should be. But, given the present modest level of assistance by the other developed countries, it is unlikely that the proposed investment goals could be met without a nearly threefold increase in the present U.S. economic assistance program, now running at about $2.5 billion a year.

The report warns against false hopes and a search for panaceas. Work should continue, it says, on the investigation and development of new sources of food supply, such as the production of high-protein food from petroleum. But the panel sees no likelihood of these endeavors making a major contribution in the near future to the closing of the food-population gap.

The panel concludes that the bulk of the increase in food supplies must come from farm crops, principally through higher yields, although an expansion of croplands in Africa and Latin America is possible. A major expansion of irrigation is recommended to make the raising of more than one annual crop possible in regions of highly variable and seasonal rainfall.

Reading between the lines, one finds in the report strongly implied criticism of the State Department and its overseers on Capitol Hill. Modernizing the economies and agricultural systems of the hungry nations will demand a long-term strategy, and, except in the gravest crises, U.S. assistance should not be withdrawn or curtailed as a foreign policy sanction, the panel says. Moreover, it recommends that foreign aid authorizations from Congress should be for a minimum of 5 years, rather than for 1 year as at present.

The shadow of famine and the political tumult it will bring is growing darker, as the President said, but thus far neither the well-fed nor the hungry nations have shown they prefer light to darkness.—LUTHER J. CARTER

Crime Control: Task Force Urges Use of Science and Technology

Federally sponsored research has regularly been directed at the physical problems of contemporary society—defense, food supply, disease, transportation, and communication. Recently, wide interest has developed in applying the methods and techniques of science and technology to still another category of problems—those that come under the heading of crime. Impetus to this interest is provided not only by the painful prevalence of crime but also by the fact that crime is now a large and easy-to-exploit political issue. In the 1964 presidential campaign Senator Goldwater constantly harped on the theme of "crime in the streets," and President Johnson replied by declaring that his administration could tackle the problem in ways better than anything Goldwater could offer. The President subsequently created a Crime Commission; as part of the commission, a special task force on science and technology was appointed.

After months of study, that task force has now reported its findings. What they boil down to is this: the *sources* of crime extend beyond the reach of any feasible technical treatment, but science and technology, properly applied, can be important components of community efforts to protect life and property.

The work of the science and technology task force represents but a small portion of the Crime Commission study. The full commission report, *The Challenge of Crime in a Free Society,* makes this clear: "For 'crime' is not a single, simple phenomenon that can be examined, analyzed and described in one piece. . . . Its causes are legion. Its cures are speculative and controversial. An examination of any single kind of crime, let alone of 'crime in America,' raises a myriad of issues of the utmost complexity."

The commission itself revised its approach as the "myriad of issues" became more evident. The work initially was divided into four major areas—police, courts, corrections, and assessment of the crime problem. As the work proceeded, the four divisions became nine. Added to the original were organized crime, juvenile delinquency, narcotics and drug abuse, drunkeness, and science and technology. Nine task forces were created, and each has published, or soon will publish, its own report.

The Crime Commission turned to the Institute for Defense Analysis (IDA) to conduct the science and technology study and chose an IDA staff member, Alfred Blumstein, to be director of the task force. A consortium of 12 universities,* IDA serves as a civilian adviser, analyst, and evaluator to the Defense Department, particularly to the Joint Chiefs of Staff Weapons System Evaluation Group and the Director of Defense Research and Engineering.

Three top officials of IDA—Milton J. Clauser, Ali B. Cambel, and Alexander J. Tachmindji—served as general supervisors for the task-force work.†

The task force found parallels between military systems and law enforcement operations but found no similarity in the amount of federal attention paid the two. In the introduction to its report the task force emphasizes how neglected criminal justice operations have been: "More than 200,000 scientists and engineers have applied themselves to solving military problems and hundreds of thousands more to innovation in other areas of modern life, but only a handful are working to control the crimes that injure or frighten millions of Americans each year." The Justice Department was the only Cabinet department in 1965 with no share of the roughly $15-billion federal R & D budget. The task force recommends establishment of a federal R & D program in criminal justice and maintains that within 3 to 5 years this program may profitably reach

* The 12 institutions are University of California, California Institute of Technology, Case Institute of Technology, University of Chicago, Columbia, University of Illinois, Massachusetts Institute of Technology, University of Michigan, Pennsylvania State University, Princeton, Stanford, and Tulane.

