

ers. The truth is the job does actually fall upon your shoulders. In a sense, I pity you because of the difficulties you must undergo in accomplishing the purpose in view, as I have at least some idea of the problems involved in changing established forms and methods of teaching. You will almost need to develop

two personalities—one, your “regular” self, the other the form and spirit of an evangelist—for if you believe the things that I have attempted to express to you today you will no longer be able to rest quietly until you have done your part in bringing about widespread education on this most vital subject.

The Topic of Greatest Importance in Biology Was—

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The development of judgment and critical appraisal should begin as early in the training of the child as possible. Often, no doubt, it starts in the first years of school without our being aware of its inception and progress. Do we consciously foster it enough? Do we deliberately set about to see that it is given the opportunity to grow? There are many chances, offered in a great variety of ways, for the alert teacher to bring out analytical powers in the school-room, to stimulate correct thinking habits, and to provide an outlet for the growing child mind.

In order that pupils might be led to give consideration to the value of biology to them as individuals and to society as a whole, two classes, consisting mainly of sophomores at the high school level, were asked to submit the topic which seemed to be of *greatest importance* among those they had considered during the first half of the year. A few upperclassmen also participated in the exercise. A twenty-four-hour interval was allowed for thinking the matter over. Forty-two girls and twenty-five boys returned answers, given with varying degrees of care and discernment.

This exercise was prepared in conjunction with another which concerned

pupil interest in topics considered during the fall and early winter months. Results and discussion of the study were incorporated in another paper.¹ Very likely it would be simpler for the pupil to state what special part of his work had been most interesting rather than to evaluate it. No complaint was heard about either request and both were fulfilled with some enthusiasm. A few returned more than one answer, indicating difficulty in choosing between portions of the subject matter. In many of the discussion periods the direct and indirect worth of what was being taken up at the time was brought out. Opinions were never dictated but direction through explanation was frequently offered and inserted when experience on the part of the pupil could not supply the same. Therefore, the author does not feel that he formulated the opinions of the group. Enough leeway was given through the many and varied items covered so that a certain amount of discrimination and critical thinking had to be exercised.

There was some parallelism between the set of replies and those made in response to the question about the most appealing and interesting facts. Also

¹ *The American Biology Teacher*, November, 1946, pp. 51.

the same answer in about the same words and phrasing appeared more than once yet not often enough to indicate a marked degree of collaboration. Reasons for selections made were not called for although it was hoped that some would be voluntarily given. That desire of the instructor's was fulfilled.

The texts² used were standard and well-known. Naturally the order of treatment of subject matter in each was a little different. For the most part one class consisted of college preparatory electees whereas those in the other had chosen the "general" course. In each there was a sprinkling of home economics and commercial majors. A critical teacher shortage prevented the agriculture work from being given for the year which carried a larger number of boys away from their regular schedule into the biology not ordinarily offered them. For purposes of lightening the teaching load and running laboratory work more efficiently, the hours for biology ran consecutively and there was no interval provided for changing materials. Therefore, the courses were much alike as to content. Yet an effort was made, in spite of all the hurdles to overcome, to stress theoretical matters

² *Everyday Biology*, Curtis, Caldwell, Sherman; Ginn and Co., Boston. *Biology*, Moon and Mann; Henry Holt Co., New York.

more fully with the classical pupils and to bring out rather forcefully the pragmatic for those taking the work without the idea of going on to college or taking up medicine, nursing, etc., as a profession.

In either case introductory presentation would lean a bit more towards the basic and abstract than to the directly beneficial. Work with the cell, the tissues, the organ-systems, protoplasm and its nature, classification, the plant and its place in nature, and the major groups of lower animals formed the bulk of what was taught for the half-year concerned. Health and sanitation, bacteria and their relation to disease, bird study, wild-life conservation and care, economics of natural resources, breeding and animal and plant improvement had not been mentioned except incidentally from time to time. It can be seen that possibly the most vital portions of biological fact had yet to be presented. Because of this the assignment required somewhat more thinking than the second half of the work would have. It would have been interesting and valuable to have repeated the question at the year's close but such was not possible. It is felt that worthwhile results for guidance are to be found in the tabulations made from available data, however.

TABLE I. *Relative Importance of Topics*

	Boys	Girls
Directly beneficial	7	6
Indirectly beneficial	17	33
Unclassified	1	3

TABLE II. *Most Important Fact Learned*

That Biology is the study of plants and animals	2	10
The topic, and the study, of plants	0	2
The study of animals	1	0
The study about animals ranging from simplest to highest	1	0
The gradual development of animals until the most perfectly developed stage is reached, which is man	1	0
Comparing each animal with others lower in the class	1	0
The organs of animals	0	1

