cells are multipotential and influenced by an axon," Aguayo says.

Because the axon and Schwann cells are interdependent—each subtly influencing the metabolism of the other—it is possible that disorders of the myelin sheath may actually be due to some abnormality of the nerve axon. Aguayo and colleagues have examined this possibility in mice with inherited diseases. The "trembler" mouse, for example, has so little insulation that its nerve signals travel much more slowly than normal. The animal has abnormal posture and an obvious tremble.

Aguayo transplanted a section of trembler Schwann cells into a segment of normal mouse myelinated nerve. He also grafted normal Schwann cells into a trembler nerve. Only the axon segments associated with normal Schwann cells were myelinated. Thus the abnormality in this case must be in the Schwann cells. The circumference of the axons, which is about half the normal in trembler mice, increased where trembler Schwann cells were replaced by normal ones. "We cured a trembler mouse a little bit," Aguayo told a symposium audience.

Aguayo has looked at two other mouse diseases. "Quaking" mice appear, like trembler mice, to have defective Schwann cells. However, in dystrophic mice, axonal factors seem responsible for the adnormality.

The most exciting result is that Schwann cells can be grafted between different species. Because of interest in human disease, Aguayo created mouse axons ensheathed by human Schwann cells, obtained from limb amputations and nerve biopsies. Aguayo suppressed the mouse immune system so that it would not reject the graft. The human Schwann cells persisted. Those from normal people produced normal myelin in the mouse, while those from a patient with the disease metachromatic leukodystrophy made myelin containing granules and other abnormalities. The human Schwann cells produced myelin around the mouse axons more slowly than did the mouse Schwann cells. Aguayo has not yet determined whether that difference lies in the cells themselves, or whether it is a consequence of the transplant.

A potential use of this technique in repair of nerve injury was revealed during experiments to check whether the new myelin really from human Schwann cells, rather than from mouse cells that had migrated into the graft area. The researchers stopped suppressing the mouse immune system, and macrophage cells immediately attacked the foreign Schwann cells. After the human cells were destroyed, however, mouse Schwann cells moved in and formed myelin around the naked axons. This result suggests that a temporary graft of foreign cells may provide guiding tracts for axon regrowth, and then later may be replaced by intrinsic Schwann cells. □

# Thirty-year follow up: Counseling fails

Unlike the results of treatment for most physical ailments, the effects of psychological counseling and psychotherapy are frequently hard to determine. Improvements in behavior cannot be measured as objectively as can changes in heart rate, blood count or blood pressure.

However, a preventive treatment program begun in 1939 for youths in Cambridge, Mass., and neighboring Somerville, is providing today's researchers with a rare chance to assess the impact of therapy more than 30 years later. The Cambridge-Somerville Youth Study originally consisted of more than 500 "difficult" and "average" youngsters, aged 5 to 13. At random, half the youngsters in each category received one-to-one therapy with a personal counselor for about five years, and the other half received no therapy. One of the study's goals was to see if such counseling would divert the children from later involvement in crime.

Nearly 80 percent of the original youngsters have been located. An extensive follow-up of their behavior as adolescents and adults has yielded some rather astounding findings: Almost without exception, therapy appeared to have had a negative, or at least a non-positive, effect on the youngsters in later life.

A comprehensive study of the subjects' criminal records reveals solid negative correlation between therapy and the onset of criminal behavior. "The study provides a basis for doubting some of the more basic assumptions—assumptions which I shared—about therapy," says Joan McCord of Drexel University, who conducted the study.

In the overall comparison between therapy and non-therapy groups, McCord reports that slightly more of the men in treatment were convicted of at least one non-traffic crime, for a serious crime and for more than one crime. She presented her results last week in Washington at a meeting of the American Association of Psychiatric Services for Children.

In addition, the results show that in the therapy group, the incidence of antisocial and criminal behavior increased (or was not decreased) among boys who received therapy over the longest period of time; had the most frequent contact with counselors; began therapy at an earlier than average age; had male, rather than female, counselors; had therapy directed at personal problems, rather than at academic or family difficulties; and had close ties with counselors. All these findings run contrary to expectations, McCord says.

