of so-called Araucarioxyla previously described on this continent and in Europe in reality belong to the genus Brachyoxylon or allied genera and not to Araucarian conifers of the Agathis or Araucaria type. There is an interesting difference of opinion between American and European paleobotanists as to the interpretation of the results. For some unexplained reason my European colleagues have ignored the important genus Brachyoxylon and have invented other and often inappropriate names for other transitional woods described by my students and myself.

Brachyoxylon differs from Araucarioxylon by the absence of wood parenchyma and by its non-persistent foliar traces, as well as by the wound canals which can always be observed in adequate material. Obviously Agathis and Araucaria have come from ancestors which were without persistent leaf traces, since no wood with continuing traces has been described from the lower Mesozoic. This conclusion is likewise reinforced by the evanescent character of the foliar traces in the seedlings of Araucaria and Agathis. Professor Torrey, working up a large collection of Mesozoic and Cenozoic woods, discovered an interesting genus connecting Brachyoxylon and Araucarioxylon, to which he gave the name Telephragmoxylon. This shows the beginning of the formation of wood parenchyma but has the evanescent leaf-traces and the traumatic canals of Brachyoxylon.

The higher members of the Abietineae, such as for example Cedrus, Abies and Tsuga, are in general without normal ligneous resin canals except in the root. When any of these three genera has its wood injured, traumatic resin canals are formed, vertically only in Tsuga and Abies, but both horizontally and vertically in Cedrus. The rational as well as natural explanation of these conditions is that the three genera in question have come from Pinus by reduction and revert under conditions of injury.

Similarly, in the case of Brachyoxylon we have a reversion of an Araucarian type of wood as a result of injury to a condition, resembling, so far as the wound canals go, that found in Abies or Tsuga. Certainly, if we regard Abies or Tsuga as having come from Pinus, we must consider Brachyoxylon as also of Abietineous origin and derived from an ancestry allied to Pinus.

Both in Araucarioxylon and in the living representatives of the Araucarian conifers, we find opposite pits and bars of Sanio *at the beginning of the secondary wood,* a further feature justifying their derivation from Abietineous origin.

It is out of place at this time to go into the question of the evolution of the conifers further. It will be sufficient to point out in conclusion how completely the situation has changed in the past ten years or more in regard to the relative status of the pine-like and Araucarian conifers. Formerly the Araucarian conifers were regarded as preponderant and the Abietineae of slight importance. In the most recent German treatment of the subject six Mesozoic genera of the "Protopinaceae" are described, including thirty or more species mostly transferred from types formerly considered as Araucarian. As a consequence of this procedure the Abietineae become the predominant conifers of the Mesozoic, and the true Araucarioxyla constitute an insignificant remnant. I personally regard the most of these so-called Protopinaceae as forms which have reached the araucarioid condition from abietineous ancestry. The German paleobotanists arrive at the opposite conclusion. It seems unfortunate from their standpoint that they have now to transfer the greater number of coniferous Mesozoic woods, formerly supposed to be Araucarian, to abietineous affinities.

In any case it is highly probable that the logical use of the biogenetic law will in the future clear up this condition of confusion. When the dust of conflict has settled, it will probably appear that Ginkgo and Pinus stand side by side as the prototypes of Mesozoic gymnosperms of cordaitean derivation. It will then be realized that Agathis and Araucaria are aberrant extremes, which merely simulate Cordaites on the basis of extremes meeting but have no near affinity with them. In any case the thesis of the predominance of the Araucarians, in the Mesozoic, must be abandoned, because, by a *reductio ad absurdum,* the German and some other paleobotanists, by their very zeal to save the time-honored Araucarian thesis, are led to refer most of what were formerly regarded as undoubted Araucarian forms to the Abietineae.

The progress of biology along historical lines lends accordingly new support to the already well-documented doctrine of recapitulation. When the doctrine of mutation is relegated to its relatively unimportant position among biological working hypotheses, the great general significance of the biogenetic law or the doctrine of recapitulation will be clearly recognized.

EDWARD C. JEFFREY
HARVARD UNIVERSITY

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE COMMITTEE ON THE PLACE OF THE SCIENCES IN EDUCATION

THE following persons have been appointed on this committee, and others are to be added:

Dr. Edna M. Bailey, supervisor of the teaching of science, University High School, Oakland, California. Representative of high schools.

