SCIENCE FOR THE GENERAL PUBLIC

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In this onrushing scientific era, so inadequately characterized as either the atomic or the space age, it is a truism to contend that everyone should know about science. Everyone must. The results of scientific progress in a material sense are very obvious. Whether there has been a penetration into the public consciousness and action of the motivations, philosophy, and rationale of science is another question.

On the one hand, it can be argued that there has been a tremendous increase in the understanding of the methods and the importance of scientific knowledge. On the other hand, the application of the fruits of science and technology to both the motivatingly intellectual and to the materialistic, falls far short of what can be accomplished.

That the hard-won knowledge of the universe is painfully acquired through trying again and again until discovery and verification brings forth truth--this process we must be convinced is the method upon which human progress is based. We must be convinced if we believe in the intellectual democratic process that this truth in all the fields of human endeavor will bring forth progress, and that it has, in fact, been the way in which the human race has evolved and risen to its present status.

That we are imperfect in our knowledge and our application of acquired knowledge does not vitiate this conviction that it is through the scientific method applied to everything from stars and atoms to mind and motivation that has created the past and can build the future.

Implicit in the idea that ours is a scientific civilization, organized most effectively along democratic lines, is the tacit assumption that freedom of mankind and the doctrine of equal opportunity really means something. We are convinced that

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all people must have the opportunity to know facts and draw conclusions and that this is not the prerogative of merely a chosen few. Newspapers, magazines, schools, libraries, radio and television, and the other manifestations of what are called culture, put this into practice. Whether these institutions and services are operated by private agencies or by government, whether as public services or for profit is pertinent to their functioning but not to the fact that all of them collectively perform the essential educating task of explaining and interpreting knowledge.

The body of new knowledge, discovered and proved, that has had the greatest influence upon the twentieth century, has until recent years, at least, been the most neglected by our media of communication and even our educational system. Science and technology has been a powerful tool for industry, for better living, and unfortunately, for the potential atomic destruction of mankind. Scientists and engineers as they were building our new scientific civilization were often too busy or too uninterested in telling the rest of the world what was going on, what it meant to them and what was likely to happen as the result. The innovators, the doers, were most of them not good interpreters, although it must be recognized that a few of them were extremely understanding, vocal and persuasive.

The two great channels for conveying knowledge to the people, the mass medium and the educational system, in the early days have been at best indifferent and at worst antagonistic to science and technology. This situation has been greatly improved in recent years since the unlocking of energy from the atom and the exploration of space, but there is still much to be done.

There are very few newspapers, for instance, that cover science and technology as adequately as they do sports. There are few classrooms in which teachers are as cogent and eloquent about the important and interesting rise of science knowledge as they are about the exciting and colorful growth of literature. Only for a couple of decades, or at the most twice that time, has there been recognition by the press that science is an important field for news and interpretation.

One can criticize perhaps the adequacy and the expertness with which the daily newspaper presents the new developments in science and technology. Nevertheless, what happens in the laboratories, the clinics and the factories is big and important news for the press today. There are science writers and there are more of them than ever before. Many are adequately and surprisingly competent to tell what is going on in

the minds and the laboratories of scientists and technologists and what it is likely to mean for the future.

The mass media (what an inclusive and very technical phrase!), especially the daily newspaper which almost everyone reads is the prime channel for the distribution of scientific information, even among the specialists of science and technology themselves. This may be decried, but it is just a fact that an important medical discovery announced, say, in the Journal of the American Medical Association is very likely to be brought to the attention of a physician by a patient who has read about the report in his daily newspaper, even before the doctor has received in the mail the copy of the journal in which the report was printed. This may possibly be embarrassing to the doctor, but it does represent a tremendous speeding up of the distribution of information that may possibly save lives. For information about the discoveries that are applicable in fields other than the closely defined area in which the research was done, this distribution of information to the public through the press is even more important.

The newspapers, magazines, radio and television represent the mechanism of continuing education. Most of the people who have now lived half their lives learned nothing at all about the atom, or space, or many phases of medicine when they went to school. The important advances in these fields occurred since then. It is only through newspapers, magazines, and television or radio that they keep up with these important things in the world.