† Other members of the task force were Ronald Christensen, University of California; Ronald Finkler, IDA; Saul I. Gass, International Business Machines; Sue Johnson, systems analysis consultant; Peter Kelly, Kelly Scientific Corporation; Raymond Knickel, electronics consultant; Richard Larson, Massachusetts Institute of Technology; Joseph Navarro, IDA; and Jean Taylor, IDA. This staff was augmented by an advisory committee and a group of consultants.

a level of about $60 million—which might still be an underestimate of the need and potential.

The task force set out to show, not that technology is the solution to crime, but that it could be addressed to specific problems in prevention and control, including making targets of crime less vulnerable. An example of the latter, mentioned in the report, is a method used in one country in South America, where police are instructed to deflate the tires of an automobile with keys left in the ignition, thereby preventing a thief from driving away with it. This may be a primitive method of crime prevention, yet it is probably quite effective.

The task force took a much more sophisticated approach to the problems of crime, but in many cases came up with recommendations as simple or obvious as deflating tires. As James Vorenberg, executive director of the Crime Commission, said, much was accomplished just by having men with scientific backgrounds apply traditional scientific analytical methods to the problems of crime. He said he felt the greatest fruit of the task-force study was the discovery of how much can be gained from collaboration of physical scientists and law enforcement personnel.

The approach of the task force was, first, to study systematically aspects of the criminal justice system to determine areas of weakness, and then to find how current knowledge and technology could improve matters in the problem areas. For example, a study conducted by the task force in Los Angeles showed that the sooner a patrol car can get to the scene of a crime, the better is the chance that the criminal will be apprehended. This seems an obvious answer. However, the analysis of the problem went further. Where are the time delays? These could be broken down into the lapse between commission and reporting of the crime; the time needed to process the complaint; the time needed to locate the closest available patrol car and relay the instructions; and the time required for getting to the scene.

Applying only current technology and a lot of common sense, the task force came up with many recommendations for cutting down on the police response time. To facilitate the reporting of the crime, the study suggested opening police call boxes to the public; having one nationwide police emergency number; providing pay telephones from which a caller can reach the operator without a dime; and providing employees in gas stations and liquor stores —establishments which are highly susceptible to robbery—with pocket radio transmitters to enable them to trigger a remote alarm.

To facilitate the location of patrol cars, the report suggests that the cars be equipped with some kind of visual, acoustic, or electromagnetic emitting device whose signal can be picked up by sensors located in police call boxes. Further, the report recommends that all policemen be furnished with portable radios so they can be in contact with headquarters, whether they are in or out of cars.

In some large cities, radio congestion delays the dispatching of instructions. This could be alleviated, the report suggests, by establishment of area-wide networks so that lesser-used frequencies could be called upon, or by use of vacant television frequencies. A conceivable but more costly method would be the installation of teletype machines in patrol cars to receive non-urgent messages.

Not all of the report's recommendations were so elementary. The task force outlined the establishment of a local, state or regional, and a national computer-based information system. Using it, a police department could receive, in a matter of seconds, a response from the national center to inquiries about stolen autos, wanted persons, or stolen property.

The task force produced many feasible ideas, but it did not set out to solve in its year of existence the technical problems of the criminal justice system. Its goal was to point the way

Russian Hail-Suppression Experiments

An experimental hail-suppression program in the Soviet Union appears to have provided significant protection to crops against hail damage. Approximately 1.25 million acres in the Northern Caucasus, the Alazan Valley of Georgia, and the Armenian SSR—areas comprising large, state-controlled farms—were protected by cloud seeding during 1964 and 1965. Silver or lead iodide was fired from shells by antiaircraft gun batteries into clouds that appeared to be potential hail-producers.

The method is described in a detailed report* by G. K. Sulakvelidze of the High Altitude Geophysical Institute, Nalchik, Caucasus. When observations indicated the presence of clouds that were likely to produce hail, the guns fired projectiles that exploded within a so-called "hail-growth zone"; radar echoes identified these zones and showed that hailstones were forming, and that supercooled water droplets were present in large concentrations at approximately −6°C. The resulting nucleation of the supercooled water droplets prevented further growth of the hailstones. Most of the stones already formed were small enough to melt during their fall to the ground, or were too small to do great damage. Overall results of the experiments indicate that crop damage by hail was reduced by 80 percent or more, when compared with previous records and with hail damage in nearby control areas.

