

SCIENCE

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LOUIS AGASSIZ.*

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It would be unnatural to have such an assemblage as this meet in the Museum and Faculty Room of this University and yet have no public word spoken in honor of a name which must be silently present to the minds of all our visitors.

At some near future day it is to be hoped some one of you who is well acquainted with Agassiz's scientific career will discourse here concerning it. I could not now, even if I would, speak to you of that of which you have far more intimate knowledge than I. On this social occasion it has seemed that what Agassiz stood for in the way of character and influence is the more fitting thing to commemorate, and to that agreeable task I have been called. He made an impression that was unrivalled. He left a sort of popular myth—the Agassiz legend, as one might say—behind him in the air about us; and life comes kindlier to all of us; we get more recognition from the world because we call ourselves naturalists—and that was the class to which he also belonged.

The secret of such an extraordinarily effective influence lay in the equally extraordinary mixture of the animal and social gifts, the intellectual powers and the desires and passions of the man. From his

* Words spoken at the reception of the American Society of Naturalists given by the President and Fellows of Harvard College at Cambridge on December 30, 1896.

boyhood he looked on the world as if it and he were made for each other, and on the vast diversity of living things as if he were there with authority to take mental possession of them all. His habit of collecting began in childhood, and during his long life knew no bounds save those that separate the things of nature from those of human art. Already in his student years, in spite of the most stringent poverty, his whole scheme of existence was that of one predestined to greatness, who takes that fact for granted, and stands forth immediately as a scientific leader of men.

His passion for knowing living things was combined with a rapidity of observation and a capacity to recognize them again and remember everything about them, which all his life it seemed an easy triumph and delight for him to exercise, and which never allowed him to waste a moment in doubts about the commensurability of his powers with his tasks. If ever a person lived by faith, he did. When a boy of twenty, with an allowance of two hundred and fifty dollars a year, he maintained an artist attached to his employ, a custom which never afterwards was departed from, except when he maintained two or three. He lectured from the very outset to all those who would hear him. "I feel within myself the strength of a whole generation," he wrote to his father at that time, and launched himself upon the publication of his costly 'Poissons Fossiles' with no clear vision of the quarter from whence the payment might be expected to come.

At Neuchâtel (where between the ages of twenty-five and thirty he enjoyed a stipend that varied from four hundred to six hundred dollars) he organized a regular academy of natural history, with its museum, managing by one expedient or another to employ artists, secretaries and assistants, and to keep a lithographic and printing establishment of his own employed

with the work that he put forth. Fishes, fossil and living, echinoderms and glaciers, transfigured themselves under his hand, and at thirty he was already at the zenith of his reputation, recognized by all as one of those naturalists in the unlimited sense, one of those folio copies of mankind, like Linnæus and Cuvier, who aim at nothing less than an acquaintance with the whole of animated nature. His genius for classifying was simply marvellous; and, as his latest biographer says, nowhere had a single person ever given so decisive an impulse to natural history.

Such was the human being who on an October morning fifty years ago disembarked at our port, bringing his hungry heart along with him, his confidence in his destiny, and his imagination full of plans. The only particular resource he was assured of was one course of Lowell Lectures. But of one general resource he always was assured, having always counted on it and never found it to fail—and that was the good will of every fellow-creature in whose presence he could find an opportunity to describe his aims. His belief in these was so intense and unqualified that he could not conceive of others not feeling the furtherance of them to be a duty binding also upon them. *Velle non discitur*, as Seneca says,—Strength of desire must be born with a man; it can't be taught. And Agassiz came before one with such enthusiasm glowing in his countenance—such a persuasion radiating from his person that his projects were the sole things really fit to interest man as man—that he was absolutely irresistible. He came, in Byron's words, with victory beaming from his breast, and every one went down before him, some yielding him money, some time, some specimens and some labor, but all contributing their applause and their godspeed. And so, living among us from month to month and from year to year, with no relation to prudence except his

pertinacious violation of all her usual laws, he on the whole achieved the compass of his desires, studied the geology and fauna of a continent, trained a generation of zoologists, founded one of the chief museums of the world, gave a new impulse to scientific education in America, and died the idol of the public, as well as of his circle of immediate pupils and friends.

