day, and they cannot be ignored without penalty.

Finally, I realize, of course, that there is no "compleat" botanist, nor can there be, because no single individual can master all of botanical fact and philosophy. The easy way out is to specialize and "let the rest of the world go by." But we must strive toward the ideal of a broad perspective, for botanists above all others should understand the relationship between society and plant resources and should be able to impart to their students and to society at large the importance of this relationship to the present and future welfare of man.

References and Notes

1. Evidently, it wasn't so clear to some botanists, who asked in all seriousness why I did not edit the title. This perhaps helps emphasize one of the points I am trying to make.
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NEWS AND COMMENT

Nobel Prize in Chemistry Awarded to Crystallographer

An Englishwoman was named last week as the sole recipient of the 1964 Nobel prize for chemistry for her work on the structure of biochemical compounds essential to the understanding and control of pernicious anemia. She is Dorothy Crowfoot Hodgkin, Wolfson research professor of the Royal Society in the Chemical Crystallography Laboratory of Oxford University, England.

Research directed toward understanding the chemistry of life processes has pointed increasingly clearly in recent years to the necessity for detailed stereochemical knowledge, on the atomic scale, of the structure of the molecules involved. These structures are frequently so complicated that attempts to represent them by formulas on paper give little account of the true shape of the molecule and fail to represent important spatial relations. Dorothy Hodgkin's achievement is twofold. She has determined the structure of a very important and complicated molecule, vitamin B_{12}, and some related structures. She has also demonstrated that it is possible to "solve" such complex structures by x-ray diffraction and to think about these complex molecules in "mental stereo." She has contributed to the understanding of vitamin B_{12} chemistry not only by the results of her research, as they became available, but also by her particular three-dimensional viewpoint of the molecular structure. A keen awareness of the potential significance of structure to the chemistry and biochemistry of the molecules in which she has been interested has always been the keynote of Dorothy Hodgkin's work.

A quotation from the Biological Chemistry Section of the *Annual Reports on the Progress of Chemistry* for 1961 gives a simple illustrative example of this type of contribution to an understanding of vitamin B_{12} and its coenzyme. "These [chemical] results could not be rationalized however until x-ray crystallographic analysis [by P. G. Lenhert and D. C. Hodgkin] showed that adenine is present as its riboside and that the riboside is, surprisingly, linked directly to cobalt at C-5′." As in the analysis of the crystal structure of hemoglobin, which was similarly recognized 2 years ago, the research on vitamin B_{12} was conceived and begun over a decade before it came to fruition in a series of papers published in the *Proceedings of the Royal Society, London*, between 1957 and 1962. To quote from one of these, "The very beautiful x-ray photographs obtained soon after vitamin B_{12} crystals were first examined by x-ray methods (in 1948) showed that it was formally possible to solve the structure of the crystals by x-ray analysis." In 1950 the word *formally* meant to most crystallographers that the idea of tackling such a complex molecule was too discouraging. But, nevertheless, the diffraction data were collected from several different derivatives by different co-workers and collaborators during the next 6 years. By the time computer manufacture had begun to catch up with the complexities of nature, and the necessary calculations could be carried out. By 1957 the main features of the structure of $C_{63}H_{88}N_{14}O_{14}PCo + 18\ H_2O$ were solved, and the details were filled out in four more publications in 1959 and 1962. The majority of the earlier computations were made on the National Bureau of Standard's SWAC in Los Angeles, and toward the end a mercury computer was in operation at Oxford.

This chronology of an exciting scientific adventure would be very unpopular with Dorothy Hodgkin if mention were not made of her collaborators in this work—J. Kamper, June Lindsay, M. Mackay, J. Pickworth, J. H. Robertson, Clara Brink (now Mrs. David Shoemaker), J. G. White (who valiantly pursued an independent study in the early stages on a hand calculator at Princeton University), R. J. Prösen, R. A. Sparks, and K. N. Trueblood at the University of California, Los Angeles.

Dorothy Hodgkin is the third woman to win the Nobel prize in chemistry. When the award was announced she was in Ghana with her husband Thomas, who is director of the Institute of African Studies at the University of Ghana in Accra. They have three grown children—Luke, teaching mathematics at the University of Algiers; Elizabeth, teaching in a girls' school in Zambia; and Toby, a voluntary social worker in India. Luke has three children, so Dorothy 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!

G. A. JEFFERY
Crystallography Laboratory, University of Pittsburgh, Pittsburgh, Pennsylvania

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