Why did therapy produce such uniformly negative effects? "I've got some hunches," McCord told SCIENCE NEWS. "It's possible that people become too dependent on counselors, and therefore they do not acquire the skills of those who do not have therapy," she said. "They come to see themselves as 'needing help.'" She also notes that while one of the groups was classified as difficult, the children were not "sick" by emotional standards. In such a case, treatment could make them worse, she suggests. The results indicate, she says, "that the most widely held beliefs about therapy may be untenable." □

# Making nuclear bombs the quick, dirty way

A simple, inexpensive, "quick and dirty" nuclear fuel reprocessing plant described by Oak Ridge National Laboratory indicates that a "bandit nation" with access to commercial spent (used) nuclear fuel could separate enough plutonium to make a nuclear weapon within only seven days. An "intralaboratory" memo outlining the procedure estimates that it would take up to six months to build such a plant, with the first 10 kilograms of plutonium metal ready for machining into bomb parts only one week later. After that, it could produce up to 100 kg—enough for about 10 atomic bombs—per month.

According to the Oct. 27 NUCLEONICS WEEK, a newsletter of the nuclear industry, the design was examined by Argonne National Laboratory and three industrial laboratories "and upheld as reasonable." A later issue (Nov. 3) quoted an Energy Department source as saying the report is "an imprudent elaboration on existing literature [the report references sources obtainable in most technical libraries]. It could help potential proliferators by simplifying their planning."

The study contained a number of crucial assumptions, such as: would-be reprocessors would have access to existing small industries (such as wineries, dairies or oil refineries) that could be pirated for instruments, tanks and fittings; the surrounding community is sympathetic to the bandit cause; and adequate funds, machine-shop equipment (such as lathes, power saws and welders) and construction equipment and materials are available. The entire plant would cover less than 1.5 acres and could be made from easily obtainable supplies. Technicians of average capability could assemble and operate it; stainless-steel welding is the most difficult skill it requires.

The study assumes that spent-fuel rods from commercial power reactors are stolen from cooling ponds and processed at the rate of one rod per day. Each rod must be cut and dissolved in an extraction-stripping operation. Resulting plutonium "buttons" are 99.8 percent

pure metal in a compound form, the report says. Preventing criticality—the energy-liberating fission chain reaction—is achieved by limiting the plutonium concentration in each part of the ORNL process.

The report does not describe how much time is needed to melt plutonium into a form that can be machined into bomb parts or describe how to develop the rest of the bomb-production process.

The study has served to fuel antinuclear sentiment, however, by suggesting that commercial power reactors are a risk to nuclear proliferation. A June 1976 report by the Joint Committee on Atomic Energy listed only nine countries which it said did not already have nuclear weapons but appeared technically capable of developing and detonating one within three years of deciding to do so. Those countries are Canada, Israel, Italy, Japan, the Republic of China, South Africa, Spain, Sweden and Switzerland. The ORNL study expands this list to include any country that operates a commercial or experimental reactor or has access to such a facility. Normally the somewhat lengthy development time necessary to safely produce a weapon that could be reasonably assured of producing a sizable yield would allow "timely warning" of that capability. ORNL's process eliminates assured "timely warning."

However, the Energy Department's Dennis Spurgeon told SCIENCE NEWS that the ORNL concept is not much of a real proliferation threat. First, any country that imports nuclear technology in the form of a power reactor does so because it feels it needs nuclear power to assure its energy future. By pirating fuel for weapons it would violate nonproliferation policies of the countries that supplied the fuel or equipment and thereby sacrifice any hope of receiving future supplies, Spurgeon said. Second, he said that it is still very difficult to make a good nuclear bomb, and that it was highly unlikely that "bandits" would have the necessary nuclear sophistication. Except for the possible scare value associated with nuclear weapons, bandits would be better off stealing conventional weapons for a real tactical advantage, he said. Finally, stealing spent fuel is difficult. Commercial fuel rods weigh one-half ton each and are highly radioactive. Thieves would likely die after only minutes of exposure, he said, and one or two rods would be necessary to get enough plutonium for a single weapon. Casks normally used to transport spent fuel would also have to be stolen, and their size, weight and availability would make the action hard to conceal. Since the reprocessing itself is also "dirty," or radioactively unsafe, the lives of the proliferators are threatened.

