News and views

The Scientist in Society

WHILE most citizens, including scientists, are aware that the last decade has seen radical changes in their world and in their relationship to society, it still has come somewhat as a shock to the scientist, in particular, to discover the sudden rise in his importance as a critical natural resource—an importance perhaps as great, he is led to believe, as that of iron or anthracite or even petroleum. He has nevertheless become reconciled to the notion of being conserved and stockpiled like other useful substances and has submitted to the dissection and examination of his talents by statisticians and of his past by agents of the FBI. He has allowed himself to be fingerprinted and photographed and has obeyed the injunctions of security by guarding zealously those parts of his knowledge stamped secret. He has taken seriously his civic responsibilities and has responded in good faith when called to public service. For reasons that are more than patriotic he has placed a high value on "truth" in the knowledge that his fellow scientists will be his most severe critics and in the conviction that the very meaning of science is the search for truth. The specialized language of his science being all but unintelligible to others, except in terms of concrete and usable objects, he has been forced to talk in those terms when speaking publicly of science, but he is disturbed by the frequently nonscientific misconceptions that result and is alarmed by the popular superstitions which his unorthodox profession seems to inspire.

These and related thoughts have been discussed to death by scientists, but for the most part privately. It is a matter of some public interest, therefore, to note that *The Scientific Monthly* (March 1954) has published a group of four symposium papers on the general topic "The Scientist in American Society" which were presented during the annual meeting last December of the American Association for the Advancement of Science. The authors are V. F. Weisskopf, professor of physics at the Massachusetts Institute of Technology, Gerard Piel, publisher of *The Scientific American*, and two members of the Harvard faculty, Mark De Wolfe Howe, professor of law, and E. C. Kemble, professor of physics.

Weisskopf, troubled by the great disparity between the realities of science and the popular conceptions of science, characterizes the public view as that by which scientists "are described as secret sorcerers who conjure up bigger and better methods of destruction in closed laboratories. In the more sympathetic moments, scientists are described as cooking up some new chemical with miraculous tricks, which will render gasoline ten times more powerful than before or will improve one brand of tooth paste much above another. Everyone who has had any real contact with science or scientists knows well that this picture of science is highly misleading. . . ." The remedy? More collaboration is needed between scientists and those who report science to the public.

Piel, speaking of the problem confronting scientists in the realm of civil liberties, is blunt: "The present erosion of their academic and personal freedoms is in itself a measure of the decline of the scientist's traditional status as an independent scholar. The public record shows an increasing frequency of affronts to the integrity of scientists as citizens. In secret proceedings, many more scientists have suffered humiliation and jeopardy as the result of invasion of their freedom and privacy. . . . The constriction of the freedom of scientists is part of a general pattern which involves the freedom of people in every department of intellectual activity. The same indignities have been visited upon writers, actors, scholars, government administrators, teachers, lawyers and ministers. The present movement differs from similar episodes in the American past in that it favors intellectuals as its target. . . . It is no mere case of democracy fumbling, as has been said, with the difficult reconciliation of security and freedom in a dangerous world. Espionage, sabotage, and treason are familiar perils to the existence of national states. Our people long ago equipped the Federal Government to deal with them by methods that accord with the institutions and ideals we want to protect. The spectacle we have been witnessing is not only repugnant to the spirit of our society but largely irrelevant to national security. . . . Though they are not really looking for the causes of these deeper troubles, our contemporary inquisitors seem to sense that the hunt is warmer when they have a scientist in the dock. It is, after all, quite widely understood that science does have something to do with the amenities and the troubles of living in our time."

Howe, whose topic is "The Legal Basis for Intellectual Freedom", finds our conception of such freedom to have been molded by the "philosophical presuppositions" of the Bill of Rights: "We began our national existence in the conviction that there are some phases of an individual's life which are not only beyond the control of government but beyond its reach as well. The area of a man's unchallenged sovereignty was furnished with what the political philosophers called his unalienable rights, among which, of course, was the pursuit of knowledge."

