

Postmortem in on Baby Fae

The newborn baby who died three weeks after receiving a baboon heart in October 1984 succumbed to a "potentially avoidable" immune response, her medical team now reports.

Although the baby died because the transplanted heart tissue died, "hyperacute rejection did not occur," Leonard L. Bailey and his colleagues at California's Loma Linda University report in the Dec. 20 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION. A cross-species transplant might have worked with closer tissue matching and other changes in procedure, they say.

White blood cell recognition and attack of foreign tissue is the primary problem in human-to-human heart transplants. But in the baboon transplant, the rejection was orchestrated primarily by antibodies, the researchers report. Though they used cyclosporine, the immune suppressant is thought to work best against the white cell response.

The infant, known as Baby Fae, was born with hypoplastic left heart syndrome, a congenital heart malformation that kills most babies within a month of birth. Other options for Baby Fae were a difficult and often unsuccessful two-step surgical procedure or a human heart

transplant. The researchers say that while a human heart transplant is the most desirable option, it is "impractical" in infants. Nevertheless, last month Bailey transplanted a human heart to a 4-day-old boy. At press time the boy was off life-support systems and healthy, according to a university spokesperson.

Baby Fae's transplant was not only cross-species, it was cross-blood-type. Baby Fae was type O, which is rare in baboons. Bailey used a heart from an AB baboon selected because of other typing matches and minimal reaction between the baboon's blood and the baby's in culture.

Kidneys, livers and hearts from chimps and baboons have been implanted in humans before, but with little success. The Loma Linda operation (SN: 11/3/84, p. 276; 11/24/84, p. 325) was the first cross-species heart transplant done since the advent of cyclosporine.

The supposition made by the Loma Linda team that a relatively immature immune system would mount less of a rejection response was "wishful thinking," Olga Jonasson of the University of Illinois in Chicago and Mark A. Hardy of Columbia University in New York City claim in an accompanying editorial. But, they say, Bailey has demonstrated that a cross-species heart transplant is technically feasible, and that such a transplant might provide a "bridge" until a human heart is available. — *J. Silberner*

DNA fingerprints to aid sleuths

It's elementary, my dear Watson. The DNA minisatellite probes show that only suspect X could be the rapist. All 15 bands in the DNA fingerprint of the recovered semen match those of his blood sample. The chance of error, Watson, is only 1 in 30 billion.

While DNA patterns have not yet condemned any criminals, forensic applications of molecular biology appear both imminent and powerful. "It is envisaged that DNA fingerprinting will revolutionize forensic biology particularly with regard to the identification of rape suspects," say geneticist Alec J. Jeffreys of the University of Leicester, U.K., and Peter Gill and David J. Werrett of the Home Office Forensic Science Service in Reading, U.K. In the Dec. 12 NATURE, they describe new analyses of blood and semen samples.

Their technique is one of several that are being developed to identify individuals and their relationships by analyzing genes (SN: 8/31/85, p. 140). These methods have promise for more definite determinations of paternity and maternity, as well as forensic applications.

The new techniques take advantage of segments of human DNA that vary among individuals. Jeffreys and his colleagues Victoria Wilson and Swee Lay Thein have described a class of short segments that they call hypervariable minisatellite regions. Each segment contains a core sequence of 10 to 15 DNA subunits, known as base pairs, which is repeated many times. The number of these repeats varies from person to person.

To analyze the hypervariable regions, the scientists enzymatically cut a sample of DNA into pieces and radioactively tag those containing minisatellite regions. This procedure creates a characteristic pattern of bands. Except for identical twins, even close relatives can be distinguished by these DNA "fingerprints." The patterns are inherited: Each parent contributes about half his or her bands to each offspring.

To demonstrate that these patterns can be valuable in forensic work, Gill, Jeffreys and Werrett produced DNA fingerprints from samples that might be available to a detective: 4-year-old bloodstains and semen stains on cloth. They also developed a method that might identify rapists: The investigators separated the nuclei of sperm from other material that is found in vaginal swabs taken more than 6 hours after intercourse. They then produced DNA fingerprints of the semen donor that match the DNA fingerprints produced from a blood sample.

