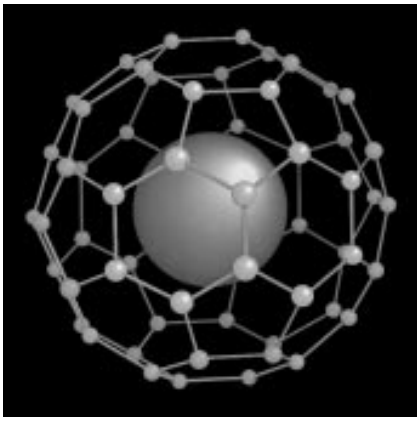
1996 Nobel Prizes Awarded; Discoveries in Immunology, Fullerene Chemistry and Superfluidity Recognized

In early October, the Nobel Foundation announced the winners of the 1996 Nobel Prizes for physics, chemistry and physiology or medicine.

Peter C. Doherty of the St. Jude's Children Research Hospital and Rolf M. Zinkernagel of the Institute of Experimental Immunology, Zurich, shared the Nobel Prize in Physiology or Medicine for their discovery of how the immune system recognizes virus-infected cells.

Doherty and Zinkernagel found that a T lymphocyte from one strain of mice could not kill an infected cell in another strain of mice even if the same virus had attacked it. The implication of this discovery was that T lymphocytes must recognize two molecules on the infected cell in order to kill it. Those two molecules are the viral antigen and a major histocompatibilty antigen, which comes from the cell itself. They concluded that the immune system must simultaneously recognize a foreign and a so-called "self" antigen in order to kill an infected cell.



Buckminsterfullerene, a carbon-60 structure which was recognized with the Nobel Prize in Chemistry.

The Nobel Prize in Physics was shared by David Lee and Robert Richardson, both of Cornell University, along with Douglas D. Osheroff of Stanford University for their discovery of superfluidity in helium-3.

While formulating a melting curve (a graph of pressure vs. time as a substance is cooled) for helium-3, they noticed a small jump in the curve. They initially thought the disturbance was a phase transition in solid helium-3 ice. Later, however, the effect was discovered to be two phase transitions in liquid helium-3. This new liquid was then shown to be a superfluid—a liquid which has no inner friction or viscosity.

The Nobel Committee awarded Robert F. Curl, Jr. and Richard E. Smalley, both of Rice University, and Sir Harold W. Kroto of the University of Sussex, U.K., this year's Nobel Prize in Chemistry. Their discovery of fullerenes—structures composed of a high number of carbons arranged in a geodesic dome geometry—earned them science's highest honor.

The structures, named after architect Buckminster Fuller and known affectionately among chemists as "buckyballs," are made when gaseous carbon mixed with helium gas is sent into a vacuum and the temperature is lowered to several degrees below absolute zero.

Peter C. Doherty and Rolf M. Zinkernagel, 1996 winners of the Nobel Prize in Physiology or Medicine.

Under these conditions, high molecular weight carbon structures form and can be analyzed via mass spectroscopy.

The most common structure to form was carbon-60, which was characterized and named buckminsterfullerene. Other related molecules are classified as fullerenes.

—Nikunj Shah

Mechanism of HIV Entry Elucidated; Chemokine Receptors Implicated in Pathogenesis of AIDS

It has long been known that the HIV virus infects human T lymphocytes by binding to a cell-surface protein called CD4. Recent research, however, has shed new light on the exact mechanism by which HIV enters the cell, sparking renewed optimism in the AIDS research community.

A report published in the June 28 issue of *Science* showed that in addition to CD4, HIV binds to a "co-receptor" protein on the T cell.

Two such proteins have already been found, and researchers are optimistic that there are others still waiting to be dicsovered. Of the two co-receptors identified, the one attracting the most attention is CC-CKR-5, a protein which normally acts as a receptor for inflammatory proteins called chemokines.

