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ALEXANDER AGASSIZ.

BY MARCUS BENJAMIN.

Men of genius have seldom been fortunate in their offspring. Neither Cæsar nor Shakespeare left children to perpetuate their fame. In the annals of American science there are remarkable exceptions to this rule. John W. Draper was fortunate in having three sons who succeeded to his name, and each of whom distinguished himself in some branch of scientific thought. The elder Silliman gave place to his son of almost equal renown. James D. Dana, referred to in a recent issue of the SCIENTIFIC AMERICAN, has an able successor in his son, Edward S. Dana, who at present is following in the footsteps of his illustrious senior. In Alexander Agassiz we have also a great son descended from a distinguished father—not great by reflected light, but great in comparison, great in his own individuality. It has been well said of him that he is "the best authority in the world on certain forms of marine life."

The little city of Neuchatel, once the stronghold of princes, is picturesquely situated on the side of one of the Jura mountains and along the shores of the lake of the same name, in whose waters lies hidden the history of a prehistoric people, who are known only through the fragmentary remains that occasionally come to us through the lacustrine finds. Peace and quiet are now the characteristics of the Neuchatelois, within whose territory there once occurred some of the greatest battles of Charles the Bold, Duke of Burgundy. There comes but little in these modern days to disturb the watch making of this industrious people. Across the lake, stretched in a long row, are the white-capped Alps, beginning with Mont Blanc on the extreme right, and ending with the famous peaks of the Bernese Oberland on the left. To a chance traveler, seated on the veranda of some country seat on the side of the mountain, sipping his *eau sucrée* or, better still, the famous red wine of the canton, he can see, when the day is clear, across the fertile Pays du Vaud, the great mountains as they glisten in the sunlight, and fancy that he can hear the running water trickling down their sides to reach the mighty Rhone, which flows on its way through France to the Mediterranean, or to swell the current of the rapid Aar, that adds its stream to increase the historic Rhine just before it leaves Switzerland. Perhaps later, if the scene tempts him, he will observe a bright speck of light coming over the mountains, which, from its brilliancy, would lead him to fancy that some forest fire had broken out on the Alps, till soon the lurid, red harvest moon comes up in all its glory.

To this little city, in 1832, came Louis Agassiz, to fill the professorship of natural science in its college. Here, with Guyot, Lesquereux, Desor, and others known in the history of American science, he founded the scientific society of that town, and here, on December 17, 1835, his son Alexander was born. On a narrow street near the Palais Rougement, and not far from the lake, on the Rue des Orangers, there is pointed out the residence of Agassiz, and I wonder was it there that the son was born.