The Sulakvelidze report, recently translated into English at the National Center for Atmospheric Research,† is stirring great interest and increased optimism among American atmospheric scientists, many of whom have been cautious about staging hail-suppression experiments on a scale similar to those of the Russians. For the past year, a group of U.S. and Canadian scientists, led by Dr. Verner E. Suomi of the University of Wisconsin, has been formulating recommendations for a national program on hail-suppression. The results of the Suomi study, sponsored by NSF at the request of the Interdepartmental Committee on Atmospheric Sciences of the Federal Council on Science and Technology, is expected within the next 2 months.—WALTER ORR ROBERTS, *Director, National Center for Atmospheric Research*

* "Rezul 'taty rabot kavkazskoi protivogradovoi ekspeditsii 1965," *Vysokogornyi Geofizicheskii Institut Trudy* **7**, 1–61 (1966). † Available from NCAR, Boulder, Colorado 80302, or from the Atmospheric Sciences Section, National Science Foundation, Washington, D.C. 20550.

for a federal research and development program which the task force felt worth while and necessary to bring the nation's criminal justice system into the modern age and somewhere near its potential effectiveness.

A basic stumbling block, the task force found, is lack of information. What is the nature of crime? How does the criminal justice system operate? What are the effects of its methods? When changes are made, what are the results? The report pointed out, for example, that no controlled studies have ever been conducted to find out whether brighter street lighting really reduces crime. In many cases, the report showed, even where needs have been identified, work on the solutions have been inadequate. An effective nonlethal weapon which can incapacitate as quickly as a gun has not yet been developed.

The report concludes that it is up to the federal government to initiate and finance a science-and-technology, research, development, and test-and-evaluation program. This program would include R & D test and evaluation projects at the local and state levels; technical support to criminal justice agencies for incorporating results of the projects; operation-research groups in the larger agencies; graduate fellowships to attract and train new professionals; research grants to scientific investigators; dissemination of R & D information; and the establishment of a major science and technology research institute.

The latter, the report says is probably the most important single mechanism for accomplishing the goals of the federal program. Although supported by the federal government, the institute, the report suggests, might best be established by a university, a group of universities, or an independent nonprofit organization and be located in a metropolitan area. Representative J. Edward Roush (D–Ind.) has introduced a bill (HR10113) which would accomplish this. His bill, which calls for the establishment of a National Science and Technology Center for Crime Prevention, is awaiting action in the House Judiciary Committee.

Identical bills to create a National Institute of Criminal Justice, which would involve science and technology research, have been introduced in the Senate (S992) by Edward Kennedy (D–Mass.) and in the House (HR 5652) by James Scheuer (D–N.Y.).

There is little doubt that the nation's

NEWS IN BRIEF

● **NEW NSF DEVELOPMENT PROGRAM**: A total of nearly $2 million has been awarded to four institutions in the first grants made under NSF's Departmental Science Development Program. The new program, which pinpoints specific departments for support, is complementary to NSF's University Science Development Program, which provides assistance for broad-scale institutional development. Those receiving the grants are: Clark University, Worcester, Mass., geography, $563,740; Drexel Institute of Technology, Philadelphia, materials engineering, $527,700; University of New Mexico, Albuquerque, mathematics, $550,000; and Tennessee Technological University, Cookeville, mechanical engineering, $300,000.

● **ALASKAN MINING RESEARCH LABORATORY**: The Bureau of Mines is establishing a mining research laboratory in Juneau, Alaska, to conduct research on the development of Alaska's mineral and fuel resources. The first project will be to test the use of a sonic drill for penetrating the permanently frozen grounds of Alaska. Under another program the Bureau's newly commissioned research ship, *Virginia City*, will conduct research and development in undersea mining of gold off the southern coast of Alaska's Seward Peninsula in cooperation with the Interior Department's Geological Survey.

● **RELIGION AND MENTAL HEALTH BIBLIOGRAPHY**: A *Bibliography on Religion and Mental Health*, containing references to books and articles published between 1960 and 1964, has been issued by the National Clearinghouse for Mental Health Information, and is available from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402, for 55 cents.

● **RADIO ASTRONOMY**: Four universities have formed a consortium, Associates for Radio Astronomy (ARA), to promote the construction of a 328-foot fully steerable radio telescope, which would be the largest of its kind in the United States. The ARA members are the University of Michigan, the California Institute of Technology, Stanford University, and the University of California. Under the ARA agreement, Caltech was given the responsibility for the planning, construction, and ultimate operation of the instrument, with the aid of ARA's policy and scientific committees. A proposal for the telescope, to be located at Caltech's Owens Valley Observatory, has been submitted to NSF. Estimated cost of the instrument is $17.8 million.

