

New life for the artificial heart

In a grueling six-and-a-half-hour operation, doctors at Humana Heart Institute in Louisville, Ky., this week pulled the diseased, dying heart from the chest of a 52-year-old Jasper, Ind., man and replaced it with an air-driven, aluminum and plastic mechanical heart. The man's own heart had been damaged by cardiomyopathy, a degenerative heart disease.

Nearly six hours after the operation, implant recipient William J. Schroeder, who is also a diabetic, was taken back into surgery to stop excessive bleeding. The bleeding may have been due to scarring from a coronary bypass operation undergone in 1983. As of midweek, Schroeder was stable and breathing on his own.

Schroeder, a retired Army quality-assurance inspector, is the second person to receive a permanent artificial heart, coined the Jarvik-7 after its developer, University of Utah bioengineer Robert Jarvik. William DeVries, who performed the first implant two years ago at the University of Utah Medical Center in Salt Lake City, headed the 17-member surgical team at Humana, a private, for-profit institution that has pledged to underwrite expenses for 100 such procedures.



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Doctors prepare to implant artificial heart.

The current artificial heart is similar to the one given to retired dentist Barney Clark in 1982 (SN: 12/11/82, p. 372). Previously faulty, two-piece valves have been replaced with stronger one-piece titanium ones, and the heart can be hooked for up to three hours a day to a 12-pound portable power pack the size of a camera bag, which can be worn over the shoulder. The pack temporarily replaces a refrigerator-sized \$40,000 air compressor.

While the artificial heart is still very much in its infancy, notes William Pierce, chief of the artificial organ division at the Hershey (Pa.) Medical Center, the limiting factor in research is not the level of scientific knowledge but rather the lack of adequate funding. "Successes with this sort of work will hopefully stimulate additional

industrial, government and private foundation support," he says.

Hershey researchers have no immediate plans to implant artificial hearts, but the device may someday play a key role in transplantation of human hearts. Nearly two-thirds of heart transplant recipients now survive the first year after surgery and about one-half live five years or more, according to Pierce. "The current model can't improve that," he says, "but if a patient is very ill, the [artificial] heart can serve as a bridge—maybe for several weeks—until a donor heart can be located."

This view is shared by DeVries's former co-workers at the University of Utah, according to university spokesperson John Dwan. Utah researchers have "changed their thinking," he says, and, "at this stage of development, feel it should be used primarily as a holding device" until a transplant can be performed.

Help to the heart in rejection detection

The health team hovering over Baby Fae in her last weeks of life (SN: 11/24/84, p. 325) battled two problems that had nothing to do with the fact that her new heart wasn't human. Both issues, the small size of the heart and the small size of the infant, complicated the already-narrow line heart transplanters must walk between giving their patients enough of the mix of medications needed to thwart the body's attempts to reject the foreign tissue, and not so much that the drugs' toxic effects are overpowering.

Since the early 1970s, heart surgeons have relied upon periodic biopsies of the heart's inner wall to gain a window on organ rejection and to help monitor the effects of drug therapy. The biopsy procedure involves threading an instrument that is essentially a wire with a clipper on the end through the jugular vein and taking a small snippet of tissue. But in the case of Baby Fae, only the second newborn to receive any sort of heart transplant, it was decided that the biopsy, while relatively safe in adults, might be unduly risky for the infant. The case represented an example of a problem all heart transplanters are eager to solve: how to detect the first signs of rejection sensitively and noninvasively. (Rejection is not a factor in artificial heart implantation.)

"I don't think anybody is yet suggesting that biopsies can be totally replaced," Diane H. Russell, of the University of Arizona in Tucson, told SCIENCE NEWS. "But it is an invasive procedure, so it would be nice to have a biochemical marker, say in urine, that would predict the proliferation and invasion of the white blood cells into the heart muscle." By the time such an invasion is picked up by the biopsy, some damage to the heart has already occurred, she says.

At the recent meeting in Miami Beach of the American Heart Association, where

In contrast to the bulky 323-pound air compressor that powers Schroeder's heart, Pierce says, the ultimate model—still years away from use in humans—will feature a miniaturized drive system permanently installed inside the chest, alongside the heart, with a portable battery pack worn around the waist.

