

THURSDAY, APRIL 24, 1879

SCIENTIFIC WORTHIES

XIV.—JEAN LOUIS RODOLPHE AGASSIZ, BORN MAY 28, 1807; DIED DECEMBER 14, 1873

LOUIS AGASSIZ, by which names he was everywhere known, was born at Motier, in the canton of Freiberg, Switzerland, on May 28, 1807. He belonged to an old French Protestant family, who had been compelled to quit their native country by the revocation of the Edict of Nantes, we are told by Dr. Steindachner, in his paper on Agassiz, contributed to the Vienna Academy, to which we are largely indebted for what follows. His father was pastor at Motier, where his forefathers for six generations had filled the same office. Agassiz received his earliest education at home under the care of his mother, a woman of high endowments and rare culture. At the age of eleven years he betook himself with his younger brothers to the Gymnasium at Biel, in the canton of Bern, where he was mainly occupied with the study of ancient and modern languages, the knowledge of which proved of important service to him in his later biological investigations. His play-hours he devoted to fishing and the collecting of insects. Thus early did his leaning towards ichthyological researches show itself, and his knowledge of the habits of fish often astonished even experienced fishermen.

In the meantime Agassiz's father was transferred from Motier to the little town of Orbe at the foot of the Jura, and here young Agassiz became intimate during the holidays with a young clergyman named Fivaz, who first introduced him to the study of natural history, and especially botany. After four years' stay at Biel he entered the Academy of Lausanne, and in 1824 betook himself to Zurich to study medicine, in accordance with the earnest desire of his parents. Soon after, Agassiz left Switzerland to continue his medical studies at Heidelberg, where, at that time, the celebrated anatomist, Tiedemann, carried on his work. After a year's stay Agassiz exchanged Heidelberg for Munich, where Schelling, Oken, Martius, Döllinger, Wagler, Zuccarini, Fuchs, von Kobell, &c., were lecturing; and these soon became not only the kind teachers, but also the friends of young Agassiz. Döllinger, especially, the great master in physiology and embryology soon recognised the high talent of his pupil, and ripened in Agassiz a long-cherished plan of devoting himself to zoology in the widest sense of the term.

It was here in Munich that the young Agassiz, who occupied a small room in Döllinger's house, soon gathered around him a circle of young and talented students, to talk over and discuss matters of scientific interest. Agassiz's room was the meeting-place of this club, which soon assumed the title of the Little Academy, and of which Agassiz acted as president. Before this society did Michaelis lay the results of his researches in the Adriatic Sea, Born exhibited his beautiful preparations of the anatomy of the lamprey, Rudolphi lectured to the students on the Bavarian Alps and the coasts of the Baltic, and Schimper and Braun here first expounded the laws of phyllotaxis. Döllinger himself did not disdain to initiate his disciples and friends of this Little Academy in his newest discoveries and ideas, ere he made them known

to the scientific world, and here he taught them the use of the microscope in embryological research.

Meantime the Bavarian members of a great scientific expedition to Brazil, under the leadership of Spix and Martius, returned to Munich, bringing with them rich collections; and after the death of Spix, the celebrated botanist, Martius entrusted Agassiz with the working out of the ichthyological material. Agassiz had scarcely reached his twenty-first year when he concluded this task in so brilliant a fashion that with this, his first-born work, on the Fishes of Brazil, he gained a reputation as one of the first ichthyologists. This work was published in Latin at Munich in the year 1829, and was dedicated to Cuvier. About the same time Agassiz began his investigations on fossil fishes. The immediate occasion of this step was a short notice by Prof. Rud. Wagner on the fossils of the Munich Museum, in which he praised the number and beauty of the unnoticed fossil fishes. Agassiz immediately applied to Prof. Fuchs, who had the care of the palæontological collection, for permission to investigate the ichthyolites in detail; Professors Wagler and Schubert placed freely at his disposal the collection of recent fishes and their skeletons, and Döllinger, Oken, and Martius in various ways encouraged him in this difficult undertaking.

From this time Agassiz devoted all the spare time left him by his medical studies to the investigation of fossil fishes, which naturally implied an adequate knowledge of the most nearly related living forms; in the holiday months he made short visits to the museums of the larger towns of Central Germany, to examine their palæontological treasures. In 1830 Agassiz went to Vienna, where he stayed a year, attending at the hospitals, and studying in the Imperial Museum the splendid collection of sturgeons of the Danube region, as well as the fossil fishes of Monte Balca. Moreover, he was so interested in the Cyprinoids of the Danube, which were already partly known to him from those of the Isar, that he concluded a work on the Freshwater Fishes of Central Europe; on account of the revolution of July, 1830, this work was not published.

