

Almighty intellect, . . . it will appear to be a mere caprice of the Creator ;" an explanation which he regards as utterly unsatisfactory.

Herr Müller next discusses at some length the developmental history of the Crustacea, which is, he maintains, inexplicable on the ordinary theory, while it is entirely in accordance with that of Natural Selection.

The chapter on Evolution is particularly interesting, and the conclusions arrived at are in many respects very similar to those stated in my memoir on the Development of Chlocon.* In the case of insects indeed he does not explain himself very clearly, since while in one place he says that "there were, I believe, perfect insects before larvæ and pupæ;" in another he expresses the opinion that "the most ancient insects would probably have most resembled the wingless larvæ of Orthoptera;" overlooking apparently the opposition between these two statements.

It is remarkable that Agassiz, while observing that "on peut regarder comme un fait général, de nature à être établi de plus en plus solidement, à mesure que les recherches embrasseront un plus vaste terrain, que les phases du développement embryogénique correspondent, chez tous les animaux vivants, à l'ordre de succession des êtres qui furent leurs représentants aux époques géologiques écoulées,"† does not appear to see how strong an argument this is in support of Mr. Darwin's views. Müller brings forward several illustrations in support of the generalisation.

We must not, however, be led into a discussion of this wide and interesting subject, but we cordially recommend Dr. Müller's book to all lovers of philosophical biology.

JOHN LUBBOCK.

The Treatise on the Dominion of Reason attributed to Flavius Josephus. [*Die Flavius Josephus beigelegte Schrift über die Herrschaft der Vernunft* (IV. Makkabäerbuch).—Von J. Freudenthal. Breslau, 1869.]

THE fourth book of Maccabees has a character of its own among all the Apocrypha of the Old Testament; it is a sermon or homily, in which the rules of rhetoric are severely observed. Dr. Freudenthal shows that it contains an Exordium, a Quæstio, and a Laudatio, and is far superior to the sermons on Samson and Jonah wrongly ascribed to Philo. Although not admitted among the canonical Apocrypha, it was much esteemed by the Church, and widely read in the middle ages. Gregory Nazianzen, in his twenty-second homily, recommends it to his hearers; and Chrysostom, as Dr. Freudenthal proves, borrows sentences from it. Another question is, whether the author destined it for reading in the synagogue, or only for private use. The philosophical character of the book speaks rather for the second of these objects, and this is also the opinion of several German scholars, because the congregation of a synagogue, even in speculative Alexandria, could never have been composed of pure philosophers. On the other hand, we must remember that a fervid orator easily forgets what audience he is addressing; and the oldest Christian sermons, as Dr. Freudenthal well observes, are equally philosophical. So much at least is certain that the writer of this book often composed such homilies, for he says that, before passing to the historical matter, he will expound the philosophical thesis, "as he is accustomed to do so." Claiming as he does to be a philosopher, he must clearly have belonged to one of the schools of the time, but he is certainly neither Peripatetic nor Stoic; he is as little of a Platonist as of a Pythagorean.

* *Transactions of the Linnean Society*, 1863-1865.

† *Revue des Cours scientifiques*, 1868, p. 820.

His philosophy is entirely ethical: he speaks of nothing but abstinence, and how reason may become master of the passions; and hence we agree with Dr. Freudenthal that he approaches, at any rate, more nearly to the Stoic than to any other school. He is no doubt a Jew, and a very strict Jew, for he never, like Philo, explains the ceremonies by allegorizing; and he must have written before the destruction of Jerusalem, else, in describing the calamities of his nation, he would not have failed to mention the greatest of all. Indeed, he speaks of the Temple as still existing, and of the priests as performing their functions. We may date the book, as all scholars agree, about 50 A.D.; hence the author cannot be the historian Josephus, as was formerly supposed. Besides, his style forms the greatest contrast to that of Josephus, being only surpassed in elegance among the Greek-writing Jews by that of Philo; whereas Josephus was ignorant of Greek before his journey to Rome, and received assistance from Greeks in the composition of his history.

Dr. Freudenthal rejects, and rightly so, the opinion of Volkmar, who sees in this, as well as in other apocryphal books, e.g. in Judith, allusions to the sufferings of the Jews in the time of Hadrian; we have refuted this by anticipation above.

As to the country where the author wrote, we cannot pronounce decisively; it is at all events not Palestine, but might with equal probability have been Alexandria, Cyrene, or Asia Minor. Curious is the often-repeated conviction that the blood of sufferers for the faith has been an atonement for the whole nation. (Compare Galatians 3. 16).

Having finished his philosophic peroration, and the history of Heliodorus plundering the Temple, he goes on to relate the martyrdoms of Eleazar and the seven brethren; here the Pseudo-Josephus has made use either of the second book of Maccabees, or of the chief source of that work—the book of Jason of Cyrene. Dr. Freudenthal inclines to the latter, and produces very strong arguments in confirmation.