But will an improved motor-driven artificial heart eventually replace the transplanted human heart as the treatment of choice?

"That'll be an interesting competition," says Pierce. "What we're going to have is a period of time where heart transplants will be used for patients under age 55, and those older than that will get motorized hearts," he says. "Then we'll begin to see if the age for transplants can't be increased, or if the age of a candidate for a mechanical heart might be moved up. There'll be a choice."

—S. I. Benowitz

several rejection detection methods were described, one of Russell's co-workers reported a technique that they say "consistently predicts rejection prior to any other clinical test known to date."

The method involves monitoring daily urine levels of acetylputrescine, a substance secreted throughout the body during cell division. In the 16 transplant patients monitored to date, Russell and her co-workers found that anti-rejection drugs generally suppressed the body's overall excretion of acetylputrescine. But among all patients whose biopsies a few days later would show evidence of rejection, the acetylputrescine output was *increased* by 50 to 300 percent.

The test needs to be confirmed in more patients, Russell says, but shows signs of being both sensitive and fairly specific for rejection. Other factors, such as a massive infection, also affect acetylputrescine levels, she says, but the pattern of the increase that seems to signal a rejection episode is clearly distinguishable.

Other noninvasive methods now being tested include:

- A combination of ultrasound and the monitoring of heart valve sounds to check for stiffness in the heart wall during a particular phase of the heartbeat called diastolic relaxation. The method, thus far tested in 24 transplant recipients at Stanford University, is already proving useful in helping doctors determine when a bout of acute rejection has been successfully treated, without necessitating a follow-up biopsy, says Stanford's Randall Morris.

- Screening blood samples for an increase in young, rapidly dividing white blood cells. Pioneered in Germany, the method is helping surgeons to minimize the number of biopsies they do, but is said to require a lot of time and labor.

The ultimate method for monitoring rejection, Morris says, might be one that

specifically focuses on the components of the immune system that regulate the response, but "the jury is still out" on what those components are. Monoclonal antibodies, which sensitively distinguish between subgroups of cells, may be a key, he says, in separating the infection fighters from the rejection modulators.

—D. Franklin

Heroin and crime: A stronger link

Urban heroin users commit a greater number and diversity of crimes than has previously been documented, according to a study conducted in New York City.

Study director Bruce D. Johnson told a Washington, D.C., press seminar this week that the average heroin user commits about 1,000 crimes per year. The offenses range from robbery, burglary and property crimes to an "extraordinary" number of drug distribution crimes. The worst criminals combine robbery and drug dealing, he says.

Johnson and colleagues, of the New York State Division of Substance Abuse Services and the privately run Narcotic and Drug Research, Inc., employed former heroin users to recruit 210 current users in Harlem. Each subject was interviewed nine times at a neighborhood storefront and paid \$10 per session. Their self-reports of criminal behavior and heroin use covered the preceding 33 days, but almost half of the group provided information for 100 days.

Most of the subjects in the study were black or Hispanic males, unemployed, between the ages of 24 and 40 and not in jail or drug treatment during the reporting period. (Many urban teenagers and young adults now shun heroin use and prefer cocaine, says Johnson.)

The findings show that their numerous crimes paid heroin users poorly. The average subject made less than \$12,000 in annual criminal income; almost half of that came as drugs rather than cash. Half of the subjects sold drugs, and virtually all of them recruited customers and transported money and drugs for drug dealers. Daily users stole more than those who use heroin several times a week, but the most crimes occurred among "robber-dealers." Each of these subjects completed about 1,400 crimes and 850 drug sales per year, although they made up only 11 percent of the sample. They committed 60 percent of reported robberies and one-quarter of the burglaries and drug deals.

While there are no easy answers to the criminal problems posed by heroin use, "this study shows a clear linkage between heroin use and crime," Johnson points out. In fact, he says, crimes are probably underreported because users tend to forget about offenses they commit on a regular basis.

—B. Bower

U.S.-Japan whaling accord still in dispute

U.S. and Japanese representatives have concluded a round of negotiations on Japan's continued whaling operations, but the two parties don't agree on what the negotiations accomplished.

