

Recently, however, it occurred to the eminent spectroscopist just named to utilise certain information obtained during the total solar eclipse of May 17 last. It was shown on that occasion that though a large part of the light of the corona gives a continuous spectrum (or, in other words, shines with all the colours of the rainbow), there is an excess of coronal light from near the violet end of the spectrum. This does not help, so far as the spectroscopic method is concerned, because a multitude of images of the corona, of various tints of violet, would not, under spectroscopic dispersion, give a single well-defined image which could be seen and examined. The use of absorptive media, cutting off all, or nearly all, but the violet light, was naturally suggested; but this method failed, chiefly perhaps for the reason noted by Mr. Huggins, that the sensitiveness of the eye for very small differences of illumination by violet light is much less than for similar differences in red, yellow, orange, or green light. But, as photography deals most effectively with violet rays, it occurred to Mr. Huggins to try whether he could not photograph the corona by means of its violet light. He received the image of the sun, and of the region around the sun, on the photographic plate, after the light had been sifted out by a screen of violet (pot) glass, and in later experiments, by a solution of potassic permanganate. The sifting thus effected was more perfect for photographic purposes than for ordinary vision, because such red, orange, yellow, and green light from the sunlit sky as found its way through, though hiding the visual image of the corona, produced no effect on the photographic plates. This arrangement being made, and the image of the sun with a due portion of the sky around it being received on the plate, it was found that the coronal image—or what looked very like the coronal image—made its appearance on no less than twenty of the plates. This appearance does not consist simply of increased photographic action immediately around the sun, but of distinct coronal forms and rays, admitting in the best plates of measurement and drawing. As Mr. Huggins well remarks, "This agreement in plates taken on different days with different absorptive media interposed, and with the sun in different parts of the field" (that is, of the photographic plate), "together with other necessary precautions observed, makes it evident that we have not to do with any instrumental effect." Nevertheless we should be glad to hear that the simple device had been employed of cutting away the portion of the plate on which the sun's image would fall, and thus allowing the rays from the sun himself to pass through, and be received where they could not in any way affect the photographic result. Still, the tests applied are probably sufficient to show that Mr. Huggins has really accomplished the great result he announces. Little reliance can be placed on the agreement between the corona photographed in September last and that seen on May 17, the sun and his surroundings being viewed in such very different directions. But the similarity of structural detail and general character is too marked to be explained by mere coincidence.

If the new method is really the success it seems to be, a most interesting series of discoveries may be expected to follow from its employment. Now for the first time, the corona can be studied from day to day and from year to year. A multitude of interesting questions which hitherto have been asked in vain may now be answered. In clearer skies than ours, and at observatories high above the sea-level, a much greater success than Mr. Huggins has yet obtained may be expected. Even more is to be hoped from the steady progress which photography is making, and the use of improved and more sensitive plates.

HUMANITY AND NATURAL HISTORY.

BY RICHARD JEFFERIES.

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NATURAL history is natural history no longer. Even the very phrase is passing out of use, having ceased to convey the meaning, which has grown too great for the words. By it was understood a catalogue of plants, a list of animals, a description of fossils. The animal kingdom and the vegetable kingdom were terms in constant use; they seem as antiquated now as the language of Chaucer.

I will go no farther back than my grandfather's bookcase. There were the little thick volumes of Buffon, some broad fragments of Cuvier in folio, the same of Linnaeus in smaller blocks, Bakewell's "Geology," Kirby and Spence, a hundredweight and a hundred years of the "Philosophical Transactions," and certain books of botany strictly in Latin, whose authors are still honoured, but I shall not name them, for I detested those particular books beyond measure. This was a very respectable body of such learning for those days, and could not greatly have been improved upon. There is a solid mass of facts—a Silurian system—buried in those books to this hour. Buffon, as sure on all subjects as a gamecock, quick, witty, and pointed, writing in lace ruffles, and bringing crooked refractory nature into trim order and easy sentences, was the father of popularisers. Cuvier's bones were gigantic; and there are superstructures at the present day that rest on them. Linnaeus worshipped our golden gorse, and was thenceforth as dear to our hearts as a fairy tale.

Bakewell made a tessellated pavement with a geometrical design of what was then sprawling geology; right or wrong, at least you could see the pieces. Kirby and Spence are at this hour capital story-books for children, so interesting are their insects. I never smoked out a wasp's nest with straw or gunpowder after I read that book. The "Philosophical Transactions" are a queer jumble, but the variety and eccentricity of the topics excite the mind to look about for original ideas. The strictly Latin botanies are sawdust. From these authors, however, who, let it be observed, were for the most part primeval and original in some manner, the book-making naturalists of the last forty years have copied their works.

My grandfather's books were genuine, and went to the full length of the knowledge then existent. They formed a kind of dictionary in which you could find particulars of any creature or thing. Turning to the antelope, its food, locality, and mode of life were accurately described, with its genus and Latin label. Turning to the sparrow, its habits, number and time of eggs were clearly recorded. Insects, fishes, plants, mosses—there was nothing known to be existent that was not described or classified. Few now understand the immense labour Linnaeus's system of botany represents. Though another system is now in use, the materials of it are practically Linnaean. What Linnaeus effected in botany was carried out by various workers in other departments. Here, then, was a vast storehouse of facts—the accumulations of the ancients down from the days of Alexander the Great's preceptor. Looking at them broadly, the whole might be summed up as definition: The definition of an antelope, of an insect, or a plant. It was an encyclopædia of living creatures—a dictionary. This was natural history as originally intended by the phrase.