Such is a short account of this learned and interesting pamphlet. The notes are full of curious information on the different titles of the book, on the manuscripts, on the editions and translations, on the homilies of Philo and Pseudo-Philo, on Pseudo-Phokylides, on the connection of the book with the New Testament, and other matters. We may announce to our readers the approaching publication of the Latin, Greek, and Syrian texts of the fourth book of Maccabees, by Mr. Bensly of Cambridge; who has, we believe, collated all the existing MSS. for his edition. This will supplement the learned researches of Dr. Freudenthal, and may perhaps throw a new light on some doubtful points.

AD. NEUBAUER.

Scientific Notes.

A New Work by Mr. Darwin.—We have just learned that Mr. Darwin is preparing a new work, in which the main conclusions arrived at in his *Origin of Species*, and accepted by most of the younger naturalists throughout Europe, will be applied to Man. The work, to be published next year, will consist of three parts: I. *The Descent of Man*; II. *On Sexual Selection*; and III. *On Expression of the Emotions*. In the first of these the evidence will be mainly drawn from a comparison of the structure of man with that of the lower animals, and from the facts of embryology; the more general arguments from the laws of geographical distribution and of geographical succession being here inapplicable.

The difficult question of the gradual development of the characteristic moral and intellectual attributes of man from lower types will also be briefly considered.

With respect to the races or so-called species of Man, Mr. Darwin has been led to the conclusion that sexual selection has played an important part. This principle depends, on the one hand, on the rivalry between males of the same species for the possession of the female; and, on the other, on the choice by the females of the more

attractive males—combined in each case with the transmission to the offspring of the characters of the more successful individuals of either sex. This part of the work will be illustrated by copious details.

In the supplementary discussion on the expression of emotions by man through muscular movements of the face and limbs, three questions will come under notice. (a.) How far is man endowed with muscles solely for the purpose of expressing emotion; (b.) how far the same expressions prevail among the different races of man; and (c.) in what manner the various animals exhibit their emotions.

Natural History, &c.

Deep Sea Life.—Dr. Carpenter has returned in safety from the third trip in deep sea dredgings. His results quite bear out the conclusions drawn from the two previous ones. Some new facts, however, of extreme interest, have been discovered, the publication of which we may expect shortly. It is hardly possible to exaggerate the importance of these investigations, in their bearings on the most important general problems of biology, physical geography, and geology. They teach us that the bottom of the deep ocean is the home of many creatures, who live there in the absence of light, under great pressure, in water often excessively cold—just above freezing point—abounding in carbonic acid and in organic matter. Of these influences the one which makes itself most felt is that of cold. It is this, and not the pressure, not the want of bright sunlight, that stunts the creatures, and makes them reproduce at the bottom of equatorial seas the fauna of arctic surface regions. Nor is the life at these depths confined to low-born Foraminifera, or to that wonderful protoplasmic Bathybius, which Professor Huxley told the British Association at Exeter, he had now found in soundings from many quarters of the globe, and which therefore seems to be a *vast thin sheet of living matter enveloping the whole earth beneath the seas*. Where, as in certain regions, the deep waters are warm, highly organized beings, of bright colours and well-appointed eyes, are brought up by the dredge. These researches press upon us the question,—Is it possible for living matter to be born and nourished in the absence of light, in the presence of carbonic acid, and in the absence of any heat higher than the temperature of about 32° F., in the absence, that is, of almost any force which can be transmuted into vital force? At these great depths there is no vegetation properly so called, and Professor Wyville Thomson, who is associated with Dr. Carpenter in these researches, is of opinion that here the lowest living beings feed on the lifeless organic matter which exists in so large a quantity in the water. We seem here to be near the transition from complex lifeless proteid matter and living protoplasm. The exact condition and nature of this organic matter is of extreme importance, and we understand a distinguished chemist is about to make it the subject of an enquiry. There is another point of no less interest. These organisms, which are thus building up chalk strata (for this deep Atlantic ooze is nothing but incipient chalk) at the bottom of the ocean are, to a very large extent, identical with many of the remains found in the chalk formations. This is so much the case that we may speak of races of animals building the old hills of millions of years ago, and laying now the foundation of the chalk hills of times to come, themselves remaining unchanged all the time between.

Skull-measurement.—Professor Cleland has brought forward a new method of measuring skulls, and so to speak of estimating their "worth." It deals chiefly with the curve of the base of the skull, which is greater in adults than in infants, in males than in females, in civilized than in savage races. In the same paper the author reasserts a fact tolerably familiar to craniologists, but apparently not so to the general public, that "*there is no foundation whatever for the supposition that the lower races of mankind have the forehead less developed than the more civilized nations.*"

Botany.

