Letters

Science and Engineering Manpower

Your news article on science and engineering manpower [*Science* **135**, 301 (26 Jan. 1962)], together with the volume of public mail in response to the President's statement at his press conference on 15 January, emphasizes the importance of the studies the President has requested. Despite differences of view over whether or not the drop in engineering enrollments is significant, and despite inadvertent errors, originating in my office (in the statistics included in the press conference statement, the year 1951 should have read 1950 in the listings of graduates in sciences, and engineering enrollments for 1951 should have read 146,000), there is, nevertheless, a growing consensus that major problems may be developing as we move further into the 1960's. As a minimum, there is an urgent need to understand the significance of the many statistics and statements relating to the subject of technical manpower.

We probably need better statistics and, more important, better analyses of what the statistics mean. For example, figures comparing present college enrollments with what they have been during the past decade are badly confused by the post-World War II "bulge." But regardless of any difference over numbers, the simple fact is that it is time for searching study and analysis of our technical manpower—its quality and utilization, as well as its quantity—and its implications for public policy. Similarly, we must make careful assessments of the demands our expanding research and development programs, both public and private, will place on our technical manpower resources. It is precisely such studies that the President now has asked for.

One matter of primary concern in the consideration of technical manpower problems is that of quality. I am convinced that it is necessary to improve the over-all quality of science and engineering education at all levels, to stimulate a high order of advanced training through research, and to make it possible for scientists and engineers to enhance their professional skills and to utilize their talents to the fullest. It is also necessary, in the planning of the government's research and development programs, to give greater emphasis to the effective use of technical manpower. The effective employment of our scientists and engineers is important for the individual as well as for the nation. In my view, far too little attention has been directed toward determining how effectively the national pool of scientific and technical manpower is distributed among industry, government, and universities, or to gaining a better understanding of the technical manpower needs and practices of each of these sectors and of the factors that influence manpower distribution.

It is for these reasons, among others, that there is a need for more study of our human resources for research and development.

JEROME B. WIESNER
The White House, Washington, D.C.

Research in Australia

My associates and I feel that the article "Financing scientific research in Australia" by S. Encel [*Science* **134**, 260 (1961)] presents an inaccurate and unflattering picture of this company's contribution to research. The following facts are provided in the hope that their publication may lead to a more balanced picture.

Encel says: "In 1955 the company embarked on a research program which has involved a capital cost of over £A400,000 ($1 million) to date, and its annual expenditure is now about £A100,000. It employs about 90 scientists, engineers, technicians, and geologists." Later, in commenting on a total estimated industrial research budget of about £A5 million, he says, "Almost all of this is for 'development' rather than 'research'."

The figures in the first quoted passage apply reasonably well to staffing and expenditure at the Central Research Laboratories alone at a time about 2 years ago. However, this is only one facet of research in this company. The Central Research Laboratories were opened in March 1957 to undertake fundamental and long-term research for the steel industry. Prior to that date research was conducted for the individual steel plants, and still is, in even greater volume.

Laboratories at present operated by the company for research purposes include the Central Research Laboratories at Shortland, the Works Research Laboratories at Newcastle and Port Kembla, the Central Mineral Dressing Laboratories at Whyalla, and smaller but important facilities in sev-

eral subsidiary plants. A modern and well-equipped research laboratory is also maintained in Newcastle by the firm of John Lysaght (Australia) Limited. This is in no way connected with our own organization.

In addition to these installations, which exist purely for research, there are other departments where a good deal of research and investigation are carried on. A new million-dollar control laboratory at the Newcastle Steelworks will undertake many activities normally listed under the research budgets of industrial concerns, quite apart from its responsibilities in control chemistry and metallurgy. The same may be said of new facilities proposed for Port Kembla and Whyalla.

Further, all evaluation and exploration of ore deposits is carried out by the Department of Raw Materials and Exploration, whose expenditure would not have appeared in Encel's listing.

The staff now directly engaged on research is as follows: Central Research Laboratories, Shortland, 117; Works Research Department, Newcastle, 30; Works Research Department, Port Kembla, 25; Central Mineral Dressing Laboratories, Whyalla, 12. The Department of Raw Materials and Exploration employs 40 graduate geologists and other scientists, including field officers.

A total budget for all research and development conducted by the company would be difficult to compute. The current research budget for the Central Research Laboratories alone is very nearly twice the figure Encel has given for the entire industry. The other branches are proportionately financed.

It should also be pointed out that by no means is "almost all" of this expenditure for "development" rather than "research." Four major projects at Shortland now are entirely innovative, and a great deal of fundamental work is done that is either complementary to or independent of these. These laboratories are engaged almost exclusively on "research"; "development" is undertaken by Works teams as the projects progress. A smaller, though important, proportion of the work undertaken by the Works Research laboratories is true research, either independent of or supplementary to developmental function. Much of the developmental work done at the Works laboratories is also innovative; though applied and practical, it calls for scientific rigor and academic competence and makes a real contribution to knowledge in the general sense.