The years 1831 and 1832 Agassiz spent in France, and in Paris had much pleasant intercourse with Cuvier and Alex. von Humboldt. Cuvier was then giving a course of lectures on the history of natural science, and combated with all the power of his science and his detailed knowledge of the organic structure of the whole animal world the development theory of Geoffroy based on the variability of species, which the latter defended in the sittings of the Paris Academy. From this time Agassiz adhered to Cuvier's ideas on the classification of the animal kingdom and on creation catastrophes especially, and with but little modification, defended them in his teaching and writing to the end of his life.

In Humboldt, again, Agassiz found an attached and powerful patron, whose support at a later time essentially facilitated the publication of many of his costly works, and to whose recommendation he in part owed the brilliant reception he met with in America, which he chose as his second home.

The Paris Museum was then in the zenith of its reputation; its zoological, palæontological, and anatomical collections were then the richest and most celebrated of

Europe, and Cuvier granted to the young Agassiz with genuine disinterestedness and liberality the complete use of its rich material. With untiring diligence and rare perseverance, Agassiz here continued his researches on fossil fishes, and anew worked thoroughly through the rich palæontological collection of Conte Gazzola, which contained the originals of Volta's celebrated treatise "L' Ittiologia Veronese."

In 1833 Agassiz again visited the great museums of Germany and Switzerland, and had already distinguished 500 species of fossil fishes, when, in August, 1834, he sailed for England, in order to study there the exceptionally rich public and private collections, in which he found 300 new species. In the year 1835 and 1840, he extended his journeys into Wales, Scotland, and Ireland, visiting London again and again, in order there to test the notes collected for many years for the completion of his work, and to make himself acquainted with the newest discoveries in the department of palæontology.

In 1844 Agassiz concluded the publication of his gigantic work on the Fossil Fishes, which appeared at Neuchâtel in five quarto volumes, with 311 folio plates. Eighty of the greatest museums of Europe had furnished the material for it, and the number of described species amounted to 1,700 in about 20,000 examples. The "Recherches sur les Poissons Fossiles" is undoubtedly Agassiz's most important work, and forms, with Cuvier's and Valenciennes' "Histoire Naturelle des Poissons" and Johann Müller's treatises, the foundation of our present knowledge of fishes, while it does not confine itself to the region of ichthyolites, but extends over the entire wide field of the anatomy and classification of fishes, essentially modifying the latter. Agassiz considered, and with justice, that the separation of the ganoids from the other fishes into the rank of a special order, as the greatest step towards progress for which science was indebted to him; and, on the basis of the comparison of the fossil fishes of all formations with living forms, he enunciated several generally valid laws, which have had an important bearing on the development theory of the whole organic world.

As a special fruit of Agassiz's stay in England appeared in 1844 and 1845, a monograph on the Fossil Fishes of the Devonian System and a smaller treatise on the Fishes of the London Clay.

As early as 1832 was Agassiz called to be professor at Neuchâtel, and in a short time raised the little town to be a chief seat of science in Switzerland. He created a Natural History Museum, and was the chief founder of the Scientific Society, which issued the first volume of its *Memoirs* in 1835. From all parts of Switzerland came young and talented pupils and friends of nature thither, and gathered round Agassiz, who understood how to inspire them with his great ideas. They followed him in his frequent zoological and geological excursions in the Jura and the Alps, and assisted him in procuring scientific material and helping him in the time-consuming preliminaries of those numerous works which date mainly from the years 1835 to 1845. Along with his friends Desor and Valentin, Agassiz published the great monograph on living and fossil Echinoderms.

The rich collection of fossil conchifera of Switzerland, which a young and able geologist of the name of Gressly

had brought back from his travels, led Agassiz to work out the fossil conchifera of the Jura and the chalk, the result being published under the title of "Études Critiques sur les Mollusques fossiles du Jura et de la Craie," in four parts with 100 plates. This was followed by several similar supplementary publications on fossil conchifera, of which the "Iconographie des Coquilles tertiaires, réputées identiques avec les espèces vivantes ou dans différens Terrains de l'Époque tertiaire," and "Mémoire sur les Moules de Mollusques vivans et fossiles," are the most important.

