Journal, with which I endeavoured to combine a monthly founded by Douglas Jerrold, the *Illuminated Magazine*. The combined papers lasted only a few months, but in them I had the opportunity of reprinting some of Wells's Stories. His attention called to this, a correspondence followed, and he sent me various manuscripts for publication, either by myself or elsewhere. Among them were two Stories which I suppose, from similarity of style and feeling, to have been written in the early days of those "after Nature." One, *Claribel*, I printed; and in 1848 dramatised it, with a dedication to Wells and acknowledgment of my indebtedness. The other, which I declined, almost offending him thereby, was a story of intense power: of a man, after discovery of his wife's infidelity, having her and her lover decoyed into a room in which he shut them up, to starve to death—visiting the place of their punishment years afterward: a story such as Webster might have written, but hardly suitable for family reading. The other MSS. were chiefly on sporting in Brittany (I am not reminded of any poetry among them), evidently of more recent writing, strangely unartistic, sometimes ungrammatical, as if the writer had forgotten his schooling. My recollection is that I got some printed in the *People's Journal*, edited by John Saunders and William Howitt, but it may be these were the articles in *Fraser* which Mr. Gosse has mentioned.

So far as I can trust my memory it must have been some years after this that I lent the *Joseph and his Brethren* (a copy given me by Wells), and perhaps the Stories also, to Mr. D. G. Rossetti. He may have seen them before; but he will recollect the interest I had in Wells's works, and some talk between us as to the possibility of getting one or both republished with his designs. To his interest in the drama, and his introduction of it to Mr. Swinburne, we owe the publication at a later date, as already stated.

As regards other poetry by Wells, Mr. Gosse's statement, apparently on the best authority, that "he tried vainly to publish, but never lost hope," that "he had composed eight or ten volumes of poetry" and "burned the whole mass at his wife's death," staggers me. In correspondence with him (and he knew how gladly I would have printed anything while I had the power), speaking with Mr. Wells, acquainted with Mr. Smith Williams, the "brother-in-law," the accomplished and kindly reader for Smith, Elder and Co., the "discoverer of Charlotte Brontë," I cannot understand how I should not have known of his publishing endeavours. Was his statement in 1877 only the loose recollection of an old man, that he had been long time before refused? My own understanding always was that, disgusted at his early failure, he abandoned poetry altogether; and certainly the later prose writing (careless as the *Joseph and his Brethren* was) evinced but little of the literary ability to be expected from a man who for so many years had cultivated the poetic art. The writer of eight or ten volumes of poetry would hardly have slipped up in the very construction of a prose sentence. I am not depreciating his genius; I rate his natural gifts perhaps higher than does Mr. Gosse; but my supposition is that he had disused and lost his power.

What professorship he could have had at Marseilles I cannot imagine. When last I heard of him (except very lately) I was told that he had been in some way connected with certain pseudo-miraculous performances in Brittany (it would only be one more eccentricity of a man of remarkably varied powers); and that his son having some employment as an engineer at Marseilles, he had gone there to live with him.

Mr. Williams, if he were alive, could set us right on all these points, and perhaps Mr. Horne still can. I do not pretend to certainty except of matters within my own personal knowledge. Even in these my memory may be sometimes at fault.

W. J. Linton.

APPOINTMENTS FOR NEXT WEEK.

Tuesday, April 15.—7.45 p.m. Statistical: "On the geographical Distribution of the Celtic-speaking Population of the British Isles," by E. G. Ravenstein.

Wednesday, April 16.—7 p.m. Meteorological: "On the Results of Comparisons of Goldschmid's Aneroids," by G. M. Whipple; "Observations on the Temperature of the Atlantic during the Month of March," by P. F. Reinsch.

8 p.m. Archaeological Association: "Easter Eggs," by H. Syer Cuming; "The Hurlers, Cornwall," by C. W. Dymond.

Thursday, April 17.—7 p.m. Numismatic.

8 p.m. Linnean.

8 p.m. Chemical.