The secret of it all was that, while his scientific ideals were an integral part of his being, something that he never forgot or laid aside, so that wherever he went he came forward as 'the Professor,' and talked 'shop' to every person, young or old, great or little, learned or unlearned, with whom he was thrown, he was at the same time so commanding a presence, so curious and inquiring, so responsive and expansive, and so generous and reckless of himself and of his own, that every one said immediately, "Here is no musty *savant*, but a man, a great man, a man on the heroic scale, not to serve whom is avarice and sin." He elevated the popular notion of what a student of Nature could be. Since Benjamin Franklin we had never had among us a person of more popularly impressive type. He did not wait for students to come to him; he made inquiry for promising youthful collectors, and when he heard of one he wrote, inviting and urging him to come. Thus there is hardly one now of the American naturalists of my generation whom Agassiz did not train. Nay, more; he said to every one that a year or two of natural history, studied as he understood it, would give the best training for any kind of mental work. Sometimes he was amusingly *naïf* in this regard, as when he offered to put his whole museum at the disposition of the Emperor of Brazil if he would but come and labor there. And I well remember how certain officials of the Brazilian Empire smiled at the cordiality with which he pressed upon them a similar

invitation. But it had a great effect. Natural history must, indeed, be a godlike pursuit, if such a man as this can so adore it, people said; and the very definition and meaning of the word naturalist underwent a favorable alteration in the common mind.

Certain sayings of Agassiz's, as the famous one that he 'had no time for making money,' and his habit of naming his occupation simply as that of 'teacher,' have caught the public fancy and are permanent benefactions. We all enjoy more consideration for the fact that he manifested himself here thus before us in his day.

He was a splendid example of the temperament that looks forward and not backward, and never wastes a moment in regrets for the irrevocable. I had the privilege of admission to his society during the Thayer expedition to Brazil. I well remember at night, as we all swung in our hammocks in the fairy-like moonlight, on the deck of the steamer that throbbed its way up the Amazon between the forests guarding the stream on either side, how he turned and whispered, "James, are you awake?" and continued, "*I cannot sleep; I am too happy; I keep thinking of these glorious plans.*" The plans contemplated following the Amazon to its head-waters, and penetrating the Andes in Peru. And yet, when he arrived at the Peruvian frontier and learned that that country had broken into revolution, that his letters to officials would be useless, and that that part of the project must be given up, although he was indeed bitterly chagrined and excited for part of an hour, when the hour had passed over it seemed as if he had quite forgotten the disappointment, so enthusiastically was he occupied already with the new scheme substituted by his active mind.

Agassiz's influence on methods of teaching in our community was prompt and decisive—all the more so that it struck

people's imagination by its very excess. The good old way of committing printed abstractions to memory seems never to have received such a shock as it encountered at his hands. There is probably no public school teacher now in New England who will not tell you how Agassiz used to lock a student up in a room full of turtle shells, or lobster shells or oyster shells, without a book or word to help him, and not let him out till he had discovered all the truths which the objects contained. Some found the truths after weeks and months of lonely sorrow; others never found them. Those who found them were already made into naturalists thereby; the failures were blotted from the book of honor and of life. "Go to nature; take the facts into your own hands; look and see for yourself!" These were the maxims which Agassiz preached wherever he went, and their effect on pedagogy was electric. The extreme vigor of his devotion to this concrete method of learning was the natural consequence of his own peculiar type of intellect, in which the capacity for abstraction and causal reasoning and tracing chains of consequences from hypotheses was so much less developed than the genius for acquaintance with vast volumes of detail and for seizing upon analogies and relations of the more proximate and concrete kind. While on the Thayer expedition I remember that I often put questions to him about the facts of our new tropical habitat, but I doubt if he ever answered one of these questions of mine outright. He always said: "There, you see you have a definite problem; go and look and find the answer for yourself." His severity in this line was a living rebuke to all abstractionists and would-be biological philosophers. More than once have I heard him quote with deep feeling the lines from Faust:

"Grau, theurer Freund, ist alle Theorie,
Und grün des Lebens goldner Baum."

