

BIOLOGY AND HIGHER EDUCATION.

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My purpose is not to give reasons for the changes in courses of study relating to the biological sciences in high schools or to explain why higher education has neglected to keep pace with the demand brought by these changes but rather to give facts, whether liked or disliked, concerning the teaching of biology, botany, zoology, and physiology in high schools in the United States and call attention to the attitude of universities, state normals, and teachers' colleges toward preparing teachers for the very popular subject, biology.

We shall first see just what changes have taken place in courses of study in the biological sciences in high schools within the last few years. G. W. Hunter, of Knox College, Galesburg, Ill., found in his study of secondary sciences for 1908 and 1923 that in 1908 there were 225 high schools teaching botany, while in 1923 there were 107 schools teaching botany; in 1908 there were 150 schools teaching zoology, while in 1923 there were 66 teaching zoology; in 1908 there were 193 schools teaching physiology, while in 1923 there were 73 schools teaching physiology; in 1908 there were 73 schools teaching biology, while in 1923 there were 299 schools teaching biology. The first three show a loss of from 30 to 50 per cent, while biology made a gain of 57 per cent. (See plate No. 1.)

Number Concerned			Per Cent Concerned		
Subject	1908	1923	1908	1923	% of gain or loss
Botany.....	225	107	81.5	29.9	-51.6
Zoology.....	150	66	52.2	1.8	-50.4
Physiology.....	193	158	69	34.3	-35.6
Biology.....	73	299	26.5	83.5	-57.6

PLATE 1. Based on G. W. Hunter's study of secondary sciences in 1908 and 1923.

A study of Indiana high schools shows the following: In 1921 there were 80 high schools teaching botany, while

in 1926 there were 182 teaching botany; in 1921 there were no high schools teaching zoology, while in 1926 there were 18 schools teaching zoology; in 1921 there were 22 high schools teaching physiology, while in 1926 there were 83 schools teaching physiology; in 1921 there was 1 high school teaching biology, while in 1926 there were 290 schools teaching biology. (See plate No. 2.)

Subject	1921	1926	% of 646 schools 1921	% of 759 schools 1926
Botany.....	80	182	12.3	24
Zoology.....	0	18	0	2.3
Physiology.....	22	83	3.4	11.
Biology.....	1	290	.15	38.2

PLATE 2. Changes in five years in Indiana high schools.

The number of high schools in Illinois during 1926 teaching biological sciences were as follows: 63 teaching botany; 77 teaching zoology; 53 teaching physiology; 136 teaching biology. (See plate No. 3.)

Subject	Schools Teaching 1926	% of 663 Schools
Botany.....	63	9.5
Zoology.....	77	11.6
Physiology.....	53	8.
Biology.....	136	20.5

PLATE 3. High schools of Illinois in 1926.

In Ohio during 1926 there were 40 high schools teaching botany, a small number teaching zoology, and 1100 teaching biology. (See Plate No. 4.)

Subject	Schools Teaching 1926	% of 1375 Schools
Botany.....	40	3.
Zoology.....	Less than 40	?
General Science.....	?	75.
Biology.....	1100	80.

PLATE 4. High schools in Ohio, 1926.

In the high schools of Massachusetts, in 1925, we find few schools teaching botany; none teaching zoology; 250

or all teaching physiology; 165 schools teaching biology.
(See Plate No. 5.)

Subject	Schools Teaching 1925	% of all schools
Botany.....	Few	?
Zoology.....	None	0
Physiology.....	250	100.
Biology.....	165	66.

PLATE 5. High schools in Massachusetts.

In our study of the courses of study of twenty states we find the % of biology taught in all high schools to be as follows: Ohio, 80%; Indiana, 38%; Illinois, 21%; New York, 95%; Pennsylvania, 76%; Delaware, 100%; Michigan, 90%; Kansas, 20%; Georgia, 90%; Wisconsin, 70%; Minnesota, 75%; California, 62%; New Jersey, 90%; Utah, 99%; Massachusetts, 66%; Florida, 60%; Nebraska, 20%; Arkansas, 80%; Oregon, 70%; Virginia, 100%. (See plate No. 6.)

State	% of Schools Teaching Biology
Ohio.....	80.
Indiana.....	38.2
Illinois.....	20.5
New York.....	95.
Pennsylvania.....	76.
Delaware.....	100.
Michigan.....	90.
Kansas.....	20.
Georgia.....	90.
Wisconsin.....	70.
Minnesota.....	75.
California.....	62.
New Jersey.....	90.
Utah.....	99.
Massachusetts.....	66.
Florida.....	60.
Nebraska.....	20.
Arkansas.....	80.
Oregon.....	70.
Virginia.....	100.

PLATE 6. Number of high schools teaching biology in twenty states, 1925 and 1926.

From the foregoing facts it is evident that biology is the most popular of all biological sciences; that biology has

been a part of the course of study of some states for many years and that biology is rapidly becoming a part of the course of study of other states such as Indiana and Illinois.

Certainly, the Universities, State Normal Schools, and Teachers' Colleges face the problem of training high school teachers in biology.

The author asked twelve representative institutions the following direct questions: first, does your school give a course or courses in general biology; second, does your school give a methods or a teacher's course in biology; third does your school give a major in biology. Plate 9 below is the reply:

Institutions	Courses in General Biology	Methods Course	Major
1. Stanford University.....	Yes	No	Yes
2. Northwestern University.....	No	No	No
3. Harvard.....	Yes	No	No
4. Cornell.....	Yes	No	No
5. Indiana University.....	Yes	Yes	No
6. Purdue University.....	Yes	No	No
7. Teachers' College, Macomb, Ill.	Yes	Yes	No
8. Ball Teachers' College, Muncie, Ind.....	Yes	Yes	Yes
9. Chicago University.....	No	No	Yes
10. University of Illinois.....	No	Yes	No
11. De Pauw University.....	No	Yes	Yes
12. Yale.....	Yes	Yes	No

Eight of twelve higher institutions give a course or courses in general biology. From their catalog statement, they purpose to acquaint the student with fundamentals of living things. Six institutions out of twelve give the future teacher of biology a methods or teacher's course dealing with text books, courses of study, lesson plans, laboratory practice, laboratory equipment, etc. Four out of twelve offer a major in biology. That is, thirty-six term hours or twenty four semester hours consisting of varied combinations. Some have the major made up of botany and zoology; others have the major made up of general biology, a method course, botany, zoology and physiology. About one-half are neglecting to train in the most effective way a biology teacher. Too many students who are majors in botany or who are majors in zoology are going into high schools where they will face a course in biology. They may

not often know the biology of the house fly or may not know the biology of milk or biology of a hen's egg. They know little as to course of study, electing text books and biology outlook. A little modernism must come into the courses of study of many of our higher institutions. A few have taken the step.

Were I to suggest a course of study for a major in biology it would consist of a few courses in general biology, courses in botany, courses in zoology, a course in bacteriology, courses in human physiology, and a course in methods or the teaching of biology.

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