and knowledge is the same as that between food and a growing organism. Like food, so-called pure facts must be digested, resorbed and assimilated in order to become knowledge; and unless they are, they become wastes. Already the hoard of unconsumed facts has become so enormous that to point—by way of alibi—to their possible utility in some future, sounds no longer convincing; if ever their time should come, they will long have become obsolete, if not altogether forgotten. This applies to unrelated facts of research as well as to unrelated data in teaching.

Now, the question is obviously not whether we should teach facts and techniques *or* principles and concepts, but rather what proportion of the student's time and energies we should allocate to the ingestion of facts on the one hand, and their digestion on the other, given a certain educational aim and a definite time limit for its attainment. It seems that, instead of letting these proportions be decided by individual preferences, institutional traditions, technical expediency and sheer accident, we might find some more pertinent formula of apportionment.

It will be the same with most of our other problems: Proportions and not volume will be the main issue. It would be idle to indulge in dreams of what volume of knowledge we, preoccupied as we are with our individual fields of specialization, would like to communicate to our students, if we had not to compete for their time, interest, endurance and resorptive capacity. The volume of instruction will always be limited by the hard reality of restricted facilities and human nature. But even though its volume may have to vary widely, the proportions of any program may be preserved without distortion. It is on these proportions, on the harmony of the educational program, that we should insist. This implies that in apportioning subject matters, attention will have to be paid not only to their factual content, but likewise to their potential value in developing those faculties which transform a student of biology into a biologist. Any carefully conceived program will have to strike a sound balance between attention to detail and generalization; between observation and experiment; analytical acumen and broad perspective; intellectual mastery and manual craftsmanship; mental stability and critical acumen; respect for tradition and courage to break it when necessary for progress; and so on. It should be easier to find our way through this maze of concrete problems with a central objective in view as our directive, than if we continued to drift apart along our various lines of specialization. Gathered here, therefore, as we are from those various lines, we may attempt to reweave a solid fabric of general biology out of the dangerously separating threads of departmentalization.

If, after these five sessions, we shall part with some clarification of purpose as guide for future action, this is all the reward we may duly expect to come from this venture. If, in addition, our collective opinion should turn out to point a way as to how to translate our conclusions into concrete action, so much the better.

ANNIVERSARY ADDRESS OF THE PRESIDENT OF THE ROYAL SOCIETY[1]

By Sir HENRY DALE

DIRECTOR OF THE NATIONAL INSTITUTE FOR MEDICAL RESEARCH

As we come to the end of another year we can see, as yet, no prospect for science of escape from urgent preoccupation with the means of waging war. On the contrary, with the Union of Soviet Russia now locked in a supreme struggle for its own existence and the world's freedom, and with the United States of America rapidly directing its tremendous scientific and technical potential to the support of the same great cause, the diversion of science from its normal uses and objectives has spread right round the world. Yet even this grim necessity has brought with it some measure of compensation, in drawing closer the bonds of friendship, between the men of science in the countries thus united in a common purpose. We in Britain received a tremendous encouragement in the early months of this year, from the visit of President Conant and his associates to establish here, in London, an office for the maintenance of regular and intimate cooperation, between the war researches of our American colleagues and those which are here in hand. More recently, and in spite of all difficulties of communication, the sense of a common peril and a common determination is bringing us into a new and growing intimacy of collaboration with our colleagues of Soviet Russia. The organization of the science of the British Empire for war has brought to London already a number of distinguished colleagues from the Overseas Dominions, and we have heard of others who are on the way. It has been a particular pleasure to gather them here, in the house of the Royal Society, and to invite them

[1] Concluding part of the address given at Burlington House, London, on November 11, 1941.

to regard it as a center and a rallying point for discussion of the means by which this new and closer collaboration, arising under the stimulus and the necessity of war, may be perpetuated and strengthened for the purposes of peace.

