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The Industrial Scientist as Citizen

By JOHN MILLS

The part that should be played by engineers and scientists in the postwar world has been heavily stressed of late. This article by John Mills should be of interest to all readers of **ENGINEERING AND SCIENCE MONTHLY**. Statements and opinions advanced are to be understood as individual expressions of the author, and not those of the staff of **ENGINEERING AND SCIENCE**, the Association, or of the Institute.

—EDITOR

SCIENCE and engineering are the recognized source of the implements and mechanisms of our material civilization. But scientists and engineers are justly accused of exerting little influence upon the uses which society makes of their contributions. They produce while others dispose. The mental characteristics which are the basis of their production—their objectivity and reliance upon quantitative results, their scientific attitude and their ability to originate workable theories of relationships—are increasingly needed to preserve their products from the control of ignorance and from exploitation by passion and prejudice. Any of their developments which they do not safeguard by thought and action, comparable to that of its accomplishment, is an incomplete and half-baked offering which may cause strange disorder in the body politic.

Why is it that the men who devise the physical mechanisms of our civilization are, as a rule—and the exceptions which might be cited only prove the rule—so unconcerned and speechless as to their social utilization? They are driven by two creative urges, intellectual curiosity and the instinct of workmanship, which have produced the art, literature, science and engineering that raised man so far above the other animals of common origin. Curiosity points the way and craftsmanship follows. But for most engineers and scientists the compelling drive of curiosity soon becomes narrow and canalized.

The long and rigorous course of training which they undergo, despite the feeble diversion of so-called courses in the humanities, soon limits their questions to their own chosen fields. They lose—and society to a still greater extent—their mental explorations into matters of human relationships, social, economic and

political. Blocked from those fields of inquiry by their own inhibitions they tend to accept unquestioningly the current platitudes of other men or the prejudices and doctrines they earlier absorbed as children.

Their interests and activity are further narrowed into particular subdivisions of science and the engineering arts. They tend to become specialists. And this tendency is pronounced in industry where organization is functional and responsibility usually specific. Much of the power of industrialized science is to be ascribed to its coordination of highly specialized experts. Although there may be breadth at the upper level of executive control, the lower, but creative, levels are departmentalized. For any problem outside an expert's immediate specialty there is, at least nominally, another thoroughly qualified expert. The sphere of influence of each is usually well recognized; and its boundaries are rarely violated, for that would be inefficient and anarchical. Each has vested his interest in his specialty; and when technical advice is needed beyond his range he learns, on a live-and-let-live basis, to rely on co-ranking experts.

In an industrial organization, engineering conferences are assemblies of the experts in the several phases of an entire job; and these men defer to each other on the basis of specialty. The executive head of a group, of course, can speak as an expert on all the phases handled by members of his department. However, his opinions, except when they are based on his individual work, are usually restatements of what his assistants have furnished him.

In industry, in other words, one quickly acquires the habit of relying upon others for all that is outside his immediate field, accepting opinions the more completely the further their fields are from his own. And this phenomenon of specialization results all-too-frequently in a laissez faire attitude in matters where the integument of one's self or department is not endangered. One may even learn how to pass the buck, or at least to feel no responsibility for matters

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seems to have justified their confidence, and the way they ran their race may have some lessons for the new team."

Dr. Millikan then presented Lee DuBridge as "the leader of the new relay team." As one of the active sponsors for Dr. DuBridge's two most important academic appointments, the retiring head of the California Institute assured his audience that "I have every confidence that the new relay team will run faster than the old one was ever able to do."

LEE A. DUBRIDGE

Acknowledging the honor conferred upon him by his appointment to Caltech's presidency, Dr. DuBridge continued: "As I take on these new duties I have often wondered if any man can help but be appalled at the task of running any educational institution in these days. In fact many thoughtful men today are just appalled—period. Are we in a world which is systematically and scientifically plotting its own destruction? Is there any hope that in either national or international affairs we can ever reach the point where we seem at least to be heading in the right direction? Is there any chance that our educational system can adapt itself intellectually, spiritually, or financially, to meet the challenge of the modern world? We may not be too late to win out—but it may take an heroic effort.

"Can we in this country in the coming few years find or produce enough men with sufficient vision, sufficient knowledge, sufficient wisdom and sufficient leadership to paddle hard enough in the right direction and save us from the wrong channel? This clearly is the great challenge which America—and the world—faces.