In spite of these numerous and comprehensive works, Agassiz found time to devote to the study of living fishes. Thus may be mentioned his treatise on the cyprinoids (1834); the great work brought out in conjunction with Carl Vogt between 1839 and 1845, on the freshwater fishes of Central Europe; in 1842 he brought out his most important "Nomenclator Zoologicus," the result of many years' gatherings, and which contained an alphabetical arrangement of the specific names of the entire animal kingdom, their etymology, information as to the authors who had proposed these names, as well as the year of their appearance. The "Nomenclator" found a magnificent conclusion in the "Bibliographie générale d'Histoire Naturelle," printed at the cost of the Ray Society, unfortunately not without some ugly mutilations on the part of the editor.

While Agassiz no doubt exercised a considerable influence on geology by means of his palæontological researches, still it is as a glacialist that his name will always be prominently associated with that science. Venet's, Schimper's, and especially Charpentier's observations and theories on the greater extension of glaciers, and their relations to erratic blocks attracted the attention of Agassiz in 1836 to the glacial phenomena of Switzerland. Charpentier's theories on the former extension of glaciers and other points especially interested Agassiz, who gave himself with his peculiar energy and fertility of idea to the study of glaciers. With Gyt, Desor, Studer, and other young friends, did Agassiz during several years visit most of the glaciers of Switzerland, and examined them in their entire extent, from their origin to their lowest margins. In 1841 was the ascent of the Jungfrau undertaken. In the middle of the Aar glacier, at a height of 8,000 feet above the sea, twelve miles from any human habitation, protected by a huge block, was a station erected, which latterly obtained a European celebrity, under the name of "Hôtel des Neuchâtelois." Here for fully eight years were researches carried out on the origin of glaciers, the forward and backward oscillations, the structure and thickness of the ice, as well as its formation, the origin of moraines, &c. In 1840 appeared Agassiz's first great work, "Études sur les Glaciers," in which he thoroughly discussed the chief phenomena of glaciers, and developed his views on their earlier extension. In a second work, "Système glacial," he gave a satisfactory account of the observations made in the years 1841-45, especially on the progress of glaciers in various years and under the influence of conditions of temperature. The adoption of a special glacial period was the final result of Agassiz's research among the glaciers of Switzerland, as well as those of Scotland and Wales. An immense ice-bed, the

result of a depression of temperature toward the end of the tertiary covered North and Central Europe, Asia, and North America, and a similar phenomenon was also found to have occurred in South America, from the South Pole to Monte Video and Chile, as Agassiz ascertained during the *Hassler* Expedition of 1872. The immense importance of this theory, both in geology and biology, was soon recognised, and its discussion has engaged the earnest attention of the ablest men in all departments of science. In the autumn of 1846 Agassiz went to America, partly on a commission from the Prussian Government and partly to fulfil an engagement to give a series of lectures on Comparative Embryology at the Sewell Institute of Boston. This course of lectures led to important results; it aroused an enthusiasm for the study of nature in the widest circles, and Agassiz understood how to make the scientific development of North America in this direction a matter of honour for the whole nation. The offer of the use of the steamers of the Coast Survey led to a scientific cruise in the summer of 1847 along the coast of Massachusetts, followed a few years later by a second larger cruise to the coral reefs of Florida.

After Agassiz had been released from his scientific mission by the Prussian Government, he accepted with pleasure the Chair of Zoology and Geology in the Lawrence Scientific School of Harvard College, Cambridge, created specially for Agassiz by the founder of the school, Mr. Abbot Lawrence. Agassiz thus gave up all thought of returning to Europe; he placed his activity, his science, and his talents, at the disposal of the nation that showed itself so anxious to keep him, and where he would enjoy a social power and a liberty which were hardly possible to the *savans* of the Old World.

As in Neuchâtel, so in Cambridge, Agassiz in a very short time attracted around him a circle of young men, enterprising lovers of natural science. With these, in June, 1848, he undertook a journey to the then little-known region of Lake Superior. In 1850 appeared his well-known work, "Lake Superior: its Physical Character, Vegetation, and Animals," in which Agassiz discussed in detail the erratic phenomena of the lake, its future form and extent, the character of its ichthyological and reptilian fauna, while Cabot, Harris, Gould, and J. Leconte worked out the rest of the collections. In succeeding years he made similar expeditions with his pupils into the interior of the United States, and with the collections brought back laid the foundation of a natural history museum, which, until then, had no existence at Harvard University.

