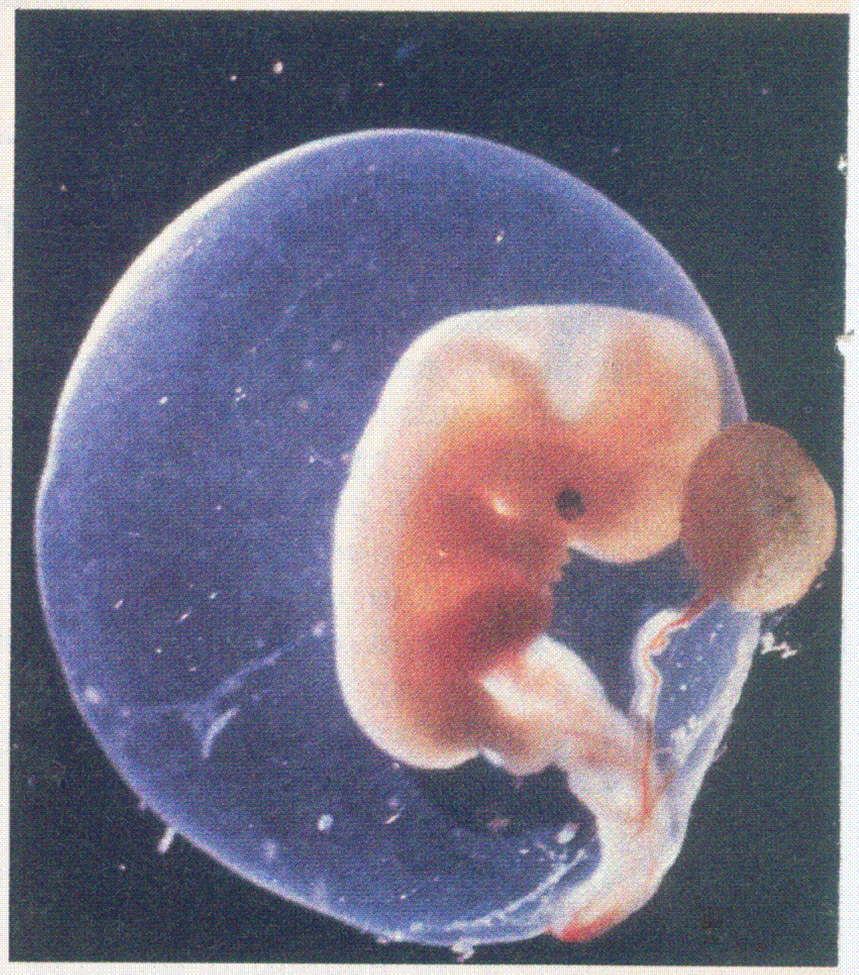
Cures from aborted fetal tissue

A startling fount of healing



PETIT FORMAT/SCIENCE SOURCE—PHOTO RESEARCHERS, INC.

Human fetuses like the one at 6 to 7 weeks, above, provide cells for medical researchers. In February, Dr. Everett Spees, a transplant specialist, gave Greg Fujita, 32, a new kidney—and insulin-producing fetal cells to control his juvenile diabetes. Last month, Fujita won a silver medal in a 400-meter relay race

■ Researchers at dozens of medical laboratories around the world are using cells taken from aborted human fetuses to develop new therapies for ailments from leukemia to paralysis. They know they can't get around the stark fact of the source of those cells. They don't try. Rather, they describe the healing powers of the cells. For while much of the work is preliminary, and many problems must still be overcome, the scientists have already discovered that the cells can fight diabetes and may be able to ease the tremors of Parkinson's disease and bridge gaps in severed spinal cords.

Researchers usually as cautious in their language as skaters testing thin ice talk about "cures" with animation. "In the field of nerve regeneration alone," says Dr. Barth Green, a neurosurgeon at the University of Miami who heads the Miami Project to Cure Paralysis, "fetal-cell implants raise the potential of helping several million Americans—including victims of brain disease, head injury, stroke and paralysis."

