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## CURRENT DEVELOPMENTS IN SCIENCE AND BIOLOGY TEACHING

W. F. LOEWING

Though science and education as a whole are currently and properly geared to the war effort, it is commendable that teachers and administrators are, nevertheless, already giving foresighted attention to desirable patterns of postwar instruction and matters of permanent curricular policy. While perhaps no one can as yet predict the exact social pattern of a world at peace nor fully foretell its demands upon education, certain emergent trends already delineate the scope of the problem and the probable areas of major change. Science is destined to play an important role in peace as it has in war but with notable shifts in emphasis. It consequently becomes the moral obligation of scientists to inventory the situation, and to pool information with a view to formulation of a program of action which embodies the best professional judgment bearing upon science education in the postwar world. The ensuing discussion deals with certain important factors which seem destined to have a great influence on the teaching of science and biology.

Science education will have to bear its share of the responsibility for immediate vocational rehabilitation of an unprecedented number of veterans and war workers. America will be confronted with the transfer of the staggering total of 20 million persons from military to civilian pursuits. Since the conversion of industry from a military to a peace-time basis will require time, our schools will be called upon to cushion the collapse of the war boom and to minimize unemployment by re-enrolling several million students whose education has been interrupted. The fact that academic credit will be granted for training and experience in military service will place a major portion of this responsibility upon American colleges and other schools at a comparable educational level. Job training will be upper most in the mind of returning students. The demands of technology will, however, be quantitatively great and qualitatively diverse along new lines as yet only vaguely discernible. The immediate demand will consequently be for educational devices which merge the objectives of vocational and cultural education adapted to a changed social order. What are these new vocational and cultural objectives likely to be? Biology and its applications will emerge to a more prominent position in peace than in war because the factors of human well-being are intimately entwined with plant and animal science especially in the realms of agriculture and medicine. The cessation of hostilities will be marked by a subsidence in the mechanized activity of war itself and by a resurgence of interest in human values. The colossal need for humanitarian services is already appallingly evident and it will claim our immediate attention as soon as the grim business of war is ended. There will be hungry mouths to feed and broken bodies to heal.

In agriculture alone a host of new workers will have to be trained to meet these needs because the war has decimated the ranks of farm and professional experts and cut off the supply of apprentices in training. To the demands in agriculture must be added the need for trained personnel in nutrition, sanitation, health, and recreation.

It is safe to predict that America will emerge from this war with a firm resolve to improve the health of the nation. Perhaps no feature in the huge mobilization of America's man and woman power for the war has been more disconcerting to the nation than the rejection of approximately 25 per cent of the inductees and the dismissal of an additional 1,200,000 men from military service itself because of physical or mental inability to qualify for active field service. These statistics give us an appalling picture of the state of America's health. Unfortunately this state of affairs will be gravely aggravated by an unprecedented number of war casualties. To the list of battle casualties, we shall have also to add a huge but as yet unpredictable host of diseased bodies and minds. The possibility of epidemics of contagious tropical diseases, which may be introduced on a large scale by returning veterans, is already giving serious concern to medical and public health authorities. In anticipation of some of these heavy demands some provision is already being made for the training of an increased number of medical personnel but little if anything is being done in the realm of agriculture and other phases of biology to meet post-war needs.

The importance of biological education in relation to the above trends is readily evident. The human body is destined to receive more attention in schools than ever before. Greater and more widespread knowledge of diet, housing and health will be disseminated in our schools probably to parents as well as to youth. The biology teacher will in the future be called upon to assist much more extensively with the scientific phases of public health and recreation. The state of New York has already assumed leadership in making health instruction mandatory in public schools. Instruction in nutrition will be pointed to improved health and more desirable dietary habits of the nation. Changes in human nutrition will in turn probably lead to certain new practices in agriculture.

In addition to these, other factors will also affect biology. The rapid expansion of social studies, already under way prior to the war, will receive added impetus from sociological problems arising in the post-war world order. Since our social order deals with living beings and rests largely upon a biological foundation, expansion of instruction in the social sciences is destined to have its impact upon biology as a collateral science. Current interest tends to center increasingly in those phases of biology which underlie legislation on health, housing, nutrition, conservation, agriculture, and medicine. Eminent civic leaders and school administrators have already recommended that biology and science education in general be presented in terms of its bearing on social action. Because the social sciences rest largely on a biological foundation and deal with human beings, the better the understanding of biology, the more effective will be the sociological pro-

gram based thereon. This is but another way of stating that biology is a logical starting point in what promises to be the major program of social action growing out of the present world crisis. The influence of biology in the field of social sciences is already evident in the adaptation of the concepts of ecology to problems of human populations and eugenics. This new sociology will be added to man's ever-dominant interest in his own biology as a living organism. It seems safe to predict a closer integration of pure biology with the social sciences than we have ever had before.

As one turns from the broader civic aspects of education to those dealing more specifically with the individual student, we also find significant changes under way. These involve major changes in methods of instruction, in course content and in teacher training. Though requirements for certification of science teachers may not be immediately raised on a national scale because of the acute shortage of trained personnel, there is nevertheless already a concerted trend in this direction as indicated by the stipulation of a master's degree as a minimal requirement for certification of high school science teachers in certain states. As the scope of instruction in the life sciences increases in breadth and the emphasis on integration of knowledge grows, biology teachers will feel impelled to enlarge their horizons by serious study in related fields in order to assist their students in grasping the interrelations and applications of science to human affairs.

