

truth (whether natural or moral) will prove consistent with itself; for all truth has "its seat in the bosom of God"—the ordainer of all law and the creator of all living things. In this honest way we may be led on by a true teaching, which embraces all nature, to give to faith what belongs to faith, while we give to reason what belongs to reason. Thus, may we hope to approach the true stature of our manhood, and to reach a lofty knowledge; which, in Bacon's words, is not to be regarded "as a tower of state for a proud mind to raise itself upon, but a rich storehouse for the glory of the Creator and the relief of man's estate."

SIR ROBERT REDE'S LECTURE—THE SUCCESSION
OF LIFE ON THE EARTH.

Sir Robert Rede's lecture to the University was delivered in the Senate House on Tuesday last, by Dr. John Phillips,

F.R.S., Professor of Geology and Mineralogy in the University of Oxford, and late President of the Geological Society: subject—"The Succession of Life on the Earth." The Vice-Chancellor, and the Masters of St. Catharine's, St. Peter's, Trinity Hall, Clare, St. John's, Sidney, &c., and a large number of resident members of the University were present; and accommodation was afforded for ladies and strangers on the floor of the Senate House: the galleries, as usual, being occupied by undergraduates.

The LECTURER commenced by observing that the subject which, by the Vice-Chancellor's command, he had the gratification of bringing before their notice, could claim in no other manner the character of being new, except in being at the present time subjected to that scrutiny which always arises on the production of new evidence; for certainly the history of life was an idea which could never be absent from the mind of any contemplative naturalist. It never could have been absent, because in all the classifications, in all the systems by which we vainly task ourselves to retain the divine idea of nature, we have invariably looked for a beginning, a progress, and a possible end, and for such variations as time, history, and the course of life have enabled us to gain a view of, according to the measure of the knowledge of the time. All nature had been found to be harmonised and linked together, point to point, by one beautiful and successive law; and perceiving, as we do, that every one thing is planned for a definite purpose, everything being thus manifestly linked together, the idea is conveyed that so perfect a plan must be permanent and subject to no material changes: yet in every stage we perceived vicissitudes from the greater to the less, and from the less to the greater: from the simple to the complex, and from the complex to the simple. This consideration made the study of nature hopeful. We might never fathom the mystery or the origin of life or of nature, but every step we take brought us towards a better understanding of the problem, and was a step in the right direction. Let us, then, take into consideration the subject of the history of the earth, not with an idea that we can altogether solve the problem, but to get a further insight into it, a further perception of the laws of nature, by the use of those senses with which the Almighty has endowed us. It would be necessary to speak of the character of the dependence of vital phenomena: life, as they were aware, existed only in certain sorts and certain combinations of matter. It might be said that it was possible for the Almighty to exhibit life in other sorts and combinations of matter; but thus we found them. Now, life was co-ordinate, dependent on its atmosphere. Plants and animals were dependent on this atmosphere, and those components of it which were exhaled by the one were respired by the other. So life was co-ordinate; and as plants fed on the atmosphere, they in their turn furnished food for the animals. This air was necessary for life and also for sight. How admirable was the adaptation of the human eye to the human mind. So also was the eye of the bird, the quadruped, the whale, and the fish, adapted by the Creator to every purpose for which it was necessary to employ this wonderful organ. Now life was subject to all these conditions. It was subject likewise to a very remarkable law, that every individual in which life is manifested is subject to a determinate duration, and the forms of life are reproduced after the pattern that was the original, with slight variations of the same type. In order to give an idea of the great richness of the subject, he would mention one or two things touching the limitation of the forms of life. Among other things that greatly limit the forms of life is temperature. If they drew a line round the earth parallel to the equator, they would enclose a space in which certain forms of life were visible; drawing a line further north, they would find that as they proceeded these forms of life gradually diminish, and the plants and animals of the torrid zone gave place to those of temperate regions, which in their turn were succeeded by the productions of colder climates. If they travelled up a high mountain, they would find all these symptoms of change. At the base the plants of the country would grow; as they proceeded these diminished; and they found further up those of a colder region, until the summit was clad in perpetual snow. Thus they saw that certain ranges of temperature were necessary to life. The same laws governed the inmates of the sea. Professor Edward Forbes probed the depths of the Ægean sea, and found that the quantities of life continually diminish from the surface downwards. Down to the depth of 230 fathoms, the proportions of quantity were as follows:—735, 161, 124, 91, 70, 50, 33, 6, 0. So the scale of life passed at the maximum above the surface to a minimum at a certain depth below. He now asked them to consider the question of the distinction of the forms of life. Take a circular diagram, representing the earth, and draw across it lines of temperature, we found it possible to represent them. Thus in the regions nearer the equator we found the larger carnivora, further north grammivora, and so on; and as in the new world certain forms of life corresponded to certain physical conditions, so it was in the old world. When we traced that subject out we acquired an idea of the provinces of life. He knew, up to that time, what he had said could have no novelty; and when speaking of geology and matters of that nature, he could not fail to remember that he had a precursor in the noblest of England's geologists, their pride and his pride—Professor Sedgwick [loud applause]. Proceeding to the question of the succession of life on the globe, the lecturer spoke of four main types of the forms of life, viz., the radiating, the articulating, the molusca, and the vertebrated animals, and of the adaptation of their structure. Three of these great types were formed for land, and capable of moving through the air and through the water. He then showed that many of the same forms and conditions of life existed now as in the earlier systems of nature, subject, of course, to certain vicissitudes with the earth's surface. It was impossible to determine the commencement, speaking in terms of geological time, of the forms of life. Let us suppose that we had the power of excavating the subterranean records of life. Below the surface at the depth of a few feet we should find elephants, mastodons, and hippopotami, and creatures which now only existed in other latitudes. Lower down we lost traces of the forms of quadrupeds, and found no remnants of animals at all. As we passed down, we found three great groups of stratification and three great groups of organization: we were passing down from the more recent to the ancient, and we had therefore a history if not a chronology of the earth, the variety of all the deposits being marked according to time. The lecturer, by a series of diagrams, illustrated the classification of these varieties; the three great divisions of cœnezoic occupied by mammalia: mesozoic, by rep-