Compared, say, with the high-tech glamour of genetic engineering, fetal-cell technology is lowbrow stuff. Depending on the disease being treated, cells from the pancreas, brain or other part of an aborted fetus 6 to 7 weeks old and less than an inch long are removed and inserted into the person suffering from the disease. The transplanted cells are hardy, vigorous and for some diseases less likely to be rejected than older cells. They thrive as though it makes no difference to them which body they belong to.

Most of the tests so far have been done only on lab animals, but for humans the procedures would be essentially the same. A few fetal therapies have already been tried on human patients. Six victims of the Chernobyl nuclear accident received fetal blood cells last May in a last-ditch and unsuccessful effort to replenish their devastated immune systems. Six months earlier, doctors implanted fetal pancreatic cells in diabetic patients, and the cells are now pumping out insulin. Perhaps early next year, fetal brain cells will be placed in the brain of a Parkinson's sufferer.

The research is starting to attract attention. The cells' source is raising thorny medical and ethical questions (see box below) that have few easy answers. Researchers yearn for alternative sources of cells, but fetal cells are easy to harvest and stand a good chance of growing in another body—attributes difficult to duplicate.

• Curing diabetes

While fetal cells haven't been tried on children, researchers are optimistic that the cells can wipe out juvenile diabetes. There are approximately 1 million Americans with the disorder. It occurs when the insulin-producing cells in the pancreas, called islet cells, gradually die. Since insulin regulates the amount of sugar in the bloodstream, blood-sugar levels rise dangerously. Eye capillaries rupture, leading to blindness, and the heart and kidneys fail. Juvenile diabetes usually strikes children and young adults. No one knows why. Daily insulin injections can ward off the disease but cannot prevent it from progressing. "There's simply no substitute for the pancreas cells," says Dr. Everett Spees, chief of transplantation surgery at AMI Luke's Hospital in Denver.

Researchers have tried extracting islet cells from adult cadavers with the idea of transferring them to diabetics.

LIZABETH JAMIESON MENZIES—USN&WR

Even groups opposing abortion are split over the medical use of fetuses

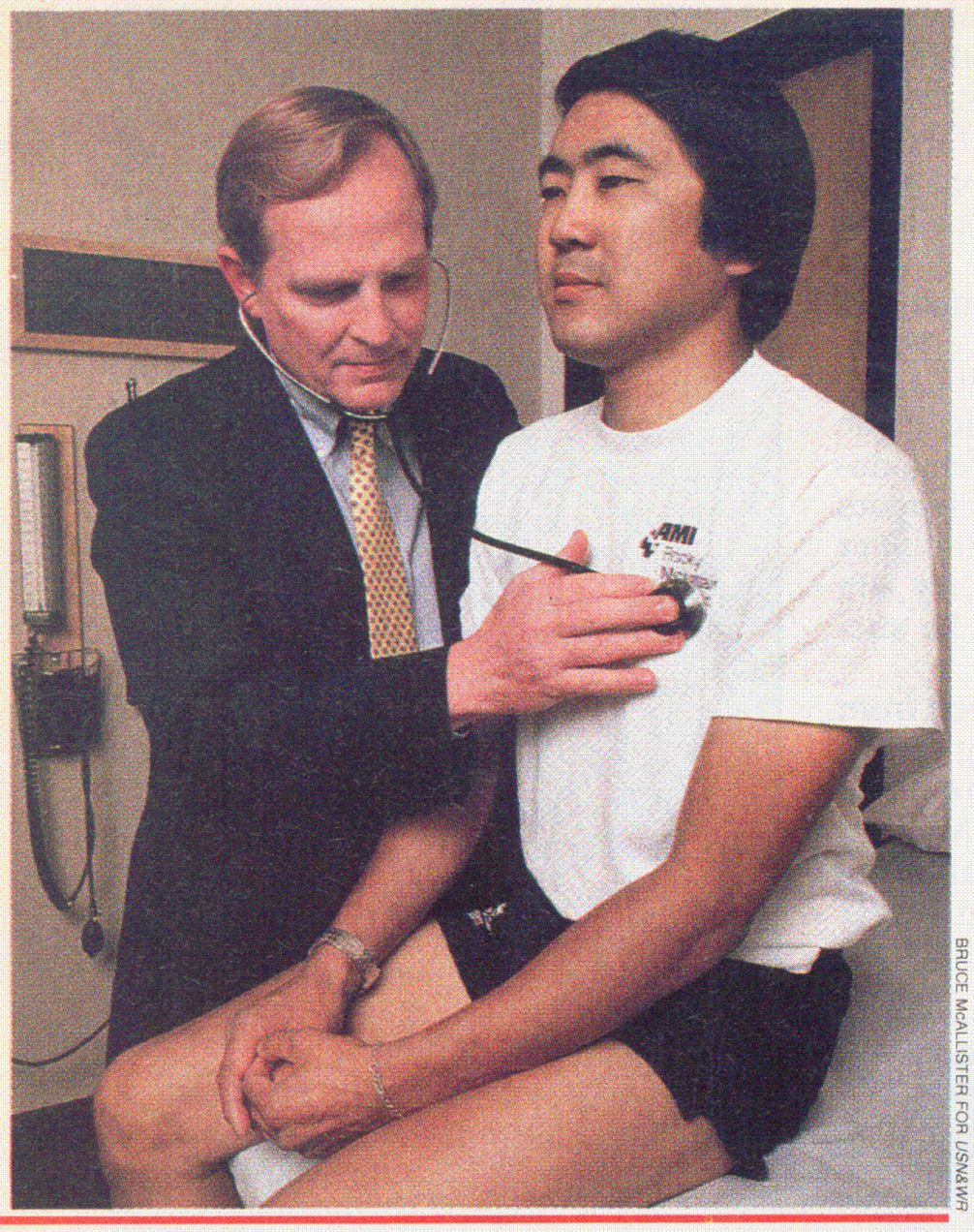
DO BRAIN CELLS SUFFER?

