More central nerve repair evidence

Up until now medical research has given little indication that severed mammalian central nerves could be repaired—even in infant animals whose central nerves would be expected to be more flexible than those of adult animals. Prospects looked especially bleak for quadraplegics and paraplegics, who seemed destined to be paralyzed and to sense nothing below the point on their bodies at which their spinal cords had been severed.

In recent years, however, glimmers of evidence have suggested that severed mammalian central nerves may not be destroyed after all, at least under certain conditions, giving hope to spinal cord victims that some day researchers might find a way to restore their lost nerve functions. During the 1950s, for instance, nerve axons were found to carry nutrients, suggesting that if they were severed, they had the intrinsic machinery for regrowth. During the 1960s, a small group of nerves in the brain—those that make chemical transmitters known as catecholamines—were found to regenerate and function perfectly if cut (SN: 10/24/70, p.37). And now a study by Katherine Kalil and Thomas Reh of the University of Wisconsin at Madison reported in the Sept. 14 SCIENCE shows that severed central nerves in baby hamsters can not only regenerate but regenerate in a functionally useful way.

The secret of Kalil and Reh's unprecedented success seems to lie in their having studied nerve regeneration not simply in infant animals, but specifically in the pyramidal tract nerves of infant animals. This tract originates in the sensory-motor cortex of the brain and descends to terminal sites of the brainstem and spinal cord. Kalil and Reh decided to study nerve regeneration in this area because the nerves can be cut on one side with minimal or no injury to other brain structures.

Kalil and Reh severed the left pyramidal tract nerves in 27 baby hamsters on various early days of their lives. The researchers also cut the left pyramidal tract nerves of several adult hamsters for comparison. Three months later, the investigators injected a radioactive chemical into the cortexes of the hamsters near where their pyramidal tract nerves had been severed. The nerves absorbed the radioactive label. The investigators sacrificed the animals and examined their brains and cervical spinal cords. The radioactive label allowed them to visualize the severed pyramidal tract nerves, to see whether these nerves had sprouted new axons or not and to see where in the brain and spinal cord any new axons might have ended up.

As they report, severed pyramidal tract nerves in the adult hamsters degenerated, both above and below the cuts. In the baby hamsters, however, the severed nerves regrew axons. (Axon regrowth worked best in infant animals which had had their nerves severed at a very early age.) What was most impressive, the nerve axons sprouted, via an abnormal brain route, to their proper targets in the medulla and spinal cord, and there was even behavioral evidence that the new axons worked properly. After the infant hamsters had had their nerves severed, but before they were sacrificed, they gave evidence of normal forepaw function, whereas adult hamsters with severed pyramidal tract nerves are known to have abnormal paw function.

So, "in contrast to previous studies," Kalil and Reh conclude, "these results suggest that axons in the mammalian central nervous system damaged early in life may regenerate in a functionally useful way." □

Economics: The way to handle energy

In creating a workable energy policy for the United States, let market forces be your guide. Or so the 19 authors of the new Ford Foundation energy study — *Energy: the Next 20 Years* — unanimously and unambiguously recommended in the 628-page report they released last week.

It's the third major study (in as many months) tackling policy to ensure availability of affordable energy, at least through the year 2000. And like the other two (SN: 9/1/79, p. 149), its rank of authors is weighted heavily (more than 50 percent) with economists. But compared with the others, its recommendations are less theoretical, appear to take into account better the "real world" business and political climate under which policy proposals will be assessed, and assume readers have a general understanding of the technology options.

"The central message of the present report," says outgoing Ford Foundation president McGeorge Bundy in his preface, "is that energy — expensive today — is likely to be more expensive tomorrow and that society as a whole will gain from a resolute effort to make the price that the user pays for energy, and for saving energy, reflect its true value."

Comparing this report with the foundation's first major energy study, *A Time To Choose* (SN: 4/6/74, p. 223), Bundy says the current one places much heavier emphasis on the role of market forces. "[A]nd I am glad," he adds, "partly because it was a valid criticism of *A Time To Choose* that it did not sufficiently consider those forces."

"We prefer to use the market where we can," says Hans H. Landsberg, who chaired the report's study group, "because it's an impersonal instrument." The director of the Center for Policy Research at Resources For the Future in Washington adds that "regulation that's applicable today can be bad tomorrow" and could reduce incentives to achieve more than the minimum that one absolutely has to by setting concrete standards. Rather than mandating a particular level of "safe" pollution that must be met by a given date, for example, policy should use economic incentives — such as progressively costly emission charges or marketable discharge permits — that over time encourage progress toward achieving cleaner air.

Other recommendations include:

- immediate deregulation of oil and gas prices, "deferring for later consideration the possibility that prices [for oil] even above the world oil price be imposed,"
- phasing out "rolled in" pricing for high-capital-cost energy projects,
- application of "marginal-cost pricing" by utilities,
- overhauling oil-stockpile policy, encouraging private stockpiles,
- temporary subsidies of conservation investments,
- greater government emphasis on developing small-scale technologies such as low-temperature heat engines, and
- letting industry choose, design and operate which new technologies to commercialize — in synthetic fuels, for example — when subsidizing supplies, not research and development is the main goal.

Authors of the study, published by Ballinger Publishing Co. in Cambridge, Mass., include: Kenneth J. Arrow, Harvard professor and 1972 Nobel laureate in economics; Richard Garwin, science advisor to the research director at IBM's Watson Research Center; Edward R. Fried, U.S. executive director of the World Bank; Theodore B. Taylor, visiting engineering professor at Princeton University; and John C. Sawhill, former president of New York University and newly designated Deputy Secretary of Energy. □

Industry support for IPM

Integrated Pest Management, which consists of deploying a number of novel techniques alongside conventional insecticides to control agricultural pests, is capturing the fancy of various segments of American society — farmers, the U.S. Department of Agriculture, the National Cotton Council, university and drug company scientists, even the President (SN: 4/21/79, p. 266). And last week, IPM garnered one more endorser — the National Agriculture Chemicals Association.

This endorsement is ironic since NACA is the voice for the American pesticide industry, and since IPM's general aim is to lessen farmers' dependency on pesticides. NACA bases its endorsement of IPM on a year-long evaluation of scientific data underscoring the advantages and disadvantages of IPM. □