Robert Gallo, a co-discoverer of the HIV virus, and Fiorenza Cocchi of the National Cancer Institute reported that when human T cells were treated *in vitro* with the chemokines RANTES, MIP-1a, and MIP-1b and then exposed to HIV, the activity of the virus was suppressed; when treated with antibodies neutralizing

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Computer Genius Seymour Cray Dies at 71; Pioneer of Circuit Architecture

Computer genius and pioneer Seymour Cray passed away on October 5, 1996 after suffering serious injuries in a car accident September 22. Cray was 71.

Born in 1925, Cray displayed an interest as a youngster in radio and electronics. Following this love, he joined an infantry communications platoon in the Army. After World War II, he attended the University of Minnesota, where he received a bachelor's degree in electrical engineering and a master's degree in mathematics.

Cray went on to develop the first fully transistorized computer in 1958. The use of transistors made the computers more reliable and allowed for miniaturization—the previous vacuum tube computers were big enough to fill a room.

Cray is perhaps best known for developing a series of powerful supercomputers that became industry standards. His designs were elegant and resourceful. He was adroit in the art of densely packaging computer components and was able to develop sophisticated machines by putting together simple components in clever ways.

One of Cray's most important contributions was a method for solving scientific and engineering problems using so-called "vector processing," which involves linking together long series of calculations in specialized hardware.

Cray's first job after completing his studies was with Engineering Research Associates, where he met John Von Neumann, the father of the modern computer. At ERA, Craymade great strides in Reduced Instruction Set Computing (RISC).

After leaving ERA, Cray worked at Control Data before starting his own company, Cray Research.

During his remarkable career he pioneered several new computers, including the Control Data 6600, which was dramatically faster than

The CRAY 2 Supercomputer, one of Cray's crowning achievements in computer design.

the leader at the time, the IBM 7094.

A later computer, the CRAY 2, had an even more unique cooling system. Its circuit cards were immersed in Flourinert, an exotic fluid, to dissipate excess heat.

Cray's computers made major contributions to diverse areas such as automobile safety, pharmaceuticals, petroleum exploration, weather forecasting, weapons design and military intelligence.

As a press release from Cray Research states, "Seymour Cray was, deservedly, a legend in his own time—the father of the supercomputer and the high performance computer industry. He was a creative and technological genius who …ranks with Edison, Ford, Marconi and Bell as one of the seminal thinkers, inventors and business pioneers of modern times."

—Brian D. Krechman

Chemokine Receptors *cont'd*

the chemokines, HIV activity was restored.

Gallo and Cocchi concluded that the chemokine receptor is needed for HIV infection, and that certain chemokines could block that infection. Their research provides insight into several long-unanswered questions about AIDS, prime among which is the observation that some individuals who are repeatedly exposed to HIV never develop infection. Some researchers have suggested that these people may possess an intrinsic defense mechanism, such as a mutated CC-CKR-5, which would render them resistant to HIV entry.

The other co-receptor, identified by Edward A. Berger of the Laboratory of Viral Diseases (*Science*, May 10, p. 872), is known as LESTR or fusin. Although fusin has not been linked to chemokine activity, the existence of more than one co-receptor suggests that HIV may use different molecules to enter the cell at different stages of the disease.

These recent findings have led AIDS researchers to direct new efforts towards finding molecules that can block these receptors and thus prevent HIV entry.

Chemokine receptors have become increasingly important to understanding the mechanism of HIV pathogenesis and transmission. However, not all researchers are convinced of their importance.

At the 11th International Conference on AIDS, held in Vancouver this past summer, an intellectual rift between leading AIDS researchers was evident regarding whether chemokine research would ever bring improved AIDS treatments or vaccines (*Science*, July 19, pp. 302-3).

Since then, that skepticism seems to have dissolved as chemokine receptors have rapidly moved to the forefront of AIDS research.

—Scott Lovitch

Professor Profile: Robert P. Kirshner

In the world of astrophysics, Professor Robert P. Kirshner claims that "There's a lot happening, but I believe you can do a good job explaining it to people who don't have any special training in physics." This belief guides Kirshner in all his work, whether he is probing the age of the universe or teaching a class of undergraduates basic astronomy.

