

after a week or so. In this case I find a few drops of Duco cement ideal for sealing the twig tightly in the plaster.

Since the cost of making such a collection of twigs is very slight, one can easily afford to replace the specimens after a year or two if the twigs become deteriorated or "shop-worn." While

I have not tried it, I think the plaster could be removed and the plaster cup salvaged for reuse. One could remove the damaged twig, and with a large-sized bit, or a pocket knife, bore a hole in the old plaster. Then a fresh twig could be inserted in the slightly large hole, and sealed in with a little more thin plaster.

## Comparison of Special-Preparation Topics Selected by Pupils in Biology

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How best may pupils be encouraged to browse around and become acquainted with the literature of their subject? To what extent should student interest influence the selection of factual material in a course? What devices may be adopted in order to vary routine performance and bring freshness of procedure into daily preparation? These and other considerations were at the root of an effort to secure guidance for classroom technique.

Eighty-four high school pupils in two biology classes, prevaillingly sophomores, were told that their preparation for the following day would be on any biological topic of their own choosing from any source available. No limiting restrictions other than this were given and an attempt was made to have it entirely clear that they were free to carry out any acceptable plan. Upon assembling at the next period small quiz sheets, occasionally used, were issued and the students were asked to summarize briefly what had been prepared. Eighty-five papers were collected, the extra one coming from a girl, absent on the

preceding day, who turned in a blank. She had made no effort to find out what the assignment had been. The contributions were used later as a basis for class discussion. Lists of the topics, classified by division and sex, with analytical comment, follow.

### I. TOPICS CHOSEN BY BOYS IN GENERAL COURSE

Frogs: adaptation, development  
Sponges: food-getting  
Earthworms: locomotion, food, uses  
Gypsy moth: damage done by  
Yellow fever: danger of, carrier for  
Tuberculosis: relation to inheritance, cure  
Malaria: cause, distribution  
Alcohol and Tobacco: effects on human body  
White Pine Blister Rust: damage by, prevention, nature of  
Grain: kinds, importance  
Respiratory system: comparison to a boiler  
Classification: double naming, groups  
Food and Drug Men: tracing food spoilage  
Biology: usefulness of  
Medicine: importance of  
Various topics: ape-man differences, animal-plant comparison, etc.  
Snow formation

II. TOPICS CHOSEN BY BOYS IN COLLEGE  
PREPARATORY COURSE

Ameba and Paramecium: structure  
 Japanese Beetle: life cycle  
 Geranium flower: structure, self-pollination  
 Flowers: structure, pollination types, life length  
 Hemophilia: snake venom effect, clotting agents  
 Chestnut Blight: immune and resistant tree types  
 Smoking Nuisance: the drugs in tobacco  
 Edward Jenner: small pox, cow pox  
 Luther Burbank: plant improvement, new creations  
 Fossils  
 Deer Antlers: a particular captive animal described  
 Calcium: sources in foods, bone and blood building  
 Brain: structure, the spinal cord  
 Bean: germination diagram for notebook, etc.  
 Notebook work  
 No preparation: could not find time

III. TOPICS CHOSEN BY GIRLS IN  
GENERAL COURSE

Ameba: structure, function  
 Poisonous Spiders: black widow  
 Monarch butterfly: habits  
 Whales: size, food  
 Snakes: helpful, harmful  
 Sponges: size, form, distribution  
 " : structure, division of labor  
 " : uses, body layers, coloration  
 " : food-taking, kinds  
 Birds: usefulness, habits, migration  
 " : coloration, nests, reproduction  
 Roots: likeness, difference in root systems  
 Seeds, Fruits: uses, distribution  
 How Plants Secure Food: photosynthesis, saprophytic habit and dependency  
 Fermentation: examples, characteristics of  
 Brain: structure, weight, injuries to  
 "Autumn Allergies": sensitization, sources  
 Tuberculosis, Spinal Meningitis, etc.  
 Pasteur: his work  
 " : rabies, pasteurization  
 Lister: antiseptics  
 Fossilization: tar pits and animal preservation

"Aquariums": how to stock and maintain  
 Necessity for Sleep: posture, nervousness from lack of