Dr. Jesse B. Davis, professor of secondary education, Boston University. Representative of secondary education in the municipal university.

Dr. Eugene Davenport, dean and professor emeritus, College of Agriculture, University of Illinois, Woodland, Michigan. Representative of agriculture and rural life.

Dr. E. R. Downing, associate professor of natural science, School of Education, University of Chicago. Representative of university school of education.

Dr. Max Farrand, professor of history, Yale University, New Haven, Connecticut, and chairman of the Educational Committee of the Commonwealth Fund. Representative of social sciences.

Dr. R. C. Gowdy, professor of physics, University of Cincinnati. Representative of physics in the university.

Dr. George W. Hunter, professor of biology, Knox College, Galesburg, Ill. Representative of college science teaching.

Dr. V. E. Kellogg, permanent secretary of the National Research Council. Representative of National Research Council, Washington, D. C.

Dr. Harvey B. Lemon, professor of physics, University of Chicago. Representative of university department of physics.

Dr. Burton E. Livingston, professor of plant physiology, Johns Hopkins University, and secretary A. A. A. S., Washington, D. C. Representative of A. A. A. S.

Dr. C. R. Mann, director, American Council on Education, 26 Jackson Place, Washington, D. C. Representative of national education.

Dr. J. Playfair McMurrich, professor of zoology, University of Toronto. Representative of biology in the university.

Mr. John Mills, personnel director, engineering department, and chairman of the College Relations Committee, Western Electric Company, Inc., New York. Representative of electrical engineering.

Dr. Mary S. Rose, professor of nutrition, Teachers College, New York. Representative of household sciences.

Dr. G. M. Ruch, professor of psychology, University of Iowa. Representative of psychological study of science testing.

Mr. S. D. Shankland, executive secretary, Department of Superintendence of the National Education Association, Washington. Representative of National Education Association, Department of Superintendence.

Dr. Frank L. Wade, head of the department of chemistry, Shortridge High School, Indianapolis, Ind. Representative of high schools.

Dr. H. J. Waters, managing editor, *The Weekly Kansas City Star*, Kansas City, Mo. Representative of the public press, and science needs of rural and city life.

Dr. Hanor A. Webb, professor of chemistry, George Peabody College for Teachers, Nashville, Tenn. Representative of teachers college.

Mr. C. M. Wescott, teacher of physics, Hollywood, Cal. Representative of high schools.

The following outline of topics has been placed before the committee. Committee members and others will doubtless add other topics, and will suggest many changes in the statements here made concerning these topics. The outline here presented is designed to serve as basis for discussions and later written comment to be submitted to the whole committee. It is hoped that small discussion groups may meet in various centers, and as a result of the discussion may formulate and submit their written comments to the chairman of the committee.

PURPOSE OF THIS COMMUNICATION

A very important piece of work has been assigned to a committee as shown in the accompanying material. If this committee may have the cooperative efforts of those to whom this communication and later ones are sent, possibly something of value may result. You are asked to read this memorandum and to make constructive suggestions in line with the committee's problems. Please submit suggestions as to opinions, facts or further studies which pertain to the work. If you know of educational studies which bear upon the topic in any way, please bring these to the attention of the committee. In case of each of the organizations of graduate students to whom this memorandum is sent, it is requested that a group conference be held and that a committee of the conference be asked to prepare, and forward to the committee, a report of the suggestions of the conference. Conferences of teachers of science are asked to follow the same procedure.

PURPOSE AND SUPPORT OF THE COMMITTEE

At the meeting of the A. A. A. S., held in Cincinnati, December, 1923, a committee was authorized to study the place of sciences in educational curricula. The members of the A. A. A. S. who initiated this committee desired that, with the unprecedented development of the sciences both in research and in everyday use of science knowledge there should be a somewhat clearer and more widely recognized understanding of the functions of the sciences in current educational programs. It may not be possible to construct the desired statement upon educational and scientific observation and experimentation so to give it a factual basis worthy of the spirit of science, which is the foundation of the association. The committee is, however, charged with the responsibility of investigating and reporting upon the question.

The Commonwealth Fund has provided financial support for initiating this work. Those interested in science education will heartily welcome the interest shown by the officers of the A. A. A. S. and the support provided by the Commonwealth Fund.

