

CHARLES DARWIN AS A MODEL STUDENT OF NATURE*

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FIFTY years ago next September — for commencement was still held in September in those medieval days—my class graduated from Brown University. I well remember my own attitude at the commencement in 1855, (the first I ever attended,) towards the men who graduated in 1805—men whose birth almost reached back to the Revolution itself. I considered that they were taking up room and using up oxygen that belonged to us young fellows, and that they ought to hurry up, or rather hurry down, into the hospitable graves that were yawning for them. Yet Theron Metcalf of this very class of 1805, who was born only three years after Yorktown, had the audacity to live till 1875—two years after I had been deemed mature enough to become a member of the corporation itself!

I have no doubt that the freshmen of to-day look upon us of '59 as almost the contemporaries of the ichthyosaurus, but I can assure them that that is absolutely a fish story.

But in truth we must recognize the fact that our lives are fast ebbing away and that though the average human life is far longer than it was fifty years ago, we cannot expect an indefinite prolongation of existence. You remember the story told of Baron Rothschild—the founder of the house—whose physician was called to see him when he fell ill at 90 years of age. He assured the doctor that he could not survive. "Not a bit of it, Herr Baron," was the cheerful reply, "You'll live to be 100." "No, no," replied the veteran banker, I suspect with a twinkle in his eye, "do you suppose that when the Lord can get me at 90 he's going to wait till I go to par?"

But old as we unquestionably are, we still remember our college days with enthusiasm and have eagerly watched

the growth of the university in numbers and in power. In 1859 the faculty numbered only 10 and the students 225; now they number 142 and 993 respectively. The courses of instruction were few in number compared with the wealth of choice now provided. But the very meagreness of the number made our instruction more individual and, perhaps, more lasting, and our memories are still stocked with the facts learned in the classrooms of Lincoln and Harkness, Gammell and Chace, and their peers. We would even be willing, if it be not made to minute, to be quizzed offhand on the topography of Athens, and would not find ourselves in the position of the lady who, after hearing a lecture on the Parthenon, enthusiastically thanked the speaker, adding "I am so much obliged to you for settling one question that has long perplexed me—whether the Parthenon was on the Acropolis or the Acropolis on the Parthenon."

That the Providence girls of 50 years ago were the sweetest, best and prettiest mortal man ever saw is indisputable—the class of 1909 to the contrary notwithstanding. How well I recall the skating parties, the sailing parties, when Cupid and the propitious breezes often becalmed our boat and bestirred our hearts, the combined search for the stealthy fragrant arbutus and the brighter-hued laurel, and the occasional mildly extravagant drives into the surrounding country. On one of these I saw a wayside sign—but memory, after over a half century is often a sad traitor and it may be that I only heard of it—with the legend "Coffins made and repaired." Whether this was grim humor to attract custom or an exaggerated instance of New England thrift intended to establish the custom of bequeathing so inevitable a final luxury

* An after-dinner address on commencement day at Brown University, June 16, 1909.

along with the family plate and jewels I know not. But the bizarre idea long lingered in my mind until finally I beheld its realization in the museum at Constantinople. A sacrilegious wretch named Tabnit had opened an old sarcophagus, had incontinently tossed out the remains of his predecessor and provided that his own should be replaced in this second-hand coffin. He had not even directed the inscription recording the virtues of his predecessor to be erased, but his own name was inscribed below the first with the added caution "Do not open this sarcophagus as you will find nothing valuable in it." Suspecting, however, that one who thus besmirched his own bones would also lie, later explorers lifted the lid and found many jewels and much other pelf.

That Annus Mirabilis 1859 was remarkable for two things. We graduated and the "Origin of Species" was published. You may smile but I assure you that there is a subtle connection between the two events which does not appear on the surface. The struggle for existence and the survival of the fittest were two doctrines which occupy many pages in that memorable book. See now the final irrefutable proof of the truth of these doctrines after half a century! We have struggled to exist and lo! here we are! The fittest have survived! Naturally then we are all enthusiastic Darwinians.