By Dec. 13, Japan will withdraw its objection to the International Whaling Commission's (IWC's) current ban on hunting sperm whales — whose numbers are uncertain — and that is the extent of the agreement, according to an Embassy of Japan representative. In withdrawing the objection, Japan will stop sperm whaling by 1988, in exchange for being allowed to hunt 400 sperm whales a year from the North Pacific in 1984 and 1985 without losing fishing rights in U.S. waters.

The U.S. Commerce Department, however, is touting the negotiations as a way to "end all Japanese whaling no later than 1988," according to a written statement. The Commerce Department is also including in its interpretation Japanese agreement to the IWC's broader commercial moratorium (SN: 7/31/82, p. 71), which, beginning next year, would prohibit whaling of the four other species that are currently hunted. As part of the negotiations, the United States had proposed that Japanese whalers, who hunt minke and Bryde's whales as well as sperm whales, agree to the overall moratorium in exchange for an allowance of 200 sperm whales in 1986 and in 1987. U.S. Commissioner to the IWC

John V. Byrne, who negotiated for the United States, says that "this is the only way we see, under IWC guidance, that the Japanese can signal to the world that they intend to stop whaling," but he says that the Japanese government must act if the agreement is to be effective. The Japanese deny any binding agreement on this commercial whaling moratorium.

While the whaling accord is still in dispute, a group of conservationists has entered the fray. They have filed a lawsuit charging that under the Packwood-Magnuson Amendment it is illegal for the United States to agree not to restrict Japan's fishing allocations — as it has done under these negotiations — if Japan engages in *any* sperm whaling, says Craig Van Note of Monitor, a Washington, D.C.-based environmental coalition working on the lawsuit.

Whatever Japan, the most active whaling nation, and the United States finally agree on, Norway and the Soviet Union still object to the overall commercial moratorium and may continue whaling, though they would be subject to U.S. fishing restrictions. The IWC voted for the moratorium "based on the understanding that virtually every whale [species] that has been taken in the past has become threatened," Byrne says, and that an assessment is needed after stocks recover to improve population estimates.

—C. Mlot

Oral bacteria: Germs of endearment

Husbands and wives may be sharing more than they think. Research from Emory University in Atlanta indicates that spouses show a close match in the types of oral bacteria associated with periodontal disease.

Our mouths are awash in a mix of bacteria — 250 to 300 species in the average adult. Some of these are anaerobic bacteria that hide out in the oxygen-free environment under the gums, where they eat away at tissue, bone and ligament, causing periodontal disease. More than half the people over 18 have at least the early stage of the disease, and it is the major cause of tooth loss in people over 35.

Steven Offenbacher and colleagues looked at 10 types of bacteria collected from the mouths of 14 married couples and found that spouses whose mates had a particular bacterium had a one-third to threefold higher risk than the general population of having it themselves. They presented their data at the recent annual American Dental Association meeting in Atlanta.

"There was a significant match between the flora," Offenbacher told SCIENCE NEWS. The relationship was so close that without knowing who the bacterial samples came from, "you could match husband with wife

on the basis of the organisms found.

"One of the clinical problems with periodontal disease is that it comes back after treatment — we just arrest the process. This work raises the possibility that the recurrence may be due to reinfection by another family member." Offenbacher says that when he's treated the spouse of a person with recurrent periodontal disease, the disease stopped coming back.

His work does not prove conclusively that spouses transmit the bacteria to each other, notes Offenbacher. Prospective studies and more exacting classification of the bacteria are needed, he says. "But it's consistent. These organisms are for the most part limited to the oral cavity, they're not found [elsewhere] in nature. So the obvious question is, if you have them, where did you get them?"

Paul Keyes, who while with the National Institute of Dental Research in Bethesda, Md., worked out a treatment for periodontal disease that involves killing the culprit bacteria, has been treating family members of his patients for years. "It's reasonable to postulate that these bacteria are transmitted from person to person by spittle," says the Reston, Va., periodontist. "They have to come from somewhere."

—J. Silberman