Friday, April 18.—8 p.m. Civil Engineers: "The Construction of Locomotive Boilers," by R. H. Read.

8 p.m. Philological: "Report on my Dialectal Investigations," I., by A. J. Ellis.

SCIENCE.

The Evolution of Man: a Popular Exposition of the Principal Points of Human Ontogeny and Phylogeny. From the German of Ernst Haeckel, Professor in the University of Jena. In Two Volumes. (C. Kegan Paul & Co.)

(*First Notice.*)

Prof. Haeckel is well known as one of the most energetic workers and advanced thinkers among German biologists. For more than thirty years he has devoted himself to the study of the animal kingdom with especial reference to the theory of development, and he has perhaps done as much to extend and popularise that theory as Darwin himself. Besides a long series of publications in various departments of biology, he has written two great popular works—*The History of Creation*, in which the development of the whole animal and vegetable kingdom is systematically traced out, and the present volumes, which treat in more detail the entire history of man's evolution, both as an individual from the parental germ, and as an animal species from the most rudimentary form of individualised animal life through a progressive series of more and more specialised animal types.

The present work is intended to render the facts of human germ history and development accessible to the educated public. It is founded on the researches of the most eminent modern anatomists and embryologists—Baer, Kölliker, Schwann, Huxley, Weissmann, and Gegenbaur, together with Haeckel's own discoveries in the history and development of many of the lower animals. We can, therefore, hardly do otherwise than accept the facts as presented to us by our author, and though we may not always agree with the inferences he deduces from them, we can but feel that they are of the very highest importance, and that a careful study of them is absolutely essential before venturing to form definite conclusions as to man's nature, origin, or destiny. As the only way to give our readers any idea of this very remarkable work, we will endeavour to indicate the general nature of its contents, dwelling here and there on points of more especial interest and importance.

In the first chapter we are introduced to the "fundamental law of organic evolution," which is: that the history of the germ is an epitome of the history of the descent, or, more fully—

"That the series of forms through which the individual organism passes during its progress from the egg-cell to its fully developed state is a brief, compressed reproduction of the long series of forms through which the animal ancestors of that organism (or the ancestral form of its species) have passed from the earliest periods of so-called organic creation down to the present time."

The evolution of the individual is termed "Ontogeny," the evolution of the race (or, as he terms it, the tribe) "Phylogeny"—words which occur in almost every page of these volumes. It is then explained why the correspondence between these two kinds of development is not accurate, the reason being that the course of development of the embryo has been from time to time altered and much shortened, so that whole series of changes that have occurred in the successive modifications of animal forms have become compressed or altogether skipped in the evolution of the germ. The key to all these modifications and anomalies is to be found in heredity and adaptation; the former having kept up in the embryo the general type of earlier animal forms, the latter having so modified their details that the special ancestral type at each stage of development is often difficult to recognise, especially in the very early stages.

Chapter ii. gives an account of the early theories of development, such as the "preformation" and "encasement" of an endless series of organisms in each germ; and of the discoveries of Wolff, Harvey, Spallanzani, and others. Chapter iii. is devoted to the discoveries of Baer, which laid the foundation of the accurate knowledge of embryology. He first showed that the primitive germ-layers bend over till the edges meet, and thus form the primitive intestinal tube. He also first laid down the important law of evolution, which has been so extensively applied by Herbert Spencer—that it consists of a continually increasing differentiation of parts and tissues, combined with an increasing speciality of general form. In this chapter we first have the statement that the cells, of which all the tissues of the body are composed, "are independent living beings, the citizens of the state which constitute the entire multicellular organism." These cells increase by segmentation, dividing first into two, then into four, eight, sixteen, thirty-two, and so on, till an extensive stratum is formed called the germ-layer. This layer divides horizontally into two layers, and from these arise one or two intermediate layers. From the upper layer is formed the skin, and all its integuments, and also the brain, spinal marrow, and nervous system: from the lower layer is formed the intestinal canal and all its appendages—liver, lungs, &c.; while from the intermediate layers arise the muscles, blood, bones, and ligaments. This remarkable discovery was made by Remak, and has been confirmed by subsequent observers. The formation and separation of the primary germ-layers occurs throughout the whole animal kingdom above the Protozoa, and constitutes the most important fundamental fact of animal development.

