othy Hodgkin is a grandmother. Since Alan Hodgkin, who received the Nobel award in physiology and medicine last year, is Thomas's cousin, these grandchildren now have a Nobel laureate on each side of the family.

Like most British crystallographers Dorothy Hodgkin has a scientific lineage from the Braggs. This was through J. D. Bernal, who worked with W. H. Bragg at the Royal Institution from 1923 to 1927. First a student of H. M. Powell at Oxford, she then studied with Bernal from 1931 to 1934 at Cambridge before returning to Oxford. At Cambridge she became interested in the sterols and collaborated with Bernal and Fankuchen in a survey of their crystal data which is monumental in its scope, even by present-day standards. This is still unfinished business, the most recent publication being one in 1963 on calciferol by D. C. Hodgkin, B. M. Rimmer, J. D. Dunitz, and K. N. Trueblood. Early in her scientific career Dorothy Crowfoot, as she was then known, realized the importance of making the results of crystal structure research readily available to organic chemists. The *Annual Reports on the Progress of Chemistry* of the Chemical Society of London had included a chapter on crystallography since 1918, when it had developed out of mineralogical chemistry. In 1935 Dorothy Crowfoot wrote for the first time a separate section on organic molecular crystals. Then and in the following years she set a standard for clear, concise, and accurate reporting which has since been characteristic of that publication. In 1942, when information on the structure of penicillin was vital for the synthesis of large quantities of the antibiotic needed during the war, Dorothy Crowfoot obtained crystalline specimens of salts and degradation products as soon as they were available. Although this is a much smaller molecule than vitamin B_{12}, the chemical information on the structure was very inconclusive at the time, and the computing equipment available for the crystal-structure calculations was even more inadequate. This structure analysis took about 5 years to complete and was fully described by D. Crowfoot, C. W. Bunn, Barbara Rogers-Low, and A. Turner-Jones in 1949.

It is said that a woman has to be more than twice as good as a man to surpass him. Dorothy, not content with the usual obstacles, had to make two scientific reputations for herself, one under her maiden name and one under her married name. I have met several organic chemists who were amazed that Crowfoot of penicillin fame and Hodgkin of B_{12} fame could be the same person. W. L. Bragg has referred to her earlier work on cholesterol iodide (with H. Carlisle in 1945) and that on penicillin as passing the "sound barrier," meaning, surpassing by means of a physical method the bounds of the organic chemist's knowledge about the arrangement of the atoms in the molecule. Vitamin B_{12} was an even bigger boom. X-ray crystal-structure analysis is not a straightforward process of collecting and processing diffraction data, even in these days of big computers. Because of the phase problem it is a matter of the scientist's pitting his knowledge, skill, and imagination against the secrets of nature. Even simple molecules often have crystal structures which are exceedingly difficult to solve.

World White

Dorothy Crowfoot Hodgkin

Dorothy Hodgkin is a wizard at this intellectual unraveling and synthesizing process. She is a person who talks of her work with quiet enthusiasm. Since 1960 she has worked in a pleasant modern wing of the chemistry building at Oxford. Prior to that her laboratory was accommodated in the Ruskin Natural History Museum, a building which, both inside and outside, can only be described as bizarre. Her laboratory at Oxford is very informal, and everyone calls her Dorothy, which is rather unusual for a professor in Europe. It is a pleasant place to visit, since at least one-third of the members are charming young ladies intent on becoming distinguished crystallographers also—if they don't get distracted on the way!

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The Midwest: New Arrangement for Argonne Holds Promise of Greater Federal Financial Aid for Region

Last year, when the White House turned down a proposal to build a $170-million nuclear accelerator in Wisconsin, midwestern congressmen, egged on by university constituents, threw a political fit for the benefit of President Johnson (*Science*, 31 January). Johnson, who rejected the accelerator in the midst of his efforts to create an economy image for his newly installed administration, didn't reverse the decision. But he later eased the Midwest's pain by announcing that he had instructed the Atomic Energy Commission to work toward turning the Argonne National Laboratory, which the University of Chicago operates for the AEC, into the "nucleus of one of the finest research centers in the world." And he simultaneously ordered efforts to increase the participation of other midwestern universities in Argonne activities.

These were conciliatory and constructive goals, in Johnson's style of locating and exploiting the areas of agreement in a contentious situation. But since it was Argonne that had led the long and bitter fight to prevent a neighboring area from becoming a high-energy research center, there were reasonable doubts that interuniversity harmony could be fostered inside the Argonne fence by presidential decree or anything else.

Those doubts have not yet been altogether resolved, but the President's directive, rich with hints of Argonne's serving as a focal point for expanded federal support for midwestern research, was a starting point for dampening the squabbles of the region. And

late last month, in a 6-page communiqué, whose cautious wording reflected the sensitivities of the parties, the AEC announced agreement on several preliminary organizational steps aimed at implementing the President's directive.