But badinage aside, the past half-century has seen a wonderful thing. One book, scarcely larger than an ordinary novel, has changed the mental attitude of the whole race, not only in science, but practically in almost every realm of human thought. On its appearance it was greeted with scorn, vehement invective, fierce criticism and even with the thunder of ecclesiastical anathemas. Only those who lived, say from 1860 to 1875, can ever realize the extent and the violence of the controversy on the platform, in the pulpit, at the dinner-table—everywhere. Yet behold a miracle! After fifty years, though there are still a few feeble voices raised from time to time in protest and dissent, its doctrines are now the common truths of practically all thoughtful and intelligent men and the semi-centenary of its pub-

lication has been made the occasion of scores of celebrations in Europe and America—a tribute to the work and genius of one man which has no parallel in scientific annals. The addresses so far as I have read them have traced the influence of Darwin upon various phases of human knowledge and human thought, but few, if any of them have pointed to him as a model student of nature.

I propose, therefore, to ask you to look very briefly at this aspect of Darwin's life and to appreciate the lessons we may learn from it.

1. The first feature of his character was his infinite pains in collecting and verifying an immense mass of facts. No one can read the "Origin" without being deeply impressed with this. Portfolio after portfolio, 30 to 40 he says, of data on the many subjects he was investigating were his capital in trade—a "huge pile of notes," as he well calls those relating only to the "Transmutation of Species." "I worked," he says, "on true Baconian principles and without any theory"—observe these words "without any theory"—"collected facts on a wholesale scale by printed enquiries, by conversation and by extensive reading. I have bought many books and at their ends I made an index of the facts that concern my work, or, if the book is not my own, write out a separate abstract, and of such abstracts I have a large drawer full."

He was fortunate in inheriting means sufficient for his personal and scientific needs, but *per contra* he lost years of his laborious life from ill health. His persistent industry in spite of almost constant daily suffering for 40 years may well amaze us all.

2. He was never content only to read, to inquire or even only to observe, but when possible always put everything to the test of experiment. Hence the constantly recurring experiments in plants, the evidence from breeders of animals, of pigeons, and other birds in which the experimental method could be used. No scientist should ever accept any new statement without thus verifying it by experiment if that is possible. In the last half-century the experi-

mental method has done more to forward science and to make it exact than all the speculations since the days of Aristotle.

3. Darwin's was an "open mind." While always challenging alleged new facts and requiring the most conclusive evidence of observation and experiment before accepting them, yet, even though they controverted his previous opinions and apparently well-established theories, he was not hostile to them because they were new. They must win a sure victory over former notions, but he would see that they had fair play.

I do not know any better illustration of this influence of scientific study on the minds of savants in general than our former and our present notions as to the constitution of matter.

The twentieth century has opened most auspiciously with a great and fundamental discovery—that of radioactivity. For the first time also in the history of science a woman—Madame Curie—has been foremost in the work. This discovery has thrown into confusion our fundamental concepts as to matter and the more we know, the more are we puzzled. The idea that there may be only one primordial substance has recently received a notable impulse in the apparent conversion of radium into helium and by the still later observations which seem to show that other substances have been transmuted into carbon so that the chemists and physicists seem to have discovered at least a fragment of the Philosopher's Stone.

This openness of mind, this willingness to give up a cherished theory should be one of the chief virtues of scientific men. Of course there are always conservatives "dyed in the wool" who reject every new idea simply because it is new. But the great bulk of savants may be said always to append to their statements of facts other than self-evident propositions a large interrogation mark, enclosed though it be in a bracket. That is to say there is no postulate so firmly established but that it may be modified or overturned by later discoveries. "By doubt they are established," says Huxley, "and open inquiry is their bosom friend." Honest doubts once solved are the foundation-

stones of robust faith. Experiment then. Take nothing on faith, except, of course, in the higher realms of thought. Love knows no "instruments of precision." Test everything else by the balance and the yard stick!

