tension in agriculture, in spite of the reiterated statements to the contrary. The point of difference lies in the explanation of their action, the one view being that they are merely so much plant food which must replace the removal by crops, the other being that in addition to any plant food value which they possess, they affect the soil and produce changes and influences such as are at least partially illustrated by the experimental results cited here. We believe that these additional—note particularly that I say additional—actions explain more fully the function of fertilizers in agriculture. From the former view the application of fertilizers would be restricted to poor and so-called exhausted soils and poor systems of agriculture; from the latter viewpoint, fertilizers are indicated as well for fertile as for infertile soils, as an adjunct to successful farming and bringing the soil to its highest capacity of crop production.

The action of fertilizers on soils is a much contested question, but the weight of evidence is against the assumption that their effect is due altogether to the increase of plant food as such. If so simple an explanation were the true one, nearly a century of investigation of this problem by scientists of all civilized nations would surely have produced greater unanimity of opinion than now exists in regard to fertilizer practise. Thoughtful investigators everywhere are finding that fertilizer salts are influencing many factors which contribute toward plant production besides the direct nutrient factor for the plant. It is this additional influence of fertilizers which makes them doubly effective when rightly used and inefficient when improperly used. To this influence of fertilizers on soil and biological conditions is due their capriciousness when applied on the theory of lacking plant food, and any study which throws further light upon the mooted question is of direct help toward reaching that view of soil fertility and soil fertilization which will eventually result in a more definite, more rational and more remunerative fertilizer practise than in the past, and thus bring about the more extensive use of fertilizers in agriculture.

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THE DRIFT IN SECONDARY EDUCATION

IN the course of a preliminary study of the conditions affecting a particular high-school subject, I have been led to glean from the reports of the Commissioner of Education data which, tabulated or represented graphically, may have a certain interest.

The table has to do with the expansion of secondary education, 1890–1910. It is self-explanatory, but one or two points in it may be noted. First, while the population of the continental United States has increased 50 per cent. the proportion of the population in the secondary schools has been multiplied by about *three*. Second, that while the proportion of students completing the secondary course and graduating has slightly but decidedly increased, the proportion of them preparing for college, either classical or scientific courses, has been diminished by about 60 per cent. Third, that the proportion of boys in the secondary schools has in twenty years not varied much from 44 per cent.; also, that the proportion of boys in the successive years falls off somewhat, but not as largely as I had been supposing; in fact, the "elimination" of girls goes on at almost as rapid a rate as that of boys. Finally, that while the amelioration of conditions as shown by the number of students per teacher is noticeable, the burden placed upon the teacher in small high schools is in this respect markedly less than in those in cities of 8,000 inhabitants or more, and in these small schools the improvement is much greater. Of course, specialization in teaching tends in some degree to counteract this.

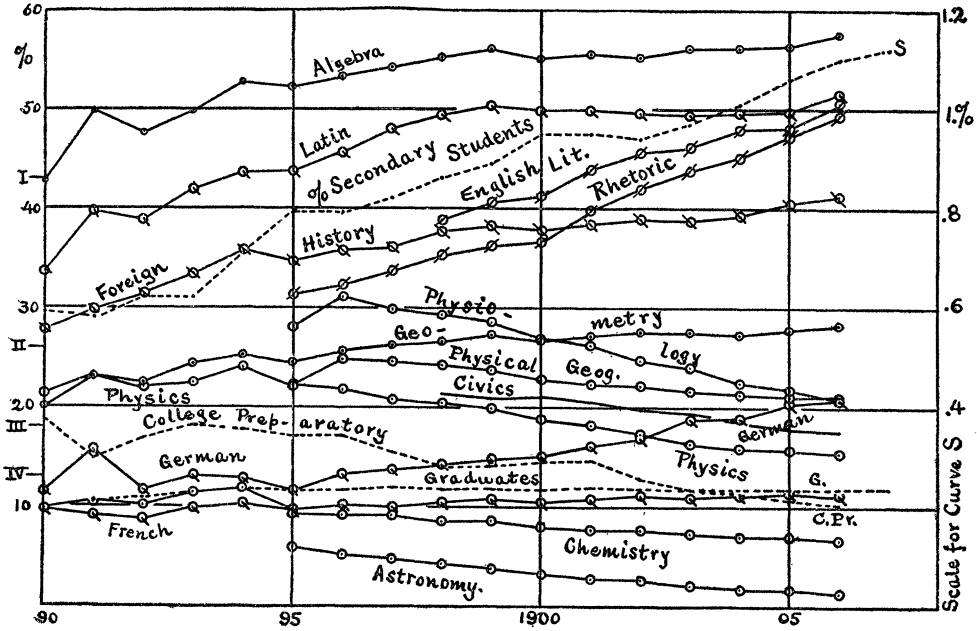

CHART I.

