom is not symmetric, but the electron is slightly lagging behind the proton. We're not sure why it does that," says Risley, who presented his findings last week at the International Conference on Atomic Physics in Seattle.



If you turned this graph upside down and poured water into it, the electron and most of the atom's charge would be at the deepest point. The rest of the water would move independently of the electron.

Risley

The recipe for creating hydrogen atoms (the most abundant and simplest element, consisting of one positively charged proton and a negatively charged electron) in a collision chamber seems straightforward enough. Helium atoms are bombarded with protons, which snatch up and bind a helium electron. But details of the well-known process, such as hows and whys of electron transfer, are unclear, Risley says.

To look at hydrogen formation, Risley monitored the light known as Balmer alpha radiation from the collision chamber. First he applied electric fields to the collision area itself (disturbing and changing the light emitted by hydrogen), and then he measured light emitted from the atomic collisions from different directions, and fed this data into a computer programmed with atomic structure theories. The motion of an electron around a proton produces a "cloud" of negative charge, normally thought of as symmetric in hydrogen atoms. But Risley finds that the cloud, where the electron most likely is, lags behind the proton, possibly because helium is trying to regain its electron. He adds, however, that some of the cloud remains around the proton.

—A. Rowand

Old-time diamonds: Dating in the rough

When diamond dealers advertise that "a diamond is forever," they probably aren't thinking about a diamond's age. But the phrase almost fits new estimates that show natural diamonds may be at least 3 billion years old. This puts diamonds in the company of the oldest earth materials still in their original form.

"Our consistent results ... provide strong age and chemical constraints on an ultimate origin of diamonds in old, enriched mantle," report Stephen H. Richardson, formerly of the Massachusetts Institute of Technology and now with the University of Paris, and colleagues in South Africa and Scotland. Their study appears in the July 19 NATURE.

For years, controversy has surrounded the origin of diamonds. One theory suggests that diamonds crystallized from the magma that cooled to form the volcanic rock (kimberlite) in which they are now found. Most kimberlites are less than 200 million years old. On the other hand, molten rock could have serendipitously picked up a random sample of diamonds, originally scattered deep within the earth's upper mantle where they were formed, and then carried them to the surface. Such diamonds would be more than 3 billion years old.

The dating scheme used by Richardson

and his group relied on the fact that diamonds sometimes contain tiny inclusions of other minerals like garnet, which show up as spots of color in an otherwise colorless matrix. These minerals, in turn, contain small amounts of radioactive trace elements (such as samarium-147, which decays into neodymium-143). By comparing neodymium isotope ratios found within the minerals with present-day ratios, the researchers came up with an age of 3.2 billion to 3.3 billion years.

Usually, it is possible to conclude only that inclusions are older than their host mineral. However, sometimes the crystal form of the silicate mineral trapped within a diamond resembles the internal structure of a diamond more than its own natural pattern. This indicates that the diamonds and their silicate inclusions probably formed at about the same time.

—*I. Peterson*

Further attack on gene-splice tests

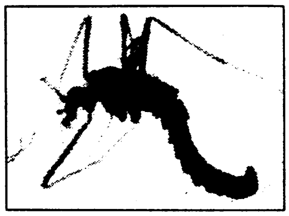
Private companies have not been prohibited from doing field experiments in which genetically engineered organisms are released, although a recent court decision at least temporarily prohibits the National Institutes of Health from allowing university researchers to undertake such tests (SN: 3/26/84, p. 325; see also page 61). Private companies were exempted from the ruling because they come to the NIH "voluntarily" for guidance; the institute has no legal authority over their actions, the court ruled. But Jeremy Rifkin of the Washington, D.C.-based Foundation on Economic Trends, the plaintiff in the suit, argued that *all* privately and publicly funded field tests of genetically engineered organisms should be banned until the NIH does a formal assessment of their potential impact on the environment. Now Rifkin is making plans to go back to court with a new argument.

The licensing agreement the private companies have signed with Stanford University for the use of the basic gene-splicing techniques includes a provision that the companies adhere to the NIH guidelines, Rifkin says. Therefore their coming to NIH for approval of experiments is not voluntary, he argues. "The private companies are more bound by law than the universities," he claims.

NIH and Stanford representatives say that Rifkin's arguments are wrong. Among the objections they are expected to raise in court is that the licensing agreement only states that the companies will comply with the physical and biological containment standards of the NIH guidelines, but makes no mention of field tests. They also are expected to argue that a private agreement between a company and a university does not extend NIH's authority.

