Heroin: Role of Technology in Curtailing Supply

The United States is believed to import between 6 ½ and 10 tons of heroin a year which supports the habits of an estimated 560,000 addicts. The national campaign against drug abuse has mobilized scientific resources to deal with the treatment and rehabilitation of addicts and, to a lesser extent, with what narcotics experts call the "supply side of the equation." Interruption of heroin supplies is primarily a political and law enforcement operation, but there are several points at which technology can be brought to bear.

Efforts to reduce the heroin supply are coordinated by a cabinet level Committee on International Narcotics Control established last October. A subcommittee on research and development is headed by an assistant director of the Office of Science and Technology, Leonard Laster. The subcommittee oversees some $5 million of research funds expended by federal agencies in the present fiscal year, and a request for a further $5 million is before Congress. Laster is reluctant to discuss the details of the subcommittee's work for fear of aiding the interests on the other side. But general areas of research activity include the detection of heroin in processing and transit, and suppression of the opium poppy.

Location of the laboratories at which opium and morphine base are transformed into heroin is one problem which may be amenable to technological attack. The conversion process, which is no more complex than making bootleg whisky, requires only small amounts of common industrial chemicals and ordinary quantities of electric power and water. Acetic anhydride, used to acetylate the morphine, is readily available in industrial countries. Developmental work on detecting heroin laboratories has been carried out by French authorities who, whether through these or other means, have discovered several laboratories operating in Marseilles.

Scientists at the Bureau of Narcotics and Dangerous Drugs (BNDD) in the Department of Justice are interested in means of tracing the movement of heroin. If an identifiable tag could be introduced at some stage of the manufacture, interception of samples at later stages might help to delineate the distribution network. Radioactive methods have been considered but ruled out for health reasons. But suitable tracer chemicals might be added to the drug or the materials used to dilute it. So far no tracers have been injected into the heroin supply system, although they have been used in other drug networks, says John W. Parker of the Strategic Intelligence Office of the BNDD. Another means of delineating the characteristics of the network is by operations research. The Office of Science and Technology is considering the feasibility of a modeling study which would furnish a quantitative description of the supply and demand for heroin.

The detection of heroin in mail and baggage is an area of technical concern. The problem is to handle large volumes of baggage rapidly, but so far no one has come up with any real solution.

Better success has been achieved with the detection of opium poppy fields by remote sensing. But though it is technically feasible to detect poppy fields from a satellite, it is not cost-effective to do so. Factors such as cloud cover, and seasonal variations around the world, severely limit the efficiency of observation by satellite. For countries that are interested in monitoring their own opium production, the fields can be spotted by simple aerial photography.

Biological Control

Location of opium poppy fields is a prerequisite to eradicating the crop. Several means of eradication are being studied by the U.S. Department of Agriculture's (USDA) Agricultural Research Service at Beltsville, Maryland. The program is conducted in cooperation with the United Nations Commission on Narcotic Drugs and is headed by John L. Creech, a plant explorer by trade. Within a budget of $1.7 million assigned to the narcotic plants program, Creech gives top priority to searching for alternative cash crops to be grown by farmers abandoning poppy cultivation. Second priority goes to the screening of herbicides for their effectiveness against the opium poppy. Of some 127 registered herbicides, about 50 have been tested this season. Creech's group is also evaluating biological means of control such as insects, fungi, bacteria, and viruses.

Biological methods of control have the advantage that, unlike herbicides, they are self-propagating. They have a low rank on the USDA priority list because at present they are distant possibilities. Literature surveys of the insects and diseases known to attack the opium poppy will be completed shortly and should give a clearer idea of the potential for biological control. Two promising insects already under study are a pair of weevils that are specific for the poppy family. Insects have been used successfully to control plants such as Klamath weed in California and prickly pear in Queensland, Australia. One of the two poppy weevils came to prominence during World War II when the opium poppy was widely cultivated in Europe as a source of vegetable oil. The weevil often reduced the yield by 50 percent and sometimes wiped out an entire harvest.

Reece I. Sailer, a USDA entomologist who is overseeing the insect part of the narcotics plant program, says the weevils, if they prove a suitable control agent, could be used in two ways. In countries where the insect is endemic, such as around the Mediterranean coast, the approach would be to mass produce weevils in the laboratory and release large numbers in the opium fields. In countries that are free of the weevils (and of their parasites), a simple "inoculation" might suffice. It is not known whether the weevils occur in the Golden Triangle, the area of Burma, Thailand, and Laos, where most of the world's illicit opium is grown.

Poppy fields tend to be small and scattered and sometimes are planted to a different crop, all of which reduces the chances of an insect infestation. But Sailer believes the problems can be overcome. "Technically there is no reason to suppose it is not possible to develop a means of insect control," he says.