IV. TOPICS CHOSEN BY GIRLS IN COLLEGE  
PREPARATORY COURSE

Butterflies, Moths: comparative number of species, wings, food storage in caterpillar  
 Grasshopper: structure, naming, related Orthoptera  
 Bumblebee: adaptations, structure  
 Gypsy moth  
 "Fowls of Land and Water Tamed by Man": fattening by "noodling"  
 Lungfish: habits, personal observations on specimens seen  
 Armadillo: food, polyembryony  
 Porcupine: habits, quill use by Indian women  
 "Ways of the Wild": response of deer to logging camp treatment  
 Seaweeds: coloration, edibility  
 Roots: types of, oat root length  
 Flower: structure  
 Seeds: germination, experiments  
 Octopus: (double topic)  
 "Science Makes Fish Fight": vitamin feeding in hatcheries  
 Plant Uses: list compiled, experiment done  
 "Allergies": seasons for susceptibility, reactions  
 Tuberculosis: Koch's work  
 Yellow fever: cures for diseases  
 Bacteria: history of bacteriology, Koch, Pasteur, fermentation  
 DDT: insects destroyed, usefulness  
 Nutrition: life processes involved in  
 Human Evolution: from cave man to present, skull development  
 Heredity: gene theory  
 No preparation: absence

What broad conclusions are justifiably drawn from a study of these answers? Pupils liked the exercise. They showed fine response, industry and originality. It is likely that "reports" were manufactured on the spur of the moment, from previous study and reading, by a few. Some papers were handed in covering facts recently discussed. By far the larger number indicated genuine at-

tempts at looking up a particular item and concerted effort to master it in readiness for whatever might be required. Several anticipated an oral exercise and mentioned that they were prepared to tell about their choice. At

sults obtained in two other studies on topics of greatest importance and facts of interest, reported previously.<sup>1</sup>

The accompanying table summarizes the results.

These figures would indicate a trend

TABLE I. TOPICS CLASSIFIED BY SEX AND DIVISION

Topic	General		College Preparatory	
	Boys	Girls	Boys	Girls
Sponges .....	1	4		
Tuberculosis .....	1	1		1
Flowers .....			2	1
Birds .....		2		1
Pasteur .....		2		1
Gypsy moth .....	1			1
Alcohol and Tobacco .....	1			1
Ameba .....		1	1	
Fossils .....		1	1	
Brain .....		1	1	
Bean Germination .....			1	1
Butterflies .....		1		1
Roots .....		1		1
Seeds (Fruits) .....	1	1		1
Allergy .....		1		1
Deer (Antlers) .....			1	1
Human Evolution .....	1			1
Notebook work .....		3	2	
Total .....	6	19	9	13

least two girls stated they had worked upon one or more self-tests.

It seems reasonable to assume that only those topics which aroused some degree of interest were investigated. The very great variety and wide range of topics, therefore, is notable. This confirms re-

toward greater individuality of choice on the part of the general course boys, with least shown by the general course girls. This is verified on a per cent basis by the following compilation.

<sup>1</sup> *The American Biology Teacher*, November, 1946, pp. 51-54, and December, 1946, pp. 75-78.

TABLE II. PERCENTAGE TABULATION OF GROUP CHOICE

	General		College Preparatory	
	Boys	Girls	Boys	Girls
Total Number in Course .....	18	25	16	25
Repetitions .....	6	19	9	13
Percentage .....	33%	76%	56%	52%

Here we find the college preparatory boys and girls showing up about equally in the degree to which they selected varying specific biological points for preparation. Careful inspection of treatment as revealed by the written summaries shows very little indication, however, anywhere that there was exact agreement in the ideas obtained and recorded. The notation of sub-topics after the main heading in Lists I-IV brings out clearly the diversity of ideas followed. The discussion of the sponges, for example, illustrates this fact very well. Aside from one statement, which was very general and not well presented, by a general division boy the other four show eight to ten different points included.

The selection by five pupils of the special topic of sponges is difficult to explain unless a current periodical carried an article which caught the attention. The facts which appear on the papers, however, do not support the view that an item of arresting nature was read and in one case the textbook pages are specified. What biology teacher would ever have predicted that sponges, of all organisms, would have led a list of vountary selections?