There was no idea in it. If you read and read steadily through the entomology, and the conchology, and the ichthyology, all the tomes from end to end, most likely you would recollect something of the camel or the rhinoceros—

a series of pictures might be formed in the mind; but you would not be the richer by one single idea. A ploughman may walk through a menagerie, and see the lions, and tigers, and the elephant, and will henceforward the better understand the infinity of life on the earth; but he will not possess a single new idea. So with these endless records in my grandfather's tomes: they conveyed nothing. I think the word "idea" carries my meaning better than theory or hypothesis. For my part, I consider that ideas are more valuable than facts, being, indeed, the greatest of all facts. Without an idea, facts are as dead as stones, on which no one can feed. Any one may stumble on a fact as a rabbit may turn up a coin. Only the wisest—or shall we rather say the secularly inspired!—can come, by long penance of thought, on the interpretation called an idea. When ideas came into natural history, it ceased to be natural history, and became philosophy.

Instead of endeavouring to trace the course of events from year to year and from thinker to thinker, till it grew to its present estate, it will serve better in way of contrast to sum in outline what that estate now is. At the central education establishments there are now three principal subjects placed before students. There are no precise terms by which these subjects can be accurately described, because they include so many branches. In effect, they are classics, the utilitarian cycle, and natural philosophy. Of old, classics took the first place, and Latin and Greek distinguished the gentleman and scholar. With recent years and the growing desire to profit by education, what I have called the utilitarian cycle has come so much to the front as to threaten the extinction of the classics. Students go to learn things that will actually be useful to them in life, by which they may secure an income. But yet something more is needed. A student may acquire a knowledge of three or more modern languages, be proficient in the higher arithmetic, and so forth—able, in short, to occupy any position in the official or mercantile world—and yet, if he stopped there, would be quite outside the living thought of the age. Without a knowledge of physical science, and that in a very extended form, he would be, however highly educated in other respects, still a mere clerk. In order, therefore, that the scholar may be able to mingle freely in the learned tone of the time, he is instructed in the elements at least of almost all the sciences. From physiology to botany, from electricity to astronomy, he is supposed to be grounded in everything. Unless he were so, half the allusions in the books and leading publications of the day would have no meaning to him. Again, very many of the best paid and most progressive employments are only open to physicists of some ability—as, for instance, the numerous developments of electricity. To indicate the various causes which have led up to the present aspect is not necessary here. The point is that natural philosophy, physical science, physics, whatever name may be given to the higher form of natural history, is now considered so important as to overshadow the rest. The whole aim of modern education is to make a man think natural science—that is, in other words, to fit him to comprehend the spirit of the time.

For the age thinks natural history in its higher or ideal form, just as former ages have thought metaphysics, or have been sceptical, or full of a revived classicism. It enters into every phase and movement. Physiology, for instance, which is the natural history of the human body, is taught—and rightly taught—to women, and even to children. If any one should object that physiology is not natural history, then his natural history is

exactly that understood by the phrase in the books on my grandfather's shelves. Sanitation is one of the most powerful movements in our time, and seems likely to gather strength. Sanitation would be impossible without an insight into natural history. Its main object is to dispose of certain deleterious organisms, and if these organisms were not studied, it would be the merest rule of thumb. The germ theory, all the researches of Pasteur, and his experiments in microscopic vaccination, these are the purest natural history. So in surgery, the antiseptic treatment; though, indeed, all surgery which depends on growth is natural history. As for the physician of the nineteenth century, he is purely a naturalist. Theories have disappeared: the one leading idea is to get at what nature needs. Nature, nature! the word is on every lip. Men's lives are saved by natural history. Athletics are based on the results of minute researches into the absorption of food, the repair of tissues, all the processes of life, training being adapted to facilitate it. Except those who return conquerors from war there are none so highly honoured as explorers of unknown regions, such as the interior of Africa, or the Palæocrystic sea at the other extreme, whose work is certainly natural history. Astronomy reaches, indeed, above our earth, but uses the forces with which the earth acquaints us as keys to open the stellar spheres. Then, returning to the earth, astronomy ventures theories as to its origin. Despite the attacks made upon it, the Lyell theory, that existing causes are sufficient to explain existing things and the means by which they become as they are, this great idea still influences the mind of every investigator. Such causes may be seen at work in any pond, or even on the window-pane; the whole idea must have been gathered from an intellectual study of natural history, since natural history presents these causes at every step. An exhaustive account of the multitudinous ways in which natural science influences the mind of the age would be of unwieldy length. Everywhere throughout the Anglo-Saxon world, eager minds are seeking new discoveries in such science literally night and day. Therefore, it is strictly accurate to say that the age thinks natural philosophy, looking to it for guidance, help, and future increase.

To gather the views of all these workers into a focus and express it in a formula may not be without its use. The one central idea which inspires their efforts is this: that every single atom of matter should be employed for the good of the human race. While this motive animates the inquirer, the search is consecrated and the seeker dignified. The reward is certain—it is in the inward consciousness of a great aim, which lifts the spirit, and, like a talisman, transmutes coarse things to preciousness. In our age nothing is holy but humanity. The human being is the one shrine towards which all pilgrims of our latter-day faith toil; the human being of itself, irrespective of race, sex, age, or distinction of good or bad. These are the ethics of natural history. The thing is plain enough to any one who stays a moment to consider; but in the hurry of life and the necessities of business, it is not so obvious perhaps to the many. I want to see it recognised as a truth so great as to be the first lesson of youth, the law of manhood, the chief dogma of the world.

It was said the other day, in the *Times* leader on the fire at Hampton Court Palace, that this collection of pictures is the only one open to the public on Sundays. This is a mistake. Miss North's Gallery at Kew is open on Sundays, and is, moreover, the only picture gallery in the metropolitan district which is so.