The agreement not only brightens the prospects for a permanent end to the regional discord in which Argonne has been involved but it also raises interesting new possibilities for the management and employment of federally owned research facilities. This is a subject that has been receiving increasing attention in Washington for various reasons, including the onset of friction between government and university researchers over the distribution of research funds, as well as concern over the long-term future of mission-oriented laboratories whose missions may become obsolete.

Terms of Agreement

As spelled out by the AEC, the once-warring parties have given their "approval in principle" to an agreement that would for the first time bring midwestern representatives into the formulation of Argonne's "policies and programs." The University of Chicago would, however, still operate the laboratory, and, since the subject was not mentioned in the AEC's announcement, presumably the university would continue to receive the approximately $1.3 million paid annually by the AEC as a "management allowance" above and beyond the direct and indirect costs incurred in running the $66-million-a-year facility for the AEC. The allowance, which is described as "in lieu of identifiable costs," is something of a tender subject for the University of Chicago, since it contends that $1.3 million is insufficient to cover all the costs that crop up in running the laboratory. Others contend, however, that the allowance is sheer profit for the university, since the contract with the AEC covers every direct or plausible indirect cost the university can bring up. In any case, Chicago retains management of the laboratory as well as the allowance that has regularly gone with that role.

The vehicle for bringing other universities into policy making for the laboratory is to be a new nonprofit corporation whose board will include representatives of the 33-member Associated Midwest Universities (AMU) and the 15-member Midwestern Universities Research Association (MURA). In addition, the AEC's announcement stated, the board will include representatives of "the scientific community and the industrial community."

Thus, if the parties actually put their agreement into effect, Argonne will be operated under an administrative setup that could provide a great deal of useful experience on the employment of national laboratories as regional centers for research and training. Administratively, the Argonne arrangement falls between Brookhaven National Laboratory, in Long Island, which is operated for the AEC by the 13-member Associated Universities, Inc., and the AEC's Lawrence Radiation Laboratory, at Berkeley and Livermore, which is operated solely by the University of California.

The Argonne agreement, which, according to the AEC announcement, was "arrived at through several months of hard work," was negotiated under the close surveillance of the AEC, which had two goals in mind: to follow President Johnson's directive and to make certain that the increased participation by midwestern universities would not diffuse Argonne's control to a point where no one felt particularly responsible for anything. Since the AEC was present in the role of friend and banker, it wasn't too difficult for it to encourage the parties to arrive at a consensus.

As for the next step, it seems that the Midwest's new scientific bedfellows are a bit astonished that they have progressed this far, and since the AEC isn't setting any deadlines, things are quiet for the moment. The MURA research group, designer of the accelerator which Johnson decided not to build, was marked for extinction with that decision. But the political outcry in the Midwest brought it a reprieve, and $1 million in operating funds from the AEC. Along with that money came a decision to merge MURA's staff with Argonne, and that process is now under way, under apparently amicable conditions. At the moment, MURA exists as a separate entity, still located at Stoughton, Wisconsin, but funded by the AEC through a subcontract with Argonne. But next year the MURA group, which now consists of about 95 individuals, is likely to be fully blended into Argonne.

Some persons have interpreted the newly announced agreement as the first step toward taking Argonne completely out of the control of the University of Chicago and operating it under a group arrangement similar to Brookhaven's. At this point, however, that seems to be an unlikely development. Chicago derives considerable pride, distinction, and academic benefit from its intimate relationship with the laboratory, and it's not likely to yield total control passively. And, considering the talent that the Midwest has demonstrated for internecine warfare, the AEC quite understandably prefers to know precisely who's in charge of its $325-million Argonne plant.

Administrators of the laboratory and of the University of Chicago seem to be genuinely satisfied with the arrangements that have been worked out. Having contributed to the defeat of what many of them regarded as a threat from MURA, they have been decently magnanimous in victory, and they are looking forward to a regional effort that will indeed fulfill Johnson's expectations for the laboratory. It is their feeling that Argonne has been open to regional university participation, and that the complaints from neighboring institutions have been less from scientists than from administrators who would like to share in the prestige that radiates from the great installation. When one of Argonne's administrators was asked what the laboratory and the University of Chicago would gain from the agreement, his reply was, "Peace and quiet."

Political Implications

The proposal for greater regional participation in Argonne comes at a time when political fortunes are rising for the nation's scientifically less-developed areas. The University of Chicago and Argonne can't claim they haven't been well treated, but if the laboratory is to become a great regional center it can stake a claim for greater financial support, and with a broadened university constituency, it can expect greater political support in Washington. And it appears that the restoration of peace in the Midwest, along with the President's commitment to the development of Argonne, would make that facility a prime candidate for the funds that are just now beginning to be directed toward the fostering of scientific excellence in places that previously haven't fared too well with the federal agencies.