The only man he really loved and had use for was the man who could bring him facts. To see facts, not to argue or *raisonnieren*, was what life meant for him; and I think he often positively loathed the ratiocinating type of mind. "Mr. Blank, you are *totally* uneducated!" I heard him once say to a student who propounded to him some glittering theoretic generality. And on a similar occasion he gave an admonition that must have sunk deep into the heart of him to whom it was addressed: "Mr. X., some people perhaps now consider you a bright young man; but when you are fifty years old, if they ever speak of you then, what they say will be this: 'That X.—oh, yes, I know him; he used to be a very bright young man!'" Happy is the conceited youth who at the proper moment receives such salutary cold water therapeutics as this from one who, in other respects, is a kind friend. We cannot all escape from being abstractionists. I myself, for instance, have never been able to escape; but the hours I spent with Agassiz so taught me the difference between all possible abstractionists and all livers in the light of the world's concrete fulness, that I have never been able to forget it. Both kinds of mind have their place in the infinite design, but there can be no question as to which kind lies the nearer to the divine type of thinking.

Agassiz's view of Nature was saturated with simple religious feeling, and for this deep but unconventional religiosity he found at Harvard the most sympathetic possible environment. In the fifty years that have sped since he arrived here our knowledge of Nature has penetrated into joints and recesses which his vision never pierced. The causal elements and not the totals are what we are now most passionately concerned to understand; and naked and poverty-stricken enough do the stripped-out elements and forces occasionally appear to us

to be. But the truth of things is after all their living fulness, and some day, from a more commanding point of view than was possible to any one in Agassiz's generation, our descendants, enriched with the spoils of all our analytic investigations, will get round again to that higher and simpler way of looking at Nature. Meanwhile, as we look back upon Agassiz, there floats up a breath as of life's morning, that makes the world seem young and fresh once more. May we all, and especially may those younger members of our association who never knew him, give a grateful thought to his memory as we wander through that Museum which he founded, and through this University, whose ideals he did so much to elevate and define.

WILLIAM JAMES.

HARVARD UNIVERSITY.

ON THE EFFECTS OF DISEASE AND SENILITY AS ILLUSTRATED IN THE BONES AND TEETH OF MAMMALS.*

I WAS very glad to respond to the invitation of your committee to address you, for the reason that I have been for a long time interested in studying the effects of diseased action and senility, I hold that they are closely related and capable of being compared in precise ways with other morphological processes.

Am I right in assuming that to no other organization is it so appropriate to present the results of my investigation as to your own?

In a scientific sense the use of the words 'morbid' and 'pathological' cannot be sustained, for it assumes the existence of morbid principles. One might speak as reasonably of the use of the words 'dirt' or 'weeds' being warranted in treating of exact conceptions.

Disease tends to interfere with efficiency

*A lecture delivered before the Graduate Club of the Biological Department of the University of Pennsylvania, December 7, 1896.

—in whole or in part—of the organism in which it is manifested. But this statement, you will observe, in no way relates to etiology. The difference between disease and senility is apparent rather than real; for senility, like disease, is a condition tending to inefficiency. Many senile states resemble diseased states and include calcification, absorption, fatty degeneration, etc. But if these processes help the organism by preparing it for its work they cannot be called perversions, since all of them are present in early and confessedly normal states of the economy. Calcification is a normal process, whether we see it in the perpendicular plate of the ethmoid bone in the young adult or in the walls of blood vessels in the aged; absorption is a normal process, whether it is seen in the roots of the deciduous teeth in the young or in the orbito-temporal septum of the aged; fatty degeneration is a normal process, whether it takes place in the mature placenta and prepares the way to parturition or occurs in the form of an *arcus senilis*. But the results of these processes are enormously divergent, one maintaining physiological activities, the other hastening to decay and death.

Senility is of no definite period and, therefore, is without accurate limitation. The postulate that 'wear and tear' on tissues or organs which cannot be replaced occur in direct ratio to use is accepted. In low forms of life large portions of the economy, and some tissues even in the highest forms, are discarded and new ones take their place. Epithelial elements are constantly being thrown off, and in many animals teeth are lost when no longer of service and others are developed to supplant them. But in old age of high grade organisms we witness loss, rather than gain, both in organs, like the teeth and hair, and in tissues, as muscle fibres in the capillary blood vessels. So far as man is concerned, this period is, on the whole, included in the time when he is no