SCIENCE NEWS of the week

Blood Vessels Support Engineered Implants

A novel combination of growth hormones and old-fashioned surgical sponges is providing a nurturing environment for genetically engineered cells in test animals, prolonging the cells' survival for unprecedented periods. The new system is allowing long-term experiments on gene-altered cells implanted in rats — an important prerequisite to the therapeutic use of such cells in humans. Moreover, researchers say, the gelatin sponge system ultimately may prove useful as an "artificial organ" capable of secreting any of a number of proteins.

"This is sort of a stepping stone," says W. French Anderson of the National Heart, Lung and Blood Institute (NHLBI) in Bethesda, Md., a coauthor of the latest research. For now, he says, the system will give researchers their best picture yet of the long-term behavior of gene-altered cells in animals. "But it may be that in some cases — for example, if a liver is so overwhelmingly damaged that it cannot recover — then perhaps this could be used as an artificial organ."

As genetic engineers have become more skilled at designing living cells that produce useful products, they have increasingly experimented with injecting these cells into test animals. Their hope is eventually to implant engineered cells into humans as a means of correcting certain genetic deficiencies. In the animal experiments, scientists typically inject cells into an animal's bloodstream or abdominal cavity. Once the engineered cells have been injected, however, it is difficult to retrieve samples to see whether they stay alive and are functioning properly.

Previous attempts to grow engineered cells on spongy substrates implanted in test animals were only partially successful. The cells remained localized on the material and were thus retrievable, but tended to die within days or weeks, apparently because they lacked a blood supply to provide fresh nutrients and remove wastes.

The new system, reported in the Sept. 9 SCIENCE, uses a cell growth "platform" made of a gelatinous, spongy material popular with surgeons since the 1940s. Produced by Kalamazoo, Mich.-based Upjohn Co. under the brand name Gelfoam, the material can be applied like a plaster to stop internal bleeding where sutures are impractical. It can be left in the body indefinitely and typically dissolves after four to six weeks.

John A. Thompson, working with Anderson and colleagues at the NHLBI, the American Red Cross in Rockville, Md., and the Children's Hospital National Medical Center in Washington, D.C., impregnated Gelfoam with a hormone that stimulates angiogenesis, or the growth of new blood vessels from nearby, larger vessels. Then they coated the treated Gelfoam with liver cells, or hepatocytes, genetically engineered to contain an easily identifiable "marker" gene. They implanted the mass into rats. Within one week after implantation, the researchers report, the cell mass was completely vascularized with a network of bright red blood vessels.

Although their report documents survival of the engineered cells for four to six weeks, "more recent experiments indicate longer-term survival," Anderson told SCIENCE NEWS. Control implants made of hepatocyte-coated Gelfoam lacking the angiogenic hormone failed to support cell growth.

"I think it's super. It's really a very nice piece of work," says M. Judah Folkman, a pediatric surgeon at Harvard Medical School and Children's Hospital in Boston and a widely recognized "founding father" of angiogenic research. "Their use of angiogenesis to support potentially important vehicles for gene therapy is very novel."

"It's very exciting," adds Fred Ledley, a gene therapy researcher at the Baylor College of Medicine in Houston, who is working with genetically engineered liver cells that may someday assist children with an inherited liver disorder (SN: 8/22/87, p. 119). "Cells are very good at not growing in places where they're not supposed to, and when they do we call it a tumor." He says the new research shows "now we're learning how to get cells to grow where they're not supposed to, under some kind of control."

Moreover, says Thompson of the NHLBI, the value of being able to stimulate new blood vessel growth in a site-specific manner goes beyond the mere support of transplanted cells; the vessels themselves may prove ideal as gene therapy sites. He envisions providing the body with genetically engineered endothelial cells with which to build new vessels, then stimulating angiogenesis. Thus entire vessels could be grown within the body from cells engineered to produce a needed compound.

"You could actually put in a vessel or a bypass made of a patient's own cells, but first we'd engineer them to secrete a peptide," he says. "If you think about it, the vascular tree is basically an organ — it's just another organ target for gene therapy." — *R. Weiss*

Another delay for the Space Telescope

The Hubble Space Telescope, whose launch aboard the space shuttle was set for next June, has been delayed to February 1990 in the latest revision of NASA's shuttle flight schedule. NASA had originally planned to orbit the telescope in February 1986, but grounded it in the aftermath of the Challenger explosion that Jan. 28. Just keeping the telescope on the ground in its pristine, "clean-room" condition costs the agency about $7 million a month, so the recent seven-month postponement may add some $50 million to the $1.5 billion price tag.

But some officials at the Space Telescope Science Institute in Baltimore, the instrument's planning and control center, see a positive side to the latest setback. A key use of the extra seven months, says institute spokesman Ray Villard, will be the continuing refinement of the Science Operations Ground System, whose software incorporates "upwards of 2 million lines of code."

Says Ed Wells, one of about 20 "operations astronomers" at the institute who will be helping to run the complex device, "We will certainly be more efficient because of this delay." One area to benefit, for example, will be the development of the telescope's ability to track moving targets such as comets, asteroids and planets. "We have software that is supposed to do that, but we're just beginning to do it. A lot of these moving target capabilities were deferred a couple of years back. We're already discovering that there are some problems with it — finding guide stars, for example, because for moving targets we have to find guide stars that move in the field of view of the fine-guidance sensors." At the Jet Propulsion Laboratory in Pasadena, Calif., scientists are preparing a refined ephemeris — a mathematical description of the motions of all moving solar-system objects — for the telescope.

In addition, Villard says, the extra time may let scientists improve their ability to use two of the telescope's five instruments at the same time, such as its Wide-Field Planetary Camera and its Faint-Object Spectrograph. Also being developed is software to let the telescope's guidance system be updated in real time so that it can track details discovered in just-taken photos of planet surfaces. — *J. Eberhart*