A few days before the Argonne agreement was announced, Representative Emilio Q. Daddario's subcommittee on Science, Research, and Development issued a report titled, "Geographic Distribution of Federal Research and Development Funds" (hearings and report, available without charge from the

Committee on Science and Astronautics, House of Representatives, Washington, D.C.). The report concluded that the geographical distribution of federal research funds is uneven to a "pronounced" degree, and that something should be done about it. It was recommended by the committee that, in seeking to help the have-nots, "particular care must be taken not to detract from or penalize those institutions and areas which, due to their own wisdom and effort, as well as their favorable locations, have built the kind of research competence to attract Federal grants and contracts." And it was pointed out that the concept of "uneven," in reference to geographical distribution, is a complex one. California ranks first in terms of percentage of federal R&D dollars, but on a per capita basis it is third, behind Nevada and New Mexico. Massachusetts, which was third in dollar totals, was ninth in the per capita standings. Ranked in terms of federal research and development funds versus federal tax collections, it turned out that New Mexico received $970 in R&D funds for every $1000 that it paid in federal taxes. California, the envy of the have-nots, got back only $388 for every $1000. These numbers, of course, illustrate the perils of statistics, and the committee went to some lengths to emphasize its appreciation of the complexities. But it couldn't get away from the fact that more than half of the federal government's R&D awards go to three states—California, 38.4 percent; New York, 9.2; and Massachusetts, 4.6—and it appears not to have been happy with these findings.

In telling what it thought should be done about it, the committee recommended, among other things, that the White House call a conference to study the problem, that the National Science Foundation earmark funds for "insuring the existence of at least one major center of excellence in research and technology in each appropriate region of the nation," and that federal agencies, particularly the Defense Department and the National Aeronautics and Space Administration, try to use their expenditures to help promote institutional excellence.

What is perhaps most significant about these recommendations is that they represent additional, and influential, support for getting away from the concept that the federal research agencies should be paying only for research and closely allied matters when they provide funds for the nation's universities. The concept has been quietly eroded over the past few years, simply because of the financial plight of the universities, and the principle of paying for no more than research has been stretched to cover a good many other things. But Congress has traditionally been balky about general support for higher education, and outside of NSF's carefully conceived and cautiously operated Science Development Program, the Congress has withheld its sanction from proposals to put the federal government opening behind efforts aimed at building institutional excellence, rather than simply buying research. The Daddario report represents another step toward changing congressional attitudes in this area. Over the next few years, it is likely that the Midwest, outside the mainstream of federal support but still high in quality and aspiration, will find Washington increasingly attentive to its needs.—D. S. GREENBERG

Comsat II: Commercial System to Avoid Tie with Defense Department; Company Now Faces Other Problems

Complicating, and at times threatening, the Communications Satellite Corporation's recently concluded talks for an international partnership were its simultaneous efforts to work out a joint arrangement with the Department of Defense. From Comsat's point of view, the reason for seeking such a liaison was simple: the Pentagon promised to be a customer whose traffic might bring in as much as $35 million a year. The Pentagon's motives were more complicated and have their roots in the muddled history of the department's attempts to develop a satellite communications network of its own.

Defense Department research in the field of communications satellites began in the Eisenhower administration, around 1958. By the time the Pentagon came under the jurisdiction of Kennedy's defense secretary, Robert S. MacNamara, the decision had been made that a synchronous satellite would best meet the military need for a flexible, reliable, and virtually jamproof communications network. Very late in Eisenhower's term, management responsibility for the satellite project, known as Project Advent, was transferred from the department-level Advanced Research Projects Agency (ARPA) to the Department of the Army. Operational responsibilities were divided among the three services, with the Army responsible for developing communications equipment for satellites and ground stations, the Air Force responsible for launching and maintaining the satellites, and the Navy charged with constructing and operating a shipboard receiving station.

This management arrangement, which was continued by MacNamara, appears to have been one of the major sources of the malaise that afflicted Advent from its inception. Although Harold Brown, Director of Defense Research and Engineering (DDR&E), told a subcommittee of the House Committee on Science and Astronautics that studied Advent in the fall of 1962 that "interservice rivalries in the strict sense are not believed to have been an important factor in the difficulties with the Advent program," a better characterization of the situation is difficult to find. Before the transfer of responsibility from ARPA to the Army, for example, the Air Force had a contract with the Space Technology Laboratories (STL) for systems engineering and technical advice on Advent. After the Army assumed management, it also negotiated a contract with STL, whereupon the Air Force closed out its contract with STL and contracted with the Aerospace Corporation, instead. On another occasion the Air Force refused the Army's request to station representatives of the Army's Advent management group at the General Electric plant where the Advent satellite was being developed under an Air Force contract.

How much the technical problems were the result of the managerial ones, or how much they flowed simply from the highly ambitious nature of the project is hard to say. In any event, the costs rose, the time allotted the program stretched out, and the various components of the project ceased to have sensible relation to each other. Thus, it had originally been planned that the Advent satellite would weigh about 1000 pounds (453 kilograms) and that it would be lifted into orbit by the Atlas-Centaur booster, which was expected to have at least that capacity. But by the spring of 1962 it appeared that the weight of the satellite had increased to over 1300 pounds, while at the same time the boosting capacity of the Centaur had fallen considerably below what had been anticipated. In the end it was this widening gulf between expanding satellite weight and shrinking booster capacity that forced the Department of Defense, after exhaustive studies, to change its plans.