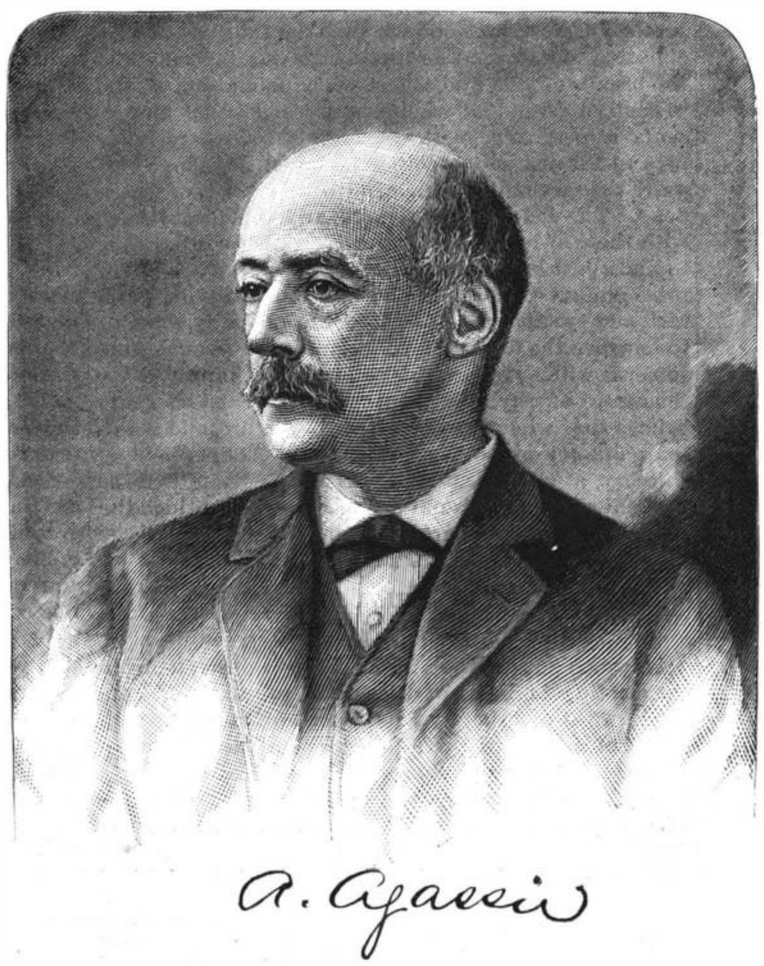
In October, 1833, Louis Agassiz was married to Cecile Braun, the sister of his college friend, Alexander Braun, later the distinguished botanist and philosopher, and of Maximilian Braun, mining engineer and chief director of the largest zinc mine in Europe, La Vieille Montagne.

Arnold Guyot says of her that she "was a noble minded young woman, of rare moral excellence. A dignified serenity, tempered by much gentleness and simplicity of manner, won for her at once respect and affection. Her deeper feelings were often veiled by a natural reserve, which, however, never assumed the appearance of coldness. Her talent for drawing was of the first order, and she was fond of placing it at the disposal of her favorite brother, Alexander. The drawings of natural objects which she executed for him, and later for Agassiz, commanded the admiration of all by their taste and exquisite correctness."

That her son would know how to draw, and would inherit a love of natural history, was probable. We shall see.

Alexander's early education was received in Europe, and we can imagine him as a boy watching the fishermen with the nets along the shores of the lake, or perhaps catching butterflies in the fields above the town. The huge granite bowlder called Pierre à Bot, that came from the Alps across the great glacier that once filled the valley of Switzerland, may have been the first geological curiosity that attracted his attention; or he may have spent his time in searching for the shell fossils so common in the soft Neocomian rock of that district.

Meanwhile, in 1846, the elder Agassiz had arrived in the United States, but the boy stayed with his mother in Neuchatel, and it was only after her death that he came to this country, at the age of fifteen years. He then prepared for Harvard, and was graduated in 1855, numbering among his classmates Phillips Brooks, the distinguished rector of Trinity Church, Boston. A college sketch of him says:



THE NATIONAL ACADEMY OF SCIENCES.

"His classmates testify that his ability with the brush and pencil was often put to excellent uses during his college life;" and "he also inherited his father's wonderful persistence in accurate study and research."

On leaving college, he determined to study for a profession, and choosing that of civil engineering, he entered the Lawrence Scientific School of Harvard, where he was graduated in 1857, with the degree of B.S. He then spent three terms in the chemical department, and during the same time was engaged as one of the teachers in Prof. Agassiz's school for young ladies.

In March, 1859, he went to California, where he was appointed an assistant on the United States Coast Survey, being assigned to work on the northwestern boundary. After the beginning of the rainy season, he returned to San Francisco, and on the completion of the office work, resigned from the survey. His skill with the pencil was brought into service at this time by drawing specimens of the fish caught along the boundary. He also began to collect specimens for his father, and showed himself an adept in their study and preservation. The greater part of the winter of 1859-60 was spent at Panama and Acapulco, collecting specimens for the Museum of Comparative Zoology at Cambridge. In the spring he again returned to San Francisco, where he was still occupied in obtaining specimens and in studying fishes, of which he made remarkably fine drawings. Later, he visited the interior of the State and examined the principal mines.