It appears that what the report best illustrates, then, is that nuclear proliferation need not be especially difficult, but it still requires important, and what may turn out to be unnecessary risks and costs to those involved. □

# The cold seas of 18,000 B.P.

Concern about possible future climatic change has led to new scientific efforts to better understand past climates. One of the more intriguing of these activities is the CLIMAP program, a National Science Foundation-sponsored effort to chart climates at specific times in the past. CLIMAP investigators are trying to get as detailed a picture as possible of what the climate everywhere in the world was like exactly 18,000 years ago, at the peak of the last glaciation.

Ocean conditions for February and August 18,000 B.P. (before present) for two widely separated parts of the earth, Antarctica and the eastern Mediterranean Sea, were reported recently at the annual meeting of the Geological Society of America in Seattle. Both showed greater differences from the present than were expected.

The analysis of the waters around Antarctica shows that, in the Atlantic sector, winter sea ice extended as far north as 46 degrees south latitude, a full 10 degrees farther than it does now. Thus the extent of the sea ice in the Southern Hemisphere was as great as the extent of the continental glaciation in the Northern Hemisphere. During summer the surface temperatures then in the southwest Atlantic were 8°C (14°F) colder than they are now.

The Pacific sector of Antarctic waters underwent smaller-scale changes. Sea ice extended 3 degrees farther north than it does today, and temperatures averaged 2°C cooler.

The Antarctic temperature maps were reported by James D. Hays, David W. Cooke and three other colleagues from the Lamont-Doherty Geological Observatory. The maps and data represent the official report of CLIMAP's Antarctic task group. The information in them was gained from analyses that are "very new and not yet published," says Cooke. A variety of evidence was used to produce the paleoisotherm maps. The extent of sea ice during August (winter), for instance, was based on the occurrence in precisely calibrated deep sea cores of fossil remains of a particular diatom (algae) that lives only in near-ice waters.

Although the Antarctic data show that the southern polar regions were undergoing extensive ice conditions at the same time as the period of maximum glaciation in the north, 18,000 years B.P., they also show that these conditions apparently abated faster in the south. By 14,000 years ago, Cooke says, the southern waters had reached much the same ice-free condition as today. By comparison, the major retreats of northern hemisphere glaciation did not take place until about 11,000 years ago.

The reconstruction of the climate of the eastern Mediterranean Sea was reported by CLIMAP investigators Robert C. Thunell and James P. Kennett of the University of Rhode Island. The greatest differences between present-day and 18,000-B.P. sea surface conditions existed in the Aegean Sea and immediately south of Crete. Winter temperatures in the Aegean were as much as 6°C cooler than at present; summer temperatures south of Crete were 5°C cooler than at present. The Aegean Sea was also less salty than it is today, by about 5 parts per thousand, although near the Strait of Sicily that difference decreases to 1.5 parts per thousand.

All these patterns of differences, Thunnell and Kennett say, are probably due to changing drainage patterns during glacial times and the diversion of cool, low-salinity water into the Aegean Sea.

"The magnitude of the observed oceanographic changes within the eastern Mediterranean," they say in summary, "are greater than those previously reported." □

# Child altruism: Saving Johnny not mommy

What would you do if two tigers escaped from the zoo, and one leaped for your mother, the other for your best friend—and you had a gun with only one bullet? You might say it depends on how you feel about your mother and your friend, but one school of sociobiology (SN: 11/29/75, p. 347) says your choice is largely predetermined by genetics.

According to the "kin selection" or "kinship genetics" theory, your altruistic action would be directed toward your mother because social organisms instinctively spring to the defense of relatives before they would do so for nonrelatives. The theory suggests that a person will altruistically defend not only offspring—to insure the promotion of their genes into succeeding generations—but parents, siblings, cousins, nieces, nephews and other relatives as well. Supposedly, the closer the relative, the more likely it is a person will come to his or her aid. In most cases, a non-related individual would be the recipient of aid when the costs to the benefactor are low, and when the non-related individual is not in competition with a relative's need for aid, according to the kin selection theory.

Although this view has been confirmed in field studies of animals, "To date, no empirical evidence has been gathered either in support or refutation of human altruism based on kin selection," says Harvey J. Ginsburg of Southwest Texas State University. Ginsburg, along with co-researchers Sandra Hense and Brian Bielefeld, recently tested the kin selection theory with 70 children, 3 years to 10 years of age. He reported the