tiles; and palæozoic, by trilobites, and being again subdivided. In this manner where one classification ceased another begun, and thus were traced the successions of life; each of these periods being as distinctly marked as eras of history. Then arose the question, is there a point of geological time which can be reached and which being reached we are justified in believing there were no traces of life on the globe. This was a serious investigation, and one that required a great deal of consideration. As we descended through these stratifications, undoubtedly the number of the forms of life diminish, until from thousands we found hundreds, then tens, and ultimately no traces of life remained. The learned Professor traced the progress of various genera through the tertiary, cretaceous, oolitic, saliferous, carboniferous, silurian, &c., strata, represented on the diagram by a band of diminishing thickness, until a zero was arrived at. In the same way certain species of mollusca were gradually diminished in the sea, until the zero of geological life was arrived at. He proved that while some groups of life were predominant in the old system of things, others just made their appearance in the ancient system of strata, and went on augmenting until they occupied the greater proportion among human things. He spoke of the perpetuity of certain ranges of forms, and of the existence of analogous productions on the earth and beneath its surface, though in widely separated latitudes. Thus for instance marine deposits and certain types of insectivorous tribes had been found at Stonesfield, corresponding to those now existing at New Holland. In some parts of Australia, on the land we found plants which had deposits among the remains at Stonesfield; and on the coast of Australia there was a shark with teeth of a peculiar formation, and teeth precisely similar were dug up at Stonesfield. The lecturer proceeded to argue from the facts laid down that the Darwin theory of natural selection, and the development of life from one original type, has no foundation to rest upon. He dwelt upon the fact that geology reveals no evidence whatever of transition from one species to another, and ridiculed the action of any such power of change dependent upon the creature and external circumstances as would enable a rook to develop itself into a heron. Geology furnished no data to support the hypothesis that one set of forms of life could be transformed into another. The argument to be good for anything should show us one set of forms of life gradually dying out, and another gradually coming in, by this process of "natural selection." But there was nothing of the sort—no branching off—no evidence whatever that one grand group of life was derived from another of a different form and a different date. In conclusion, he said, that whatever researches had been made, however the science of geology had been developed, no new conclusion had been arrived at beyond this, that we have successive forms of life suited to the successive ages of the world, and all are the creation of one Almighty hand for some wise and useful purpose.

The meeting then broke up.