Generous gifts to the society, during the year, from sister societies in America, have given further welcome evidence of the determination of our colleagues there to come to the help of British science in this time of need. The American Philosophical Society, founded in 1743 by Benjamin Franklin, with this society as his model, sent us ten thousand dollars "for the aid of science in Britain." They have confirmed our interpretation of their fraternal gift, as betokening a desire to help us to preserve some measure of normal scientific activity in this country during the war, and to keep alive the tradition of a free pursuit of knowledge for the benefit of all men. We have been able to find good use already for a large part of this benefaction, in the maintenance of a number of important researches, which war conditions had threatened to interrupt or to bring to an end. The American Physiological Society similarly sent us five thousand dollars, as a spontaneous contribution, to the support of scientific publication in Britain, mentioning physiology as the subject to which they, as physiologists, desired us to give the first consideration. The Rockefeller Foundation, that truly international benefactor and promoter of natural knowledge, had already asked us to be responsible for the distribution of twelve thousand five hundred dollars in aid of scientific publication in Britain in these difficult times.

As I have taken occasion earlier to state, gifts such as these, welcome for their own intrinsic value and for the practical uses which we are readily finding for them, are even more welcome on account of the evidence that they bring, of the feeling of comradeship between our American colleagues and ourselves. We can do no less, I think, than assure them of our determination that this closer sense of unity in aims and ideals, with them as with our fellow citizens of the British Overseas Dominions, shall not be lost, but rather strengthened, when we face together the new problems which the end of the war will bring.

Though the first and imperative call on the science of all free countries is for the means of winning the war, to save the freedom without which science can not in any true sense survive, we can not put aside the duty of preparing for the part which science must play, in rebuilding and maintaining civilization when peace returns. The conference recently organized by the British Association, on "Science and the World Order," attracted more attention from the press and the public than is usually given to scientific events and discussions; and it was, indeed, an impressive and significant fact that men of science from a dozen or more different countries, some far distant, should have found it possible now to meet, here in our war-scarred London, and to find the time and the impulse for such debate. We may offer our very sincere congratulations on the success of such an enterprise. Many who took part in these meetings, held at a time when science finds itself conscript and organized as never before, for the destructive purposes of war, were clearly ready to support the view that it should be as fully organized by the governments of a world at peace, for its proper purposes of enriching life and enlarging the opportunities of happiness for all men alike. There were not wanting voices, however, such as that of our biological secretary, to sound a warning of dangers which might be entailed, by such fulness of association between science and government as others were advocating with conviction and enthusiasm. Freedom and opportunity, it was pointed out, rather than organization, provide the conditions for the highest types of research, and thus, in the end, for the greatest services which science can give to mankind. I find myself in sympathy with this view, and nobody here, I think, would suggest that it is usually possible to organize the researches which advance boldly into the unknown, and open new vistas to human understanding. Here we shall certainly not overlook the fact that, in the period between the two wars, important funds have been placed at the disposal of the Royal Society by a series of generous benefactors, to be administered for the support of researches over a wide range of subjects, in complete independence of any control by the state.

On the other hand, I think that it will be agreed that the remarkable development in this country, since 1914, of the state support of research administered by the three advisory councils, normally in relation to the needs and the activities of a nation at peace, has taken place without any obvious detriment or danger to the freedom of science. The Royal Society's former function, of advising the government directly on all scientific matters, and of organizing such systematic researches as were then undertaken in the public interest, has, of necessity, been shared and greatly diminished. We as a society, however, can fairly regard this development as, in many respects, a realization of the plans and the dreams of our predecessors here; and I do not think it fanciful to claim that our society's traditions and standards have been still effective, through the influence of our fellows on the advisory councils and their committees, and through the filling of their chief executive offices by men of our fellowship. As a whole-time research worker myself, since 1914, under the body which became the Medical Research Council, and the senior now in that service,

I can bear grateful witness to the freedom of opportunity which can exist under an enlightened organization and control, exercised on behalf of the government. I have no reason to suppose that the conditions are otherwise under the other research councils. Nor should we lose sight of the fact that a further large proportion of the free scientific research of the country is now indebted to support from the state through grants to the universities, administered without any trace of detailed government control.

