

rections along the *c*-axis, as in the ideal structure (structure A, Fig. 2), or in the same direction (structure B, Fig. 2), without appreciably changing the environment of any atom. Hence, the two structures must be energetically nearly equivalent. As a result, in actual crystals of rutherfordine, faults occur in the stacking of the layers; regions in which the sequence of layers corresponds to structure A are occasionally terminated by regions in which the layers follow the sequence of structure B. There is evidence that the degree of disorder may differ significantly from crystal to crystal, perhaps as a function of the age of the crystals. This situation has not yet been completely analyzed.

#### References and Notes

1. Publication of this paper was authorized by the director of the U.S. Geological Survey. This work was completed as part of a program undertaken by the U.S. Geological Survey on behalf of the Division of Raw Materials of the U.S. Atomic Energy Commission. We are indebted to Clifford Frondel of Harvard University for the mineral specimen from which the crystals of rutherfordine were obtained. A detailed discussion of the structure of rutherfordine, particularly of the nature of the disorder and its mineralogical implications is in preparation.
2. P. D. Miller, H. A. Pray, H. P. Munger, U.S. Atomic Energy Comm. Rpt. AECD-2740, Aug. 1949.
3. I. Fankuchen, *Z. Krist.* **91**, 473 (1935); W. H. Zachariasen, *Acta Cryst.* **1**, 277 (1948).
4. F. H. Ellinger and W. H. Zachariasen, *J. Phys. Chem.* **58**, 405 (1954).

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## Communications

### Big Business and Research

R. W. Lippman has made a comment [*Science* **120**, 1036 (1954)] about big business and scientific research that runs counter to my own experience. I think it creates, moreover, a rather false notion of the way many business corporations look on the role of basic science in today's world. Lippman states that anyone who has tried to find money for basic research from business organizations knows the difficulties. He states that even what business calls basic research is not that but, rather, something of limited scope and usually directed toward the solution of a specific project in which the company has a direct business interest.

It is true that responsible officers of large corporations often feel that their support of basic scientific research must be directed toward something with relevance to the operations of the company. But this does not mean that such officers seek to impose limitations on the nature of the research, its directions, or its outcome. Moreover, there is a fast-growing tendency for the managements of many large corporations to make very liberal interpretations of the interests of the companies in judging what is proper for them to support.

Our observatory has just completed the construction of a new solar laboratory made possible by some 37 nongovernment donors. The building will be used for fundamental research in solar astronomy. No specific company will gain direct benefit from our research, although the welfare of the nation as a whole will be advanced. No "practical" goals have been set for our study, and no conditions of any sort have been imposed by any donor. I have just made a quick count, and, of the 37 contributors, 11 were corporations, six of which are definitely in the category of "big business." In addition, at least nine contributions were made by individuals who were primarily businessmen. Moreover, seven additional contributions were given by foundations established by men who had made their fortunes in business.

Naturally we expect that our basic research will have widespread practical application and, thus, will materially benefit a wide variety of interests. But no individual company can expect to be preferentially aided. The support so generously given is for basic research—and the fact that such support is available is an evidence, to my mind, of the sound insight of these business executives into the role of fundamental science in modern life.

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### Influence of Humic Acids on Plant Growth

Recently attention has been paid to the ferric chelate of ethylenediamine tetraacetic acid (EDTA) as a source of iron for plants in nutrient culture (1) and for chlorotic fruit trees (2). Evidence that the FeEDTA molecule was absorbed and translocated as a whole was provided by supplying FeEDTA containing isotopically labeled nitrogen, whereupon it was found that the amounts of iron and isotopic nitrogen reaching the leaves were in stoichiometric agreement (3).

In recently described experimental work (4) in which the roots of a sunflower plant were divided so as to absorb nutrients from two containers, it was demonstrated that the plant grew healthily if EDTA was supplied to one compartment and iron and phosphate to the other, whereas the plants became chlorotic if EDTA was omitted.

In our earlier work (5) we showed that the growth-promoting effect of a lignite was the result not of its trace-element content but of humic substances that made iron in the nutrient solution readily available (6), even in the presence of high phosphate. Iron chlorotic plants were found to have high concentrations of iron in the roots, probably immobilized as