"These preliminary results demonstrate that DNA fingerprints are capable

House passes tough Superfund bill

The House on Dec. 10 approved a Superfund extension that calls for \$10 billion to be spent on cleaning up toxic-waste dumps over the next five years. This bill, however, is in many ways much tougher than the version passed by the Senate earlier this year. Resolving the differences may take weeks of negotiations between the House and Senate next year. Until then, the Environmental Protection Agency (EPA) has no authority to collect a tax from the petrochemical industry to fund cleanups. The original Superfund law expired at the end of September (SN: 10/5/85, p. 215).

During the final days of the House debate, the biggest battle was over how the cleanup program should be financed. A plan to create a tax that would affect almost all manufacturers was defeated in a close vote. Instead, the oil and chemical industries face a sharply increased tax on crude oil and chemical feedstocks to pay for the program.

The bill that finally emerged from the House was a victory for a coalition of environmentalist groups, including the Sierra Club and the National Audubon Society, which had made reauthoriza-

tion of Superfund the focus of a major lobbying effort. The groups helped push through a stronger bill than the House's energy and commerce committee had first proposed.

The final House bill would tighten standards and set more strict schedules to ensure faster cleanups. In the program's first five years, EPA lists only six out of hundreds of toxic-waste dumps as being completely cleaned up. The bill also requires extensive reporting of chemical emissions that seriously endanger human health.

The House rejected a controversial amendment that would have allowed victims exposed to hazardous waste to sue for damages in federal court. Nevertheless, the bill does allow citizens to sue EPA to force it to clean up a particular toxic-waste site.

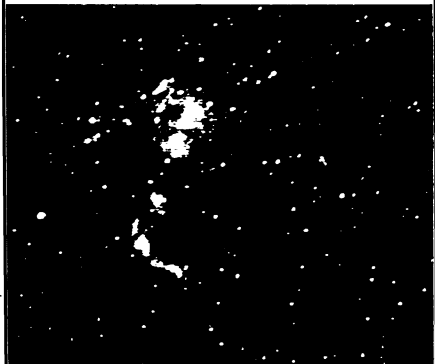
Now environmentalists are urging the Senate to accept the House provisions when they confer to resolve differences. Originally, the Senate approved a \$7.5 billion program funded by a broad manufacturers' tax. In either case, the negotiated bill may face a presidential veto. The Reagan administration wants only a \$5.3 billion program (SN: 3/2/85, p. 133). — *I. Peterson*

of changing completely the emphasis of blood-grouping [biochemical identifications] in forensic science," say Gill, Jeffreys and Werrett. Currently, a series of tests can rule out suspects, but it cannot produce a positive identification. With the DNA test, using two types of mini-satellite DNA, the chance of a mistaken identification is less than 5×10^{-19} .

Although the potential is great, DNA fingerprints are not expected to replace immediately the current battery of tests. The new methods still must be subjected to extensive family and population testing. Barbara E. Dodd of London Hospital Medical College says that the DNA fingerprint test, as Jeffreys currently performs it, is very time-consuming and needs meticulous expertise.

In at least one case already DNA fingerprinting has been used to settle a dispute. Jeffreys helped a Ghanian woman living in the U.K. to convince immigration officials that a boy returning to the U.K. was her son and not the son of one of her sisters. The problem was especially difficult because the boy's father and the woman's sisters were not available to test. Jeffreys calculated that the chance that the woman is the boy's aunt, rather than his mother, is less than 1 in 100,000. Jeffreys and his colleagues conclude, "This difficult case demonstrates how DNA fingerprints can give unequivocal positive evidence of relationship, even in some cases where critical family members are missing." — J.A. Miller

A wide-angle CCD camera



The North America Nebula (NGC 7000) is a region of ionized hydrogen in the constellation Cygnus. A lane of dark dust superimposed on the glowing hydrogen gives the appearance of the U.S. East Coast and the Gulf of Mexico. This is one of the first pictures made with a new camera designed for studies of Halley's comet by George Herbig and Burt Jones of the Lick Observatory in Santa Cruz, Calif. The camera combines the high light sensitivity of charge-coupled-device (CCD) photosensors with a wide field of view (4° by 6.5°) that CCD cameras have heretofore lacked. The picture was taken by Rick Pogge.