For this reason the adequacy of coverage of science and technology by these mass media is extremely important. Who writes, selects, or edits is therefore of public importance. It is essential that our great press associations and syndicates supplying newspapers with the news and features shall be sufficiently understanding and motivated to give adequate and expert coverage of science and technology. The television and radio networks with a much more limited amount of "space" compared with the newspapers must have the public service and educational motivation to allow serious science and technology to creep into the body of the broadcasting. It is not enough to have science relegated to sunrise hours to be gulped like an awakening cup of coffee. Magazine and book publishers do their share of science distribution and interpretation when sales persuade them that science is an important field for publishing subject matter. Perhaps a mechanism should be worked out to convince the publishers that science is important, but in the long run the play of the market place will undoubtedly be

more persuasive.

We should be as concerned about the expertness and the quality of the interpreters of science through the mass media as we are of the competency and training of our teachers. Many of the editors, reporters, script writers, commentators, and actors are expert and knowledgeable in many fields. In general, it may be said that in politics, international affairs, the drama, sports, the practitioners of the mass media are often more expert than those who attempt to interpret science. Too often those entrusted with science presentation know little or nothing about science and technology. They have had no training in any of the multiplicity of scientific and technological disciplines in high school or college. And very often one person is expected to be competent in the whole vast spectrum of scientific and technological knowledge. This is a serious deficiency that can be remedied if it is recognized. But those who operate the mass media may need assistance from the public in realizing the necessity for a change.

Schools have been a powerful educational force for science and technology even in the days when science was considered natural philosophy and some knowledge of nature, the stars, arithmetic, even a bit of chemistry and physics, did find its way into the elementary school courses. In recent years there has been a renaissance of science in secondary schools that has extended to the elementary schools. There is a great ferment of course content revision. Colleges and universities, which have been the bulwark of education in the sciences and engineering have been inspired to do an even more adequate preparation of those who will operate our technological civilization and provide the new explorations of the universe upon which future development will rest. The new development of elementary and secondary science education is giving our collegiate education in science and technology a new and substantial underpinning.

Quite as important as the preparation for scientific and technological careers that is being well-developed in our educational system is the viewing of science as an important facet of liberal education. To a larger extent it is being recognized that some basic knowledge of science is necessary to the well-rounded person. The animosity of those who were fond of insisting on a liberal education which too often meant the exclusion of science and technology is diminishing under the impact of the times. The insistence that liberal education is good educational practice, and that scientists and engineers should know something about literature, history, language, and other

disciplines, is paralleled by an equally important insistence that those who are going into the other professions should know something about science and technology.

Science clubs, science fairs and similar science youth activities on the extracurricular as well as the classroom level are playing an increasingly important part in interpreting science to the public. Each year some 600,000 boys and girls in our secondary schools undertake experiments and science projects which they are able to present in exhibits. These are shown in the schools themselves and then some of them are sent to local and regional fairs, and finally a few of them are recognized at the National Science Fair each year. More and more of the science courses in our schools, even those in the elementary grades, are being taught with some experimental practice instead of just book learning and the parodying of what the teacher has said. Instead of learning by rote, the students get their hands dirty and their minds disturbed in order that they may better understand and have some of the precious thrill of discovery which is the priceless ingredient of learning. The result of this science youth development is that many thousands of boys and girls are becoming acquainted with science during their formative years. Some in their ranks will become scientists, technologists, and the engineers of the future. Even more important is the fact that every young person who has pursued science as a hobby will have a better understanding of its place and power in our everyday life. They will make better decisions in the other fields of work and professions in their futures.

The considerable body of individuals who are interested in science, not as professionals, but as hobbyists, is inevitably going to be augmented by the interest of today's young people in science. The groundwork for an amateur science movement among adults is therefore being laid more effectively than ever before. To the considerable number of science amateurs--those who have their own workshops, that build telescopes, botanize, study birds, etc.--the coming years will add many more who have obtained their background of science in our secondary schools, their science clubs and their science fairs.

The future is likely to see an increase in the multiple use of the plant and the equipment of schools. There is a feeling that the considerable investment in classrooms and other educational plants and equipment should more adequately be utilized. During a quarter of the year, the summer, they are generally idle. There will undoubtedly be a demand that more generally than now the schools shall be utilized in the evening

and over weekends by adults in the interest of continuing education.

The joint use of school facilities for all sorts of education, and not just for tutoring of the young, will also include a better appreciation of the place of libraries in the civilization's educational process. This will be on all intellectual fronts, not just that of science and technology. The growth of the paperbacks or the soft bound books and the distribution of large numbers of them at relatively low cost is a development that ranks with the earlier establishment and prevalence of public libraries. In planning for library expansion and the integration of schools and libraries, one with the other, this new phase of book publishing might be taken into consideration.

