Double Duty Cells in Human Immune System

Teamwork between cells has been considered essential for the immune system to eliminate undesirable invaders. White blood cells called helper T lymphocytes recognize a foreign substance, proliferate and produce a chemical signal that prompts other white blood cells, killer T lymphocytes, to attack and destroy the intruder cell. But now scientists have discovered that some T lymphocytes can both proliferate in response to foreign material and attack it. Originally these cells were called helper cell-independent cytotoxic T lymphocytes, which was abbreviated HIT$_C$. Soon the abbreviation led to the more graphic name of HIT ("hit") cells.

"It's exciting that a single cell can do what two other cells do. It's like a hermaphrodite," Fritz H. Bach of the University of Minnesota in Minneapolis told SCIENCE NEWS. "These cells may well function in some situations when the other cells won't function — for example, against a tumor."

Bach described recent work on HIT cells during the American Red Cross Annual Scientific Symposium, held in Washington. Discovery of these autonomous killer cells required techniques that allow investigators to grow a line of cells—a clone—derived from a single cell. "Ability to clone T lymphocytes is a major advance. You can start with a single cell and have, in a few months, a gram of identical cells," Bach says. "It would have been extremely difficult to establish the existence of the HIT cell without cloning."

The HIT cell was first demonstrated in the mouse immune system by Bach and Michael B. Widmer. Looking at the cells of individual T-lymphocyte clones, the scientists found that some proliferated in response to a foreign target but did not kill cells; others killed but did not proliferate and a few could both proliferate and kill. These HIT cells, like helper cells, produced and released a chemical factor that could drive killer cells requiring helpers.

More recently human HIT cells were demonstrated by Bach and colleagues Siew-Lin Wee, Li-Kuang Chen and Gideon Strassmann. They found HIT cells among the white blood cells of a normal donor and a patient with malignant melanoma, a skin cancer. The investigators observed that the HIT cells kill the same cells that stimulate them to proliferate. Thus the two functions of the cell are triggered by the same target, although it is not yet known what specific chemicals make up those targets.

HIT cells are not equally prominent in all types of immune response, the scientists find. "HIT cells predominate in certain situations, but we still need to work out which," Bach says. In two cases, so far, human HIT cells made up 3 percent and 74 percent of the clones studied.

"This supports the concept that HIT cells play a differential role," Bach says. While the scientists do not yet know what is responsible for the frequencies of cell types, one possibility is that HIT cells preferentially respond to modified native cells, such as tumor cells.

Because HIT cells can kill tumor cells without the aid of helpers, Bach envisions potential application of HIT cells for tumor treatment. He says the recent findings "add a cell to the immune repertoire."

—*J.A. Miller*

Homing in on the Basin and Range

COCORP trucks inch along the nation's roads. They send vibrations through the earth and record the echoes as the seismic waves encounter layers in the crust.

Cornell University

As the fleet of trucks used by the Consortium for Continental Reflection Profiling (COCORP) inches across selected areas of the United States, scientists gradually are working out details of the earth's crust. The latest efforts have been focused in the Basin and Range province in western Utah where the crust, the uppermost portion of the earth, is becoming thinner. The seismic data show that three enormous slabs of crust are stacked up, scraping over each other along faults with shallow slopes extending for more than 120 kilometers. The findings are helping geologists to understand how surface features relate to movement deep in the crust, and also are raising fundamental questions about the nature and evolution of the Moho (Mohorovičić discontinuity), the transition between the crust and the underlying mantle.

The long horizontal faults are called detachment planes, meaning that the slabs are stretching out — the opposite of processes believed to build mountains. Movement along these faults may help explain the puzzling topography of the Basin and Range where, for thousands of square kilometers, mountain ranges protrude at intervals, separated by broad flat expanses of land. In 1982, a COCORP survey was conducted in a 170 km line from the Snake Valley near the Nevada-Utah border, across to the Sevier Desert. The data showed faults similar to those noted elsewhere on the continent.