4. This openness of mind was especially shown by Darwin by his mental attitude towards his own theories. Most of us are quite content for other fellows' ideas to be upset, but few like Darwin welcome criticism of our own ideas or are willing that our own intellectual children shall be declared other than the smartest and best-looking. "Darwin," says Huxley, "may be trusted always to state the case against himself as strongly as possible." Listen to what he himself says: "During many years I had followed a golden rule, namely, that whenever a published fact, a new observation or thought came across me, which was opposed to my general results, to make a memorandum of it without fail and at once; for I had found by experience that such facts and thoughts were far more apt to escape from the memory than favorable ones. Owing to this habit very few objections were raised against my views which I had not at least noticed and attempted to answer."

Well may he call this "a golden rule" too often, I fear, more honored in the breach than the observance. Well would it be if it were observed not only in science but in every other department of thought.

Moreover he not only noted these unfavorable observations for his own private consideration and reflection, but fearlessly published them. The "Origin" is full of such instances. Never have I known a man so fair in discussion, of so limpid and transparent a mind.

5. Having collected, arranged, and digested his facts, then came the brilliant generalizations, the statement of great principles. While minutely observant, he never limited his vision to the dative case or the enclitic *de*. He saw not only the trees but the great forests. Reflecting upon his marshalled facts, seeking for the explanation of the often bewildering diversity of his observations, he was many times baffled, but never dismayed or discouraged.

Who does not share his delight when he writes of one problem, "I can remember the very spot in the road whilst in my carriage when to my joy the solution occurred to me." Who of us who have been teachers—a title beyond all other titles—cannot remember how our nerves have been set a-tingle to the very finger-tips, when by some happy phrase or apt illustration suddenly flashing into our minds, we have been able to explain to our pupils, or even to ourselves, a difficult problem, or have discovered a new truth. The joy of the miser at discovering a hidden treasure of gold shrinks into utter insignificance beside such a delight.

But these generalizations were never formulated in haste. Though flashes of deep insight sometimes came to him early, he waited and waited, patiently accumulating more evidence, and constantly reflecting, till he felt sure of his ground and then he published. Even after he believed he had really discovered the method by which new species were formed, he says "I was so anxious to avoid prejudice that I determined for some time not to write even the briefest sketch of it." The first brief sketch of 35 pages was not written till after four more busy thoughtful years had passed! The "Origin" was not printed till 22 years after his first note-book was opened and till he had written two condensed sketches and a third bulky work, of which the "Origin" as published was a condensation—and all this laboriously written out by hand. The "Descent of Man" was the result of 24 years of labor; the "Expression of the Emotion" of 33 years, and the work on "Earthworms" of more than 40 years

of thought. Were everyone as patient and self-restrained, I warrant that yonder John Hay Memorial Library would suffice for scores of years longer than we now anticipate.

6. One more trait in Darwin, unhappily not common among scientists, was his deliberate decision not to engage in controversy. Like Gamaliel, he believed that "if this work be of men it will come to naught, but if it be of God [that is to say of the truth,] ye cannot overthrow it." Time has vindicated his wisdom and his work, and his beautiful character is not besmirched by controversy, and the heated and unwise words which controversy begets.

7. One serious warning he gives us. "Up to the age of 30 or beyond it, poetry of many kinds, such as the works of Milton, Gray, Byron, Wordsworth, Coleridge and Shelley, gave me great pleasure and even as a schoolboy I took intense delight in Shakespeare." The same was true of pictures and of music. "But now," he goes on, "for many years, I cannot endure to read a line of poetry; I have tried lately to read Shakespeare and found it so intolerably dull that it nauseated me" and he had almost lost his taste for pictures and music. Well may he call this a "curious and lamentable loss of the higher aesthetic tastes," and say, "If I had to live my life again I would have made it a rule to read some poetry and listen to some music at least once every week."

Looking back on the brief sketch I have drawn, how impressive is the noble character of this scientific giant. Humbly may we walk in his footsteps and copy his splendid example!