In 1852 Agassiz went to Charleston as Professor of Zoology and Comparative Anatomy, but returned to Cambridge after two years, the warmer climate of the south not agreeing with him. Soon after he visited all the great towns of North America, lecturing in all departments of zoology and geology. Everywhere he was received with enthusiasm, for his expositions were remarkably clear and full of suggestive thought, his language noble and fluent, his knowledge of human science of the widest, his manner so charming and his conversation so full of the highest instruction, that every one felt it a privilege to be near him. From that time Agassiz became the declared pet of the Americans; he was the most popular man in the whole broad land, and in intel-

lectual matters became its greatest benefactor, exercising his influence in improving education and increasing educational establishments.

In 1855 Agassiz began to prepare for the publication of a magnificent work, "Contributions to the Natural History of the United States," he having already published several papers on the subject in American journals. In a short time the necessary means were obtained by subscription, and in 1857 the first volume appeared, dedicated to Döllinger and his generous friend Francis Calley Gray. Unfortunately this work only reached the fourth volume. The first volume contained as introduction the universally-known and much-discussed "Essay on Classification," which latter, as a separate work, was published in London in 1859, and in an enlarged French translation in Paris, 1869. Agassiz treated in this work the questions of the origin, development, and systematic arrangement of the organic world, and developed from these his philosophical views which he had obtained from his own studies and observations, and which stand in direct opposition to the Theory of Descent.

Agassiz's collections had grown so enormously that the accommodation at his disposal was quite inadequate. By the liberality of Mr. F. C. Gray and the State of Massachusetts, as well as Cambridge University, a great Natural History Museum was begun in June 1859, and by December was so far advanced, that the greater part of Agassiz's collections could be transferred to it. From this time the improvement and completion of this museum became the chief object of Agassiz's activity. He aimed at making it in comprehensiveness and suitability for its purpose, a pattern institution for the whole world, and fitted to give the friends of natural history all possible help in their researches. The Museum of Zoology and Comparative Anatomy is much better known to the public of Cambridge and Boston as "Agassiz's Museum."

In 1864-65, Agassiz somewhat broke down from his continued labours, and he was advised to travel. He decided to visit Brazil, the fish of which furnished him with the subject of his first work. With six assistants he left New York in April, 1865, for Rio Janeiro. The party divided to work in various directions, Agassiz, himself, selecting the Amazon as his sphere, sailed up the river to Manaos, at the Mouth of the Rio Negro, and thence to Tabatinga. During the journey from Pará to Manaos 300 species of fish were collected, of which one half were drawn from life by Burkhardt. His headquarters were at Teffe and Manaos, where he studied the habits of the fish in their migrations in the main stream, and several of its tributaries. While he stayed here, his assistants explored some of the other tributaries of the Amazon, while others explored the regions on the Rio Francisco, Rio Doce, Paranahyba, &c. In July of the following year Agassiz returned to the United States with such a collection of booty as would have filled another Museum. With the co-operation of Agassiz, his wife, the true companion of her husband, and full of sympathy for his ideas, brought out the journal of these remarkable travels, which in a short time reached a sixth edition in America, and was translated into French in 1869.

Again, in the end of 1871, Agassiz left for South America, on board the war-ship *Hassler*. Count Pour-

tales, in this well-known expedition, had charge of the deep-sea researches, while Dr. Steindachner with Agassiz, was responsible for the other zoological collections. The results of this expedition are well known to naturalists. The leisurely cruise along the coast of Patagonia and Chili gave Agassiz an opportunity of studying the glacial phenomena of South America. His stay in San Francisco and Sacramento gave an impulse of the greatest importance to education and science in these towns, and in the latter led to the creation of a Natural History Society, which was named after him, the Agassiz Institute.

The history of the Penikese School of Natural History must be so fresh in the memory of our readers that we need not here repeat the details. The success of the school, modelled somewhat after that of Dohrn, at Naples, exceeded all expectation, the accommodation being quite inadequate for the number of students who appeared. At the end of the first summer his pupils bade him a long good-bye in the hope of meeting their much-loved master next year. But the additional burden seems to have been too great for the strength of the never-resting devotee of science. After scarcely eight days' illness, he died at Cambridge, December 14, 1873, in his sixty-third year, in the height of his fame. He has been justly named by his fellow-citizens of the States the "Humboldt of America." Ever amiable and open in intercourse, stimulating and instructive, clear and concise in exposition, was Agassiz; and his numerous pupils, of whom several have developed into important workers in science, as Alex. Agassiz, Stimpson, Putnam, Shaler, Wilder, Morse, &c., clung to him with truly child-like love and respect. The news of his unexpectedly sudden death shocked the whole population deeply, for America had lost in him one of her citizens of whom she had the best right to be proud.