Chapters iv. and v. give the history of Phylogeny or the theory of descent, from Lamarck to Darwin. Prof. Haeckel here maintains: *that the struggle for existence in nature evolves new species without design, just as the will of man produces new varieties in cultivation with design*, and, "that the evolution of the species or tribes contains, in the functions of heredity and adaptation, the determining cause of the evolution of individual organisms; or, briefly, Phylogeny is the mechanical cause of Ontogeny." We have here as it were the key-note of the work, the fundamental idea which the author never loses sight of. The science of rudimentary organs, which Haeckel terms "Dysteleology, or the Doctrine of Purposelessness," is here discussed, and a number of interesting examples are given, the conclusion being that they prove the mechanical or monistic conception of the origin of organisms to be correct, and the idea of any "all-wise creative plan" an ancient fable.

But all this is merely preliminary, and it is only in chapter vi. that we enter upon the real matter of the work, in a most interesting account of the egg-cell and the Amoeba. The popular idea of a cell (derived from those so easily seen in plants), as a closed sac or bladder with a defined solid envelope, is incorrect. The envelope is no essential part of the cell, but is in all cases a secondary formation. The modern definition of the cell is, that it is a small body, neither solid nor fluid, of an albuminous nature, and having enclosed in it a smaller roundish body, also albuminous. This is the nucleus, and it is this which is the essential characteristic of a living animal cell as distinguished from a mere lump of protoplasm. "Nucleus and protoplasm, the inner cell-kernel and the outer cell-slime, are the only two essential constituents of every genuine cell." Cells of various kinds are described and beautifully illustrated, and the nerve-cell is said to "possess the capacity to feel, to will, to think. It is a true mind-cell, an elementary organ of mental activity." These nerve-cells are highly complex in structure, whereas the egg-cell is in no way specialised; yet, from its active properties, we are obliged to infer a highly complex chemical composition of its protoplasmic substance, and a minute molecular structure, which are completely hidden from our eyes. Every cell is an independent organism. We see that it performs all the essential life-functions which the entire organism accomplishes. Every one of these little beings grows and feeds itself independently. It assimilates juices from without, absorbing them from the surrounding fluid; the naked cells can even take up solid particles at any point of their surface, and therefore eat without possessing either mouth or stomach. Each cell is also able to reproduce itself, and to increase. It is also able to move and creep about, if it has room for free motion, and is not prevented by a solid covering, while from its outer surface it sends out and draws back again finger-like processes, thus modifying its form. Cells from the watery humour of a frog's eye have been seen to move freely, and creep about just like the independent organisms termed Amoebae and Rhizopods. The young cell also has feeling, and is more or less sensitive, performing certain movements on the application of chemical and mechanical irritants. Thus we can trace in every single cell all the essential functions, the sum of which constitute the idea of life—feeling, motion, nutrition, reproduction.

Although there are even more simple organisms than cells, mere masses of living protoplasm without a nucleus, yet the cell as above described must be considered as the organic unit, the basis of our physiological idea of the elementary organism. For every animal without exception, from a sponge or worm up to man, originates in a primitive egg which is "an entirely simple, somewhat round, moving, naked cell, possessing no membrane, and consisting only of the nucleus and protoplasm." These egg-cells differ somewhat in size and form in different animals, but are essentially alike. Many organisms remain in this simple one-celled form, of which the Amoeba is the most familiar example. This creature, which most of our readers must have seen in a drop of water under the microscope, is important as being an example of the naked living cell, moving and feeding, and exhibiting all the signs of animal life, although a mere nucleated mass of protoplasm. It increases by division, the nucleus dividing first, and then the surrounding protoplasm distributes itself around the two new nuclei and parts into two distinct animals. Now it is a wonderful fact that the unfertilised eggs of some of the lower animals, as sponges and medusae, are absolutely undistinguishable from an Amoeba. Yet more, the blood-cells of many animals, and even the white corpuscles present in human blood, are exactly of the same character, moving, eating, and acting, just like Amoebae. For these reasons, the Amoeba is regarded as that one-celled organism which approaches nearest to the ancestral form of all animal life: and from a very similar cell every individual animal still originates.

