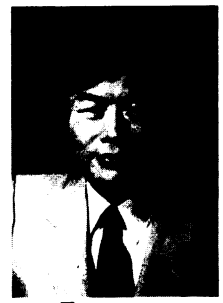
Behavioral, DNA workers win Laskers

Leder

Schou

Hood



Tonegawa

Three molecular geneticists who clarified the relationship between DNA and antibody production, along with a psychiatrist who pioneered drug treatment for the mentally ill, are recipients of the 42nd annual Albert Lasker Medical Research Awards, which were announced this week.

Given by the Albert and Mary Lasker Foundation of New York, the awards cited the winners for outstanding contributions to medical science in either a clinical setting or in a basic research laboratory.

Sharing the $15,000 award for basic research are Leroy Hood, chairman of the Division of Biology at the California Institute of Technology in Pasadena; Philip Leder, chairman of the Department of Genetics at the Harvard Medical School in Boston; and Susumu Tonegawa, professor of biology at the Massachusetts Institute of Technology Center for Cancer Research in Cambridge.

Mogens Schou, professor and research director of the Psychopharmacology Research Unit at Denmark's Aarhus University Psychiatric Institute in Risskov, received the clinical research award, which also totals $15,000.

A Lasker committee of scientists chose Schou for his "landmark clinical trials of lithium therapy and prophylaxis for manic-depressive illness, which initiated a revolution in the treatment of mental illness," according to statements released by the foundation. Marked by cyclic bouts of depression and mania, manic-depressive illness is thought to affect an estimated 1 to 2 percent of the world's population. Between 800,000 and 1.2 million people in the United States have had the disease at some time in their lives, say federal health officials.

In the early 1950s, Schou and his colleagues designed the first controlled clinical study of lithium therapy for psychiatric patients. Partly because of results in animal studies, Australian scientists previously had suggested the drug as a treatment of manic episodes. But the rest of the scientific community was not convinced by their test results. Through a series of carefully constructed experiments, Schou's group demonstrated that lithium could halt manic attacks and lessen depression, as well as prevent recurrences of both.

Using laboratory techniques that predated much of today's bag of genetic engineering tricks, Hood, Leder and Tonegawa independently determined in the 1970s how the immune system can make antibodies to all the foreign substances (antigens) that one encounters in life — despite having inherited a finite number of genes coding for antibody production.

Hood noted that different parts of the antibody molecule can vary in their biochemical structure, and that this antibody variation is governed by genes, which themselves can be altered by random mutations. The possibility of many such rearrangements allows the body to produce a multitude of antibodies, concluded Hood. More recently, he contributed to the development of the first automatic DNA sequencer (SN: 6/28/86, p.407).

Cited for his "elegant studies of the genetic basis of antibody diversity and the role of genetic rearrangement in carcinogenesis," Leder also described how the body can make antibodies against a barrage of different antigens. He then expanded his work to the study of cancer among the antibody-producing B cells in Burkitt's lymphoma, and provided early evidence for a genetic component in cancer. In 1977, his success in cloning the gene for the globin protein marked the first time a mammalian gene had been cloned.

Tonegawa located and cloned the genes for antibody production from both reproductive cells and B cells. By comparing genes from the two sources, he found that parts of the B-cell DNA differed from DNA segments in the reproductive cells — evidence that inherited genes are later rearranged inside B-cells to make antibodies against specific antigens. Tonegawa has since found a similar "rearrangement" phenomenon in the T cells of the immune system, which directly attack invaders like viruses and bacteria. These changeable genes may affect T-cell-surface receptors for foreign particles (SN: 7/19/86, p.36).

— D.D. Edwards

Ariane flies again

Europe's doorway to space is open again, with the successful Sept. 15 launching of an Ariane 3 rocket that deployed a pair of communications satellites, one for the 26-nation European Telecommunications Satellite Organization and another for Australia.

