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of large numbers of otherwise intelligent people being unable to grasp fundamental ideas in mathematics and science.

HY RUCHLIS

Science Materials Center, New York

Publications and Basic Research

In his article "Basic research in industry" J. C. Fisher [*Science* **123**, 1653 (1959)] attempted to gauge the extent of basic research in U.S. industry by a count of scientific publications. I suggest that Fisher's basic assumption may contain a much larger error than he recognized.

Fisher assumes that a count of publications gives a "relatively good picture of the quantity and distribution of basic research effort." He also states, "Publications were counted indirectly, by counting abstracts . . . in the 1955 volume of *Chemical Abstracts*. . . . It is only approximately true that *Chemical Abstracts* finds and abstracts all publications concerned with basic research and rejects all publications concerned with applied work. However, the proportion of abstracts dealing with applied work appears to be *reasonably small and invariant*" (italics mine). It is this latter premise which my associates and I question.

Through the courtesy of Fisher, we obtained a list of the titles of those articles which he counted in the 1955 volume of *Chemical Abstracts* for Esso Research and Engineering Company, Humble Oil and Refining Company (which carries out research and development under contract to Esso Research), and two other leading petroleum research organizations. We have analyzed the articles so listed and find that the bulk of these articles would, in our opinion, be classed as other than basic research. Furthermore, the proportion of papers which we would class as basic research varies greatly, from about 10 to 48 percent of the total listed in *Chemical Abstracts*.

Fisher's tabulation of papers for Esso Research and Engineering Company also was incorrectly low, due to his assignment of ten Esso Research papers to Standard Oil Company (Indiana). A paper originating from Standard Oil Company of Ohio was also attributed to Standard Oil Company (Indiana). These errors perhaps arose because various companies use the Standard Oil name. The papers appearing in 1955 *Chemical Abstracts* were published from the Standard Oil Development Company, the predecessor to Esso Research and Engineering Company.

A final comment—there has been a marked increase since 1953-54 in the

amount of basic research being done by private industry. I am sure Fisher would be the first to suggest that this subject warrants an up-to-date and quantitative analysis.

W. T. KNOX

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I wish to thank W. T. Knox for finding the error in Table 1 of my article, wherein ten papers belonging to Esso Research and Engineering Company were mistakenly attributed to Standard Oil Company (Indiana). The wrong figures were

Rank	Company	No. of publications
13	Standard Oil (Indiana)	48
48	Esso Research and Engineering	13

The correct figures are

Rank	Company	No. of publications
15	Standard Oil (Indiana)	38
28	Esso Research and Engineering	23

The change affects the position of Standard Oil (Indiana) relatively little, moving it from 13th to 15th position. Esso Research and Engineering is more significantly affected, moving from 48th to 28th position. The error came about because Esso Research and Engineering changed its name from Standard Oil Development during the period covered by the study, and the earlier name did not appear in my check list of companies and affiliates (*Poor's Register of Directors and Executives*, 1956). I extend my apologies to Esso Research and Engineering for the error.

The Standard Oil of Ohio paper mistakenly attributed to Standard Oil (Indiana) seems to be an example of the random errors that arose because of company names that were missing, wrong, or incompletely given in *Chemical Abstracts*.

The assumption that a reasonably small and invariant proportion of abstracts dealt with applied work is not as good as I had thought, and I must agree with Knox's criticism of this point. My associate, J. B. Newkirk, has made an independent study of this matter and feels that only about half of the chemistry research and two-thirds of the physics research was properly classifiable as basic. Although the proportion of basic work abstracted by *Chemical Abstracts* is smaller than I had thought, I believe that the general conclusions of the study remain valid. Certainly a more up-to-date study is in order to show the considerable growth of basic research in industry since 1954.

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