The next chapter, on the processes of evolution and impregnation, is no less interesting and suggestive. The first step upward from the simple cell, would be the formation of groups of cells which remained attached to each other instead of parting as in the Amoeba. In this little community a division of labour would soon arise; some of the cells becoming specialised to absorb food, others to reproduce themselves, others to form protecting organs for the community, thus forming a distinct many-celled organism.

We have, then, a long discussion of the nature of reproduction, which is shown to be really a continuation of the growth of the individual; but we cannot see that any attempt is made to show how or why the sexes came to be differentiated as soon as the organisation became complex. This part of the subject is rather slurred over, and the whole process of fertilisation is said to be "extremely simple, and entirely without any special mystery. Essentially it consists merely in the fact that the male sperm-cell coalesces with the female egg-cell." The very mobile thread-shaped sperm-cells (spermatozoa) "find their way to the female egg-cells, penetrate the membrane of the latter by a perforating motion, and coalesce with the cell material." We hardly think that Prof. Haeckel's readers among the educated public will find this such a very simple matter. Considering that in the case of many marine animals these sperm-cells are discharged into the water, and have actually to seek the egg-cells and then penetrate their outer covering, it will be impossible to avoid the assumption that these apparently simple "cells" are not only living but intelligent organisms, endowed with a wonderful impulse to seek out and penetrate into eggs, thus destroying themselves in order to give birth to a new and higher being. However, when the two cells have coalesced, an important change takes place in the egg. Its nucleus disappears, and a new nucleus takes its place, which possesses the wonderful power of growing into the form of the parent organisms, however complex they may be. The egg-cell is now, therefore, a new formation, possessing in itself the vital activities of both parents combined.

Alfred R. Wallace.

C. Solli Apollinaris Sidonii Opera. Œuvres de Sidoine Apollinaire: Texte Latin. Publiées pour la première fois dans l'ordre chronologique d'après les MSS. de la Bibliothèque Nationale, &c. Par M. Eugène Baret. (Paris: E. Thorin.)

The importance of the letters of Apollinaris Sidonius for the history of the Western Empire in the latter part of the fifth century after Christ has been fully recognised by historians. A glance at the references in Gibbon, Guizot, Ampère, Ozanam or Thierry will be enough to show how large a part of our knowledge of Gaul, especially at the time when the Visigoths and the Burgundians were pressing hard upon the enfeebled empire, has to be drawn from the correspondence of the learned and lively Bishop of Clermont. It is hardly too much to say that Apollinaris Sidonius is to the historian of the fifth century what the younger Pliny is to the historian of the times of Domitian and Trajan, or Mdme. de Sévigné to the historian of "le siècle de Louis XIV." It is not so much the facts which he records, though here, in the scantiness of our extant authorities, the testimony of one who was so nearly connected with the leading men in the Roman world, and who had himself played no unimportant part in politics, has an unusual value. It is rather the numberless details of public and private life which he drops for the most part quite unconsciously, but which enable us to reconstruct in imagination the Gallo-Roman society of the period with a fullness which leaves little to be desired. The pictures which he gives us, for instance, of the splendid villas of the provincial nobles, glittering with marble colonnades, their dining-halls strewn with roses, enriched with paintings, sculptures, and tapestry, and fragrant with lamps which, in the place of oil and wax, burned nothing but *opobalsamum*, leave with us a deep impression of the luxury which justified the extension to the whole of Gaul of the phrase with which Pliny had denoted the Province, "breviterque Italia verius quam provincia." His sketch of the Franks, a tribe then only just beginning to appear on the field of their future lordship, has passed into one of the commonplaces of history. His picture of the Court of Eurich at Bordeaux gives no exaggerated conception of the power wielded by some of the Visigoth kings, and his detailed description of Theodoric was borrowed alike by Gibbon and by Kingsley as the most