Tough questions in the lab

As treatments using fetal cells move from the lab to trials on human beings, doctors must face the wrenching question: Is it right to use cells from aborted human fetuses to treat someone suffering from a severe, incurable disease?

Even individuals staunchly opposed to abortion are divided. Dr. John Willke, president of National Right to Life, has no problem with putting an aborted fetus to medical use, so long as it is dead. "The ethics should be the same as those that apply to harvesting tissues from any other human corpse," he says. The Vatican, on the other hand, objects, holding that abortion itself is a criminal act.

Patients themselves have had to sort out complicated feelings. "It's sad to think that the cells that are helping me come from aborted fetuses," says a 33-year-old woman who received fetal cells this year to treat her diabetes. "But is it really that different from getting organs from a brain-dead person? If you believe the soul goes to heaven,



BRUCE McALLISTER FOR USN&WR

same time he underwent a kidney transplant. For convenience, in fact, Spees implanted the fetal cells on top of Mispagel's new kidney before inserting it—rather than on the surface of the pancreas, where they're usually found. "It was purely arbitrary for nature to put the [insulin-producing] islets in the pancreas to begin with," says Spees.

Four months later, says Mispagel, he could feel the fetal cells "kicking in," and he reduced his dosage of insulin by 15 to 20 percent. The cells, says Spees, "blossomed like seeds."

Fifteen other diabetics have since received fetal islet cells along with a new kidney. The results are promising. Some are already cutting back on their insulin. Spees and Lafferty expect that many of them will need additional implants, because the researchers still don't know exactly how many fetal cells are required. "If these trials are successful," Spees says, "we might then try fetal implants on children."

But it's an arduous task with very low return. Harsh acids, scraping by hand and other crude means are used to remove the cells from the pancreatic tissue. The adult pancreas is tough and gritty, and many cells are damaged in the process.

In fetuses, however, the islet cells are embedded in soft, easy-to-handle tissue. Spees, working last December with Kevin Lafferty, head of research at the Barbara Davis Center for Childhood Diabetes in Denver, implanted fetal islet cells in the first human subject—51-year-old Jerry Mispagel of Longmont, Colo. Mispagel's kidneys had failed, so the procedure was carried out at the

• Healing the brain

Fetal nerve cells may be implanted as soon as next January in a human brain to treat Parkinson's disease, a disorder that afflicts almost a million elderly Americans with terrible tremors and rigidity. The disease is caused by degeneration of a brain structure that produces dopamine, a neurochemical vital for proper motor coordination.