In July, 1860, he returned to Cambridge, and was made agent of the museum. After a full course of study in the zoological and geological departments of the Lawrence Scientific School, he was appointed assistant in zoology, and during the absence of his father in Brazil, in 1865, had entire charge of the museum. Subsequently, during the same year, he became engaged in coal mining in Pennsylvania, in addition to his appointment in Cambridge.

In 1866 he went to Lake Superior, and became connected with the Calumet mine, as treasurer. Soon after he was engaged in the development of the adjoining Hecla mine, becoming, in 1867, superintendent of the combined properties. For two and a half years he worked on an average of fourteen and a half hours a day, and in 1869 returned to Boston as the president of the Calumet and Hecla Mining Company, at present the owners of the largest and richest copper deposits in the world. In the development of this great mining property, Mr. Agassiz showed unusual ability as a mining engineer, solving difficulties in this field without precedent.

The mines have become exceedingly valuable, and great wealth has been the reward of his activity. Edwin H. Abbot, one of his classmates, writes in this connection that "the development of the Calumet and Hecla mines, which supply annually one-tenth of all the copper used in the civilized world, and control the American market, is more the result of his scientific and executive ability than of any other one thing. Its plant of machinery alone has cost over $3,000,000. It has been devised and created under his direct supervision, and has rendered these mines second to none in the world. For most men this mining achievement would alone be a life work, and glory enough to make its author famous. To Agassiz, however, it is merely an incident in a scientific life which has already placed him in the front rank of natural scientists."

In the autumn of 1869 he went abroad and examined the museums and collections of England, France, Germany, Italy, and Northern Europe. A year later he returned to Cambridge, and became assistant curator of the museum, which office he retained until the death of Professor Agassiz, in 1874, when he was selected to succeed him as curator. A contemporary scientific journal comments on this event as follows: "It is rare that the mantle of the father sits worthily on the son. Especially is this true when the father has been signally eminent in pure science. Happily indeed is it for America, and for biological science, that the vast plans of the late Agassiz are to be continued, as far as possible, on the grand scale upon which his great mind projected them."* He has since retained the executive office of the museum, and during 1887 was engaged in making extensive repairs and alterations in the building. Mr. Agassiz has been a most liberal benefactor to the museum. President Charles W. Eliot said,† in 1880, that since 1871 he had given no less than $230,000 to a single department of the university. He has a peculiar way of giving. If he sees a need in one of the departments of the university, he goes and supplies it, pays the bill, and says nothing more about the transaction. He thinks this department needs more room. At once he contracts for a building, and erects it on the land of the president and fellows, without even communicating the fact that he proposes to erect such a building. His donations in all to Harvard University have amounted to upward of $500,000. He was elected by the alumni one of the overseers of Harvard in 1874, and chosen by the corporation to be one of its fellows in 1878, but in 1885 failing health compelled his resignation.

In 1873, he became connected with the direction of the Anderson School of Natural History, on Penikese Island, and subsequent to his father's death conducted that enterprise, but differences between himself and Mr. Anderson led to the closing of the school.

(*Continued on page* 389.)

* *Popular Science Monthly*, March, 1874.

† Harvard Club dinner, New York, February 20, 1880.

ALEXANDER AGASSIZ.

(*Continued from first page.*)

He made an expedition in 1875 to the west coast of South America, for the purpose of examining the copper mines of Peru and Chili. During this time he also made an extended survey of Lake Titicaca, and with the aid of his assistant, Samuel Garman, gathered an immense collection of Peruvian antiquities, which are now in the Peabody Museum at Cambridge. These collections represent the antiquities of the lake, of old Trahuanaco, and of the shore Indians at Ancon.