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(*Second Notice.*)

In chapter viii. the succeeding stages of development of the fertilised germ are traced throughout the animal kingdom, with special reference to the *gastrula*, a primitive animal form which Prof. Haeckel believes can be discovered in the early stages of all animals, and must, therefore, be considered as representing one of their earliest ancestral types. In the corals the successive cleavage of the parent cell leads to the formation of a globular mass, called from its appearance the mulberry germ. It consists of a single layer of cells in close contact, forming a hollow ball filled with a clear liquid. There next occurs an extraordinary process of inversion. A groove forms at one point by the sinking in of the cellular layer; this groove deepens and widens till it forms a cup-shaped cavity, and at last the two sides come together, forming a double-walled cup. The mouth of this cup then narrows, vibrating threads are formed on the outer surface, and the gastrula germ is then complete. The cells of the outer and inner surfaces have now assumed a different form, size, and appearance; the inside is a stomach, the outside a skin. A great variety of animals go through this peculiar stage of development with but slight differences—such as zoophytes, worms, star-fish, crustacea, molluscs, and the lowest of vertebrates, the Amphioxus or lancelet. In all the higher vertebrates this process of gastrulation is highly modified; but in every group, even up to man, Prof. Haeckel maintains that it exists, and can be traced in its various forms, of which he gives very instructive illustrations. The essential feature of gastrulation is that the mass of cells formed by cleavage becomes differentiated into two groups or layers, from one of which is ultimately formed the outer skin, from the other the intestinal organs; hence these are termed the animal and the vegetative germ-layers respectively. Many of the lowest animals—such as some of the Polyps—remain throughout their life in the gastrula stage, their whole body being composed of only two cell-strata or layers; hence the important conclusion is arrived at that all the higher animals, including man, which in the first stages of their individual evolution pass through a two-layered structural stage or gastrula form, must have descended from a primaeval, simple parent form of like structure, to which Prof. Haeckel gives provisionally the name of Gastraea, or primitive intestinal animal.

In the next chapter the scheme of classification founded on this gastraea-theory is explained. From the gastraea developed in one direction the zoophytes—such as sponges, corals, medusae, &c.; in another direction the worms. The zoophytes are a side branch, while the worms form the main stem of the animal tree from which all the other great classes—molluscs, insects, and vertebrates—have been evolved. The vertebrate nature of man is next discussed, and the structure of the ideal primitive vertebrate explained in great detail; and then comes an account of the various parts and organs which arise from each of the four germ-layers into which the two primitive layers divide at a very early period. This is very remarkable and instructive. From the first or outer layer are formed, not only the skin and all its appendages, but also the central nerve system. This first develops from the outer surface of the epidermis, and only at a later stage moves inward so as to be surrounded and protected by bone and muscle. The organ of the mind, therefore, is a development of the outer skin where alone it could be in contact with external nature. The kidneys also arise from the skin, and subsequently take their place deep within the body. From the second layer arise the skeleton and all the chief muscles of the trunk and limbs. From the third arises the entire vascular system, the heart and blood-vessels, the blood, and the muscular coating of the intestines; while from the fourth or inner layer arises the intestinal canal proper and its appendages, such as the lungs, liver, and salivary glands.

In chapter x. the process of development of the gastrula into a perfect vertebrate organism is described in detail, and illustrated by numerous diagrams. The extraordinary processes by which the external cell-layer bends inwards, forms loops and folds which then become detached to form internal organs, such as the spinal cord and kidneys, are made very intelligible by means of elaborate figures, in which the parts that arise from each germ-layer are distinguished by different colours. The two following chapters carry on this examination into further details, describing the development of the vertebral column, and the successive appearance of the more important organs in the human embryo.

