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## THE SCIENCES AT YALE.

**Silliman Taught Alone in 1804—Now  
Sixty-Six Specialists are in the  
Department—The Work and  
the Men Who Do It.**

While Yale College has been in the past, and still is, conspicuous for training young men in the old knowledge and wisdom of the fathers, she has also been foremost in the sciences which have made such prodigious advances during the present century. In 1804, Benjamin Silliman was appointed "Professor of Chemistry and Mineralogy." Educated as a lawyer, it was necessary for him to go to Scotland, England and France to find instruction to fit him for his professorship, and to take the few minerals Yale College then possessed to Dr. Seybert of Philadelphia, the only American to be found who was versed in such subjects, for identification. For the first quarter century, Professor Silliman led the way among Americans in teaching science.

In the year 1838, the science-teaching at Yale was done by three men, viz., Silliman the Professor of Chemistry, Pharmacy, Mineralogy and Geology; Olmsted, the Professor of Mathematics and Natural Philosophy, and C. U. Shepard, assistant to the Professor of Chemistry. The Sophomores then studied surveying and Olmsted's Natural Philosophy and Mechanics; the Juniors listened to experimental lectures on Chemistry, Mineralogy, Geology, and select subjects of Natural Philosophy and Astronomy, given by Silliman. In the following sixty years the force engaged in teaching science has grown, from two professors and an assistant, to twenty full professors, six assistant professors and directors, and forty instructors and assistants,—a force of sixty-six men, without mentioning those engaged in teaching pure mathematics, or those teaching the medical applications of science in the Medical School.

In no department is the characteristic thoroughness of the Yale training bet-

ter exhibited than by the quality of the men selected to lead in teaching these sciences. Eleven of the full professors are members of the National Academy of Science, and all of them are conspicuous in their special departments for their contributions to the advancement of science.

This group of related sciences is naturally divided into four departments, viz.: I, Mineralogy, Geology and Paleontology; II, Physics; III, Chemistry; IV, Biology, all of which were taught by Professor Benjamin Silliman alone, less than a century ago, but by sixty-six specialists to-day. A brief statement of the scientific work and standing of a few of the chief of them will best exhibit Yale's present equipment for teaching the natural and physical sciences.

### MINERALOGY AND GEOLOGY.

Following Silliman, the late Professor J. D. Dana did more than any one else in America to reduce the innumerable facts of Geology to a science, to show the system in the history of the American continent, and also to systematize the science of Mineralogy. His "Manual of Geology," and "System of Mineralogy" are both classics; and the former, in its fourth edition, is still the standard exponent of American Geology the world over.

As the Scientific School developed, the active investigation in Mineralogy was shifted to that Department, and in 1864 Professor Brush was appointed Professor of Mineralogy. In the next twenty years he described many new minerals, coöperated with Prof. Dana in issuing the successive supplements and new editions of his "System of Mineralogy," in 1874, published his "Manual of Determinative Mineralogy"; accumulated one of the finest study-collections of Minerals to be found in the land, and his laboratory became the training-place of many of the present experts in the science, including his successors, Profs. E. S. Dana and Penfield. As Director of the Sheffield Scientific School, Professor Brush's services, not only to Mineralogy, but to all the sciences, have been more important than they could have

been had he restricted his attention to his favorite science alone.

In the field of Chemical Mineralogy and Crystallography, Professor Penfield maintains the high rank for investigation and training for which the laboratory was famous under Professor Brush. His numerous investigations and descriptions of new minerals are known far and wide. His accuracy and painstaking assistance for special students, together with the beautiful Brush collection of crystals, models and instruments and library, make the laboratory a favorite place for the enthusiastic students of Mineralogy.

Professor E. S. Dana, in his "New System of Mineralogy," has taken the same place of preëminence in Physical Mineralogy, held by his father half a century ago in the general subject, and collections of minerals everywhere are labelled and catalogued according to this system, and definitions in Webster's dictionary, in the Century dictionary, and similar places, rest upon his authority for their accuracy. His "Text Book of Mineralogy," and "Minerals and How to Study Them," bring the science within the grasp of the general student.

Professor Pirsson, of the Sheffield Scientific School, gives the courses in Petrology. This branch of Geology is in its infancy, but has already shown that its chemical and microscopic methods are adapted to exploring new fields otherwise closed. Professor Pirsson has written a number of papers dealing with the theoretical side of the science, but his best known work has been on the U. S. Geological Survey in Montana, the results of which are embodied in the four bulletins on "Castle Mountain," "Highwood Mountain," "Bear Paw Mountain," and "Judith Mountain." Students in this branch are given active work in determining and classifying rocks, and studying their history and origin by optical and chemical methods.

Professor H. S. Williams is chiefly distinguished for his studies of the relations of organisms to geology. His course, "Geological Biology," and his book with the same title, treat of fossils as determining geological formations and their relation to environment and past evolution. As a member of the U. S. Geological Survey he is

known for his work and numerous papers on the Devonian, and on the principles of correlation in stratigraphical geology. As the American member of the Committee of Classification and Nomenclature of the International Geological Congress, Professor Williams holds a place of honor and influence abroad. An outgrowth of his paleontological and zoological studies is the course on the "Philosophy of Life and Organisms," in which life is discussed in relation to other natural forces, and evolution is reduced to a systematic science.

Professor Marsh offers courses to advanced students in Vertebrate Paleontology. The great advances and marvelous discoveries in paleontology of the last half century are closely connected with Professor Marsh's work. His discovery and study of the fossil fauna of our Western States is a well-known story, and forms an important part of geological history. Out of 282 pamphlets and volumes written by Professor Marsh, it is difficult to select the most important, but to students the most striking of his works are: The Discovery and Explanation of Birds with Teeth, The Discovery and Study of the Great Saurians of Mesozoic Time, and the tracing of the successive genera of the horse-type from the Orolhippus of the Eocene to the modern horse. That his standing is recognized at home and abroad is shown by his continuous reelection to the Presidency of the National Academy, and as recipient of the Cuvier medal.

The Professorship of Historical Geology in the Sheffield Scientific School is held by Charles E. Beecher, who offers courses in Invertebrate Paleontology. The extensive collections of the Peabody Museum furnished abundant material for illustration. Professor Beecher is particularly known for his works on the structure, development and affinities of Brachiopods and Trilobites, investigations which were begun while connected with the New York State Museum. He is one of the editors of the *American Geologist*.

The Peabody Museum is stored with material for comparison and study. Students of Paleontology at Yale are fortunate in having at hand such extensive and typical collections for study. The Vertebrate fossils donated by Pro-