In 1875 he was invited by Sir Wyville Thompson to assist him in arranging and making up the collection of the great English exploring expedition of the Challenger. A portion of these collections he brought with him to Cambridge, and there wrote his report on the sea urchins of this famous expedition, which ranks high as a contribution to original research. His previous investigations on the Echinoderms gained for him, in 1873, the Walker prize of $1,000 from the Boston Society of Natural History. This was the first bestowal of the Walker prize. In 1878 he received the "Prix Serres," awarded only once in ten years, from the Academie des Sciences de Paris, and was the first foreigner to secure this distinction.

From 1876 till 1881 Mr. Agassiz spent his winters in deep-sea dredging, having had placed at his disposal, by the superintendent of the coast survey, the steamer Blake. These expeditions have enabled him to explore the deep waters of the Gulf of Mexico and of the Caribbean Sea. The success that has attended his trips has been very great, mainly, he says, from the interest shown by the commanders of the Blake, but much more, we are persuaded to believe, through his own great ingenuity and special familiarity with hoisting and mining machinery, which has enabled him to introduce new methods in place of the old ways of deep-sea dredging.

In 1887 he received the degree of LL.D. from the University of Cambridge, England. He was elected a member of the American Association for the Advancement of Science in 1869, six years later he became a fellow, and in 1879 was made vice-president. At the Boston meeting, held in 1880, he delivered his retiring address on "Paleontological and Embryological Development," in which he took a decided stand against the prevalent development theory. In 1866 he was elected to membership in the National Academy of Science and held the office of foreign secretary till 1886, since when he has entirely severed his relations with that organization, owing to the impaired condition of his health.

Mr. Agassiz is likewise a member of the following societies: The Academy of Natural Sciences, Philadelphia; the New York Academy of Sciences; the American Philosophical Society, Philadelphia; the Essex Institute, Salem, Mass.; the Society of Natural History of Montreal, Canada; the Geological Society of Manchester, England; the Zoological, Linnean, and Royal Microscopical Societies of London, and other less famous foreign societies.

His bibliography includes numerous titles in the "Proceedings of the Boston Society of Natural History;" "The Annals of Lyceum of Natural History," New York; "Proceedings of the American Academy of Arts and Sciences," Boston; "American Naturalist," "American Journal of Science," and the "Archiv der Zoologie." They are principally on subjects connected with marine zoology. The "Report of the Anderson School of Penikese," 1873, and the "Reports of the Museum of Comparative Zoology," from 1873 till 1885, are by him. To many of the "Bulletins" of the museum he has contributed valuable papers; and of the "Memoirs of the Museum of Comparative Zoology," he is the author of "Revision of the Echini," "Echini of the 'Hassler' Expedition," and "North American Starfishes." Besides the foregoing, he has written, with Mrs. Elizabeth C. Agassiz, "Seaside Studies in Natural History" (Boston, 1865), "Marine Animals of Massachusetts Bay" (1871), and the fifth volume of "Contributions to the Natural History of the United States," left incomplete by his father.

These great undertakings have unfortunately injured his health to such an extent that he has been advised to put aside all work and rest awhile. Early in May of the present year he started on a long voyage to Alaska, from which it is hoped he may return thoroughly recuperated and able to again prosecute his scientific labors.

Personally, Mr. Agassiz is a bright, intelligent, busy man, easily approached, something more than a man of science, abounding in liveliness, interested in all that concerns humanity, but too much occupied with special work ever to be idle. His life has been one of continuous development along the lines of which his genius or temperament has naturally led him. Though a Swiss by birth, he is essentially an American in his intellectual grasp and in all that belongs to his ordinary life.

Where so much has been done since he gained the wealth which has enabled him to do what he thought best worth doing, what may not be looked for in the rich prime and aftermath ?*

*Julius H. Ward, in the *Harvard Register*, December, 1886.

Correspondence.

Scientific Improvement of Beef.

To the Editor of the Scientific American:

I desire to call your attention to a few physiological experiments recently made in the laboratory of Dr. Hal. C. Wyman, of Detroit, which may have a bearing upon certain economic questions. The experiments consisted in dividing certain nerves which supply motion and sensation (I will say certain spinal nerves) to the muscles in the necks of rabbits, and carefully noting the results. A large number of rabbits were experimented upon, and a careful microscopical examination made of the fibers of the trapezius muscles, which showed that such fibers had undergone fatty degeneration. This, however, is no more than what has been known to every physiologist and pathologist who has given any attention to the study of paralysis.