● **U.S. RESEARCH IN THE MID-EAST:** The United States temporarily suspended support of all research projects in the Middle Eastern countries involved in the Arab-Israeli war at the time of the outbreak of hostilities the week of 5 June. Since then, the suspension has been lifted for programs funded by U.S. owned local currency in Israel and Tunisia. Studies are now underway on a country-by-country basis to determine the future of the remaining U.S. supported projects. The largest installation involving American citizens, a Naval Medical Research Unit in Cairo, Egypt, has been temporarily placed under the administration of the Spanish embassy, and the 28 military and 3 civilian workers have been evacuated to Greece. The National Science Foundation had 13 grantees and fellowship holders in the Middle East at the time of the outbreak. Communication problems have prevented the location of all of them. Departure of another group of NSF grantees and fellows to the Middle East has been cancelled. The suspension of payments affects, among others, 50 projects in Egypt, funded over varying time periods for a total of $4 million and one project in Syria, under a $5000 grant. These two fall under a U.S. program of supporting research using U.S. owned local currency in the countries. The numerous government agencies supporting research in the Middle East, have been advised by the State Department to hold off payments for the projects until the country-by-country study is complete.

● **FRENCH ASTRONOMER WINS KALINGA PRIZE:** Paul Couderc, a French astronomer, has been selected as the 15th recipient of UNESCO's international Kalinga Prize. The award of approximately $2800 was presented to Couderc for his work in aiding the popularization of science.

police agencies are far from even approaching maximum use of modern technology for law enforcement (the report estimates that most police departments could have been equipped 30 to 40 years ago as well as they are now). But just how important technology can be in dealing with crime is by no means certain. The commission readily acknowledges that the motivations for crime extend far deeper than the reach of any foreseeable technology. It is worth noting that, in Vietnam, the most technologically advanced military force in history has its hands full with what, by all accounts, is a relatively small and poorly armed opponent. Gadgets and systems help, but they appear to be a small—perhaps, very small—part of the answer.

—JOAN ANDERSON

Molecular Biology: U.S. and Italy To Establish New Graduate School

Naples. Graduate education, American style, is coming to Europe under a cooperative arrangement between the University of California, at Berkeley, and the International Laboratory of Genetics and Biophysics (ILGB) in Naples. The object of this cooperation will be a Graduate School of Molecular Biology in Europe to be established at the ILGB, with financial support from the U.S. and Italian governments.

As the program is now planned, a 3-year course in a new "studium of molecular biology" will lead to the Ph.D.; standards for the degree will be those prevailing in American universities. The faculty will be international, composed of some members of the resident staff of ILGB and visiting professors from Berkeley and other institutions. The studium's calendar will mesh with the Berkeley quarter system so that Berkeley faculty will be able to travel to Naples to give 6-week courses.

Applications for admission to the school will be accepted from students from all countries. About 20 fellows will be admitted each year, initially, and the total number of fellows will be limited to about 60.

Present plans are that, at the outset, all fellows will receive stipends of $3600 a year, paid by the studium. The organizers of the studium believe that such an arrangement is especially important in the program's formative period, since it will help assure that admissions will not be affected by the applicant's financial means. After the studium has become established, it is felt, adequate fellowship awards from the applicants' countries may be expected.

The studium is one of three initial projects under a 5-year "Agreement for a Cooperative Program in Science between the United States and Italy," signed by representatives from the two nations on 19 June, in Washington. The agreement provides that the two governments will undertake a broad-range program of scientific cooperation for peaceful purposes, and that each government will provide financial support for its portion of the program. The other two projects under the agreement involve an exchange of personnel and information in the field of molecular developmental biology between the Massachusetts Institute of Technology and the University of Palermo, and collaboration between scientists at the Department of Zoology, Washington University, St. Louis, and the Center for Neurobiology of the Istituto Superiore di Sanità, in Rome.

The studium, the largest of three, will be supported in the early period mainly by a 3-year National Science Foundation grant of $486,000 to the University of California, and by a similar amount to the ILGB from the Consiglio Nazionale delle Ricerche (CNR), NSF's Italian counterpart. The ILGB is supported by the CNR and also performs research under grants

INTERNATIONAL COOPERATION: Signatures are placed on the recently negotiated Italian-American science agreement, 19 June, at the State Department. Seated, left to right, are Leopoldo Rubinacci, Minister for Coordination of Science and Technology, Ambassador Egidio Ortona, Eugene Rostrow, Undersecretary of State for Political Affairs. Behind them are Vincenzo Caglioti, President of the Italian National Research Council, and Donald Hornig, presidential assistant for Science and Technology.