In the next two chapters (xiii. and xiv.) we enter upon another branch of the subject—the origin of the vertebrate type. We have first a full description of the structure of the Amphioxus and the Ascidians. The former is universally admitted to be the lowest existing type of vertebrate animal, while the latter were formerly classed as Mollusca, but are now believed by many biologists to be extremely modified forms of the most rudimental vertebrate. In appearance they are shapeless lumps, hardly like animals, but looking more like fleshy potatoes. In the Italian fish-markets they are known as "sea-fruit." When caught they feebly contract their body and spirt out a little water: hence they have been called Sea-squirts. They vary in size from a quarter of an inch to a foot long, and they are found in the seas of all parts of the world. They are fixed by a kind of foot or root to the sea-bottom; at the top is a round opening which serves as a mouth, and on one side is a smaller opening. The mouth opens into a large latticed gill-sac into which water is drawn and discharged by the side opening, and through the gills the food also passes into the stomach, the intestine bending upward and opening into the cavity which surrounds the gill sac. The outer covering is tough and leather-like, while there is no trace of any internal skeleton.

Here there is absolutely nothing of the vertebrate structure, though there are some peculiarities in the formation of the gill-sac which resemble the same organ in the Amphioxus. But, strange to say, in the earlier stages of the development of the Ascidian there appear unmistakeable signs of resemblance to the vertebrata. A free-swimming long-tailed larva is developed from the gastrula, and in this there appears a medullary tube and also a notochord or rudimentary vertebral column, exactly as in the Amphioxus. Rudimentary sense organs also appear, according to Kowalewsky, who has studied the history of this animal; but then its progressive development ceases. It sinks to the bottom of the sea and becomes fixed, the tail with the notochord degenerates and is cast off, and the tailless body, by retrograde metamorphosis, loses all its vertebrate characteristics and becomes a shapeless sac, as already described. While in the Amphioxus the medullary tube develops into a complete spinal marrow, in the Ascidian it shrinks away to an insignificant nerve-ganglion situated just above the gill-body. These curious facts are held to prove that the Ascidians really represent a degenerated branch of the ancestral vertebrate, very near the point of its actual origin.

From this original form it is not difficult to understand the development of the Amphioxus, which is universally admitted to be a true vertebrate, though of very low type. It is usually classed as a low form of fish; but Prof. Haeckel holds this to be a great error. By the complete absence of a skull and of even the rudiments of limbs, and by its excessively simple internal structure, it is said to be further removed from fishes than fishes are from man. He therefore looks upon the Amphioxus with special veneration, as the only living animal which can enable us to form an approximate conception of our earliest vertebrate ancestors.

We now come to the second volume, which is devoted to a more special examination of the line of animal ancestry that has ultimately culminated in the development of man, and to a detailed account of the development of the various parts and organs of the human frame, with constant references to the comparative embryology of other animals. We have here much repetition of facts and arguments already given in the first volume, and shall therefore only briefly notice a few points which seem to call for remark.

Prof. Haeckel seems quite unable to appreciate the extreme imperfection of the geological record, and the absolute worthlessness of its negative evidence as regards the life of the earliest periods. He speaks of the inhabitants of our planet consisting exclusively of aquatic forms down to the Silurian period (p. 10), and that we may infer with tolerable certainty that no land animals then existed (p. 115), quite regardless of the fact that the enormous deposits of this period are all marine, and are therefore not likely to contain remains of land animals, and also of the equally important fact that the sandstones, grits, shales, and limestones of which they are composed necessitate extensive continents from the denudation of which they were formed, and that it is in the highest degree improbable that these continents were lifeless wastes. Equally improbable are his suppositions that mammalia originated in the Trias (p. 144), and placental mammals in the Tertiary epoch (p. 15). Considering that even in the Lower Eocene most of the orders and many of the family groups of placental mammals are well differentiated, most English biologists would look very far back into the Mesozoic epoch for the first differentiation of the placental and the implacental divisions.