“The facts we studied concerning parts of animals”	0	1
Plants and living matter	0	1
The striking and fundamental likenesses between plants and animals	0	1
The relationship between plants, animals and man	0	2
The study of the living and things that have been living	1	0
All living things have the same foundation material, protoplasm	0	1
All substance in the world is either organic or inorganic	2	2
The common functions of nutrition, sensitivity, and reproduction	1	2
Definitions of the various kinds of sciences such as biology, geology, zoology, botany, bacteriology, physiology and many others	0	1
Embryology	0	1
“The development of life starting with the plant cell and continuing through to the most complicated living thing, the brain”	1	0
Insects, insects and man, insects and plants	2	4
Metamorphosis	2	1
Insects and crop damage; control	0	3
“Characteristics and adaptations of all animals and plants, their struggle to live, especially insects”	0	1
Pollination and fertilization of flowers	1	1
Economic importance of animals	1	0
Protozoa	1	0
“That the hookworm enters through the foot”	1	0
That some invertebrate animals, roundworms and flatworms, get inside the human and live there as parasites	1	0
That there is only one poisonous lizard and only four poisonous snakes in the U.S.A.	1	0
Amphibia and reptiles	0	1
Fish	1	1
Spores in blister rust	1	0
Photosynthesis, its results	2	2

“That fossils can be traced back to animals living thousands of years ago” was listed by one girl. Her class marks were low but her mind was active and it would have been interesting to find out what she would have given as her reason for selecting that fact. One boy wrote “I have *enjoyed* the study of prehistoric animals the best so far in Biology,” probably mixing the assignments of interest and importance. A number handed in several answers. One girl wrote her name but her paper was blank. She came from a family of slender means, worked a great many hours after

school, was often seemingly embarrassed by lack of preparation, did conscientious work for the most part and possibly thought that she would have to account for herself if only by handing in a slip. Of course she may also have found herself in a dilemma over choosing between several items considered important and refrained from committing herself to a single one. As can be seen, practically the entire class engaged upon the performance in spite of its rather forbidding nature, and produced a variety of answers. A few of these are quoted as follows:

"If it was not for the process of photosynthesis (the action of chlorophyll and light in producing carbohydrates in green plants) there would not be any form of life on earth." (Boy)

"Pollination and fertilization of flowers is the most important subject we have studied because after we learn how this is done we can raise better plants as we will have a better idea of what we can do to help them grow." (Girl)

"The most important fact is that Biology is the study of plants and animals in order to know what you are going to find out about." (Unsigned)

"It is all very important because without knowing about the fundamental things, we wouldn't be prepared for further studying." (Girl)

"The most useful fact was how plants pollinize and keep on living." (Boy)

Most important is insects and plants, "They have so much to do with man and all other animals." (Girl)

"Facts concerning some of the methods used in intensive insect control, such as spraying, or importing insect pest's enemies." (Girl)

"I have learned several things of importance in my course of Biology. Before studying the divisions of labor, characteristics, etc., of plants, and animals, nature meant very little to me." (Senior girl)

There was definite correlation between experience and the type of choice made, in some instances. Two sisters living on a farm realized, and spoke of, the task of fighting insects pests. A boy had had summer work on eradication of carriers of pine blister rust. A youth living on a poultry farm understood the economic significance of parasitism. Several were undoubtedly influenced by the discussion of the value of the fisheries industry and comments on salmon, formerly very abundant in the Connecticut River. The legend is that farmers used to drive to the river and load their carts with this now valuable fish, hauling them away in some cases for fertilizer, and it is very natural that the vital connection between food manufacture in the chlorophyll-bearing plants and the sustaining of all life should make its appeal. In view of the stress placed upon some of the more outstanding phenomena of living things it seems unusual that they received such

scant attention. There may have been some collaboration but the replies are too varied to admit of much copying. They show considerable independence of thinking as a matter of fact. In this study they frequently revert to early lessons, possibly because of frequent repetition of basic fundamentals. For instance, on appropriate occasions pupils were directed to recall relationships existing between all forms of living matter such as need for food to keep the individual functioning, response to stimuli to help in its survival, and the ability to reproduce to ensure propagation of the race.

From the study, brief as it may be, one may learn to be cautious about saying that boys and girls of this particular age are not too well able to express competent judgment concerning relative values. They have opinions and can support them. They can be taught to reason and to think critically.

Members of THE NATIONAL ASSOCIATION OF BIOLOGY TEACHERS are cordially invited to attend two sessions at the Boston meeting sponsored by *The Co-operative Committee on Science Teaching* of the AAAS.

Friday, Dec. 27, 10:00 a.m.

Parlor A, Bradford Hotel

Dr. Oliver J. Lee presiding—Three papers, as follows:

"Science Counseling in Secondary Schools," R. W. Lefler

"Certification of Science Teachers," K. Lark-Horovitz

"The Crisis in Science Teaching," Raleigh Schorling

Sunday, Dec. 29, 8:00 p.m.

Oval Room, Hotel Bradford

Forum on *Problems of Science Teaching*

Anton J. Carlson will be moderator and K. Lark-Horovitz, Morris Meister Laurence L. Quill, and Raleigh Schorling will participate.