The new President sketched the part that can be filled by the California Institute in bettering, or perhaps even saving the modern world. "Leading mankind in the task of learning the proper use of this power of science can not be done by men who understand nothing of the nature of this power. Nor can it be done by men who understand nothing else. Clearly our leading men in all fields must understand something of science—and we must have leaders in science who understand something of the world of human beings in which we live."

Quoting from the Institute's charter, Dr. DuBridge went on to say "Every effort shall be made to develop the ideals, breadth of view, general culture and physical well-being of the students. Research shall be made a large part of the work, not only because of the importance of contributing to the advancement of science and thus to the intellectual and material welfare of mankind, but also because without research the educational work of a higher institution of learning lacks vitality and fails to develop originality and creativeness in its students."

"The second world war brought the first great chapter of the history of the Institute to an abrupt close. For a period of five years its campus and its staff were devoted almost exclusively to war service. During this war period the Institute proved—if proof was any longer needed—that it had become one of the nation's scientific assets. And the nation's scientific assets, we have now learned, are among its most important and critical possessions in war or in peace.

"Chapter two of the Institute's history began as the war ended. If it was unfortunate that a change in leadership should have to come just now, it is most

fortunate that chapter one's leader is still with us to supply help and guidance."

After describing the need for acquiring and retaining the finest faculty possible, and citing methods for doing so, Dr. DuBridge turned his attention to the student body at the Institute. "Acquiring a great faculty—and all that it involves—almost but not quite, insures the second necessary asset of an educational institution—a great student body. Caltech now has a great student body—undergraduate and graduate. But keeping a student body fine is also a continuous task. We want first and foremost men of the highest intellectual calibre—but we want them also to be well rounded human beings—men with spirit, with imagination, with character, with health. Of course, we want, and the world needs, the occasional genius who forgets to get his hair cut. But we also need the man whose intellectual power is combined with the spark of leadership and human understanding. Our present student body is great because it contains so many young men with just these qualities.

"A great institution (please note I say 'great' and not 'big') with a great faculty and a great student body—aimed at the great ideals which were laid down 25 years ago—that is our goal. And achieving it is (if I may use the word once more) a great task.

"I believe it can be accomplished. I pledge my every effort in that direction. I know that the Trustees, the Faculty, the Students, and the Alumni, join also in pledging theirs. We shall need but one more thing—the support of the citizens of this community and of this state. The Institute can rise no higher than the people of the community want it to rise. I believe the people of this community do want it to rise. Unless the Institute is one of the community's most important assets it deserves no longer even to exist. If it has been, and continues to be, one of its most important assets, then you will not only wish—you will demand that it continue to move forward. I am here today—and glad to be here—because I believe you will demand just that. When you cease to demand it we will know that somehow we have failed. But with your help we shall not fail."

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beyond strict engineering, where engineers pool their expertness. He accepts without question—beyond some confidential mumbling to most intimate friends—the judgment of legal, personnel and patent departments of those concerned with public relations, advertising and sales and of all those engaged in fabricating, utilizing and exploiting his products of science and engineering.

As an expert he bows to the authority of others, whether actual experts or merely in the position thereof. He keeps strictly out of preserves that are not his own; in fact, if he didn't, he would have his ears boxed and hear his more restrained colleagues say that he was shooting off his mouth without knowing all the facts. Nor will he ask searching or embarrassing questions about those other matters "which aren't his business," for that might endanger his career if not the security of his employment.

And thus by a natural transition he becomes sterile in thought and criticism on matters social, economic

and political. Would he, for example, take a public position as to tariff changes which now threaten? Wouldn't he instead trust to his company's experts? He will damn a communist, and unjustly, for following his "party line" and taking opinions from Marx or Moscow; but he can remain blissfully unconscious that he is following a "policy line" without subjecting it to an objective criticism.

He has the brains and the analytical ability to handle these larger questions of social import—I.Q. is usually higher than that of many who do handle them. He has reason to concern himself, for these matters vitally affect all men including himself. But whether or not he considers them, he rarely speaks out and almost never acts. Despite his unique value to society, due to his application of the scientific method, he pulls his punch and fails to follow through. Even as to such a selfish matter as his own remuneration, and its relationship to that of others who produce or acquire, he is usually uninformed, accepting it as a handout like a fellowship grant instead of a reward which should be justly proportioned.