PREVIOUS REPORTS REGARDING SECONDARY SCHOOL SCIENCE

In the report of the Committee of Ten in 1893, there appeared very definite statements of objectives and lists of recommended science subjects. This highly valuable report served a useful purpose for the sciences as for other school subjects in the years immediately following its appearance. Science advanced so rapidly, however, that the 1893 report soon became less than an adequate record of accomplishment in science teaching.

In 1913 a National Education Association committee of fifty science teachers began work upon the reorganization of secondary science teaching. This committee worked under the guidance of the United States Bureau of Education. Its report appeared in 1920 and was widely distributed. The purposes, outlines of subjects and sequences of subjects as presented in the 1920 report were based upon practices then in use in the more advanced school systems. Since the report was issued the types of courses and sequences advocated have become fairly common. Limitation in time of pupils in which they may take courses in science, and limitation in availability of teachers with desired preparation have prevented many pupils from securing as much instruction in science as thought desirable. Furthermore, the failure of the content, method and organization of science courses to recognize the most insistent needs of modern social, industrial and esthetic living is thought to have kept some of the objectives of the 1920 report from being as widely realized as was expected.

SUMMARIES REGARDING THE HIGH SCHOOL SCIENCE SITUATION

The following summaries are presented to show the present situation in representative schools as to sequences of science subjects and relative student registration in each subject.

Sample Summaries of Specific Studies

1. A Summary of the Pennsylvania State Report for 1923 on Status of Sciences in All Four Year High Schools

(a) Of 1,005 high schools general science in 910 schools—Required in 76.9 per cent. and elective in 23.1 per cent. in first year high school; 2.6 per cent. elective in second year high school;
 that is, of the 53,904 pupils in general science
 53,273 " are in first year.
 Of all high school pupils in Pennsylvania in 1923, 26.3 per cent. were studying general science.

(b) Biology in 871 schools—Required in 51.5 per cent. and elective in 48.5 per cent.
 29,638 pupils in biology—14.6 per cent. of all high school pupils;
 26,881 of these were in second year (10th grade) of the high school;
 2,148 in first year of the high school;

(c) Physics in 728 schools—Required in 36.4 per cent. and elective in 63.6 per cent.
 19,704 pupils in physics 9.7 per cent. of all high school pupils;
 14,216 " " third year (11th grade);
 4,800 " " fourth year;
 664 " " second grade;
 24 " " first year;

(d) Chemistry in 528 schools—Required in 18.2 per cent. and elective in 81.8 per cent.
 17,715 pupils—8.7 per cent. of all high school pupils;
 10,975 " in fourth year;
 6,733 " " third year;
 7 " " second year;

(e) Agriculture in 328 schools:
 4,003 pupils 1.5 per cent. of all high school pupils.

(f) Physical geography in 88 schools:
 3,447 pupils 1.2 per cent. of all high school pupils.

(g) Astronomy in 3 schools:
 119 pupils.

(h) Geology, 58 pupils.

(i) In Pennsylvania there was an increase of 19.8 per cent. in the total high school enrollment in the sciences in 1922–23 as compared with 1921–22.

2. Bolton, F. E., "Should physics be required for the university?" *Sch. Rev., 32;* p. 433 (1924).

Table II Distribution of 47,804 high school pupils in Washington in the different science subjects in which they were enrolled.

Physics	4,200	
Chemistry	3,288	
Botany	2,673	
Zoology	1,061	
Biology	1,604	6,332
Physiology	994	
General science	7,802	
Physical geography	1,322	
Geology	54	
Astronomy	2	

3. Science sequences.

The Distribution of the Various Sciences Indicated on the 286 Reports Received 1920–21

Subjects	GRADES									
	7th & 8th		9th		10th		11th		12th	
	No.	%	No.	%	No.	%	No.	%	No.	%
General science	77	26.8	198	68.9	17	5.9	3	1.0	2	0.6
Biology	7	2.4	23	8.0	109	37.9	21	7.3	16	5.4
Botany	2	0.6	36	12.5	98	34.1	36	12.5	24	8.3
Zoology	1	0.3	12	4.1	59	20.6	20	6.9	7	2.4
Physiology	51	17.7	35	12.2	42	14.6	47	16.5	29	10.1
Chemistry	0	0	5	1.7	14	4.8	154	53.6	186	64.8
Physics	1	0.3	7	2.4	38	13.2	180	62.7	148	51.5
Physiography	3	1.0	40	13.9	38	13.2	22	7.6	15	5.2
Geography	7	2.4	24	8.3	31	10.8	18	6.2	14	4.8
Domestic science	6	2.0	11	3.8	9	3.1	5	1.7	5	1.7
Agriculture	11	3.8	4	1.3	10	3.4	7	2.4	5	1.7
Astronomy	0	0	1	0.3	0	0	3	1.0	8	2.7
Psychology	0	0	0	0	0	0	2	0.6	1	0.3