An important aspect: ". . . the individual scholar and the isolated heretic, rather than the enterprise of scholarship or the pursuit of heresy, became the effec-

tive instrument of freedom. Our Constitution and our law make no commitments in favor of academic or scientific freedom as such; their guarantee is that the individual's mind—whether that mind be academically, politically, or scientifically inspired—should be beyond the reach of government. . . . Our law still looks upon intellectual freedom as a right of individuals and not as an obligation of groups. When government denies the scholar or the scientist the enjoyment of his right, he stands essentially alone against the state. In any such conflict, particularly when the people's fears support the state, the outcome is readily predictable. The individual succumbs. Since the law's concern was with him as an individual and not with humanity's pursuit of knowledge, it is easy to pretend that any injustice which may have occurred has no larger significance than that of other personal tragedies. The community of scholars will feel that tragedy more intensely than will the body of citizens, but there being no constitutional commitment to the enterprise of scholarship, an appeal to law made in those terms will be unavailing."

The gloom, Howe asserts, may be somewhat dissipated if we recall Judge Learned Hand's admonition that the spirit of freedom cannot be preserved by law alone and if we recognize "that intellectual liberty must find its strength beyond the law and through other agencies than those of government. . . . Our schools and colleges, even perhaps our churches, have lived in the blandly mistaken assumption that the law is omnicompetent and that intellectual freedom will somehow survive the conflict when the individual scholar goes down in defeat before the state's authority . . . no organizations other than universities and churches are strong enough to assert against the state that something larger than the fate of individuals is being destroyed by the abuse of power. It is timidity, not wisdom or statesmanship, that converts all problems of freedom into questions of law."

Kemble poses some relevant questions: "How can the scientist properly seek to implement his sense of social responsibility? What limitations should he impose on his activities in this direction? Should he act in these matters solely as an individual, or is there a legitimate area for collective action on the part of the scientific fraternity?" Kemble's conclusion: "American scientists have a clear duty to keep themselves informed about what is going on, and by individual and collective action to make their voices heard."

Individual influence must be primary, he suggests, in public questions involving matters of scientific judgment, but collective action can offer a useful contribution by providing reliable sources of factual information necessary to scientists and the public alike in considering issues of common interest.

The AAAS symposium in Boston, the occasion for these addresses, was under the chairmanship of E. U. Condon. At the close of the symposium, according to *The Scientific Monthly*, the chair was asked from the floor what could be done about "unfair practices" in congressional hearings and in loyalty and security board proceedings. The chairman responded, in part, as follows:

"One of the most important things that any one of us can do is to stand by friends if they get into trouble of this kind and give them every possible support and encouragement.

"We must stand true to the basic American principle that a man is to be regarded as innocent until proved guilty. And in support of this principle, any one who finds himself in trouble should assume that his friends are good Americans who will be true to this principle, and therefore he should not hesitate to call on them for such help and support as they can properly give. . . ."

The Origin of Cosmic Rays

A THEORETICAL MODEL designed to describe the motion of cosmic rays through our galaxy as "a random motion between scattering centers represented by moving magnetized clouds" has been offered in a recent paper [1] to clarify the conditions needing to be satisfied by any attempt to explain the origin of cosmic rays.

The authors, Philip Morrison of Cornell and Stanislaw Olbert and Bruno Rossi of MIT, find it necessary to depart in some respects from the theory proposed five years ago by Enrico Fermi to the effect that cosmic-ray particles are accelerated by coming in contact at irregular intervals with moving magnetic fields in interstellar space until their accumulated energy is finally lost in sudden collisions with hydrogen nuclei. Below certain initially required energies, which depend on the mass of the particle, the ions lose energy faster than they gain it. Fermi's theory, while sufficient to explain the observed characteristics of the cosmic-ray protons, fails to account for the alpha particles and heavy nuclei also observed as primaries. The difficulty arises both from the enormous injection energies required for heavy nuclei and from the likelihood that they would suffer more frequent collisions with interstellar hydrogen.

To circumvent this problem, Morrison, Olbert, and Rossi propose a faster rate of acceleration than Fermi assumed, thus reducing the injection energies to reasonable values and making possible the attainment of high energies by heavy nuclei before such collisions. The authors state, however, that "it is doubtful whether or not the high rate of energy gain is compatible with astrophysical evidence. We do not intend here to minimize this difficulty. Indeed, we wish it to be clearly understood that the main purpose of this paper is not to uphold a given theory of the origin of cosmic rays, but rather to specify the conditions that must be met by any theory that explains the high energies of cosmic-ray particles by a mechanism of gradual acceleration in the motion through space."

A disc-shaped volume corresponding to the rough outline of the galaxy is used in the present calculations, with the probability for escape—rather than the mean

[1] "The Origin of Cosmic Rays", *Phys. Rev.* **94**, 440 (1954).