—*J.A. Miller*

New bug comes in from the cold


Koshima/NATURE

Scientists scanning the surface of a Himalayan glacier for signs of life have uncovered a new species of insect that thrives in frigid climes that dip as low as −16°C.

While some Antarctic insects are known to survive even colder temperatures, most "winter over" in the larval stage of development, and save adult activities for the spring thaw. But during his month-long stay at the Yala glacier north of Katmandu, Shiro Koshima of Kyoto University in Japan spotted more than a thousand adult representatives of a new species of Chironomid midge, a flightless cousin to the mosquito. "In view of the fact that temperatures in this range normally cause cold stupor, even in Antarctic insects, this finding is amazing," Koshima reports in the July 19 NATURE.

More than 99 percent of the midges Koshima found strolling along the ice surface were single females, while most of the males and mating pairs remained in cozier crevices created by melting snow. The insects apparently feed on tufts of bacteria and algae that crop up on grains of mud in the snowmelt. Exactly how the midges manage to stay warm and active in winter remains to be determined, though overcoats may safely be ruled out. Simply getting in out of the cold may play a role; the midges seem to prefer daytime wanderings, and return to their snow caves at night. Some previously studied species of cold-adapted insects are known to make their own anti-freeze, supercooling their bodies but never freezing, while others literally freeze for the winter, and start circulating again in the spring.

—*D. Franklin*

Giving the business to ancient Maya trade

The advanced Maya civilization of Middle America disappeared 500 years ago, but this has been a good year for scientists studying what life was like during the Maya's heyday, the Classic period from about A.D. 250 to 900. In May, the National Geographic Society announced the discovery of an untouched 1,500-year-old Maya tomb that contains a cornucopia of revealing artifacts (SN: 5/26/84, p. 326). To top that off, three Canadian anthropologists report in the July 27 SCIENCE that obsidian, a volcanic rock prized by the Maya for its sharp cutting edges, was traded more extensively and along more routes than previously thought.

The Maya's two major sources of obsidian in the highlands of what is now Guatemala were at the hub of an intricate distribution network, say researchers Paul F. Healy and Bernie Walsh of Trent University in Peterborough, Ontario, and Heather I. McKillop of Northeastern Archaeological Associates in Port Hope, Ontario. They suggest that obsidian from the two sites, El Chayal and Ixtepeque, as well as other sources, was transported in canoes throughout the lowlands of Guatemala, southern Mexico, Belize and the Yucatan Peninsula by multiple routes.

Until now, many Maya researchers assumed that obsidian was traded along two major routes, one winding inland from El Chayal along several large rivers, the other stretching from Ixtepeque to the Caribbean and then up the coast.

But in a trace element analysis of 13 obsidian samples recovered from Moho Cay, a small island in the Caribbean just off the coast of Belize, the investigators identify 12 of the samples as originating at El Chayal. The artifacts date to A.D. 400 to 700. Trace element ratios, arrived at through special X-ray and neutron activation procedures, vary characteristically for obsidian from El Chayal and Ixtepeque.

This suggests, say Healy and coworkers, that "El Chayal was a major obsidian source for coastal as well as interior Classic Maya lowland sites." Islands such as Moho Cay probably served as "trade nodes," they add, where the long dugout canoes of the Maya could pull in so that paddlers could rest and exchange goods for trade. Moho Cay is ideally situated at the mouth of the Belize River to handle trading canoes.

Classic Maya civilization brought great advances in the arts, sciences and agriculture and provided fertile ground for a complex trading system, Healy told SCIENCE NEWS. There were hundreds of large ceremonial centers in Middle America at the time, each containing hundreds of thousands of people.

Aside from obsidian and ceramic objects, most other Maya trading goods have deteriorated over the years, says Healy. "The materials from the highlands may have been traded for lowland goods available in the rain forests, such as hardwood products, animal skins and woven cotton goods, but these objects don't survive for anthropologists to study," he explains.

Although the Maya largely traded among themselves, there may also have been some export-import business, Healy adds. He just returned from Belize with some granite artifacts that date from the Classic period and were probably obtained from non-Maya sources. Trace element analysis may uncover the origin of the stones, he says, which were used to grind foodstuffs.

—*B. Bower*