There is one other major possibility that must also be recognized in the consolidation of our interpretation and distribution of scientific information through various channels. The body of human knowledge, particularly in the fields of science and technology, is becoming too widespread and complex to contemplate having all the knowledge that one community needs contained in its own institutions. The young physicist who is attempting to build a radio telescope as a science fair project needs facilities, from the standpoint of information and technical literature, far beyond the possible resources of his local library or even his local college. Information sources of the world should be sufficiently adequate to provide an individual with the knowledge he needs regardless of how complex technically it may appear to be. We need what will be essentially one big library for specialized literature and an information service which would give access promptly and inclusively to all the world's literature so that those who need it may have it. This is a gigantic task, but it is one which every scientist, technologist, teacher, librarian, and administrator must contemplate and must help to solve. With the increasing mechanisms for scientific information distribution, such as microfilm and computers, this is a problem which can now be solved or at least contemplated, whereas even a few years ago, it seemed to be chimerical and visionary.

The production of the written record of our civilization is continuous and almost overpowering in science and technology alone. Hardly a day passes that there is not a new science journal established and there are many more science books published than there are days of the year. Much of this plethora of publication is justified by the increasing specialization of science and the outpourings of research laboratories magnificently supported today compared with a generation ago. To the

librarian as the conservator and distributor of recorded knowledge, the rising flood of science and technological literature is both an embarrassment and a challenge. Only the most specialized library collection can hope to keep up with any one field in all of its details. For financial and for purely digestive reasons, the ordinary general library can do no more than confine its collections to general and popular books and magazines. As has been indicated, the general library in many instances will be inadequate certainly to the professional and often to the serious amateur.

Possibly the time has arrived when it will prove to be impossible to give complete publication to everything that is published in the field of science and technology. No longer will it be expected that a specialized journal of limited interest and field will be available at even the largest and most inclusive libraries of the world. No longer will even the abstract journals be able to note all of the literature that is published or even attempt to list it as they now do.

In the attempt to make the new information of research available to all who should have it, there will be need to utilize such devices as auxiliary publication or "demand publication," such as was established through Science Service's efforts in the 1930's. This innovation has proved quite successful in a number of very large and important utilizations such as the publication of government reports, the enemy documents of World War II, in addition to its original and continuing utilization (through the American Documentation Institute) for giving distribution to supplementary material too specialized and too voluminous to be printed in the journals themselves. This device of depositing a detailed manuscript and issuing it upon demand, at reasonable cost in microfilm or photoprint form, is made practical by the arrangement that the journals of original publication will note the existence and availability of such documents in their journals. Greater utilization of this device will not reduce the volume of scientific literature, but it will make it more manageable, more accessible and at the same time it will relieve the shelves of the libraries of material which might never be required for issuance. The information resulting from research will nevertheless be available for specialized individuals who wish it now or years in the future.

At the other end of the scientific information spectrum there may be need for an inclusive scientific newspaper potentially capable for circulation to every scientist and engineer, several hundred thousands of them, in the nation. If the administrative organization can be achieved, the value of placing in

the hands of all at least the essence of the whole record of science might be evident. If "one big science journal" were achieved, there would be an extraordinary cross-fertilization between disciplines and a consequent acceleration of scientific research. This one big newspaper of science would not replace the broad reporting of scientific progress to the public through the mass media, but it would be an application of the extraordinary mechanism of publication that American journalism has developed. It would apply the economies and speed of rotary presses and newsprint to the distribution of technical knowledge. If such a gigantic effort as the translation of Russian scientific literature by the National Science Foundation and associated scientific societies and government agencies is justified, and this writer feels that it is, then this utilization of new techniques to spread the scientific record to more people more effectively would certainly seem to be worth attempting.

With greater effectiveness of the publication of scientific record, there will come inevitably a better presentation of the new developments to the general public through the mass media and public institutions. For this reason those of us who are primarily concerned with the distribution of science to the public are very concerned and appreciative of the necessity for improved scientific publication from the most detailed level. Inevitably the record of science must become increasingly technical. The great task of the public, and particularly that of the oncoming generations, is to recapitulate and absorb the learning and knowledge of the past in order that they may understand the present and prepare to continue the great adventure of exploring the unknown future.