The Utah COCORP findings were presented last week in Salt Lake City at the meeting of the Geological and Seismological Societies of America by Richard W. Allmendinger and colleagues of Cornell University in Ithaca, N.Y., and Robert B. Smith of the University of Utah in Salt Lake City.

It has been known that the crust in the Basin and Range is 25 km to 30 km thick, relatively thin compared to the crust in the Sierra Nevada range to the west, which is about 50 km thick. Jack Oliver of Cornell, director of the COCORP program, explains that one way to understand how the crust is being pulled apart is to learn what happens at depth to faults seen at the surface. There are three basic models to explain the stretching. One model is that as the Basin and Range is pulled apart, it breaks into blocks that are bounded by steeply dipping faults that continue throughout the crust. A second model is that the faults dip steeply until they blend into a zone where material, under high temperature and pressure, begins to flow. The third model, which the recent survey supports, describes a long horizontal fault with blocks sitting on it, sliding and gradually rotating.

The authors report that the present stretching began in the last 65 million years. There is evidence, they say, that in the preceding geological period the motion was in the opposite direction, with the slabs being thrust over each other along the same gradually sloping faults. Thrusting has occurred repeatedly in the Appalachians (SN: 6/9/79, p. 374; 10/20/79, p. 265), but there the record of stretching, or extension, seen in the Basin and Range is not observed.

The mechanics of extension along detachment planes remain "enigmatic," Allmendinger reported. There is abundant evidence that the crust pulls apart on very low-angle faults, but it "appears mechanically impossible," he said. If, as expected, the crust becomes weaker as it is stretched, it would seem more likely that the slabs would break up into blocks bounded by steep faults. The COCORP reflections show that this is not the case.

The COCORP data are obtained when pads on the trucks pound the ground, sending seismic waves vibrating through the earth. When the waves reach the Moho, their echoes are reflected back to thousands of small seismometers spaced along the route and relayed back to a truck where the information is recorded. While the seismic profiles are invaluable in discerning details of the continental crust, they leave many questions for scientists to ponder. For instance, no one can say exactly what caused motion on the faults to reverse. It may be related to the end of subduction of the Pacific Plate along what now is the California coast, and to the activation of the San Andreas fault, which cuts from north to south.

One provocative — and highly speculative — outcome of the recent survey is the possibility that the thinness of the crust in the Basin and Range may not be due to this episode of stretching, but instead was caused by the previous period of thrusting and compression. The classical view of the Moho is that it represents a change in composition from the silica-rich material of the crust to mantle material, which is called ultra-mafic. Oliver says that instead (in some locations) the lowermost slab may have been subjected to so much pressure by the heavy slabs rammed on top of it that it may have subsided. Exposed to high temperatures and pressure, the minerals in the slab might have changed phase — become other kinds of minerals but with the same basic chemistry. A phase change, like a change in chemical composition, would affect the seismic and physical properties of the minerals. At that point, Oliver suggests, "it might be that some of the crustal rocks would turn into something that we would identify as mantle." Such a change would result in a thinner crust.

If this finding can be substantiated, it would lead geologists to revise their view of the Moho. Doug Nelson, a Cornell researcher and a COCORP research associate, says that if a phase change can be demonstrated through petrology and geochemistry, "it would be a very dramatic result" that would change views of the continental crust and how it evolved. "It will be interesting either way it goes," he says. "We're all enthused with this data set."

—*C. Simon*

Help wanted: To seek an asteroid's moon

Do some asteroids have their own satellites? There have certainly been some tantalizing hints. On several occasions, astronomers watching a star apparently blink off and on as an asteroid passed in front of it have noted brief "secondary blinks" shortly before or after the main event, as though other objects in the asteroid's vicinity were getting in the way. Yet the possibility has been a matter of controversy for years, even as the list of asteroids with possible "companions" has continued to grow. The reason is that the evidence has always been frustratingly inconclusive, usually because the observers were too few or too close together to provide differing viewing angles that would confirm that a secondary event indeed represented an object orbiting the asteroid, rather than some unrelated object that merely happened to be crossing the line of sight.

