SCIENCE NEWS of the week

Steps Toward Healing Damaged Spines

Mending the shattered spine and flooding deadened limbs with life, a feat considered unthinkable just a decade ago, represents climbing Mount Everest for many neurobiologists. It also sustains the hopes of paralyzed actor Christopher Reeve and 90,000 others nationwide who share his plight.

Now, that goal is inching into view. From studies of rats, a team of scientists reports for the first time having obtained "true functional regeneration" of a severed adult spinal cord. They describe their findings in the July 26 SCIENCE.

Lars Olson of the Karolinska Institute in Stockholm and his colleagues sliced a small section from the rats' spinal nerves, closed the gap with nerves from outside the spinal cord, glued the fibers in place, and biochemically coaxed severed spinal nerves to grow through this neural infrastructure. Within 2 months, the animals had regained limited use of their hind legs.

What this accomplishment means for people who are paralyzed remains to be seen. The scientists acknowledge that rats are very different from humans. Moreover, the eight rats in this study have not regained the ability to walk. Olson cautions that it will be years before anyone ventures to apply the method—severing damaged nerves and reconnecting the spinal cord—to humans. Nevertheless, he and his colleagues say it represents "a possible repair strategy" for human spinal cord injuries.

The experiment is sending excitement coursing through the neurons of interested scientists. "It is a fascinating finding," says Michael Walker of the National Institute of Neurological Disorders and Stroke in Bethesda, Md. "I approach this with cautious optimism, but the optimism is very real."

Wise Young of New York University Medical Center called the study "a major milestone" set in a sturdy foundation of prior research, but he sounds three notes of caution in a commentary accompanying the report.

First, the rats' spinal cords were neatly sliced, whereas most human spinal cord injuries involve crushing. Second, even after the grafts took hold, the rats were "barely able to stand" and none of them "recovered coordinated locomotion."

Finally, since no one has done this before, the researchers may not be able to improve the outcome by refining their method. "This is not the final word," Young says. "It is part of a long line of convincing experiments indicating that regeneration does occur and can contribute to functional recovery."

The team's experimental approach rests on some basic observations about the nervous system. Nerve cells have three distinct parts: a filigreed tree of sensation-receiving filaments called dendrites; a central cell body that processes stimuli; and a long transmitting fiber, called an axon, that joins other nerve cells at synaptic junctions. Most axons are coated with a whitish, electric insulating layer, called myelin, composed of proteins and fats.

Research has shown that spinal axons make proteins that inhibit regeneration of damaged nerve fibers; however, axons can grow through the hollow shafts of nerves from outside the spine. Experimenters have also found that a protein called fibroblast growth factor (FGF) speeds nerve growth.

After Olson and his coworkers severed a section from the rats' spinal nerves, they bridged the gap with transplanted peripheral nerves. Rather than place both ends of the transplanted nerves next to myelin-coated axons, which would halt growth, they placed one end against nerve cell bodies. These cell bodies—found in a gray, H-shaped region at the core of the spinal cord—contain only traces of myelin.

They glued the nerves in place using fibrin, the key ingredient of blood clots, and laced it with FGF to stimulate growth.

Within 2 months, Olson says, the rats had stopped dragging their paralyzed hind limbs. "The limbs now can partially carry body weight. It also appears as if their forelimbs and hind limbs are used in a coordinated fashion."

Olson says his team has already begun new experiments. Rather than cutting the spine and repairing it in the same session, for instance, they are doing the repair the next day to see if it works in "chronically paralyzed" rats, whose injuries resemble those of many nerve-damaged humans.

Eventually, he says, his team plans to scale the experiment up to a creature as large as a person to see whether "the nerve fibers will grow as long as they must grow in a human." —*S. Sternberg*

First results from upgraded CERN collider

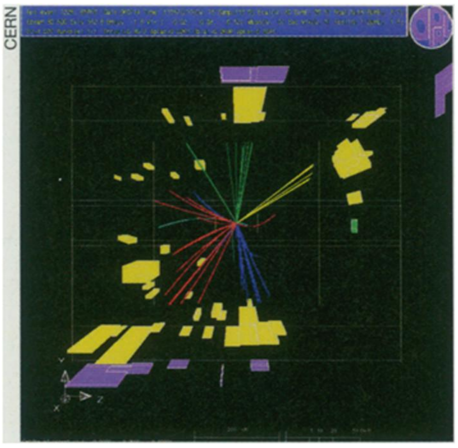
The hunt for elementary particles of matter entered a new phase this month with the start of operations at the upgraded Large Electron-Positron (LEP) collider at the European Laboratory for Particle Physics (CERN) in Geneva.

The LEP collider, which accelerates electrons and positrons in a circular tunnel 26.7 kilometers in circumference, was designed specifically for studying the weak interaction. This fundamental force is responsible for some forms of natural radioactivity and for the production of neutrinos in nuclear fusion reactions. The force is carried by three particles, designated W^+, W^-, and Z°. By studying these particles in detail, researchers hope to detect traces of exotic particles predicted by various theories but not yet found (SN: 4/13/96, p. 231).

For more than 6 years, the LEP collider operated at an energy of about 91 gigaelectronvolts (GeV) to produce electron-positron collisions of just the right energy to create large numbers of Z° particles. The resulting data allowed physicists to determine precisely the mass and other characteristics of this particle (SN: 9/29/90, p. 204).

With the addition of new devices for accelerating electrons and positrons, the collider can now reach an energy of 161 GeV, sufficient for producing W^+ W^- pairs. Though detected occasionally at other accelerators, these W particles can be produced at CERN in much larger quantities with fewer by-products.

Each of the four detectors along the LEP ring has already picked up signals characteristic of the creation of W particles. —*I. Peterson*



CERN

A computer display from the LEP collider Opal detector shows the result of an electron-positron collision. The interaction created a pair of W particles, both of which immediately changed into quark-antiquark pairs. The four quarks, in turn, transformed into four jets of detectable particles (tracks shown in red, yellow, blue, and green). Pink and yellow patches record the active detector sections.