The nerves divided were the muscular branches of the inferior cervical nerves and that portion of the spinal accessory which supplies the trapezius muscle. The fiber of these muscles supplied by these nerves was found to have been very appreciably softened, and the writer desires to ask whether these experiments do not open a field for the study of processes by which the large, tough muscles of the necks of beeves may be converted into tender and more salable food. It is well known to all butchers that the most inferior portion of beef—that is, those parts which are most difficult to dispose of—are the muscles of the neck; and if experimental physiology can teach a method whereby this meat may be rendered more tender, digestible, and salable, a great good will have been accomplished.

The writer ventures to state that the studies promoted by Dr. Wyman are steps in that direction. It might be advanced as an objection that a division of the sensory and motor nerve of a muscle would result in its atrophy from disuse, and that the gain in quality would be lost in quantity. But the experiments dissipate such an idea, because there are left undisturbed sufficient of the deep muscles of the neck to maintain passive motion, insuring a fair amount of exercise and a reasonably good circulation of blood to maintain the volume of the enervated muscles.

Trusting you will give this matter space in your valuable journal, and that it will invite discussion, I have the honor to be, etc., ZINA PITCHER, M.D.

Detroit, May 26, 1887.

The Destructive Power of Torpedoes.

To the Editor of the Scientific American:

Having noticed your article on the power of torpedoes, I send you an account of the destruction of the Chinese corvette Yang Wo during the fight between the French and Chinese at Foochow. The French flagship had two torpedo boats attached to her. They were stationed on either side of her, at the gangways. This ship was about 300 yards below the Yang Wo. As soon as the firing commenced, both boats attacked the Chinese vessel. The first one fired her torpedo directly under the Yang Wo's after gangway—starboard side. No damage whatever was done to the ship, but the officer in charge of the torpedo boat was wounded in the chest by the return action of the torpedo. The other boat had in the mean time attacked the ship forward, a little abaft the cathead, on the same side. This torpedo was in direct contact with the ship. The effect was, when the torpedo exploded, that it penetrated the fore magazine (or, I should say, the fire from it did). This blew up, and the whole forward part of the ship was demolished. This all happened inside of three minutes. The remainder of the wreck drifted ashore, and burned for seven days. The Yang Wo was a wooden corvette of fourteen guns. The torpedoes used were booms—contact ones.

I was an eyewitness—in fact, too close a one. One of the torpedo boats was lost afterward at Samtur, Formosa, but in what manner the French have never stated. She is simply put down in their list as lost.

Gakow, April 27, 1887. AN EYEWITNESS.

Rapid Railway Building.

A correspondent of the St. Paul *Pioneer Press* thus describes some rapid railway construction:

"Just beyond this point, and eighty miles west of Minot, the traveler finds himself at what railroad men call 'the front,' or the end of the track of the extension which the Manitoba Railway Company is now making to Great Falls, Mont. To speak more accurately, this was the end of the track yesterday, but to-night that point will be five miles further westward, and by to-morrow yet five miles further. From Minot here the work has been in progress since the first week in April. From now on it is proposed to complete five miles of track each day, thus achieving the greatest feat ever attempted in the way of rapid railway construction. From here to Fort Buford the distance is a little over sixty miles, and it is the intention to have the road open to that point by June 1. Thence to Great Falls the distance is 403 miles, and trains will in all probability be running to that point before the middle of September.