The celebrated Bathybius—the living protoplasm of the ocean depths, which was first described by Prof. Huxley from specimens preserved in spirit and given up by him when the living animal was sought for in vain during the *Challenger* expedition—is resuscitated by Haeckel on the authority of Dr. Emil Bessil, who is said to have obtained it alive from a depth of 550 feet in Smith's Sound. It is often said that the protoplasm of Amoeba and other simple organisms is only apparently structureless owing to the insufficiency of our optical powers; but Prof. Haeckel remarks that the experiment of feeding these animals with solid coloured particles which can be seen passing through their substance irregularly in all directions shows that they are really structureless in the sense in which we always use the word as applied to molar, not molecular, structure. When we consider that these structureless particles of slime yet exhibit, as Prof. Haeckel himself tells us, all the phenomena of life, "even the mental phenomena," his theory, which he is never tired of putting forward, that all the phenomena of the organic no less than of the inorganic world are due to "mechanical laws" does not seem to throw much light on the matter. He is equally confident that our

"highly purposive and admirably constituted sense-organs have developed without premeditated aim; that they originated by the same mechanical process of Natural Selection, by the same constant interaction of Adaptation and Heredity by which all the other purposive contrivances of the animal organisation have been slowly and gradually evolved during the Struggle for Existence."

Yet Prof. Haeckel is not a materialist. He maintains that the materialistic philosophy, which asserts that the vital phenomena are due to the properties of matter, is as false as the opposite spiritualistic philosophy, which declares that active force precedes or causes matter. Both, he maintains, are dualistic, and therefore both are equally false. The *monistic* philosophy which he upholds as alone tenable can as little believe in force without matter as in matter without force. So far, we might not perhaps differ greatly from him; but when he goes on to say, "the 'spirit' and 'mind' of man are but forces which are inseparably connected with the material substance of our bodies," and to argue that thinking-force and motive-force are equally functions of the body, he seems to confuse radically distinct conceptions, by the use of the misleading word "forces" as applicable to thought or emotion. His final conclusion is—

"that in the entire history of the evolution of man no other active forces have been at work than in the rest of organic and inorganic nature. All the forces at work there can be reduced at last to *growth*—to that fundamental function of evolution by which the forms of inorganic as well as of organic bodies originate. Growth, again, itself rests on the attraction and repulsion of like and unlike particles. It has given rise to Man and to Ape, to Palm and to Alga, to crystal and water."

Although I have endeavoured to give an account of some of the more suggestive portions of this very remarkable work, a notice such as this can afford no conception of the wonderful variety and complexity, or of the intensely interesting nature, of the subjects it discusses. There is probably no book in any language which gives so full, so clear, and so perfectly intelligible an account of the earlier stages of the development of animals. The phenomena described are, as compared with the later stages of development, simple and easily followed, but it is impossible to exaggerate their importance; and as enabling any intelligent person to obtain a correct knowledge of the facts of this wonderful history in its earlier, and a correct conception of their general outlines and bearing in their later and more complex stages, the work is one of the most important in the English language. Its faults are diffuseness of style and complexity of general arrangement, and a competent editor would be able to condense it into one half the bulk without curtailing it of any important matter. It is nevertheless most acceptable even as it is, and should be studied by everyone who wishes to appreciate the full meaning of the familiar saying, that "we are fearfully and wonderfully made."

Alfred R. Wallace.

OBITUARY.

PROF. NICOL, F.R.S.E.

