security directive issued by President Reagan in 1985 which forbids restrictions on the distribution of unclassified research except as provided in "applicable U.S. statutes"—such as existing export laws. Shattuck said this exception should be deleted, and added that the National Security Council should undertake "a thorough review of the current system of export controls and related restrictions on the communication of unclassified scientific and technical data."

In a similar vein, Robert L. Park, public affairs director of the American Physical Society, called for a narrower definition of classified information and the reversal of a 1982 executive order which expanded the scope of classifiable material. "We recommend higher fences around less information."

In addition, Park said the government should extend First Amendment protection to electronic information. In 1986, then national security adviser John Poindexter issued a memorandum detailing controls on some types of information in electronic databases, but the memo sparked a barrage of protest and was withdrawn the following year. "We are fast approaching the day electronic databases will supplant conventional libraries as the repositories of scientific and technical information," said Park. "Any attempt by the government to restrain this electronic revolution . . . is to ensure that other nations will take the lead in shaping the future."

Gerald Dinneen, foreign secretary of the National Academy of Engineering, told the committee that international scientific exchange programs have already become easier to coordinate over the past year, thanks to a reordering of U.S. priorities. "In several cases, proposed exchange visits and scientific workshops which were rejected by the U.S. government just 1 year ago as being in militarily sensitive areas have now been endorsed by the U.S. government as being very important in fostering scientific linkages between East and West."

All three panelists welcomed the upcoming liberalization of export controls, saying they expected both science and industry to reap benefits from a freer exchange of information. As for safeguarding proprietary information, Shattuck argued that Western nations should ensure that Eastern European nations agree to the Berne Convention on patents and copyrights so that "Western intellectual property rights are not unintentionally compromised by the new openness of technological communication."

■ **DAVID P. HAMILTON**

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# Neglected Neurotoxicants

When young people started exhibiting classic symptoms of Parkinson's disease a few years ago, researchers quickly nailed down the cause: exposure to tiny amounts of a chemical called MPTP that is sometimes produced during the illicit manufacture of synthetic heroin. The discovery, says a new report by the Office of Technology Assessment (OTA), provided dramatic evidence of how a toxic chemical can poison the nervous system, and it has helped fuel concerns that a variety of neurological disorders might be linked to exposure to neurotoxicants. But the report says the federal government has not yet come to grips with these concerns.

Research on neurotoxicants is chronically underfunded, the report says, and regulations are fragmented and poorly coordinated. The regulatory agencies have focused largely on the carcinogenic potential of toxic substances, but "the adverse effects [of such chemicals] on organs and organ systems, particularly the nervous system, may pose an equal or greater threat to public health."

The true extent of the health hazards posed by neurotoxicants is unknown, the report points out, because very few chemicals have been tested to determine if they affect the nervous system. But OTA notes that a large percentage of the 600 pesticide ingredients registered with the Environmental Protection Agency (EPA) are known to be neurotoxic to varying degrees. Potentially neurotoxic substances are also found in industrial chemicals, food additives, cosmetic ingredients, abused drugs, therapeutic drugs, and naturally occurring substances such as lead. Moreover, OTA cites evidence that environmental agents may play a role in the recent increases in the incidence of amytrophic lateral sclerosis (ALS, or Lou Gehrig's disease) and Parkinson's disease in the elderly.

One major problem in devising regulations to limit exposure to neurotoxicants is that their effects can vary widely and the biochemical and physiological changes that link exposure to the development of neurological disorders are not well understood. Take the problems in regulating exposure to lead, one of the oldest known neurotoxicants. Over the past five decades, as new evidence has accumulated, the maximum blood lead level deemed safe has steadily decreased. And "lead poisoning in the United States still occurs in epidemic proportions," OTA writes.

Lack of knowledge of the mechanisms of neurotoxicity is also a barrier to screening new commercial compounds because there's no firm basis to predict from a compound's structure whether it is likely to damage the nervous system. Indeed, current screening practices, which rely on structural comparisons with known neurotoxicants, are "a game of chemical Russian roulette"—a dangerous gamble based on shaky assumptions—says neurotoxicologist Peter Spencer of the Oregon Health Sciences University, who chaired OTA's Neuroscience Advisory Panel. Furthermore, adds Spencer, until tissue cultures can be used for testing, different animal species "must be selected to test specific classes of neurotoxicants." Nevertheless, the regulatory agencies could do much better, OTA says. They "have not widely adopted or applied neurotoxicity test protocols," and there is "little coordination of regulatory efforts."

To Spencer, the most immediate concern is "to build a solid base to understand the mechanisms of action" of neurotoxic chemicals. OTA reports that the federal government is spending a mere $67 million on research on neurotoxicants. Its conclusion: "Given the threat the neurotoxic substances pose to public health and the lack of knowledge of the mechanisms by which these substances exert adverse effects . . . federal research programs are not adequately addressing neurotoxicity concerns." EPA, for example, has no extramural grants program in neurotoxicology, and when the Office of Management and Budget made across-the-board cuts in the agency's 1991 budget, a $1.5-million research initiative had to be nixed.

If, as Senator Albert Gore, Jr. (D–TN), puts it, "chronic neurotoxicity presents a health risk every bit as large and as tragic as cancer," should funding for neurotoxicity research approach that for cancer? Yes, says Spencer. If neurotoxicants play a role in Alzheimer's, ALS, and Parkinson's disease, the early onset of these diseases may be preventable. That, he suggests, is at least worth rigorous investigation.

OTA concludes ominously, "available neurotoxicity data are insufficient" to ensure the safe use of many commercial pesticides, industrial chemicals, food additives, and drugs. Spencer says: "More research is needed to fill this chasm of biomedical ignorance."

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