Fertilization of Plants.—That in the majority of highly-developed plants the presence of pistil and stamen in the same flower is, as it were, a kind of safety-engine kept in reserve in case of the failure of the ordinary modes of fecundation, was a fact unsuspected before Mr. Darwin's patient and laborious researches established the fact, that as a rule the pistil is not fertilized by the pollen from the stamens of the same flower, but by pollen carried from other flowers through the agency of the wind, and especially of insects. The American traveller, Spruce, has indeed come to the conclusion, from his investigations of the palms of the Equator, that the hermaphrodite structure of plants is an earlier development, which has gradually advanced to the higher type of unisexuality. On the Continent, Prof. Hildebrand of Bonn has contributed several articles to the *Botanische Zeitung*, and other botanical Magazines, containing the result of observations which fully bear out Darwin's principle of cross-fertilization, and which show that many hermaphrodite plants are so constructed either that the pollen cannot fall on the stigma of its own flower, or that the stigma is not in a receptive state at the time that the pollen is discharged. Our own *Parnassia palustris*, or "Grass of Parnassus," a common plant in damp

mountainous situations, has been shown to be an illustration of a similar structure; the anthers, at the period of maturity, completely covering and enclosing the pistil, and discharging their pollen outwardly. The stigmatic surfaces are also not developed till a later period, and absorb the pollen-grains conveyed to them from other flowers by insects while seeking the honey attached to their peculiar nectaries. Any careful observer may detect similar phenomena in the case of our common "London Pride" and other saxifrages. More recent observations have been made by several observers on the fertilization of the genus *Sakia*, several species of which are furnished with remarkable appliances for cross-fertilization. Each anther consists of two cells at opposite ends of a long and very versatile connecting thread. One of these anther-cells only contains pollen, and this is attached to the longer arm of the thread, and is concealed in the throat of the corolla; the barren cell attached to the shorter arm projecting into its mouth. When a bee enters the flower in search of the honey abundantly contained at the bottom of the tube of the corolla, it strikes against the shorter arm, causes the structure to rotate, and brings the fertile anther-cell in contact with the back of the bee, where it necessarily deposits some of its pollen, which the insect carries away, and leaves on the stigma of the next flower it enters. The French botanist, M. Bidard, has, on the other hand, paid attention to the fertilization of grasses, and finds a set of phenomena with a different signification. He states that the pollen of *Gramineæ* does not exhibit any trace of pollen tubes, and that self-fertilization takes place before the anthers are extruded beyond the scales of the flower. The heat of the breath or a ray of sunshine is sufficient to bring about the phenomena of fecundation; and the natural hybridization of grasses is impossible, owing to the exact closing of the chamber containing the fecundating organ.

Unsown Crops.—The sudden and apparently spontaneous appearance of unsown crops on a slight change in the condition of the soil, or of plants entirely new to the neighbourhood, when fresh ground is tilled for the first time, is a well-known phenomenon. In particular farmers are familiar with the fact of the universal appearance of sufficient white or Dutch clover completely to cover the ground when heath-land is first ploughed. It is very common also for railway embankments or cuttings to be covered, for the first few years after their construction, with plants indigenous to the country but new to the neighbourhood. The usually accepted explanation of these facts is that the soil is everywhere full of buried stores of seeds of all descriptions, which require only favourable circumstances of warmth, light, and moisture, to bring them to life. In his Anniversary Address to the Linnean Society, the distinguished President Mr. Bentham points out the objections to this theory, which rests rather on circumstantial than on direct evidence. Where the seeds are not very small, as is the case with the white clover, they ought to be easily detected by a careful search, if present in sufficient quantities to form a complete crop. Mr. Bentham doubts also whether there is any satisfactory evidence of seeds retaining their vitality for any considerable length of time unless kept perfectly dry, as in the case of the grains of wheat preserved in Egyptian mummies; and calls attention to the rapidity with which large numbers of seeds may be transported to a given spot of earth in an exceedingly short space of time by the agency of birds. The interest and importance of this subject would amply reward a careful series of experiments and observations.

Chemistry and Physics.

The Atomic Theory.—Many persons are apt to think that the atomic theory is the corner stone of chemical science, and would be surprised to hear that one of our most distinguished chemists had found it necessary to undertake an elaborate defence of it. The September and October numbers of the *Quarterly Journal of the Chemical Society* contains the remarkable lecture on the Atomic Theory delivered in June last by Professor Williamson. That theory is held, Dr. Williamson thinks, by all chemists, in spite of much mistrust and even positive dislike. Strongly convinced of its truth himself, and viewing it as among the best and most precious trophies which the human mind has earned, his immediate object is to unite the scattered evidences of the doctrine, and give it consistency. The whole recent development of chemistry, he argues, has been in favour of it, and more especially the modern doctrine of molecules: while the theory of radicals, itself an extension of the atomic theory, did much to aid the molecular classification of compounds. Compound atoms were thus found to be analogous to undecomposed atoms, and a great step was thereby gained. For by including in one common term 'atom' the smallest particles of those compounds which behave as elements, the word 'atom' was deprived of its only objectionable peculiarity, its absoluteness. When Professor Williamson speaks of 'compound atoms' the reader begins to be aware that the view of the atomic theory which he defends is not the commonplace one. Now the existence of molecules is proved by all chemical re-action. Moreover, the density of gases and vapours, the phenomena of ebullition, melting, and diffusion, all point towards or confirm molecular weights. Molecules, however, have no *locus standi* in the absence