A naturalist whose name is intimately connected with geological work in the north of Scotland has just been taken from our midst. For nearly a quarter of a century Prof. James Nicol held the chair of Natural History in Marischal College and University, Aberdeen. Even before 1853, the date of the Aberdeen appointment, he was professor of kindred subjects in the Queen's College, Cork. The best part of his life had, therefore, been spent in the active duties of a professorial chair. As early as 1839 he wrote a *Catechism of the Natural History of Man*, followed in 1842 by a *Catechism of Geology*, and in 1844 by an *Introductory Book of the Sciences*. His favourite study, however, was geology; and he not only prepared a geological map of Scotland, but wrote a *Guide* to its geology, and a sketch of the *Geology and Scenery of North Scotland*. To the eighth edition of the *Encyclopaedia Britannica* he contributed an important article on "Mineralogy," largely drawn, however, from the German of Naumann. This article was re-published as a *Manual of Mineralogy*, and afterwards abridged under the title of *Elements of Mineralogy*—two works which have long been standard text-books in our English schools. Prof. Nicol was a clear and popular lecturer, but of late had suffered from a defect in his speech. At the time of his death he was upwards of sixty years of age.

SCIENCE NOTES.

Nine-Year Catalogue of 2,263 *Stars deduced from Observations at the Royal Observatory, Greenwich.*—In the Appendix of the Greenwich Observations of 1876 the results of the star observations made with the transit circle during the years from 1868 to 1876 have been gathered into a new general catalogue for the epoch 1872. The catalogue has been derived from the star places in the annual volumes in nearly the same manner as its predecessors, the two Greenwich Seven-Year Catalogues—the first of which comprehends the observations made from 1854 to 1860; the second, those made from 1861 to 1867. A new determination of the colatitude furnishes the value 38° 31′ 21″·40, and this value has been adopted in the reductions. The publication of the new volume has been somewhat delayed in order to allow the results of some examinations respecting its polar-distances to be inserted. A comparison of the polar-distances of the Nine-Year Catalogue with those of the two preceding ones shows differences which are evidently of a systematic character, and which would appear to depend almost entirely on the change in the coefficient of refraction which was made at the beginning of 1868 on the authority of an investigation by Mr. Stone, an abstract of which was published in the Monthly Notices of the time. The change, amounting to a diminution of refraction by about the 184th part of its previously-employed value, seemed to be too large to be reconcileable with previous determinations; but, as the details of the investigation were not published, astronomers were prevented from properly testing its legitimacy. Some of the consequences of the change, however, were not satisfactory. Better means for forming a decision have been presented by the publication of the Cape Catalogue for 1860 and the Melbourne Catalogue for 1870. The result of a recent comparison of these two catalogues with the first Seven-Year Catalogue, which was formed with the old refractions, shows satisfactory agreement. But an indirect comparison with the Nine-Year Catalogue indicates that the changed refractions do not represent the observations of southern stars; and it also appears that the new investigation of colatitude, while pointing to the existence of considerable instrumental errors, does not lend any support to the diminution of the refractions adopted in 1868. An examination of the observations of circumpolar stars for several periods leads to similar conclusions. It is therefore inferred that the polar distances of the Nine-Year Catalogue ought to be modified by the corrections required for reducing them to the old refractions and to the colatitude 38° 31′ 21″·90, which is the mean of those adopted in former Greenwich catalogues. In order to sift the question properly, it would be necessary to know something of the details of Stone's investigation.

New Determination of the Ratio of the Electromagnetic to the Electrostatic Unit of Electric Quantity.—A paper on this subject, by Profs. Ayrton and Perry, was read before the Society of Telegraph Engineers on February 26, and is printed in the *Philosophical Magazine* for April. The ratio in question, which is of the nature of a velocity, and is usually denoted by the letter v, was determined by Weber and Kohlrausch in 1856, by measuring the same quantity of electricity, first in electrostatic and then in electro-magnetic units. The value obtained was 310·7 million mètres per second. The values assigned to v by Sir Wm. Thomson and Prof. Clerk Maxwell from their experiments in 1868 were 282·5 and 288 respectively. These numbers represent very nearly the velocity of propagation of light, which is, according to Foucault 298, and according to Cornu 300, millions of mètres per second. According to Prof. Clerk Maxwell's theory, the velocity v must be that of the propagation of electro-magnetic disturbances in a non-conducting medium, or, assuming that