Mr. James A. Keech, teacher of sciences in North Carolina, made a study of the science subjects and their tendency toward a definite sequence arrangement in 286 high schools selected at random through the country. His tabular report is given below:

4. Dr. George W. Hunter, Knox College, Galesburg, Ill., is just completing a study of 274 schools most of which were included in a previous study made by him over 15 years ago. He finds that of the 274 schools reporting, 184 now teach general science in the first year of the four-year high school and that 56 others teach general science in regularly organized junior high school divisions. In the second-year high schools 242 of the 274 teach biology or one of the separate biological sciences. In the third year 150 teach chemistry and 167 physics, and in the fourth year 158 teach chemistry and 135 physics. This study, still unpublished because new data are to be added, shows the same general tendency to adopt a definite high-school science sequence of the type elsewhere set forth.

Help Desired by Those Who Organize Science Sequences

There is a widespread interest in securing a closer relation between science subjects in the different years of schools and junior colleges. A careful study of the results of the many experiments on these questions, a consideration of the inherent relations of science subjects, a study of the amount of time and the conditions involved in science courses, should result in a formulation which might be very generally useful. Such a formulation might prove a guide without fostering the development of a stringent standardization.

Help for Those Who Build Science Laboratories

All know that the science situation in schools and colleges is different from two decades ago. These differences appear in magnitude of the problem, nature of classes, relation of lecture, discussion, laboratory and field work, and in other important points. This would seem to require a study of the appropriateness of the construction designed for use in science work. New types of construction are being devised and their usefulness should be considered and any possible improvements should be made available to all who plan new buildings. The physical provisions should be made to accord with the types of instruction thought to be best.

Further Investigations of Science Teaching Problems

There are many needs for intensive studies on topics related to science teaching. It will prove helpful if the committee may assemble these with brief synopses of their purposes and methods of work, and results when the work has proceeded far enough to be so reported. Also, requests are frequently made for assistance in guiding studies. The committee may not be able to assist in such studies, but the whole question may properly be one for the committee's consideration.

A Synthetic View of Science

There was an early period of the naturalists or natural history men. These had a comprehensive view of science, but few of them were intensive students in any one field of science. They were descriptive scientists in the main.

Then came the period of intensive specialists, which probably must continue even to greater specialization than we now have. But in gaining high specialization we lost general views. We now need a synthesis of sciences, general views, common interpretation of the meaning of science. We need to develop this synthetic interpretation without losing or reducing specialization. Indeed synthesis is essential as a background or a foundation for understanding the necessity and value of high specialization.

May not science secure for many people, both those who are intense students of science and those who study it briefly and broadly, an "appreciation of the universe" which is something beyond mere science knowledge, but no less real. Most teachers teach knowledge, few teach appreciation. May we not come to sense an interlocking of various fields of knowledge, a trained feeling for the value and significance of "things in general" based upon but rising much above the results of our own specific scientific studies. One outstanding scientific critic says: "What always is most astounding to me is that people may know many things of science and still have feeling responses as though the universe were quite different from what they know it to be." Are "college departments busy teaching teachers to teach teachers to teach?" Or are they busy teaching people to be, to see and to respond as truly parts of an appreciative and responsible group who desire scientific truth for the sake of its whole service; not just to record it bit by bit in its proper and logical arrangement with other truths of its own kind. In our necessary separate specialization, have we not reached a point when we must climb upon some sort of vantage position and get the whole landscape again and often? Else the truly engaging general views shall not only be lost but we lose the ability to sense them if they should come.

College Courses in Science

Most college courses in science appear to have been designed as parts of series of courses arranged for those students who are to study a particular science. Students frequently express a desire to study several sciences as part of a whole college program of studies. It is said that college science departments are inclined to regard students as departmental perquisites, once the students have begun to take courses in a given department, and that the departments recommend and urge intensive and technical work in one branch of science, to the inhibition of a general foundation in sciences. Because of these things it is claimed that college students in many institutions regard the science courses as set up for those who already have a start in science subjects.

