AN Associated Press dispatch from Stockholm reports that six Nobel prizes will be awarded for 1944. There will be two prizes in physics, two in chemistry, one in letters and one in medicine.

IT is reported that the Society for Visiting Scientists, with premises at 5, Old Burlington Street, W.1, London, has been founded on the initiative of the British Council, in consultation with the Royal Society, to provide a meeting place and information center where scientists can be given advice and information about scientific institutions in Great Britain. In many other countries houses and organizations have been established for the use of visiting scientists and scholars. One of the best known of these is the Fondation Universitaire, Brussels, and there is another center in Leningrad, which occupies one of the palaces next to the Winter Palace beside the River Neva. London hitherto has had no center of the same kind, even on a modest scale, for it is not part of the ordinary work of scientific societies to look after the more general needs of visiting scientists. The information center now will be at their disposal, and any scientist arriving in Britain can go at once to the house, use the facilities offered and find out how he may apply for membership. The president of the society is Professor F. G. Donnan, who is also the acting chairman, and the chairman of the honorary council is General Smuts. The honorary presidents of the society are Sir Malcolm Robertson, M.P., and Sir Henry Dale.

DISCUSSION

THE OBLIGATIONS OF A SCIENTIST

THE criticism has frequently been raised that scientists are as much responsible for the evils of civilization and the horrors of war as they are for the good arising from their contribution to our present technical advancement. The implication of the criticism is that scientists should either limit the breadth of their activities or else guide the application of their work so that their results could not possibly be misused. The object of this note is to make two points: one, there is no valid basis for such criticisms of science; two, a scientist has certain obligations which, if met, discharge his responsibilites to society.

The fallacy of a scientist being able to predetermine all the ultimate uses to which the results of his efforts might be put is self-evident. In addition, it could be argued extensively and successfully that the good arising from the results of scientific effort has far exceeded the evil. But in a larger sense science is responsible for neither. The principal concern of science is to add to our knowledge. It should not be considered primarily responsible for the use society makes of that knowledge. In the final analysis it is the option of society to approve or reject the utilization of these additions. Many cases are on record in which society has permitted the withholding of technical advancements, even though they were of obvious benefit. Is it not then equally the option and obligation of society to reject such applications of knowledge as would appear to be detrimental to the common good?

The duty of the scientist is to search for truth disinterestedly and to present his findings without prejudice. One of the principal duties of students of social problems should be to examine and recommend the best utilization of the advancements of science.

Such a division of responsibility is inherent with the complexities of our civilization. The achievement of an advance of real worth may require the undivided attention of one or more scientists for an extended period. Fortunately, the results of years of work can often be summarized concisely, even into a single word such as "penicillin." Although many scientists can suggest applications for their findings, it requires also the full cooperation of those concerned with social problems to achieve the maximum benefit from even such an obviously desirable discovery as penicillin. The final responsibility of the utilization of knowledge rests upon this group and not upon the scientists who discover it.

Does this mean then that the scientist is free to become a recluse and ignore the world about him in the pursuit of his scientific interests? No, a scientist has obligations to his calling and to society which can not be ignored.

First, and most important, is his obligation to the scientific method. Too often does one meet workers in scientific fields whose fine training has been lost through subjugation of scientific principles to personal whimsey. A scientist must constantly reexamine himself and his work and keep both in line with the most rigorous scientific precepts. Only by so doing can he be sure that his efforts will be a real and lasting contribution to society.

Second, a scientist must conscientiously instruct those who come under his tutelage, whether they be students or associates. He must instruct them both in the scientific method and in knowledge which has been established. It is as essential to pass on the scientific method to future generations as it is to practise it. Courses which are alleged to emphasize training in the scientific method should not ignore it

completely! (In this connection Richmond's[1] recommendation of a course in "scientific method" for all college students is one that should be considered most seriously). It is important also for a scientist to fulfil his teaching obligations completely. A teacher in science must constantly add to his personal store of knowledge new facts as they are made known. He must sift these carefully and give his students a sound foundation to which they can add the advancements that accrue in their lifetimes.

Third, a scientist has the obligation to indicate clearly to society what good he believes might be achieved from his contribution to knowledge. This is an obligation which should be taken seriously. Although he may not know fully the needs of society, he knows his work, and he should where possible take the first step towards the full utilization of his results.

It is possible that many would wish to modify these suggestions. It might be valuable to amplify and extend them. If, however, this discussion stimulates the reader to consider his relations to society and the obligations which they impose, the writing of this note will have been well justified. If, however, a scientist should acknowledge the three obligations listed here and conscientiously attempt to fulfil them, he is worthy of a respected place in society and his contributions will be lasting. After the scientist does his part, it is then the duty of those who guide society to see that means are available for the utilization of the achievements of science for the highest good.

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BIOLOGICAL TERMINOLOGY

AN additional point may be considered in the discussion of the college course in elementary biology.[1]

We may expect that the course will justify the effort required in installing and giving it, and that it will overcome the distrust of specialists and win a better place in the curriculum than that of a tolerated alternative. These hopes can scarcely be fulfilled, however, while many fundamental terms, common to all branches of biology, are used in distinctly different senses by specialists in the different branches. If the instructor in biology, being a zoologist, teaches these terms definitely in the senses to which he is accustomed, he imposes a handicap upon any of his students who may subsequently take up botany. This is the factual basis of the trite witticism that biology is botany taught by a zoologist.

[1] SCIENCE, 99: 2576, 385, 1944.

[1] The presentation of this course is defended in SCIENCE, volume 99 (1944), by G. Alexander, p. 78; L. J. Milne, p. 471; L. H. Taylor, p. 364; and M. B. Visscher, p. 383.

With diffidence, I submit the results of efforts to frame generally acceptable definitions for some of these terms. The results would be more recognizably authoritative if it could be shown that each term had been traced back through historical usage to original publication. Such is not the case. The definitions presented are based on much reading of text-books, on conversation and on experience in both ends of the classroom. In intention, at least, due weight has been given to original and current usage, to etymology and to the application of words to facts.

CELL AND PROTOPLAST

The word "cell" was brought into biological usage by Hooke, who designated by it minute cavities discovered by him in cork. Lamarck and Mirbel are said first to have formulated the principle that organisms consist entirely of cells and cell products. According to this principle, the cell may be defined as the unit of structure and function in organisms. In animal bodies, most of the units so described consist entirely of living substance. If, however, one defines the cell as the unit body of protoplasm, one comes into conflict with the basic meaning of the word, and with prior botanical usage which applies it to walled spaces from which the living substance has disappeared. The living unit is properly designated by a term ascribed to Hanstein:

A protoplast is a unit body of protoplasm.

The infallible mark of the individual protoplast is not the nucleus. It is the continuous differentiated living membrane called the plasma membrane or cell membrane.

A cell is a unit of structure and function in organisms, consisting of one protoplast together with any lifeless structures which may be attached to it, or of the lifeless remains of the same.

Thus the unit of the bodies of animals is at the same time a protoplast and a cell; the active unit in plants, containing a vacuole and possessing a cell wall outside the cell membrane, is a cell of which a protoplast is a part; a fiber of cotton is a cell from which the protoplast has disappeared.

RESPIRATION AND ENERGESIS

Forty years ago, the botanist Barnes, studying respiration according to the accepted botanical meaning of the term (which excludes breathing or gas exchange) consulted zoological literature and found out that breathing or gas exchange is precisely what it means. The zoological usage is justified by priority and etymology; Barnes coined the term "energesis" to replace it as it had been used in botany. That this term has not been in general use is an example of the perversity natural to man.