Monkeys Get Human Fetal Cells

Scientists performing the first reported U.S. transplants of human fetal brain cells into the brains of monkeys found good graft survival after 70 days, according to findings published this week. The experiments sought to prove the feasibility of therapeutic fetal-cell transplants into humans suffering from neurological disorders such as Parkinson's disease. They are the first performed anywhere showing nerve cells from human fetal cadavers can be isolated, frozen, tested for purity and safety, then thawed and implanted successfully into primate brains.

While allaying many of the remaining doubts about the safety and survivability of such transplants, the report may also fan the flames of controversy over researchers' growing use of fetal tissue from induced abortions. The United States has placed a moratorium on all government-sponsored studies of human fetal-tissue transplants pending the results of a policy review by the National Institutes of Health (see story, p.296). The latest transplants, reported by D. Eugene Redmond Jr., and his colleagues at the Yale University School of Medicine, along with researchers at the University of Rochester (N.Y.) School of Medicine, were supported by private funding.

"This is an important advance, as it demonstrates the viability of cryopreserved, cadaverous fetal tissue for use in implants," says Irwin J. Kopin of the Bethesda, Md., National Institute of Neurological and Communicative Disorders and Stroke. A proposal by Kopin and others to perform similar research in humans this past spring had prompted the government moratorium.

Researchers in Sweden, Mexico and elsewhere have already transplanted human fetal neural tissue into the brains of patients with Parkinson's disease, but graft survival in those recipients remains uncertain. Some researchers have criticized those experiments because they involved immediate transplantation of the fetal tissue without thorough testing for bacterial or viral contamination. In Redmond's study, tissue was frozen in liquid nitrogen while scientists checked for contaminants.

Seventy days after transplantation, the grafted cells had formed dense networks of maturing nerve cells (see cover photo), the U.S. researchers say. Two of three grafts showed signs they were producing dopamine, the neurochemical that is in short supply in parkinsonian brains. Similar transplants into monkeys with Parkinson's-like symptoms — already performed by the team but as yet unreported — should indicate whether the procedure has therapeutic potential.

In an unusually lengthy footnote to their research, which appears in the Nov. 4 SCIENCE, the researchers spell out the ethical guidelines they followed in obtaining and using the fetal tissue from consenting women who had independently elected to have first-trimester abortions. *— R. Weiss*

Shedding light on photosynthesis

Scientists have succeeded in using genetic engineering to study the first steps of photosynthesis, an achievement that should speed understanding of how plants and bacteria change light energy to chemical energy.

The researchers used recombinant DNA technology to change a specific amino acid in a protein that forms part of the "reaction center" where photosynthesis begins in bacteria. The method allows scientists to tinker with a few key parts of the reaction center and then use ultrafast lasers to analyze how these changes affect photosynthesis, they report in the October PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES (Vol.85, No.20).

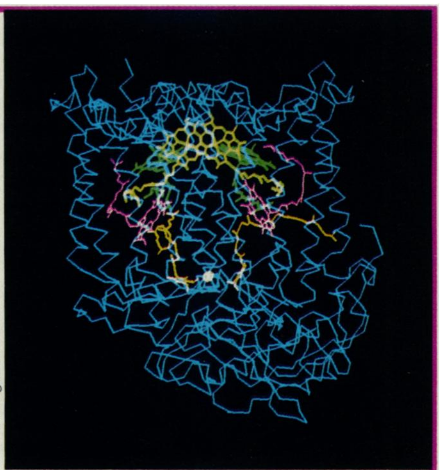
The reaction center for photosynthesis is an elaborate protein cage holding other molecules, including chlorophyll, in such a way that light-energized electrons pass along these molecules, known as prosthetic groups. Usually, incoming light energizes a pair of chlorophyll molecules so that they pass on an electron to a close relative of chlorophyll called a pheophytin, which passes the electron to a molecule called a quinone. The movement of the negatively charged electron causes a separation of positive and negative charges in the reaction center, creating an electrochemical potential that can power reactions in other cell parts.

In the engineered protein, the researchers altered the primary link between the protein and one of the chlorophylls so the chlorophyll lost a magnesium atom and became a pheophytin. This changed the chemistry of the reaction center, but it still functioned at about half its original efficiency, report Douglas C. Youvan and Edward J. Bylina of the Massachusetts Institute of Technology and Christine Kirmaier and Dewey Holten of Washington University in St. Louis.

The genetic engineering method "supplies scientists with the material to study the effect of specific perturbations [in the reaction center] instead of the random changes provided by classical genetics," Youvan says. The work got a big boost by the discovery of the structure of the bacterial reaction center, for which three German scientists won this year's Nobel in chemistry (SN: 10/29/88, p.282). "When the crystal structure came out it was marvelous," Youvan says. "It's now possible to look at the structure on a computer screen and choose amino acids that seem critical for either prosthetic group binding or helping the electron transfer reaction."

The amino acid they changed seems to take part in both actions, because it anchors the prosthetic group and contributes to the electron transfer process itself, Youvan says.

Because the engineered reaction center differs so much from that found in nature, "it's a surprise it works at all," Kirmaier says. The observation that the changed reaction center does work "suggests someone should look for similar compounds for artificial photosynthesis," Youvan says. At some point, he adds, scientists and engineers may be able to use knowledge about bacterial reaction centers to construct compounds that efficiently synthesize chemical energy from sunlight without the help of biological molecules. *— C. Vaughan*



Schiffer/Argonne

A computer representation of the bacterial reaction center shows protein in blue, chlorophyll pair in yellow honeycomb pattern, pheophytin molecules in pink and quinone molecules in yellow-orange. Extra chlorophyll molecules, called voyeur molecules (shown in green), may or may not take part in photosynthesis reactions. The image of the reaction center was produced by Chong-Huan Chang, David Tiede, Ossama El-Kabbani, James Norris Jr. and Marianne Schiffer of the Argonne (Ill.) National Laboratory.