Today in his development he has reached a point where, in the words of a Biblical paradox, to save his life he must lose it. He must, at any rate, make some sacrifice, diverting time and energy from the scientific work that interests him most to the social and economic problems that vitally concern his future and that of all his fellow men. No longer can he safely pass the buck to rely on expertness not his own or that of other men of similar scientific objectivity.

This world of ours already has at its disposal enough products of science to wreck it good and plenty. What it needs is some hair of the dog that bit it. It needs an application to its present problems of the same methods of science as unwittingly provided the mechanisms by which it got where it is. And engineers and scientists must organize to insure that the prescription is filled.

C. I. T. NEWS

JOHN MILLS TO SERVE AS STUDENTS' ADVISOR

“WITH obligations to any student but without portfolio’ describes,” says John Mills, “the position in the Institute to which I have recently been appointed.”

Mr. Mills does not engage in research or teaching, and has no responsibilities in Institute management or business affairs. Instead, to use his own words, “I will be at the beck and call of all students, undergraduate or graduate, who wish to consult me unofficially and confidentially about their educational and vocational problems.”

To this work Mr. Mills brings a wide background of experience in industry and in education. He is a graduate in arts from the University of Chicago and in electrical engineering from M. I. T. After 10 years of university teaching he joined the research staff of Bell Telephone Laboratories. Then after 10 years of research and engineering—marked by about

30 patents and by pioneer work in transcontinental wire-telephony and early radio-telephony—he became personnel director with the responsibility of the selection and placement of scores of engineers and scientists each year. This work was followed, until his retirement last year under the Laboratories Pension Plan, by activities in publication and publicity.

He is a fellow in the professional societies of physics, electrical engineering and radio engineering. Mr. Mills has also written 11 books. In the first of these, **Electricity, Sound and Light**, he was junior author to Dr. Millikan, who first excited his interest in physics. His text, **Radio Communication**, was used by the Signal Corps in World War I and is a pioneering treatment of the triode and an exposition of vector methods as applied to radio circuit problems. His latest books have been popularizations. **Electronics, Today and Tomorrow**, is now in its sixth printing, and over 150,000 copies were issued by USAFI during the war. This book is also recorded on phonograph records as a feature of Talking Books for the Blind. His latest book, **The Engineering Society**, published last March, is a provocative study of the scientist as a citizen; and as Harrison Brown said in a recent Saturday Review of Literature, “It contains a bold and comprehensive discussion of salaries and organizational hierarchies in industry.”

To the problems of engineers and scientists, Mr. Mills brings years of sympathetic observation and a cold-blooded knowledge of what manner of men scientists are and what industry should and should not expect of them. Students are taking advantage of Mr. Mills' experience by visiting with him during his regular office hours.

MEMBERS OF '26 AND '36 TEAMS GUESTS AT ANNUAL GRID BANQUET

ATTENDING the annual Varsity Football Banquet held Dec. 9 at Brookside Municipal Clubhouse were over a hundred students, faculty and alumni, with Dr. J. E. Wallace Sterling, professor of history and government, acting as toastmaster.

Present at the dinner were representatives of the varsity football teams of 10 and 20 years ago. Speakers were President Lee A. DuBridg, Coaches J. Mason Anderson and Pete Mehringer, and Frederick Runyon, editor of the **Pasadena Independent**. The Wheaton Trophy presented on the basis of scholarship, sportsmanship and moral influence was awarded to this year's stellar halfback, Doug MacLean of the junior class. MacLean and Norman Lee, guard, were announced as co-captains for 1946, elected by the team. Twenty-four grid men, 10 water polo men and 6 cross country men received awards.

Members of the 1926 varsity football squad invited to the dinner were: Elmer Muff, Guy Chilberg, George Watson, Phil Cravitz, Clyde Shields, Layton Stanton, Ed Hines, Dick Folsom, Austin Hoyt (Mgr.), Bob Heilborn, Charles Lewis, George Moore, Al Lombard, Bill Mohr, Gary Collings, Frank Nickell, Ray Copeland and Len Ross (Mgr.).

Grid men of 1936 also invited were: Claude Brown, Clay Smith, John McLean, Jack Baker, Carl Larsen, Bill Wetmore, Jim Balsley, Al Zimmerman, Jack Osborne, George Mann, Wendell Miller, Jim Van Horn, John Griffith and Frank Hewett.