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## OPPORTUNITIES FOR RESEARCH

By F. K. RICHTMYER

The Optical Society of America is fortunate in having come into existence at a time when it is unnecessary to overcome the indifference—not to say prejudice—formerly experienced by some of the older scientific societies. The whole world today recognizes its debt to the scientist. The graduates of our universities need no longer look forward to teaching as the only career open to them, for biologists, chemists, physicists are demanded by the industries in increasing numbers. The growth of the industrial research laboratory is a matter of common knowledge.

Realizing the extent to which the advances of applied science depend directly on the advances of pure science, the Optical Society should early consider the means available for actively promoting research work in the several branches of Optics.

The Society itself cannot, as a society, engage directly in research. But there are several ways in which it can actively, through various standing committees, further the doing of research.

For example, there are, throughout the country, a large number of potential investigators who simply need encouragement, or the suggestion of some specific problem, to get a start on research. Many a promising

young scientist, after graduation, has found a place as teacher in some smaller university, where, lacking the inspiration of co-workers, or perhaps suitable apparatus, he has gradually lost his enthusiasm and has become content to use his full time in the routine duties of teaching. There are over 500 colleges in the United States, but only a very small proportion of them can be classed as contributors to the work of the several scientific societies. One of the most potent means for utilizing, to the full, our research facilities is to take active and immediate steps to enlist the services of these men who, not being *required* to do research, are content to sit aside and watch others.

It is true that the university is the home of pure science. But the average university regards the doing of research not as a duty but as a privilege, freely or grudgingly extended, as the case may be. There are many who regard this attitude as inadequate—perhaps even unworthy of the university of today. The doing of research should be a part of the duties of every university professor, on a par in every way with teaching. The Optical Society can further the general recognition of this principle by creating on the part of those (at present) scientifically inactive teachers a demand for research facilities.

What is needed is suitable machinery for collecting a variety of specific (not general) research problems, and placing them before potential investigators, either through the columns of the JOURNAL or otherwise, with such individual encouragements as may be necessary to ensure a start on the work.

The collection of such problems should not be difficult in a society like the Optical Society, which is composed of both the pure science and the applied science groups of workers. We hear much today about the utilization of by-products. The by-products of any scientific investigation is a large number of problems more or less closely connected with the work in hand, but which must be absolutely passed by if the investigator is to proceed along the main lines of his investigation. These side issues, if they be followed out, frequently lead to results of quite as much importance as the original problem. The discovery of the phenomenon of photoelectricity by Hertz is a case in point. An important part of the report on any investigation should be a brief summary of such side problems as the investigator is willing to pass on to his fellow workers.

The increasing importance of the work of the scientist has imposed on him new obligations. What these obligations are, and how they can

best be met, are questions which are being considered by a number of scientific societies and organizations at work on the problem of utilizing and organizing our research facilities. Whatever be the lines along which such organization takes place, due recognition must be given to the fact that advance in science is almost exclusively due to the insatiable curiosity of the individual; on his desire to "learn the truth," regardless of what its ultimate value measured in material standards may be. Any organization of research must therefore leave the individual worker, once started, free to follow paths of his own choosing. Perhaps in this connection the phrase "co-operation in research" is preferable to "organization of research." The latter implies a central agency directing research toward a definite end. The former suggests the banding together of individuals whose interests are mutual. It is a case of the monarchy as contrasted with the democracy.

In other words, the Optical Society should not be content to hold meetings a few times a year and to publish a journal. Its opportunities extend far beyond these functions, which up to the present time have been the chief, if not the only, activities engaged in by many societies.

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## THE NATURE OF THE VISUAL RECEPTOR PROCESS<sup>1</sup>

By LEONARD THOMPSON TROLAND

### I

The attempt to analyze the process of visual response into its constituent phases, and to determine the mechanism of these phases, makes progress by purely physical and inductive methods, so long as attention is confined to the relation between the external object and the image which is cast upon the retina. However, as soon as we proceed to inquire into the nature of processes of vision which lie posterior to the retinal image, we find ourselves forced to rely primarily upon the method of hypothesis and upon a study of the psycho-physical laws which correlate the dimensions of the stimulus (radiation) with those of our visual experience. The method of hypothesis becomes legitimate only when our speculations or inferences are given a form which is sufficiently definite to permit an accu-

<sup>1</sup> Presented before the Optical Society of America, at the New York meeting held December 28, 1916.