We realize that delays in publication

may be responsible for the article's inaccurate appraisal of the present situation, but since the expressions "expenditure is now" and "under present conditions" are used, we feel that the company's true present position should be made known. It is about five times better than it would appear to be from the article.

J. L. JENKINS

Broken Hill Proprietary Company, Melbourne, Australia

It is gratifying to learn that the expansion of basic research within the Broken Hill Proprietary Company is proceeding so rapidly. However, I do not think that the information contained in Jenkins's letter should be regarded as having any significant bearing on my article. The article was written to provide data for Australia which were comparable with the analyses of expenditure on scientific research produced by the National Science Foundation, the British Advisory Council on Scientific Policy, and the recent NATO study group on scientific expenditure in the Western countries. In order to express these figures as a proportion of the national income, I decided to use the year 1958–59, which was the last financial year for which complete figures were available at the time my article was written (in November 1960). The article is, therefore, intended to convey a comprehensive picture of the situation in Australia as it was roughly at the beginning of 1959.

I did, however, hint in my article that changes were taking place, and the speed of these changes is indicated in Jenkins's letter. In the last 3 or 4 years the expansion of basic research in a number of large industrial firms has gone on with increasing speed. Two other notable examples are the Colonial Sugar Refining Company and Imperial Chemical Industries, of Australia and New Zealand. However, this growth is too recent to reflect substantially on the emphasis of my article, and in any case it is still confined to a very small number of leading firms. I might perhaps add that my comments about Australian industry were directed to industry in general, and my article makes no specific reference to the balance between basic research and development in the Broken Hill Proprietary Company in particular.

S. ENCEL

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Meetings

Forthcoming Events

February

19–23. American Soc. of Civil Engineers, Houston, Tex. (W. H. Wisely, 345 E. 47 St., New York 17)

19–23. Automatic Control in the Iron and Steel Industry, intern., Brussels, Belgium. (Institut Belge de Régulation et d'Automatisme, 98 Chausèe de Charleroi, Brussels 6)

20–21. International Inst. of Sugar Beet Researchers, winter congr., Brussels, Belgium. (O. J. Kint, HSBR, 152 rue Beauduin, Tirlemont, Belgium)

21–25. National Assoc. for Research in Science Teaching, Washington, D.C. (H. Branson, Dept. of Physics, Howard Univ., Washington 1)

22–24. American Acad. of Forensic Sciences, Chicago, Ill. (W. J. R. Camp, Univ. of Illinois, 1853 W. Polk St., Chicago 12)

22–24. Genetics Soc. of Canada, Winnipeg, Man., Canada. (Scientific Liaison Office, Natl. Research Council, Sussex Dr., Ottawa, Ont., Canada)

23–24. American Physical Soc., Austin, Tex. (K. K. Darrow, APS, Columbia Univ., New York 27)

23–24. Canadian Aeronautical Inst., mid-season meeting, Halifax, Nova Scotia. (Scientific Liaison Office, Natl. Research Council, Sussex Dr., Ottawa, Canada)

25–1. Pan American Assoc. of Oto-Rhino-Laryngology and Broncho-Esophagology, Caracas, Venezuela. (C. M. Norris, 3401 North Broad St., Philadelphia 40, Pa.)

26–28. Importance of Electricity in the Control of Aircraft, conf., Inst. of Electrical Engineers–Royal Aeronautical Soc., London, England. (Secretary, IEE, Savoy Place, London, W.C.2)

26–29. Central Treaty Organization, Economic Committee, Washington, D.C. (Office of Intern. Conferences, Dept. of State, Washington 25)

26–2. Current Trends in Nuclear Power, symp., Tucson, Ariz. (L. Weaver, Nuclear Engineering Dept., Univ. of Arizona, Tucson)

27–1. Application of Switching Theory in Space Technology, symp., Palo Alto, Calif. (J. P. Nach, Lockheed Aircraft Corp., Sunnyvale, Calif.)

March

1–3. Florida Acad. of Sciences, Gainesville. (J. B. Lackey, Dept. of Civil Engineering, Phelps Laboratory, Univ. of Florida, Gainesville)

1–3. Fundamental Cancer Research, Conceptual Advances in Immunology and Oncology, symp., annual, Houston, Tex. (Univ. of Texas, Anderson Hospital and Tumor Inst., Houston 25)

1–3. Scintillation and Semiconductor Counters, 8th symp., Washington, D.C. (G. A. Morton, RCA Laboratories, Princeton, N.J.)