THE EXPANSION OF SECONDARY EDUCATION[1]

	1890	1900	1910
Population of U. S., millions	62.622	75.063	91.972
Number of public high schools reporting	2,526	6,005	10,213
Number of other sec. schools reporting	1,632	1,978	1,657
Number of secondary pupils	367,003	719,241	1,131,466
Percentage of boys, secondary pupils	45.03	43.16	43.97
Percentage of population, sec. pupils	0.59	0.95	1.23
Percentage of high school pupils, urban	—	45.3	47.3
		(1906–7)	
Percentage of high school pupils, yr. I	—	(42.35)	42.09
Percentage of these boys in yr. I	—	(44.2)	45.6
Percentage of high school pupils, yr. II	—	(27.23)	27.10
Percentage of these boys in yr. II	—	(42.6)	43.3
Percentage of high school pupils, yr. III	—	(18.17)	18.18
Percentage of these boys in yr. III	—	(41.6)	41.8
Percentage of high school pupils, yr. IV	—	(12.25)	12.63
Percentage of these boys in yr. IV	—	(40.2)	39.7
Percentage secondary pupils graduating	10.05	11.74	12.18
Percentage of these boys	—	—	40.3
Percentage preparing for College	18.66	14.53	6.80
Urban high schools—number	—	691	838
(In cities of 8,000 or over.)			
Teachers per school	—	11.4	19.0
Students per school	—	340.3	516.3
Students per teacher	—	29.9	27.1
Rural high schools—number	—	5,314	9,375
Teachers per school	—	2.4	2.7
Students per school	—	53.5	51.5
Students per teacher	—	22.7	18.8

[1] Extracted from the reports of the Bureau of Education.

Chart I. gives graphically the history of the decline in scientific studies as compared with humanistic, from 1900 to 1906. It was accidentally omitted from its proper place as illustrating a previous article.[2] Besides show-

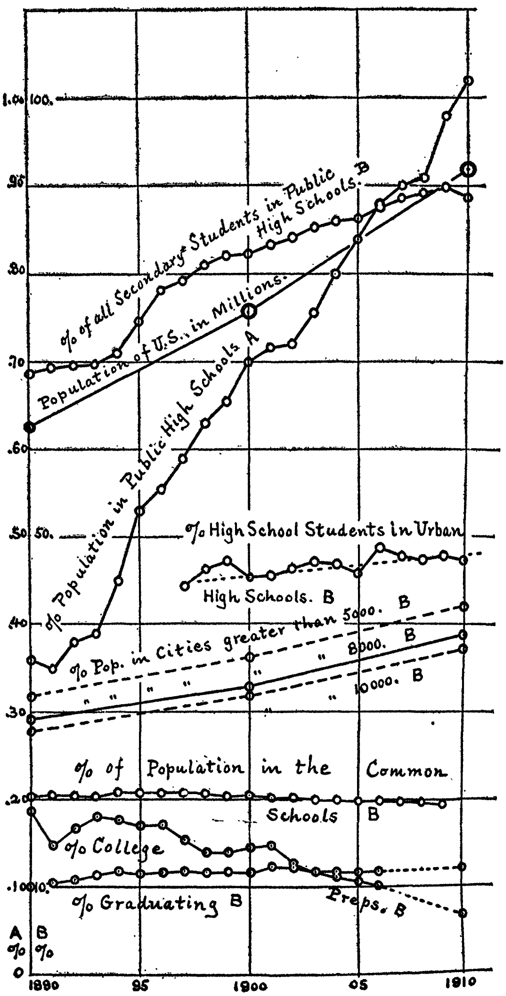

CHART II.

ing this decline in a striking way, the dotted curves show also the facts about the proportion of secondary students to population, and the proportion of graduates and college preparatory students to the whole mass of students. The points marked I., II., etc., at the left, indicate the approximate proportions of secondary students in the first, second, etc., years of the course. The decline of science indicated up to 1906 is continued in 1910, though not plotted.