The door had been slammed shut on May 30, 1986, with the takeoff of the previous Ariane, an Ariane 2. The rocket's first two stages had worked fine, but the third stage (the same kind used with the Ariane 3) shut off prematurely, forcing safety officials to blow it up in mid-ascent. The loss, which also destroyed a $55 million communications satellite, capped a disastrous four-month span for Western launch efforts that had begun with the space shuttle Challenger explosion, followed by failures of the U.S. unmanned Titan 34D and Delta rockets.

The latest Ariane launching incorporated a redesigned version of the booster's third-stage ignition system. The next Ariane is presently scheduled to take off in November, carrying Germany's first direct-broadcasting television satellite. In December, another Ariane is to deploy a pair of communications satellites for customers in France and the United States. □

New vaccine aids infants

An experimental vaccine that uses a novel approach to boost immunity is proving effective against potentially fatal infections in infants, researchers report. The vaccine, not yet approved for use in the United States, is specifically engineered to protect children younger than 2 years of age against infection by the bacterium *Haemophilus influenzae* type b — responsible for most cases of childhood bacterial meningitis and other serious diseases in children. The only U.S.-approved *Haemophilus* vaccine is incapable of inducing immunity in children younger than 2, despite the fact that most cases occur in the first 24 months of life.

Researchers last week released the results of a large-scale field study in which the new vaccine was given to more than 700 infants. Results of the study, which was performed by researchers in Finland in conjunction with Toronto-based Connaught Laboratories, appear in the Sept. 17 New England Journal of Medicine.

The researchers conclude that the vaccine can reduce by 87 percent *H. influenzae's* yearly infection rate in children. In the United States, 18,000 such cases occur annually among children under 5, and approximately 1,000 infants die of the infection each year.

Lance K. Gordon, one of the Connaught researchers, told SCIENCE NEWS that the experimental vaccine represents the first successful application of a "carrier-hapten" approach to vaccine development. The technique uses a part of the *Haemophilus* bacterium that would normally stimulate only a weak immune response (a "hapten") and links it to a potent immune system stimulant, or "carrier" — in this case a protein component of diphtheria toxoid. The resulting antibody response is rich in *Haemophilus*-specific "memory cells" that enable infants to mount an amplified attack against the bacteria. — *R. Weiss*

Stone Age site gets pushed back in time

More than 20 years ago, the potassium argon technique for calculating the age of ancient rocks revealed that early hominid sites at Olduvai Gorge in East Africa dated to 1.8 million years ago, a much older estimate than had generally been recognized. The same method, which depends on the decay of potassium's naturally radioactive isotope to the nonradioactive gas argon, now has significantly pushed back the age of another East African site containing remains of later hominid activity during the Stone Age.

Artifact-bearing layers of volcanic ash at the Olorgesailie river basin in Kenya were formerly estimated to be about 500,000 years old, but now are more accurately dated at 700,000 to 900,000 years old, report Bethany A. Bye of the University of Utah in Salt Lake City and her colleagues in the Sept. 17 NATURE.

Large numbers of stone hand-axes have been uncovered at Olorgesailie (SN: 4/25/87, p.264), which is considered a key site of the Stone Age Acheulean culture. The almond-shaped axes are the primary Acheulean remains. The Acheulean era ranged from about 1.4 million to 150,000 years ago, but within that expanse there are few well-dated points at which cultural change can be examined.

In addition to revising the age of artifact-rich portions of the Olorgesailie site, Bye and her co-workers found that lower layers of volcanic ash differ chemically from overlying layers that contain the abundant Acheulean remains. They suggest that the lower and upper layers were created by separate volcanic eruptions.

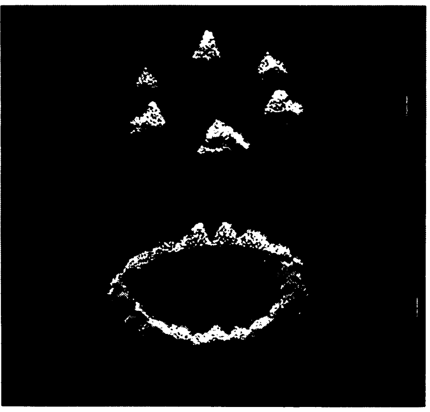
According to J.A.J. Gowlett of the University of Liverpool, England, writing in the same NATURE, the aging of Olorgesailie leaves researchers wondering whether they can confidently place any African hominid sites in the period between 700,000 and 300,000 years ago. — *B. Bower*

Going for a molecular spin

A surface is a busy molecular metropolis: Passing molecules restlessly jostle in and out of binding sites against the skyline of a material's atomic architecture.