Researchers have already reversed such damage in monkeys and temporarily halted it in humans. In experiments reported last May, Dr. Eugene Redmond, Jr., of the Yale University School of Medicine and John R. Sladek, Jr., of the University of Rochester School of Medicine and Dentistry induced Parkinson's disease by destroying the part of the brain in adult monkeys that produces dopamine. Then they extracted dopamine-producing cells from the same part of a fetal brain and implanted them in the injured part of the adult monkeys' brains. The animals improved, and by the time they were sacrificed 67 days later, their symptoms had almost disappeared. The microscope revealed that the fetal cells had sent out nerve fibers that connected up with the hosts' brains. A British team has since come up with similar results. "When I show before-and-after video footage of the monkeys," says Redmond, "it knocks the socks off scientific audiences."

A Swedish team at the Karolinska Institute in Stockholm will probably conduct the first human trials. In the spring of 1983, the group tried to cure a man with advanced Parkinson's disease by transplanting cells from his adrenal glands—organs perched atop the kidneys that also make dopamine—into his brain. Researchers hoped the adrenal tissue would eliminate the need for an embryonic donor, a controversial measure even in Sweden. The implant only helped for a few months, and three subsequent patients did little better. None, however, got worse—suggesting that fetal brain tissue will do at least as well, says Dr. Ake Seiger, a member of the Swedish team.

Fetal nerve cells also might be useful in treating two other major brain disorders. In Alzheimer's disease, the leading cause of senile dementia for about 1.6 million older Americans, some nerve pathways in the brain deterio-

and transcends the body with all its interchangeable parts, then that alters your view."

To keep researchers from exploiting aborted fetuses, federal rules that took effect in 1975—two years after abortion was declared legal in the U.S.—set explicit guidelines. The rules, which apply to any institution receiving federal grants for research on human subjects, permit the use of fetal tissues for medical or scientific purposes if the fetus is dead, and if the woman's decision to end her pregnancy has nothing to do with the research.

As the guidelines are framed, the medical use of most fetal tissues—liver cells or pancreatic tissue, for instance—poses no conflict. Fetal nerve cells are something else. The fetus and its brain are technically dead, but the brain cells are by definition alive. This could raise fears—unfounded, in the opinion of scientists—concerning fetal suffering.

To the public, the idea of implanting brain tissue also sets up vaguely metaphysical suspicions. Dr. Ake Seiger, an investigator at Sweden's Karolinska Institute, worries about a popular impression, "based on Frankenstein, that we are transplanting personalities." At Vanderbilt University, Dr. George Allen reports that "people unfamiliar with neuroscience ask me, 'Hey, are you transplanting the person's soul?' "

Many of the scientists using fetal tissue are acutely uncomfortable about it. "I personally believe that unwanted babies should be put up for adoption," says Efrain Azmitia, a New York University biology professor. "But if society condones abortion, and if tissues from the destroyed fetus could help someone dying from Parkinson's or some other terrible disease, then I think it is immoral to throw that tissue down the drain."

Tissue from spontaneous miscarriages may provide a partial alternative. Half of the thousands of fetuses miscarried in the U.S. each year are unusable, says Dr. Barth Green, a University of Miami neurosurgeon, "but the other half could supply more than enough tissue for people with religious objections."

rate. Physiologist Alan Fine of Cambridge University in England has created the symptoms in rats by destroying some of their nerve pathways. Like people, the animals become forgetful—losing their way in mazes they've successfully run many times before, for instance. By injecting cells from the brain of a fetal rat, however, Fine has restored the rats' memory. A similar procedure has worked in rats induced with the symptoms of Huntington's disease, an inherited and invariably fatal nerve disorder that affects 25,000 middle-aged people. But human trials won't take place anytime soon for Alzheimer's and Huntington's sufferers. "We need more-accurate animal models of these diseases," says Dr. Jed Wyatt, chief of neuropsychiatry at the National Institute of Mental Health.

- **Mending the spinal cord**

Several groups of investigators think they can help victims of spinal-cord damage. The teams have made fetal neurons grow across gaps in the spinal cords of rats. The animals can't walk, since the fetal neurons don't duplicate the intricate "wiring" needed, but more and more researchers are studying the problem. The numbers of scientists studying nerve regeneration, and their output of research papers, have grown exponentially since the late 1970s. "The rapid advances in this area make us think that curing paralysis is a feasible goal to pursue," says Green of the University of Miami. "A year ago, we could not say that."