Chart II. is for the most part self explanatory. It shows again the facts about population, graduates and college preparatory students, and adds data about some other interesting relations. The highest curve of all shows the extent to which public high schools are monopolizing the work of secondary education. The curve for per cent. of population in the common schools shows that, contrary to the tendency in secondary education, this ratio tends to diminish, though not varying much from 20 per cent. But the group of curves relating to urban high schools and urban population develops a fact of considerable interest. The two dotted curves are taken from census data; the heavy curve between them is partly interpolated. They give the proportion of urban to total population. The curve above them shows what proportion of the high-school population attends school in places of 8,000 or more. This latter proportion has increased irregularly from about 44 per cent. in 1897 to a little over 47 per cent. in 1910. This is clearly seen to be less than the rate of increase of urban population, so that in some fifteen years the cities of 8,000 or over will have only their share of the high-school population—the country high schools are catching up to the city. Of course the drift toward industrial education will certainly largely modify our classifications in the next decade; but in what way can not now be concluded.

Chart III. shows to what extent we may find local influences hidden under general averages. The data are taken from the report for 1910. The black dots are points representing conditions in the old slave states; the crosses stand for the New England states —no longer *Yankee* states. The dotted lines represent averages for the United States. The plotted points group themselves so as to show, as no table could, that where the number of secondary students per thousand of population

[1] SCIENCE, 35, p. 94, 1912: "Is Science Really Unpopular in High Schools?"

is small, there the proportion of secondary students pursuing algebra tends to be large. One is reminded of Booker Washington's remark about the freedman's penchant for studying Latin and holding office—but the

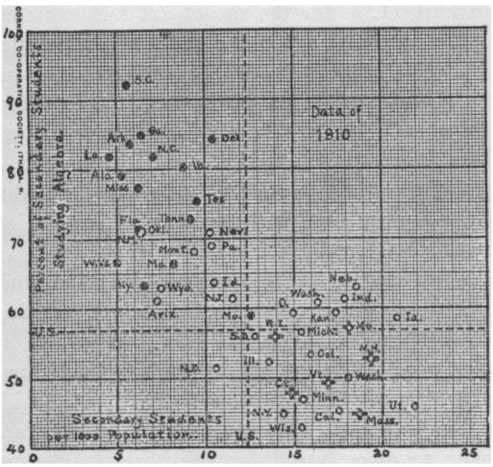

CHART III.

black dots on the chart represent mainly white education.

The method of this last chart may be applied as well to other studies and to the percentage strength of the various years of the course, all of which are shown to be more or less strongly related to the number of students per thousand of population. An attempt to correlate these statistics with urban congestion has, however, failed, as urban density so crosses state educational systems, and counts for so much more in some states—as Rhode Island—than in others, that a satisfactory disentanglement of the relations is practically impossible.

I would draw one general conclusion from this study. Our impressions of secondary—and other—education are strongest as they are derived from our own experience as students. Most college and university men, even those who have the closest relations with the work of the secondary schools, have done little actual secondary school teaching, and hence are very likely to be strongly under the influence of impressions received twenty, thirty or more years ago. Such impressions are, however, nearly valueless as guides in dealing with the present situation. The tabular and graphical representations of statistical facts show at a glance that since 1890 the problem of the secondary school has changed from that of the fitting school to one of a decidedly non-fitting school—some bigots would say a decidedly *unfitting* school; a school in which only 6.8 per cent. of the pupils anticipate college work of any sort. This being the case, the colleges and universities can not lead the way in the fashion of 1892 and the Committee of Ten; the problems of secondary education can be solved only in the schools.

WILLARD J. FISHER

ITHACA, N. Y.,
June, 1912

SCIENTIFIC NOTES AND NEWS

THE American Society of Naturalists will meet at Cleveland on January 1 and 2, 1913. The session on January 1 will be given to the reading of papers on genetics, and that of January 2 to a symposium on adaptation. The annual dinner, open to members of the affiliated societies, will be held on the evening of the second, with the president's address by Professor E. G. Conklin.

THE American Society of Zoologists will hold a joint meeting of its eastern and central branches in conjunction with the meeting of the American Association for the Advancement of Science at Cleveland, Ohio, during convocation week. Notice of this meeting, together with a request for the titles of papers to be presented, will shortly be sent to all members. Communications from members of both branches should be addressed to Professor Winterton C. Curtis, University of Missouri, Columbia, Mo., the secretary of the Central Branch, since the constitution provides that "the meetings of the societies shall be arranged for and conducted by the officers of that branch in whose territory the meeting is held." The president of the Central Branch during the current year is Professor Henry B. Ward, of the University of Illinois, Urbana, Ill.