in employing the mental processes of abstraction, analysis, discrimination, comparison, classification and generalization; in other words, for attaining skill in thinking, or the perception of relations.

PURPOSES IN SECONDARY SCHOOL BIOLOGY.

BY HENRY B. WARD,

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It is difficult to separate the practical, pedagogical, and scientific bases for secondary school work in biology. Through the study of biology we obtain a knowledge of the principles of life which underlie all nature about us, which are the foundation of our own being, which give us the proper understanding of health and disease, of success and failure, of social relations and personal control. At the same time the laboratory training develops keenness of eye in seeing things as they really are, correctness of judgment in distinguishing between that which apparently happens and the real occurrences, in deducing proper conclusions from the facts which are presented, all of these things are of incalculable value for the individual in later life, whatever line of activity he may be called upon to follow. The most of the errors to which men in general are subject and the most of the difficulties into which they fall are due to inability to see correctly and to think clearly. Moreover in real life a man is not called upon to think in the abstruse but to observe everyday facts and draw from these concrete instances the proper conclusions. True biological study is more than book training. It is obtained by contact with nature and natural objects and consequently yields precisely the training which is most valuable in later life.

In my opinion it is rather immaterial whether the course be a general one, using both plant and animal material for developing the fundamental principles in order that the student may acquire some conception of life in its contrasted lines of development, or whether on the other hand, it should be an entirely distinct course in botany and zoölogy. In most cases that course will be best taught which follows the mental bent of the individual teacher and if the instructor be warned not to neglect the dual aspect through his overpowering interest in the one or the other side, it will be best to allow him the exercise of

his own preference in keeping the lines of study distinct or in combining them to reach his ideal biological study.

So far as work in human physiology is concerned, I feel that better results will be obtained by placing this alone in the last year of the secondary school course. In the first place there has been a rest from the legal grind and from the uninteresting and often deadening repetition of the required instruction in grammar grades, and there is also the possibility of discussing the subject from the advanced standpoint which a study of chemical, physical, and biological science has made possible.

PLANT ECONOMICS.

BY WILBUR H. WRIGHT,

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One of the criticisms more commonly made on our courses in high school botany is that they are "too scientific." The principals tell us that we are trying to imitate the college too much; those parents who try to be particularly practical often elect book-keeping or stenography for their children instead of botany, and some of the pupils themselves, if they do not openly express their idea of a less utility of plant study, manifest it otherwise by occasional fits of indifference. Thus the parent and the child, although they may not be able to formulate their criticism as well as the principal, are often in agreement with him in their objection that the botanical courses lack sufficient contact with ordinary life.

The old idea of spending most of the time in the study of leaves, flowers, fruits, seeds and so forth and in making herbaria may not have been a well balanced or a scientific one, but it at least resulted in the acquaintance of the pupil with the plants that surround his daily walk in life and that is wherein many of our present courses are weak. This does not mean that our present efforts in physiology and ecology should be lessened. Plant physiology and its applications, as far as they may be brought out in secondary work, make such courses more valuable in this respect than the corresponding zoological studies. And although the late enthusiasm for ecology seems to have declined somewhat, ecological studies have come to stay, as is proper. But as a result of these tendencies and a much fuller treatment of the lower