Atmospheric footprints of icy meteors

On the basis of radar measurements, scientists have come to think of the meteors that rain on the earth as small, pebble-like objects plunging through the atmosphere. But recent satellite images of the sunlit side of the atmosphere imply another picture, in which a meteor starts as a much more massive clump of material, possibly a dirty-snowball-type piece of a comet, which sheds gases in the upper atmosphere before releasing the pebbles that are tracked by radar.

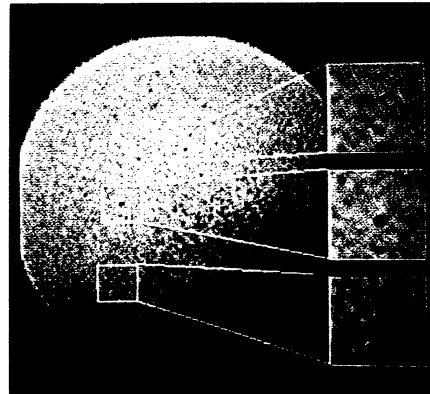
This means "there has to be 1,000 to 10,000 times more material coming in and being added to the earth's atmosphere than we would have guessed with radar measurements," says Louis Frank.

Frank, John Sigwarth and John Craven, all at the University of Iowa in Iowa City, base their conclusion on a study of images of the earth's dayglow—sunlight absorbed and then reradiated by oxygen atoms residing at altitudes of about 200 to 300 kilometers. These images were taken by an ultraviolet sensor aboard NASA's Dynamic Explorer (DE-1) Satellite, launched in August 1981. In the images, the researchers discovered dark spots, or holes, which they attribute to the meteors piercing the atmosphere.

"This is an entirely new and unexpected phenomenon," says Sigwarth, who presented the group's findings Dec. 12 at the meeting of the American Geophysical Union in San Francisco.

At first, the researchers thought the dark spots were errors, but when the holes appeared in consecutive images, Frank's group was convinced they were seeing a real event. According to Sigwarth, each hole expands like a drop of dye spreading out in a glass of water; within about 30 seconds the dayglow intensity drops by about 95 percent over an area of about 3,000 square kilometers. Then, over the next 3.5 minutes, the dayglow intensity increases toward its normal value as the hole grows to an area of about 25,000 km^2 .

The researchers think the holes are related to the passage of meteors because the change in the number of holes created with time parallels the observed distribution of meteors. For example, in analyzing 10,000 images, they found that more holes are produced over the dawn side of the earth than over the dusk side. The dawn side faces the forward direction of the earth's orbit, so it should sweep up more meteors, "just as a windshield wiper collects more drops in front of it than it does behind," says Sigwarth. The researchers also noted that the number of holes doubled on Jan. 3, 1982—just the time when the Quadrantid, an



Satellite image of dayglow, primarily the emission of light from atomic oxygen at wavelengths of 130.4 nanometers. The dark spots in the dayglow, enlarged to the right, are thought to be caused by the passage of meteors through the upper atmosphere.

annual high-latitude meteor shower, passed through the atmosphere.

The big remaining question is how the meteors create the holes. "It could be that the meteor is laying a blanket over the atmosphere so that the light can't get in and back out of the atmosphere," says Sigwarth. Another possibility is that the meteor material, such as water vapor, is chemically reacting with the atmospheric oxygen so that there is less free atomic oxygen to produce the dayglow in the ultraviolet. "There are a lot of unknowns in the problem because it's unclear exactly what [substances] are in meteors before they hit the atmosphere," says Sigwarth. Within the year, the group is hoping to collaborate with another group to launch a rocket that would release a canister of water vapor into the upper atmosphere to see if it could simulate the effect of a meteor.

Thus far, from the sizes of the holes created by the vaporized meteor material, the researchers conclude that the mass of each meteor is probably around 10 kilograms—much greater than the pebbles, each weighing less than a gram. And in order to deposit most of that material into the atmosphere, a meteor must be mostly like a fluffy snowball and contain a relatively small amount of the denser pebbles that fall to the earth.

If this interpretation is correct, says Frank, there may be many more of these "baby" comets in space than anyone ever suspected. And this conclusion is possible only because of the DE-1 satellite, which Frank says is the first attempt to view the earth's atmosphere on a global scale. With the DE-1, he says, the earth can be used as a giant meteor detector. — S. Weisburd

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