Professor Robert P. Kirshner.
Photo courtesy Harvard News Office

Professor Kirshner, chairman of Harvard University's Astronomy Department, is fascinated by astrophysics and loves to share his enthusiasm for the field with his students. Kirshner's group is currently using supernovae as tools for guaging the size and age of the universe. He first became interested in supernovae in the early 1970's when 1972E, the brightest supernova ever recorded, was discovered. A California Institute of Technology graduate student at the time, Kirshner studied 1972E in great detail. "I've been working on supernovae ever since," he said.

Kirshner's research aims to measure cosmic distances by making use of a supernova's brightness. By finding the ratio between the apparent brightnesses of two objects, one can calculate the square of the distance between them. Initially, scientists relied on the vibrations of cepheids to measure distances based on this principle. However, without the use of supernovae, which can be as bright as a billion stars according to Kirshner, scientists could only accurately measure distances of up to sixty million light years.

Supernovae, on the other hand, are bright enough to be seen a third of the way across the universe. After initially calibrating the new supernovae scale with the known measurements based on the cepheid vibrations, Kirshner has been able to measure distances of billions of light years with a mere error of seven percent.

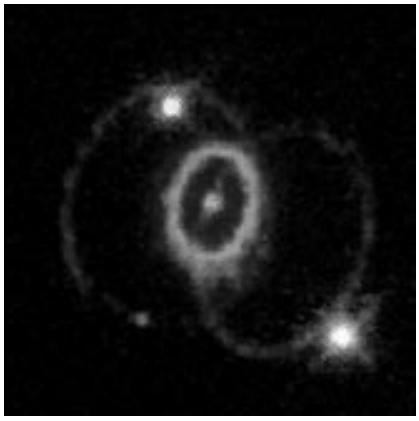
This new tool, however, raises interesting new questions about the age of the universe. The most popular model of the universe is one which is expanding, but decelerating in the process. This model suggests an age of approximately ten billion years. Scientists, however, have determined the age of the oldest known star to be fifteen billion years old. Kirshner states that in order to solve this apparent contradiction, "we can measure the geometry of the universe using supernovae as our tool. If we could measure the properties of the universe we could tell if it has the geometry of flat space or curved space."

At the core of his project is a regression line, the points of which are still evolving as new supernovae are discovered and their distances measured. The final line will closely match a line representing one of three scenarios for the universe: one that is expanding and will continue to expand, one that is expanding but decelerating, or one that will eventually reverse direction and contract.

At the present time, the data is fairly inconclusive because the baselines for the three scenarios are very similar at small distances, but as Kirshner measures distances farther away, his data will correspond with one of the three baselines, and he can hopefully form a theory regarding the size, age, and future of the universe.

Apart from probing these deep mysteries of the cosmos, Kirshner teaches the *Matter and the Universe* course at Harvard College, as well as other courses within the Astronomy department. *Matter and the Universe* deals with "both the evolution of matter on the microscopic scale and the evolution of matter on the macroscopic scale," and is a perennial favorite among Harvard students.

Kirshner believes strongly in the power of classroom scientific demonstrations, which he is renowned for. Students "especially like it when something unplanned happens," Kirshner explained. According to student evaluations, his pupils love his classroom humor and find his presentations incredibly interesting. Professor Kirshner is an inspiring teacher, and his research is bringing the farthest corners of the universe closer and closer to home.



Supernova 1987A. Supernovae are the primary subject of Professor Kirshner's research.

