It should be emphasized that the success of such laboratories depends largely on the training and personality of the men in charge. Not only must they be well informed in their own fields, but they must have broad interests, ingenuity, curiosity, and a real desire to cooperate with their colleagues in other fields in solving a wide variety of problems.

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## On Introductory Biology Courses

In the recent discussion of the nature of the elementary course in biology reported by Dr. Hamburger (*Science*, 1945, 102, 511–513), consideration was given to the problem of whether a single course in general biology should be given for all students, general and professional, or whether a special course should be set up for the latter. At Stanford University both methods have been tried, and the author has taught under both plans. The staff has been sufficiently large to allow two introductory courses, so the choice has depended upon the performance of the students. Our plan and experience might therefore be of interest to others.

Stanford was one of the pioneers in giving a general biology course designed primarily for the liberal arts student and organized along lines quite different from the classical courses in botany and zoology (L. L. Burlingame and E. G. Martin, *Science*, 1920, 51, 452–455). This course and its successors have used the principles of biology and their corollaries as the basis of organization. Thus, the broader concepts of biology are emphasized as the basis of an understanding of the functioning of the human body and the place of man in nature as one of the animals in a community of organisms.

On the other hand, such a course, while excellent for the liberal arts student, may not necessarily be the best beginning for the person who, by virtue of high school training or a strong interest in organisms awakened in some other way, already has a fair understanding of the general concepts and is anxious to begin directly on his professional training. In two attempts to put all students together—majors in biology, premedical and liberal arts students—we have had this brought to our attention strikingly. The pace necessary for the newcomer is too slow for the student already introduced to biology. The repetition of the same material as he had in high school is not most stimulating to him. On the other hand, accelerating the course or making it more intensive soon carries it beyond the ability of the newcomer. Segregation of the majors and premedical students into a special advanced laboratory section helps but does not solve the problem, for the lectures are still aimed mainly at one group. As a result of these experiences the professional and premedical students were allowed to elect plant and animal biology instead of general biology. This most of them did, although some, feeling the need of orientation, took general biology. Both routes are allowed to serve as an introduction to the advanced professional courses.

In the introductory plant and animal biology courses the plan has been to introduce the student to the major plant and animal groups, their behavior, nutrition, structure (gross and histological), life cycles, and evolution. In so far as is feasible, principles of adaptation, distribution, homology, recapitulation, evolution, and heredity are considered when the material favors their discussion, and the cell theory serves as a unifying principle throughout.

The professional and premedical student does not receive adequate training in all the principles of biology in his introductory plant and animal biology courses, since time is inadequate for this purpose. On the other hand, by the time he finishes a good advanced sequence in his professional field he will have been introduced to all the principles of biology, each strongly reinforced by a body of data far in excess of that possible in the general biology course. If he still needs a general treatment of the principles of biology and their application to man, a course on the senior level, encouraging him to focus his attention on the principles and to weld these into a philosophy of biology, might serve his needs far better than time taken out at the elementary level.

Such a double entry into biology may require more staff, and it taxes the type of adviser who wishes to rubber-stamp all college entrants. Inasmuch as the entrants are diverse in ability, background, and training, why not recognize and take advantage of this diversity as well as of the differences in objectives and subsequent training an individual is to receive? While all members of our own staff are not in complete agreement on this arrangement, practice has borne it out as preferable under local conditions. It would be interesting to know the experience of others in this regard.

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## Support of Scientific Research

In reading the various interesting and stimulating discussions of different aspects of the proposed national legislation for the support of scientific research, there is one phase of the problem that seems to me to have been largely, if not entirely, overlooked. This is the educational value to a democracy derived from the individual support of such work. There has been a well-organized effort in this country to emasculate the emotional and participative factors in individual charity and philanthropy.