Late this month, however, there may finally come a chance to confirm the existence of at least one such asteroidal moon — if enough observers, from professionals with specialized instruments to rank amateurs with binoculars, will join in the cause.

On Saturday night, May 28-29, a star known as 1 Vulpeculae will be briefly occulted, or blocked out, by the large asteroid Pallas, at least to observers (who will be legion) along a narrow path across the southernmost United States and northwest Mexico. The position of this primary occultation track is well known in advance, based on calculations of the asteroid's orbit. But if Pallas has a moon, *that* occultation may turn out to be visible only from as yet unknown locations somewhere in a wide area that includes almost all of North, Central and South America as well as parts of Africa. And the signs that Pallas indeed has a moon include what has been called "the best evidence yet."

Various secondary occultations near Pallas were reported in the early 1970s, and another in 1978, says David Dunham of the International Occultation Timing Association, which encourages and coordinates such observations. But in 1980, E.K. Hege and colleagues from Steward Observatory in Arizona produced an image by a technique called speckle interferometry (unrelated to occultations), in which the asteroid appeared to have a bulge on one side, as though another object were present but too small and nearby to be separately resolved by the telescope (SN: 11/8/80, p. 295).

The occultation track of such a moon is unknown because the rotation axis of Pallas (and the plane of the suspect moon's orbit) is nearly pole-on to the earth. Thus Dunham and others hope that observers throughout the country will try to spot a secondary blink, even from sites where the main blink is not visible. Interested

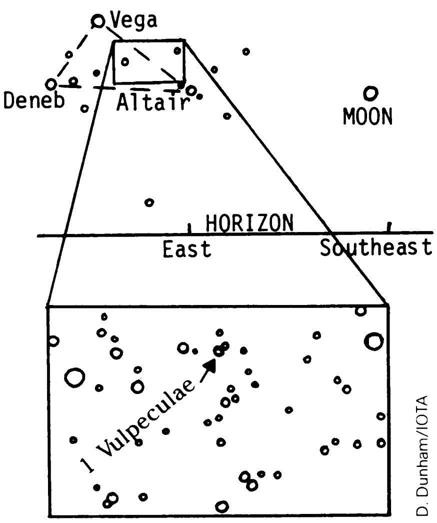

Diagram shows position of star that may be occulted by a moon of asteroid Pallas.

watchers should look at 1 Vulpeculae (binoculars will do) for about 15 minutes, starting at 12:50 a.m. EDT on May 29. The star is located within the "Summer Triangle" formed by the bright stars Vega, Deneb and Altair (see diagram). But establishing the time of such a blink is critical in combining the observations. Set a digital watch (to the second) from WWV shortwave broadcasts or an accurate telephone time source (the U.S. Naval Observatory's is 202-653-1800 in Washington), and dictate your starting, ending and observed occultation times to a tape recorder (or an assistant) as you look. Indicate your location to within 200 feet if possible (such as by reference to a street intersection), and send your report to IOTA, Box 596, Tinley Park, Ill., 60477. Help discover a moon. And watch this space.

—*J. Eberhart*

Oversight groups for supercomputers

Three government study groups will oversee the federal role in developing and using new "supercomputers," the White House announced last week. The move is part of an effort to keep U.S. supercomputer technology ahead of foreign competition, particularly from Japan.

Supercomputers are the fastest and most powerful scientific computers available. These computers have special characteristics that allow them to perform calculations up to 80 times as fast as the largest general-purpose computers. Supercomputers are used in weather forecasting, scientific research, aircraft and weapons design, seismic data analysis and even for animation and special effects in filmmaking. About 60 supercomputers are