biology because such a course will best include the important values of biology in secondary education.

The above discussion has included only the information side of the values of high-school biological study. Limitations of space forbid appropriate discussion of the scientific discipline derivable from the study; but I fail to see any valid argument against the year in biology as far as discipline is concerned. On the contrary we may expect to get more valuable scientific discipline from the study of the more important subject-matter which would be concentrated into a year of biology. The possible objections all center around the idea that science study must be carried far into useless detail in order to give the best scientific discipline. This may be true from the research standpoint; but as applied to the everyday life of the average cultured citizen the results of such study of details have been far from satisfying. We seem to be moving rapidly towards that science study which is so correlated with information worth having that the discipline obtained will meet with greater application in practical life.

Summary: The practical problems of the school curriculum seem to demand a course in biology for the majority of pupils, and there is nothing in the content of the science and in approved methods of teaching which opposes this. Considering the recognized values, a course in biology will tend to emphasize the great ideas or principles worth knowing, and there is no inherent reason why scientific discipline should not be as well developed as in any other high-school course in science.

THE PRACTICAL, PEDAGOGICAL AND SCIENTIFIC BASES FOR THE STUDY OF BIOLOGY.

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The "practical" in education has until recently meant, and to most still does mean, that which gives the individual an advantage in his competition with others. As education becomes both public and universal the "practical" must come to mean that which gives the community the advantage in its struggle against its environment, animate and inanimate. The welfare of a civilized community depends, and will with the years more and more depend, upon, *inter alia*, the degree to which its citi-

zenry coöperates in the public activities directed towards the maintenance of general health, the conservation of natural resources, and the advancement, through research and organization, of man's control of his environment. So much of the daily activity of a large part of the population in every civilized community depends upon the application of biological knowledge, so much of the public activity consists in the application of biological knowledge, that if the citizens are to coöperate intelligently and efficiently it is necessary that they shall in ever increasing proportions be sufficiently well informed to understand the facts and principles upon which these activities are based, even where each is not directly engaged in these activities. It is of great practical importance that at least all who get a high-school training shall understand the bases for society's fight against various plants and animals whose activities are of direct or indirect economic or hygienic bearing; the bases for vaccination, and quarantine and food-inspection; the bases for restricting hunting and fishing and water-polluting and forest-destroying. It has been possible in the past to teach people to abhor the thought of mixing milk with flesh, or of eating meat on Friday, or of laughing on Sunday; it would be just as easy, and practically much more desirable, to teach people to shrink at the thought of violating any of the restraints or demands upon our conduct imposed by an understanding of the biological foundations of hygiene or of economic welfare. The fact that we are living beings whose well-being depends more and more upon an understanding of our external relations to other living beings, and of the internal processes of living things, furnishes the practical bases for the study of Biology.

In common with other high school subjects, the study of Biology must contribute to the amplification and the deepening of the pupil's interests and sympathies; to the elaboration of his thought processes and to the facility of his thought expression. In common with the other sciences it must cultivate the habit of looking to facts for the foundations of opinions, and must give him some skill in discerning facts through observation and experiment; it must cultivate the habit of analyzing problems and looking for causal relations, and must give him some skill in distinguishing between essentials and incidentals in various classes of phenomena; it must impress strongly upon the pupil an appreciation of the debt of civilization to science as method,

and the living faith that in all matters knowledge is better than ignorance, and choice better than chance. In addition, high school Biology must cultivate on the one hand an appreciation of what human life has in common with plants and with other animals, and on the other hand a strong and highly differentiated feeling for relative values; at the same time it must counteract the tendency to consider man as the end of the universe, either in the sense that all exists for his especial benefit, or in the sense that he is in his present state the final product of all evolution. To relate these various ideas to the activities of everyday life is a part of the pedagogical problem.

The scientific bases for the study of Biology are the fundamental problems that apply to all living things: comparison of living and non-living; properties of protoplasm, and the activities and capacities of organisms conditioned thereby; the notion of life as adjustment; the conditions essential to life and the limitations upon its continuance; the essentials of nutrition, the Nitrogen, Carbon and Oxygen balances; the relations of plants and animals to each other and to man; interdependence, types of symbioses, communal life; organization as integration and differentiation; reproduction and the essentials of sex; tropisms, taxes and instincts; increasing importance of consciousness in utilization and control of environment; variation and heredity; artificial selection and hybridization, etc.; evolution and man's place in nature. If the high school, and especially the public high school, is to give its pupils anything more than what passes under the name of "culture" in the boarding-schools for young ladies of the well-to-do middle class, surely these scientific ideas and their related ideals and effects upon conduct are eminently worth while; at any cost we cannot afford to do without them.

The structure of the Biology course will depend upon the end in view. If we are to present *Biology* at all we must teach it as a single science. To teach Botany, Zoölogy and Human Physiology in one year as three subjects is to sacrifice thoroughness or balance; and there is not enough material of sufficiently general interest or importance in any one of these to justify the expenditure upon it of the full time for a year. The most important part of each of these subjects lies just in those things that can be most easily and most profitably correlated with the things in the other subjects; but the most useful synthesis and perspective cannot be readily obtained if the matter is presented

as under separate subjects, and is generally not obtained at all when so presented. The single Biology course can give all that is necessary of the strictly botanical and of the strictly zoölogical and of the strictly physiological; it alone can give the more generalized material in a thorough, balanced and coherent way.

THE BASIS OF THE TEACHING OF BIOLOGY IN SECONDARY SCHOOLS.

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The subjects that may be taught in schools below college fall naturally into two groups: first, the tools of education, such as reading, spelling, number, a knowledge of which is necessary to the study of any others; second, all other subjects. But no one, I suppose, would now argue that, because reading and number have a utilitarian value with reference to the pupil's further schooling, they should not be taught at all unless the pupil is to proceed further than the elementary grades. A knowledge of these subjects has another value than merely that of a gateway to history, literature and the sciences as taught in school. Knowing how to read enables the pupil whose formal education may stop with the eighth grade, to broaden his interests and his general intelligence after leaving school, and to become a more useful and desirable member of society. Therefore reading, spelling, *et cetera*, should be taught, not only because they prepare the pupil for the high school, but because they fit him for more complete living in case his school course is not continued.

When we consider what subjects should be included in the high school course of study, the fundamental question first arises: What is the object of the high school course? Is it to prepare for college, or to continue the process, begun in the lower grades, of equipping the pupil for more complete living and more effective social service? Space is too brief to discuss here what the purpose of a high school course should be, but I take the position that we should insist upon the latter purpose rather than the former.

On this basis, the question of the inclusion or exclusion of different studies from the high school curriculum is to be decided on their relative value as instruments to accomplish the end indicated.