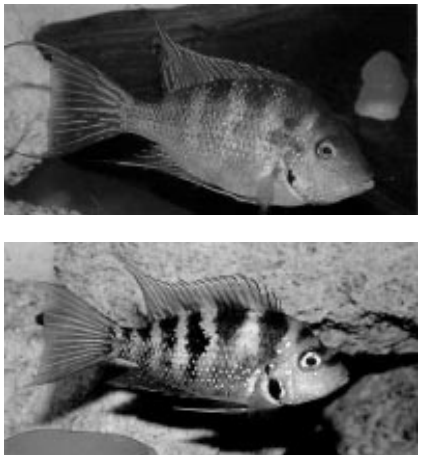
—Mala L. Radhakrishnan

Accelerated Evolution Observed in Africa's Lake Victoria: New Questions on Maximum Pace of Adaptation

Researchers have long been debating the history of Lake Victoria, located in the East African Rift Valley. The lake, Africa's largest, contains a wide diversity of cichlid fish which have evolved over a compressed time scale. The exact length of this period of evolution has been the focus of much investigation.

Now, results from a research team led by Thomas C. Johnson suggest that Lake Victoria completely dried up during the late Pleistocene period approximately 12,400 years ago and, furthermore, that the many species of cichlid fish did not exist in surrounding satellite lakes during this period. At the end of this arid period, the lake was flooded; the authors suggest that the lake's cichlid fish have evolved completely in the time since then. This conclusion predicts a very rapid rate of evolution of these cichlid fish.

Using the techniques of seismic reflection profiling, piston coring, and radiocarbon dating, the authors conclude the shows that the lake level fell around 17,300 years ago, and



Two species of cichlid fish native to Lake Victoria.

that the basin was flooded around 12,400 years ago. Since evaporation from the lake provides nearly 50% of the rainfall for the region, there would not have been enough water to sustain smaller satellite lakes during this dry period. Without these satellite lakes, the cichlid fish presumably had no place in which to wait for the return of water to the main lake.

Based on these observations, the authors conclude that all of the species which inhabit Lake Victoria today evolved in the past 12,400 years. Their conclusion is also supported by mitochondrial DNA evidence showing that the species are young and monophyletic. This research proves that the diversity of fish found here was brought about not by a stable ecosystem, but rather one with so-called lacustrine instability. These conclusions have surprised scientists in the field, who have long believed that evolution of the type seen in Lake Victoria must occur on a slower time-scale.

—Heather L. Mason

6th Annual Ig Nobels Awards Ceremony

On October 3, 1996, science relinquished most aspects of normalcy by presenting awards to researchers whose achievements "cannot or should not be reproduced."

The Sixth First Annual Ig Nobel Prize Ceremony, named after Ignatius Nobel who believed he was a relative of Alfred Nobel, was held at Harvard's Sanders Theater.

Actual Nobel Laureates including Dudley Herschbach, William Lipscomb, and a balloon likeness of Sheldon Glashow helped to present the awards amid a constant stream of paper airplanes from the audience.

Anders Baerheim and Hogne Sandvik of the University of Bergen, Norway, received the prize in biology for their report in the *British Medical Journal* titled "Effect of Ale, Garlic, and Soured Cream on the Appetite of Leeches."

The award for medicine was given to three U.S. tobacco industry executives for, as organizers put it, "their unshakable discovery, as testified to in the US Congress, that nicotine is not addictive."

Robert Matthews of Aston University, England, received the physics prize for his report, "Tumbling toast, Murphy's Law and the fundamental constants" printed in the *European Journal of Physics* demonstrating that toast always falls on its buttered side.

Purdue University's George Goble earned the Ig Nobel Prize in chemistry for using charcoal and liquid oxygen to ignite a barbeque grill in a mere three seconds.

The editors of the journal *Social Text*, under fire recently for their publication of a farcical article submitted by a physicist, received the Ig Nobel Prize in literature for, as the event organizers put it, "publishing research that they could not understand, that the author said was meaningless, and which claimed that reality does not exist."

Finally, Jacques Chirac, President of France, received the peace award for "commemorating the fiftieth anniversary of Hiroshima with atomic bomb tests in the Pacific."

With characteristic zaniness, dryness, and enjoyable disregard for serious prize ceremonies, the 1996 Ig Nobels ended with the simple speech of, "Goodbye, goodbye."

—Denis Sirringhaus