Teacher Training School Courses in Science

The normal school and teachers college situation is important. In spite of the limitation in these institutions the brief general courses given often provide a general foundation which is very different but probably no worse than the highly differentiated and unbalanced college work in the sciences. Since many secondary school teachers and other citizens are being educated in these normal schools and teachers colleges in rapidly increasing numbers, it is important that some adequate plan of science instruction be incorporated in those institutions. What can be done or should be done?

SUPPLY OF SCIENCE TEACHERS

A larger and better trained supply of science teachers in secondary schools and colleges is needed. Due to the most commendable increases in salaries and the accompanying better social status of science teachers, more men and women are already preparing themselves for science teaching. It is thought that a still higher grade of teachers will be available when there is better understanding of what science as a whole means in current life, and what the different sciences are trying to accomplish.

PUBLICATIONS POPULARIZING SCIENCE

In an age and in a country in which all the people are to have education in so far as they have capacity for it, at a time when science knowledge has made such advances, and when every activity of common life is conditioned by its relations to modern science knowledge, it is important that consistent, prolonged and definitely planned programs be put into operation for adequate popularization of modern science knowledge. The reception by the public of efforts in this direction indicates an encouraging readiness to receive and use such popular and authoritative publications.

SCIENTIFIC METHOD IN COMMON AFFAIRS

It seems desirable that there should be presented a series of specific illustrations of how the scientist's method of working may be useful in the common affairs of people in non-scientific pursuits. Being guided by the facts, is now becoming a useful slogan in certain commercial and industrial institutions. The inefficiency which accompanies failure to make a scientific analysis is in contrast with the less wasteful results secured when dependable analyses are made.

REGARDING OBJECTIVES IN SCIENCE TEACHING

There are many statements of the ends to be sought in science courses. These statements are probably incomplete and certainly are not harmonious. There is needed adequate technique for assembling, classifying and interpreting objectives. If they may not be made harmonious, all points of view may be fairly presented, so that in one report science men may find a well-balanced presentation of the various purposes now held in mind by those who have clearly defined objectives for their work.

WHAT IS MODERN SCIENCE TRYING TO DO?

What is it which modern science is trying to accomplish? Science is trying to encourage the spirit of inquiry, the desire to know, the ability to ask and answer questions for the sake of answers only as they increase interest and ability in answering other questions. Science recognizes that continued evolution of human mind depends upon the continued use of mind in inquiry, in conclusions, in application, in the establishment of new truth. Science accepts Poincaré's statement that "man is the measure of his own universe."

Science asserts that negative ethics is inconsequential as compared with positive. That a socially working belief that principles are operating to produce results in materials is safer and more hopeful than the older notion that it is merely wrong to act in certain ways. Should not the ethical implications of the scientist's notions of the constant evolution of truth, of the constant relations of cause and effect, the necessity of constant fidelity to true principles, be given a clearer setting so that they may be more readily seen both by persons trained in sciences and those not so trained?

As stated elsewhere, the above paragraphs are designed to suggest topics for consideration by the committee and by any others who are interested in making contributions to the committee's work. These topics are presented for the purpose of giving the committee a start in its work, not to limit or control the committee's work. Please send suggestions to the chairman.

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425 WEST 123RD STREET,
NEW YORK, N. Y.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
THE FIFTH WASHINGTON MEETING

PREPARATIONS for the approaching Washington meeting of the American Association and associated organizations are approaching completion. The preliminary announcement of the meeting, a booklet of 90 pages, was in the mails before December 1 and should have reached all members long before these notes are published. Lists of the local committees for the Washington meeting have been given in SCIENCE for August 29, 1924, and lists of the forty-four societies that are to meet with the association this year have appeared in these pages for August 29 and November 28. The secretaries of the sections and societies have been generally very helpful in sending in material and the announcement presents a better picture of the approaching meeting than has been the case in recent years. Extra copies of the preliminary announcement may be had from the permanent secretary's office by non-members as well as members.

The state of the association is very satisfactory; membership has been greatly increased during the last year. At the time of writing these notes (December 2, 1924) the total number of names on the roll is 13,361. And 8,397 have already paid their dues for 1925. Besides increased membership the asosciation needs increased endowment and increased active, critical and constructive interest on the part of the members and of the affiliated organizations. Especially are members asked to help to increase the number of