In connection with educational methods, it may be pointed out that certain as yet inconspicuous but nevertheless widespread tendencies have been gaining ground. There already exists a definite movement in the direction of a balanced earn-learn program. This idea of providing realistic job experience as an integral part of the student's schooling is by no means new and it has long been successfully practiced at the well-known Berea and Antioch Colleges and more recently at the University of Chicago. This policy, of course, has as its prime objective the immediate employability of college graduates and the establishment of contacts which are helpful in obtaining their first full-time job. The significant recent development has been the rapid expansion of this method of education as fostered in the prewar period by outside subsidy from the United States National Youth Administration and during the war by subsidy of the federal E. S. M. and W. T. programs. Government and industry are currently urging immediate adoption of such a plan for the post-war period and it is not unlikely that something comparable to the E. S. M. and W. T. program may be perpetuated.

The earn-learn program envisions enlarged opportunity for complete or partial self-support and bona fide job experience while the student is in school. Self-support aims to provide not only the means to education itself for those who would otherwise be barred, but to introduce the elements of morale, self-confidence and job apprenticeship as well. Pre-war census figures make it evident that education was not accessible to some three and one-half million youth of 14 to 17 years of age for financial reasons. Only 11 per cent of our college-

age, pre-war population were actually enrolled. Of the 21 million high school and college age group, nearly two-thirds were excluded from schooling by pitifully small financial margins. During the depression, most of the 13 million out-of-school youth were also unemployed and, ironically, often prevented from obtaining jobs because of child labor laws. The very laws which had originally been idealistically enacted to prevent industrial exploitation of children, in the depression penalized preeminently the very group they were designed to protect. This grave situation was subsequently aggravated for out-of-school youth by restrictive regulations of trade unions against minors. Before the war America was rapidly recruiting a vast army of disillusioned adolescents, many of whom become politically militant in their economic desperation, and the N. Y. A. and C. C. C. programs were instituted as relief measures and job training for the nation's youth.

The youth crisis became nationally acute and the federal N. Y. A. and C. C. C. stepped in at this juncture to forestall the possibility of fascism and communism in America. The National Youth Administration was started in 1935 as an emergency relief measure for the purpose of removing school-age children from the labor market by financially subsidizing their return to school. It is interesting to note that by creating an opportunity to earn from five to twelve dollars per month, 650,000 children were restored to school. The Civilian Conservation Corps proved to be highly successful as a job-training project and enjoyed about a 40 per cent annual turnover due to acceptance of C. C. C. graduates into permanent employment as compared to only one per cent for school age youth registered with federal unemployment agencies. The C. C. C. obviously possessed spot value in job training which the public school education lacked.

Federal subsidy thus came into American education on a large scale for the first time in the nation's history. As unemployment diminished both the N. Y. A. and C. C. C. were nevertheless continued for several years largely as a nation-wide experiment with the earn-learn program. Though the N. Y. A. and C. C. C. have been eliminated, the E. S. M. and W. T. program still continues under federal subsidy. We thus have the precedence, policy and experience necessary to develop a comprehensive national educational program of this sort on a large scale and to modify it to meet post-war exigencies. Problems similar to those of the pre-war depression may again arise with collapse of the present war boom and federal subsidy may again be necessary for education designed to facilitate employability of American youth.

One may ask how this shift in educational method will affect biology. The answer may prove to be that biology will be called upon to prepare more students for gainful employment in its applied phases at technical as well as at professional levels. Formulation of details for such a program may not be difficult in vocational high schools and agricultural colleges, but real administrative ingenuity may be required to create such projects in our liberal institutions. One im-

mediate problem will be that of the time schedule. Classroom studies may have to be staggered with outside work, perhaps on alternate days of the week. Daily classroom meetings of one hour are poorly adapted to realistic laboratory work in biology. The length of laboratory periods may have to be increased and to a large degree biology courses may be transferred from the laboratory to the greenhouse and the out-of-doors. Such biological information can be given sound scientific values and made more valuable to the student because he acquires information directly instead of through the textbook or lecture. The imperative need for wider information on **conservation in** all its aspects will also give further impetus to field work. Despite the informality of method, substantial quantities of sound biological information can be effectively inculcated in the field and laboratory under informal auspices. But the schedule of courses must provide periods of time long enough for field work and for completion of biological experiments in the laboratory.

While it is only proper that education should alter its curricula to meet new social needs, it will be necessary for administrators and teachers to safeguard standards and to avoid the assumption that curricular change alone constitutes educational progress. The place which science and biology assume in the new educational order will in large degree be determined by its close correlation with new social developments and by the preparation of a comprehensive program of science instruction supported in a unified way by scientists throughout the nation. The large educational and biological societies of America have the opportunity and perhaps the obligation of leadership in placing the talent of science at the disposal of the nation in peace as it has been in war. Our schools and industry stand ready to consider any educational program for science and biology which embodies the consensus of scientists themselves.

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