While, therefore, the existing mechanisms for the support of science by the state are doubtless susceptible of improvement at one point or another, I find no reason to fear any threat to the freedom of science from them, or from any natural development on those lines. Nor do I fear it from a wider use of the organized application of science and scientific method to problems of public welfare; nor, again, from a more effective access of scientific knowledge to those responsible for government. A year ago Sir William Bragg told the society of the formation of the Scientific Advisory Committee to the War Cabinet, under the chairmanship of Lord Hankey, with the president and two secretaries of this society as members *ex officio*. The representation of the society has, indeed, been strengthened since then, and in a manner most welcome, by the fact that, though I have succeeded him *ex officio*, Sir William Bragg still gives his wisdom and experience to the work of that committee, as an extra member.

There is one direction, however, in which I do find some reason to fear for the freedom of science. If science should become entangled in controversial politics, through the over-eagerness of its advocates and champions to invoke the sanction of science, or to claim its potentialities, in support of any special political doctrine, then indeed I believe that the threat to its freedom might become a real danger. Let there be no misunderstanding of my meaning. I am not abusing the privilege of this chair by using "controversial" as an epithet, to be applied to political opinions which I do not happen to share. I see danger if the name of science, or the very cause of its freedom, should become involved as a battle cry in a campaign on behalf of any political system, whether its opponents would describe it as revolutionary or reactionary. If science were allowed thus to be used as a weapon of political pressure, it would be impossible to protect science itself eventually from the pressure of sectional politics. If that should happen the dangers are, I believe, beyond dispute—the danger, for example, that fundamental researches, having no immediately practical appeal, would be allowed to fall into arrears through relative neglect; or the danger that the rigid standards of true science would be relaxed, by allowing the convenience of results for policy or for propaganda to enter into the assessment of their validity as evidence. This society, with its firm and unbroken tradition of complete aloofness from political controversy, may still find it an important part of its function, to keep watch and, if necessary, to stand without compromise, for the right and the duty of science to seek the truth for its own sake, in complete freedom from any kind of extraneous influence. I hope, indeed, that there will never be need thus to invoke our tradition, to protect the freedom and the integrity of science from the enthusiasm and the advocacy of any of its friends.

OBITUARY

FREDERICK HUTTON GETMAN

DR. FREDERICK HUTTON GETMAN, physical chemist, died suddenly on December 2, 1941, at the Stamford Hospital in Stamford, Conn. He had been in failing health for several months but in September attended the meeting of the American Chemical Society in Atlantic City, where he presented a paper.

He was born in Oswego, N. Y., on February 9, 1877. He was the son of Charles Henry and Alice (Peake) Getman. The family had a very considerable fortune, made in the lumber business, and young Getman had an assured position in business if he chose to follow his father's calling. However, his natural inclinations were along other lines. He early developed a taste for music, which remained with him throughout life. He was an excellent organist. Just when he decided to make science his major interest in life is not known to the writer, whether it was under Mallet or Remsen; but we have his own testimony of his love and admiration for the latter. He was educated at Rensselaer Polytechnic Institute, Lehigh University and the Department of Chemistry at the University of Virginia, from which he graduated in 1896. He was an instructor in chemistry and physics in the Stamford High School from 1897–1901. He then went to the Johns Hopkins University, where he received his doctorate in physical chemistry in 1903. He was fellow in physical chemistry at the Johns Hopkins University from 1901 to 1903 but remained as fellow by courtesy during the following year. He then became Carnegie research assistant for the year 1903–1904. Dr. Getman's first position after leaving the Johns Hopkins was as lecturer in physical chemistry at the College of the City of New York. He was then lecturer at Columbia University in physics from 1907 to 1908. In 1909 he became associate pro-