If promising fungi or viruses are identified in the literature survey, they may be evaluated by the USDA Epiphytology Research Laboratory at Fort Detrick, Maryland. Formerly a part of the army's biological warfare program in which anticrop agents such as rice

blast and wheat rust were allegedly investigated, the laboratory under USDA is now engaged in studying exotic pests that might invade U.S. crops from abroad. C. H. Kingsolver, director of the laboratory, says that a promising pathogen for biological control of the opium poppy would be one that is as widespread as its host, easily and rapidly transmitted, and hardy. If such an organism exists, it is unlikely that a breeding program could significantly improve its characteristics in the short term, Kingsolver says. Although reluctant to comment on poppy pathogens in particular since his laboratory has not yet entered the program, Kingsolver says he rates the chance of developing a suitable pathogen as a "long shot." Unlike other crops, opium poppies have probably retained a large measure of genetic diversity and are unlikely to succumb to a single pathogen, Kingsolver points out.

USDA officials stress that the purpose of the narcotic plants program is solely to develop information that may be placed at the disposal of countries where poppies are grown; there is no question of the United States acting unilaterally to eradicate poppies.

Complete eradication of the opium poppy is probably neither a feasible nor desirable goal; and even the suppression of the poppy in one area may be countered by the development of new sources of supply in others. The supply network is often likened to a balloon—squeezing it in one place may simply cause it to expand some place else. The dimensions of the problem are sketched out in a report prepared for the Cabinet Committee on International Narcotics Control. According to the report, *World Opium Survey 1972*, some 1500 metric tons of opium were produced in 1971 for the licit market (opium is used to manufacture medicinal opiates such as codeine) and probably 1000 tons or more for the illicit market. Much of the illicit opium is consumed at the source, but an estimated 200 tons became available for the international heroin market, enough to make about 20 tons of heroin.

At present there are three major illicit marketing complexes, the Turkish–French–U.S. network, the Southeast Asia network, and the Middle East–Southeast Asia network. According to the World Opium Survey, the first is the primary source of supply of heroin to the United States. Since the Turkish government has forbidden poppy cultivation after this year, the second two networks have the potential for becoming crucial elements in the problem. The price of heroin landed in New York has risen by 150 percent over the last decade, reflecting both the increased demand in the United States and the greater risks involved in smuggling. But the rising level of seizures still represents only a small fraction of the illicit flow. "The international heroin market almost certainly continues to have adequate supplies to meet the demand in consuming countries," the survey observes.

Economics is an obstacle to efforts to eliminate poppy cultivation. The price paid to the farmer for opium is so small a fraction of the selling price of heroin that the traffickers could easily absorb increased costs for opium. Prices for raw opium have remained relatively stable over the last decade, suggesting that "the sources of supply have readily accommodated to increases in demand without encountering higher unit costs." Another obstacle to elimination is that the opium poppy can be cultivated in many regions of the world. The major producer of illicit opium is the Golden Triangle, which was the source of an estimated 700 tons in 1971. Another 220 tons or more were produced in India, Pakistan, and Afghanistan. Illicit Turkish production

Fellows Program at Academy

The National Academy of Sciences (NAS) is establishing a program of fellowships whose purpose is to give younger scientists, particularly women and members of minority groups, the opportunity to study the world of science policy-making.

With the initial aid of a 3-year grant of $250,000 from the Alfred P. Sloan Foundation, the academy will support eight in-house fellows a year. Criteria for selection are a Ph.D. degree or its equivalent and 5 to 10 years of experience in science, social science, medicine, or engineering.

Four fellows are expected to be chosen some time this year, each to spend up to 1 year at the academy. Each is expected to have some project in mind that is related to the interests of the academies of science or engineering, the National Research Council, or the Institute of Medicine. They will be given office space, stipends of up to $25,000 a year, and opportunities to participate in the work of the multitude of committees and boards that give science policy advice to the government. They will be given free rein to pursue their own projects, and to use the prestige of the academy to summon the resources of experts from around the country. Most of the fellows are expected to come from academic settings, but the program is also for the benefit of researchers and administrators from government and industry.

According to John Coleman, NAS executive officer, the idea for this program has been kicking around for a decade. The academy conducted a similar program of research fellowships in the 1930's, but it was abolished when the government went into supporting researchers in a big way after World War II.

Adolph Wilburn, an educational planner on the NAS staff, will run the new program. Wilburn says the idea received its real impetus at a meeting of minority group scientists and engineers which the academy called in early 1971. The conferees wanted a program specifically geared to minority group members but this concept has been watered down somewhat.