"It can readily be surmised that the accomplishment of this gigantic enterprise requires little less than an army of workers, and that is what one finds here. The number of men now at work is 6,600, and the number of teams 3,000. With this force it is hardly to be wondered that the dirt is flying at a lively rate. From here to seventy miles beyond Fort Buford there is one unbroken series of graders' camps. Fifty of these camps can be seen from one point some distance beyond White Earth. By June 1, between 3,000,000 and 4,000,000 cubic yards of earth will have been taken out, and by the time Great Falls is reached the amount will aggregate not far from 10,000,000. On the Canadian Pacific, during the whole of last summer, the amount of earth handled was 6,700,000 cubic yards, and this was considered a remarkable piece of work. A few figures may serve to give a clearer conception of what is involved in the construction of five miles of railway track in one day. A rail is 30 feet long, and there are consequently 352 to the mile, or 1,760 to every five miles. As each rail weighs 600 pounds, the amount of steel handled in one day aggregates 1,056,000 pounds. It takes 2,640 ties to the mile, or 13,200 per day. Thirty-six 200 pound kegs of spikes are used to the mile. There are 32 'spikers' to every five miles of track, each man of whom drives 840 spikes a day, which, at the average of three blows to the spike, gives 2,520 blows per man per day. A mile of rails takes 1,408 bolts, which are handled by fourteen 'bolters,' or 503 each per day. To avoid delays in the progress of construction by reason of rough country, it is the intention of the contractors to work five gangs of men in five hour reliefs during a portion of the time. Work will begin at 3 o'clock in the morning, and the darkness will be scattered by thousands of torches.

"With such an army of men and teams at work far from the centers of civilization, and in a totally unproductive country, it can be readily seen that the task of securing and distributing supplies is one of enormous magnitude. Indeed, there is little doubt that greater executive ability is required in this than in almost any other department of railway construction in the far West. Here at White Earth is, for the present, the headquarters of the supply train, consisting to-day of twenty cars filled with every conceivable thing necessary for man and beast. There is grain, flour, canned goods of all sorts, butter, hams, sugar, wagons, harness, plows, boots and shoes, pipes and tobacco—in fact, nothing is lacking. Every day sees a big hole made in the stock, and every day sees the hole replenished by incoming trains. Day before yesterday 15,000 bushels of oats were sent out by wagon and yesterday 5,000 bushels, all for distribution along the line for a distance of forty miles. From here on the trail along the line is marked by one continuous stream of freighters' teams distributing supplies to the various camps. The other day a herd of 170 head of cattle was driven in, and it seemed that there at least was enough meat for some time to come. A rapid calculation, however, showed that it would furnish only about ten pounds to the man. Already 250,000 pounds of flour and 500,000 bushels of oats have been purchased. Lovers of baked beans will learn with alarm that the supply of that luxury is about exhausted. A letter just received from one of the largest wholesale firms of St. Paul states that if the demand is to continue throughout the summer as large as it now is, it will be necessary to import from Europe. They say they have now secured all the beans that can be found in the United States, and that they have only enough to last this army here for two months.

"Another interesting feature of this train is the hospital cars, where the laborers suffering from disease or accident are cared for by a regular physician, assisted by several nurses, the expenses being met by a contribution of two cents a day from each laborer employed."

Luminous Paint in Theaters.

Herr Stehle, the Government Inspector of the Royal Bavarian Court Theater, has, according to *Iron*, given high testimony to the use of luminous paint as a safeguard against panic in theaters. Any explosion or disaster with gas leaves the exit passage of the theater in total darkness, and even if additional oil lamps were used, they would probably be extinguished by the air concussion. In the above named theater inscriptions in luminous paint are suspended over the exit passages, which direct the audience to the "way out" (*Ausgang*). "These placards, in spite of being exposed to the very poor light of the corridors in the daytime and the gaslight in the evening, are so luminous after the gas has been turned out that any one can gain the stairs in each corridor without difficulty." The *Lancet* says the precaution is so simple and inexpensive that we wonder it is not immediately adopted in all theaters. Indeed, we see no reason why its use should not be made compulsory. Surely some provision of the kind might be included in the theaters bill now before Parliament.

THE first street railway in America was completed in New York city in 1832.