Community chests with pooled and budgeted objectives are undoubtedly, on paper, an efficient method of giving. By the conduct of a single campaign covering many needs it effectively obviates the necessity of the donor investigating and considering the individual needs. It is a soporific to individual responsibility and tries to make giving an easy and comfortable process devoid of any unpleasant realities that make the donor even temporarily uncomfortable. It kills thought and, with

thought, imagination. It attempts to do for charity toward one's neighbor what many of the organized religions have done to man's thoughts about a deity, namely, make them less a personal and more an organizational responsibility.

Support of education and of research by taxation is much the same sort of process. One's taxes are rarely itemized in proposed expenditure although analyzed *ad nauseam* in origin of income. When one's Federal taxes are paid, personal interest in their expenditure promptly and unfortunately ceases for the average man unless some flagrant abuse or scandal is later unearthed or unless they are abruptly or extensively increased.

This country sorely needs more, rather than less, individual appreciation of its educational and research problems. It can gain this end best by forcing greater rather than less, individual participation in raising funds for these purposes.

The experience of the American Cancer Society is a large enough example of this principle to be significant and impressive. This Society has long recognized that cancer obviously and insistently requires individual responsibility, knowledge, and action for its ultimate conquest. The Society has gone far along the road toward arousing the American public to its essential part in the fight against this disease. The effort has required time, hard work, and faith in the average American citizen. It has, however, begun to prove its soundness by the results already obtained, and its permanency by the increased evidence of autocatalytic increase in interest by the public.

A democracy which could and did obtain its support of scientific research in the same way would send the roots of intelligent, personal giving deep into the soil of its citizenry. These roots in turn would make that soil more porous to education and more fertile in contributing succeeding generations of better-equipped and more cooperative men and women who would understand more completely and naturally their duties as citizens of a free state.

Government support of research involves no new principle. It has a long and distinguished record of achievement to its credit. It can well be greatly extended and broadened. It is only when it becomes too regimented, circumscribed, or handicapped by administrative methodology that it becomes dangerous in just the same way that these same impersonal and overorganizational factors can endanger individually supported research.

There is a very real place for government support of research but it might well be in cooperation with increased private and individual effort. Neither system alone is as strong as a combination of the two, for when both exist together there is a chance to compare the results and to supplement one another where mutual interests are involved. Each can learn by the mistakes of the other. Each can use the experience as a valuable "laboratory course" in the relationship between individual and Federal responsibility.

The main point is that both governmental and private support of research need and must have a continuing individual educational emphasis so that both may constantly be more intelligently and universally supported by citizens who know what they are supporting and why.

The time to establish this principle is now. If we delay we shall find it increasingly difficult to introduce it at a later date.

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# Book Reviews

***Pulmonary edema and inflammation.*** Cecil K. Drinker. Cambridge, Mass.: Harvard Univ. Press, 1945. Pp. viii + 106. (Illustrated.) $2.50.

This book is of particular importance because it is the only publication at present available in which the factors involved in the excessive accumulation and distribution of fluid within the pulmonary system are presented. Observations based on experimental technics devised by Drinker, Warren, and their associates for determining quantitatively the pulmonary lymph flow in the dog form the groundwork for a discussion of the mechanisms of pulmonary edema and its treatment. Four of the five chapters are based on the Nathalie Gray Bernard Lectures given by Dr. Drinker at the Bowman Gray School of Medicine. A fifth chapter on artificial respiration completes the book.

The anatomy and physiology of the lung are discussed in relation to transudation. It is pointed out that the pulmonary capillaries, unlike all other capillaries, depend for their oxygen supply on air reaching the individual alveoli and not on arterial blood. The presence of fluid in the alveoli or bronchioles excludes air and thereby produces anoxia of the involved pulmonary capillaries. Experimental observations in the dog are presented in detail and interpreted to show that anoxia produces excessive leakage of fluid from the pulmonary capillaries, whereas increased capillary pressure does not readily cause recognizable pulmonary edema. The pulmonary lymphatic system in the dog is extensive and drains into the right subclavian vein by way of the right lymphatic duct. The right lymph duct is small and limits the rate of pulmonary lymph flow. A new drug, related to thiourea, which is capable of producing pulmonary edema was used to demonstrate the inadequacy of the lymphatic