NAS officials don't like to get too specific because they say they are still feeling their way along in the matter, but the idea seems to be to give qualified scientists the experience needed to assume administrative and advisory posts—or, as Coleman says, "to get into the national swing of things." A member of a university science faculty, for example, might be appointed dean or provost after his stint at NAS. Wilburn, in particular, sees the fellowships as a way to get minority types into government decision-making by giving them the expertise necessary to qualify for sitting on advisory boards.

Wilburn says nominations are now pouring in, but there is no word as yet when the first fellows will be chosen.—C.H.

was at least 35 tons. Persistent reports of expanded poppy cultivation in the highlands of Latin America suggest that production in this area is rising. According to one estimate, accepted by the BNDD, the opium needed to supply the entire U.S. addict population could be grown on as little as 10 square miles of suitable land.

The heroin supply system has a flexibility and economic vitality that presents problems for enforcers. According to Parker of the BNDD, the strategy is to apply pressure at all parts of the system with the aim of raising the risk to unacceptable levels for traffickers and driving heroin addicts into maintenance programs. "The hope is that you can price people out of the system," says Laster, R & D subcommittee chairman of the Committee on International Narcotics Control. "There are optimal locations in terms of transportability. You may be able to cause the system enough trouble at these points to throw it out of balance."

Laster believes that at each step of the supply route there are opportunities for technology to be brought to bear. "Innovation is at a premium in this job and I would welcome ideas from the academic and industrial community," he says. And Frederick Garfield, BNDD assistant director for scientific support, sees the interdiction of heroin supplies as a "tremendous responsibility for the scientific community."

Technology, and the law enforcement processes to which it is an adjunct, are unlikely to provide an answer to the problem of heroin addiction. But the technical initiatives under way and in application offer at least a small handle on a large problem.

—NICHOLAS WADE

Medicine at Michigan State (I): Educators and Legislators

In the 1960's, Michigan was one of the states which responded to growing public concern about health care by mounting a major expansion of medical education. The federal government contributed substantially to this expansion, particularly with construction grants and funds for biomedical research. But state legislators found themselves called on to vote matching funds for construction projects and to provide big operating budgets for expanded programs. They learned that medical education is very costly.

In recent years two things have happened to alter the postwar pattern: (i) Medical schools have suffered from the squeeze on federal spending, particularly the squeeze on construction funds, and (ii) medical education has encountered increasing competition for state funds from other programs such as welfare, housing, and recreation, not to mention other sectors of the health and education budgets.

During this period, not only did costs rise precipitously, but key Michigan legislators began to feel that promises of progress made to them by medical school officials were not being fulfilled. The result has been a growth of sophistication and skepticism which seems to be affecting very significantly the way in which the legislature deals with medical education.

There are four medical schools in Michigan, all of them state schools. The University of Michigan at Ann Arbor and Wayne State University in Detroit each has a medical school. Michigan State University at East Lansing has two medical schools, one of them the first state school of osteopathic medicine on a university campus.

The main concern of Michigan legislators has been a shortage of doctors in rural and inner-city areas and the loss to other states of doctors trained in state medical schools. The problem is not unique to Michigan, but legislators note that after more than a decade of heavy investment in medical education their constituents are still complaining, if anything more bitterly, about a doctor shortage. The legislators wanted more doctors, especially more family doctors in small towns and cities, and what they think they have gotten is more researchers and more specialists who settle in the big cities or emigrate to California.

Until the late 1950's the situation in Michigan was relatively uncomplex. The University of Michigan operated the only state medical school and seemed to get pretty much what it asked from the legislature. Then in 1956 the state took over Wayne in Detroit, which had been run by the city and was essentially a struggling streetcar university with an underfinanced medical school. Observers say it was not until 1964 that the legislature really backed Wayne's expansion and then with the understanding that the medical school would increase class size drastically and emphasize training physicians to serve the inner city.

In the case of Michigan State the preliminaries were protracted. MSU had undergone a rapid postwar metamorphosis. From an overgrown state college known for turning out veterinarians, ag students, and teachers, it became an upwardly mobile university with a wide range of graduate programs. The expansion was presided over by John A. Hannah, a man of legendary entrepreneurial talents and drive. MSU moved so fast that it bypassed building the professional schools of medicine and law that traditionally round out a major university. Getting medical education on the MSU campus was to cap Hannah's career as an institution builder, but the goal was won after strong resistance by the legislature and long delay and was finally achieved, close observers say, under a compromise in which acceptance of a college of osteopathic medicine in tandem with a school training M.D.'s was a necessary element.

The legislature's leverage in dealing with medical schools is exerted, not surprisingly, through the power of the purse, and the fulcrum is the appropriations committees of the state senate and house. But the mechanism that sets Michigan apart from other states is a joint capital outlay committee. This is a six-member body—three from the senate, three from the house—which examines proposals for new state-funded capital construction and