Besides Dr. Steindachner's paper, we would refer the reader who desires further details to a paper in the *Revue des Deux Mondes* for July and August, 1875.

WATERTON'S LIFE AND TRAVELS

Wanderings in South America, the North-West of the United States, and the Antilles, in the Years 1812, 1816, 1820, and 1824. With Original Instructions for the Perfect Preservation of Birds, &c., for Cabinets of Natural History. By Charles Waterton. New Edition. Edited, with Biographical Introduction and Explanatory Index, by the Rev. J. G. Wood. With 100 Illustrations. (London: Macmillan and Co., 1879.)

THE reading world will feel grateful to both author and publisher for this handsome edition of one of our classical books of travel and natural history; while those who are already familiar with the work will read with interest and pleasure the excellent biographical notice of Waterton here given. We have first a sketch of his school and college life, when his taste for natural history got him into many scrapes; but we learn that the Jesuit fathers at Stonyhurst wisely utilised his irrepressible love of animals by making him rat-catcher and general vermin-killer to the establishment. We next find him travelling on the Continent, where he had a narrow escape of dying of the plague at Malaga. He visited Gibraltar, and saw a whole colony of the well-known apes which were then far more abundant than now. He speculates on the "tremendous convulsion of nature" which had

opened the channel of the Straits, observing that—"if apes had been on Gibraltar when the sudden shock occurred, these unlucky mimickers of man would have seen their late intercourse with Africa quite at an end"—a passage which recalls to us those extreme catastrophist doctrines in geology which are now happily extinct.

When his wanderings in South America were at an end he settled down in his ancestral Yorkshire home, Walton Hall, devoting himself to the management of his estate and the study of nature, and living a life of the most Spartan simplicity. His single room had neither bed nor carpet. He always lay on the bare boards with a blanket wrapped round him, and with an oaken block by way of pillow. He went to bed at eight, and was up, dressed and clean shaven every morning at four, having himself lit a fire and boiled water to shave with. His devotions and reading occupied him till six; his bailliff's report, writing and business till eight, his breakfast hour; so that he had done a fair day's work before most people are out of bed. His room was at the very top of the house; he never touched fermented liquors, and took very little meat.

His great delight was in studying the habits of birds and other wild animals; and he devoted his park of over 250 acres to this purpose. He had moats, and ponds, and swamps, woods and trees of all kinds; and he spent 10,000*l.* in surrounding the whole with a wall nowhere less than eight feet high, in order to keep out poachers and animal intruders. In this domain no gun was ever fired or anything done to disturb the feathered inhabitants. The very year after the wall was finished the herons came and established themselves in the park, where they had never bred before; and, as Mr. Wood remarks, it is strange that they should have known that the wall, which they themselves could so easily pass, would be any protection to them. He constructed a yew fortress for pheasants, built a cat-proof tower for starlings, and a lofty dovecot to secure his pigeons from poachers. Owls and titmice and many other birds had special haunts constructed for them, while rats and other bird-enemies were carefully trapped or poisoned.

Waterton was one of the kindest and most humane of men. He studied the comforts of his horses, his dogs, and even of his pigs, as if they had been human beings. He had his gates specially constructed so that his horses and cows could lean over them and converse together, without inconvenience to themselves or injury to the gates. When he took possession of a deserted country house in Demerara, tenanted by frogs and snakes, owls and vampires, he tells us in his quaint language,—“The frogs, and here and there a snake, received that attention which the weak in this world generally experience from the strong, and which the law commonly denominates an ejection. But here neither the frogs nor serpents were ill-treated; they sallied forth, without buffet or rebuke, to choose their place of residence; the world was all before them. The owls went away of their own accord, preferring to retire to a hollow tree rather than to associate with their new landlord. The bats and vampires stayed with me, and went in and out as usual.” Even when, going down the St. Lawrence, he caught, crawling on his neck, the only bug he saw in North America, he “thought of my uncle Toby and the fly;” and so, instead of killing it, he “quietly chucked it among some baggage that was