Understanding how such molecules interact and bond at surfaces is key to designing a host of industrially important technologies, from semiconductor processing and catalytic and electrochemical techniques to corrosion control and the production of adhesives and lubricants.

One experimental technique that has helped scientists visualize the static bonding geometries between adsorbed and surface molecules is called ESDIAD, or electron stimulated desorption ion angular distribution. Now it has also enabled researchers to observe the rotation of adsorbed molecules, spinning like tops on a crystalline nickel surface. While spectroscopic techniques had suggested such molecular motions, says John T. Yates Jr. at the University of Pittsburgh, this is the first direct evidence of spinning molecular rotors.



Alvey and Yates/Univ. of Pittsburgh

With ESDIAD, the six fluorine ion beams indicate that at 85 kelvins, PF_3 molecules are sitting with their fluorine atoms sticking up in the air and are oriented in two possible positions over the underlying nickel crystal (top). As the temperature increases to 275 kelvins, the fluorine beams spread out into a ring, indicating that the molecules are spinning around their phosphorus hubs (bottom).

Yates expects that one possible spin-off of ESDIAD's ability to image rotational molecular motion will be the development of superior high-temperature lubricants; the technique can help scientists finger the molecular motions that turn well-ordered lubricants into disordered, more frictional substances at high temperatures.

In the ESDIAD technique, which was invented in 1974 at the National Bureau of Standards by Theodore E. Madey, Yates and a visiting Polish scientist, adsorbed molecules are bombarded with electrons. This breaks the molecular bonds, jettisoning positively charged pieces of the molecules. Because the ions are ejected along the original bond directions, their trajectories provide an image of the surface binding geometries.

ESDIAD shows, for example, that the phosphorus atom in the pyramidal molecule phosphorus trifluorine (PF_3) does all the clinging when the molecule is adsorbed onto the surface of a single crystal of nickel; emitted fluorine ions indicate that the molecule looks like an upside-down three-legged stool with fluorine atoms flung into the air directly above nickel atoms.

In an upcoming issue of the JOURNAL OF PHYSICAL CHEMISTRY, Yates, Pittsburgh's Mark D. Alvey and Kevin J. Uram at IBM in Yorktown Heights, N.Y., report that when they heat the PF_3-nickel surface, the fluorine-ion beams spread out into a ring, indicating that the fluorine-phosphorus bonds are spinning around the phosphorus seat of the PF_3 molecular stool.

By measuring the temperature at which molecules begin to spin and by modeling the rotation quantum mechanically, the researchers determined the amount of energy needed to initiate rotation. However, Yates says they do not yet understand the force that prevents spinning at low temperatures and that orients the PF_3 molecule in a very specific way relative to the nickel surface. He also notes that if the PF_3 molecules are closely packed on the surface, their rotation is strongly hindered by interactions between neighboring molecules, "somewhat like interlocking gears."

In another study, the researchers used ESDIAD to prove that similarly configured ammonia molecules also spin on nickel surfaces. Yates says he and others detected a ring pattern of ejected hydrogen ions from ammonia in the past, but they have not been able to cool their samples to temperatures low enough to halt the rotations. In their recent work, Yates's group instead used carbon monoxide and other molecules that form hydrogen bonds with ammonia to grab legs of the ammonia stools and make their rotations stop.

"So far we've only been able to do hydrogen bonding, but in principle we might be able to use these ideas to see stronger chemical bonds form between different species," says Yates. "This is really the beginning of the visualization of chemical reactions between two molecules sitting on a surface in a catalyst ... where you can see molecule A beginning to snuggle up to molecule B and interacting with it." — *S. Weisburd*