There is another way of looking at the grouping of the subjects. Considering the list from the point of view of disease, both animal and plant, with causation, medicine and investigators in the field included, eighteen are found to bear upon this line of thinking. Insects, too, in one way or another constitute a group of eight choices, a sizable bloc. Five relate particularly to mammals, excluding man. Very few are noticeably functional or concern abstract processes; this would naturally be expected of such an age group. Possibly ten fall in such a category. About five are stated in very broad general terms, Biology, for exam-

ple. Nearly all are very concrete and factual conforming to the paper answers. Three only are definitely along developmental and embryological lines. There is a surprising and almost total lack of interest in any kind of reproductive process. Perhaps the group thought that adequate coverage had already been given although the author is not conscious of especial emphasis. Human anatomy, physiology, and hygiene create no great urge or craving for mental satisfaction apparently, two discussing the brain, one the respiratory system, two the effects of alcohol and tobacco, the latter being boys.

Table III presents some broadly general headings as classified by sex.

TABLE III

Topic	Boys	Girls
Plants .....	7	12
Animals .....	9	17
Human Diseases .....	4	5
Human Anatomy .....	2	1
Physiology .....	2	2
Drugs .....	3	2
Notable Biologists .....	2	4
Processes .....	0	6
Structural .....	4	3
Prehistoric, evolutionary	2	1
Abstract, very general ...	4	2
Chemical .....	1	1
Bordering on Economic Values .....	7	7

The greatest difference noted in this table deals with plants and animals. By percentage 34% of the girls favored plants to 26% of the boys. The girls have a slight edge over the boys in looking up animals, 24% to 20%. Nearly 20% of the boys dealt somehow with uses and values to 14% of the girls. The girls seem to lean rather heavily toward processes as compared to the boys.

A listing of references was not required nor suggested but it was evident that many had done so. One boy wrote "I read a whole book of Tarzan to learn a few things about jungle life." He also said that he enjoyed his labor! In very few cases did papers show that no real effort at preparation had been made. Five general division and seven college preparatory boys showed clear-cut evidence of having consulted outside references though none cited them. Among the girls, fourteen of the college group and four in the general clearly had read elsewhere than from the text. By percentage 39% of the boys to 36% of the girls looked up special references.

Ten boys in each group wrote very good summaries, there being little distinction in quality between them. In both divisions some answers were a single statement of the subject taken. Among the girls, however, seventeen papers in the college class were definitely superior in content, clarity, comprehensiveness, grammatical expression and interest. Four from this number mentioned the *Reader's Digest*, *Current Science* (twice), and *Outdoor Life* as the source

consulted. A considerable number quoted the title of the article used. Ten general division girls wrote commendable summaries, ranking less high in volume and quality than the preceding.

Two college preparatory girls tried experiments. One "... put a drop of water on waxed paper to see what happened," reporting that it behaved like a mercury globule, not soaking in but "would run all over." Other drops on the paper "ran into one," exhibiting typical surface tension effects. The second experimentalist tested the temperature of soaked beans in a glass, checking against soaked paper in a second container, noting an increase, after some hours, in the former.

Aside from poor grammatical construction and spelling there were few errors. Grossest mistakes were the calling of a sponge a plant by a general division girl and the consideration of snow crystal formation as a biological phenomenon by a general group boy. If the exercise accomplished no more than to orient one pupil correctly in his thinking concerning life and its processes it may have been worth while.

## The Biology Teacher's Place in an Improved Health Program

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Youth needs more attention and more periods of activity in the gymnasium and on the athletic field. The thinking public is aware of this fact and likewise sees a need for more complete preventive measures of diseases. The teaching of health, if it is worth its salt, is an integral part of the improved program for the organic well being of people in which considerable attention has already been

given by our co-workers in physical education and public health.

Frequently, in the course in health, the student has been confronted with excessive terminology together with rules of health which he has applied more or less in his daily living.

This sort of learning in regard to one's health is demoralizing, inadequate, and antiquated. Far more convincing is an