- **New blood for old**

Treating blood disorders such as leukemia and aplastic anemia, cancers that afflict 21,000 in the U.S., and sickle-cell anemia, which affects 80,000 blacks, may be the most difficult feat.

"Transplantation of the blood system is twice as complicated as any other organ transplant, because immunity is carried by the blood," says Dr. Robert Gale, the University of California bone-marrow specialist who treated Chernobyl's radiation victims with fetal liver cells, which produce blood before birth. Not only might the body reject the new blood cells, but the blood cells might reject the body as well. Using fetal liver cells, which don't trigger this life-threatening reaction, may be the best treatment if a sibling with a tissue type closely matched to the patient's isn't available. Soviet physicians tried fetal liver cells on the most severely irradiated Chernobyl victims, for example, because they had lost so many blood cells that doctors had no way of deducing their tissue type.

Fetal transplants could not save these patients, whose immune systems were already too far gone. But Gale, who assisted the Soviet medical team, believes the same approach could be refined to help other types of patients—including the three quarters of leukemia victims in the U.S. who need marrow transplants but don't have a sibling with a matching tissue type.

"We save the lives of more than 700 Americans each year by doing bone-marrow transplants between siblings," says Gale. "In theory, we could triple those figures if we could use fetal donors." In dogs, he and his colleagues are routinely transplanting fetal liver cells to adult animals. And they are confident the procedure would be successful with humans.

Liver cells might even be moved from an aborted fetus to a developing one to treat severe blood diseases before birth. In August, a team led by Dr. Michael Harrison at the University of California at San Francisco tried it out on sheep. The researchers took blood cells from aborted sheep fetuses and injected them into fetuses still in the womb. After the lambs were born, several produced a mixture of their own blood cells and those of the donors.

LIANE ENKELIS FOR *USN&WR*

Teresa Willey wanted to donate the organs of her baby, born in July with no brain. A legal nicety stopped her

As the list of diseases that might be treated grows, doctors are looking harder for fetal-cell substitutes. At the University of Rochester, neuroscientist Don Gash is trying to tame neuroblastomas—cancerous neurons that grow in much the same way that fetal neurons do. Other researchers are doing somewhat better at extracting islet cells from adult cadavers.

But human fetuses and their easily harvested, eagerly adaptable cells may prove to be the best choice to treat most diseases. If so, the pace of research will quicken, and scientists—as well as the public at large—will be unable to put off any longer painful questions about the source of these miracle cells. ■

by Kathleen McAuliffe

LAW VS. SCIENCE

Rejected donors

In the middle of her third pregnancy, Teresa Willey, 23, was watching the "Phil Donahue Show" and heard the parents of a baby who had received a heart transplant express gratitude for the heart that saved their infant. "Right then and there," she says, "I decided that if anything went wrong, and my baby died, I would donate its organs."

In July, four days before giving birth, Mrs. Willey got crushing news: Her fetus was anencephalic. With neither skull nor brain and sustained only by brain-stem activity, the fetus would die shortly after birth. "The first question out of my mouth was: Can we donate its organs?" says Mrs. Willey.

But she and her husband were stunned to learn that such babies cannot be used as organ donors. Even though it lacked a brain, their baby could not legally be declared brain dead—because its brain stem still functioned. "The law was designed to protect the victims of car accidents—people who had brain function and lost it," says bioethicist John Fletcher of the National Institutes of Health. "Yet it must be applied to anencephalics, who have no cerebral cortex to begin with." Some people fear that modifying the law might weaken it.

Meanwhile, an estimated 2,000 newborns who are on waiting lists for a kidney, heart or liver die each year in the United States. "Everybody knows there's not enough organs for adults. Most people don't know that there is a far more severe scarcity of small organs," says Dr. Michael Harrison, a pediatric surgeon at the University of California at San Francisco. "The 1,900 anencephalic fetuses that are delivered annually in the U.S. could supply enough small organs for all the infants in need."

Teresa Willey is supporting Harrison and other pediatricians who are trying to change U.S. law. "If they succeed," she says, "then I will feel my baby's death served a higher purpose."