evolution is very difficult for an English reviewer to judge. The author deals with the subject in a way that has been made familiar by the writings of Haeckel, and we cannot say that he sheds any new light on the various questions or that his treatment is particularly lucid. Here and there Dr. Laloy lets fall a suggestive analogy or makes a remark which shows that on many of the fundamental questions of modern biology his views are at any rate sound. If he admits of being pigeon-holed at all, we should say that as regards the origin of life he is a neo-vitalist. His suggestion that protoplasm may have arisen in the first place by the direct combination of carbon with water and the subsequent combination of the carbohydrate with nitrogen under the influence of the electric discharge (p. 28) is based upon a statement of Berthelot's—that cellulose and dextrin can "fix" nitrogen under the influence of the silent electric discharge. This view is not likely to find favour, we imagine, until we have some more substantial basis of fact to support it.

Concerning the descriptive part of the book, in which the various groups of animals and plants are dealt with from the point of view of evolution in ascending order, there is little to be said. The chief interest for the student of evolution is really concentrated in the seventh chapter, in which the author reveals his position. After putting forward the well-known arguments from rudimentary organs and embryology in favour of some doctrine of evolution being necessary, Dr. Laloy proceeds to consider the factors of evolution. He considers "la lutte pour la vie et la sélection" of Darwin to be inadequate and he accordingly assigns to natural selection a quite subordinate part in the formation of species. It is difficult, however, to find out precisely what is, according to the author, the prime factor of species formation. So far as can be gathered from the text, he appears to favour a kind of sudden and spontaneous variation of all the individuals simultaneously in the direction required to adapt them to new conditions (p. 104). He relies for this remarkable factor upon the experiments of Bonnier and the observations of De Vries, and he adds :—

"Ce serait selon moi cette variation brusque et totale, cet état de mutation, comme s'exprime De Vries, qui serait la véritable cause de la formation des espèces. La lutte pour la vie et la sélection ne seraient plus que des facteurs secondaires, qui n'entrent en jeu que pour fixer et rendre stables les variations acquises en bloc et surtout, pour supprimer les différenciations fâcheuses. Elles maintiennent les espèces dans leur caractère normal, mais ne sauraient en former de nouvelles. Ainsi, comme cause principale de l'évolution, nous retrouvons encore cette finalité du protoplasma qui lui permet de s'accommoder aux circonstances les plus diverses."

This is the key to the author's position as an evolutionist. It is not likely that many adherents to these views will be found in this country. Pure Lamarckism—however inadequate we may regard it—seems, on the whole, to have something more tangible about it than the variation "brusque et totale" of all the individuals of a species in order to meet any emergency in the conditions of life. It is remarkable that a countryman of Lamarck's should go out of his way in order to introduce a factor which receives such very slender support from the observed facts of nature. R. M.

OUTLINES OF PHYSIOLOGY.

A Primer of Physiology. By Alec Hill, author of "An Introduction to Science," &c. Pp. x + 105. (London : J. M. Dent and Co.)

IN this tiny primer of 105 pages the author attempts to give a general sketch of the subject of physiology, treating especially of those parts which may be supposed to be of most interest to a reader who is not contemplating the profession of medicine, and has not the appliances of a laboratory at his command.

As the author truly remarks in his preface :—

"The subject is so vast that a series of primers would be needed to approach its several departments through the elements of physics, chemistry, anatomy, and the other sciences upon which they are based."

Mr. Hill does not state whether these needed primers are subsequently to appear from his pen, but should they do so there is little doubt that they will prove quite as interesting to the student of physiology as the one now under consideration.

Although the space at his disposal is so exceedingly limited, yet the author finds room to dip occasionally into the realms of medicine. Here is an example of such an application taken from p. 14 :—

"The expression to 'purify the blood' is a vestige of a long-abandoned theory of medicine. In the sense in which it is used, to imply that carbuncles, boils and pimples are due to 'bad blood,' it is absurd and misleading. It is none the less true, however, that health, as shown by muscular vigour and perfect freedom from neck-ache, pains in the limbs, and other 'gouty' symptoms depends upon the blood being fully charged with oxygen, and sufficiently free from nitrogenous waste products to keep the juices of the body in a pure state."

Then in a few cogent words the author deals with the *rationale* of massage, the effect of hot baths, and the therapy of diuretics such as "sweet spirits of nitre" or "salts of various kinds"; and all this is done in one short half page.

Terseness is naturally the characteristic of this little primer throughout, but we scarcely agree with the tacitly assumed idea of the author that by the judicious use of leaded type the necessity for wasting precious space in giving definitions can be avoided. For example, the hitherto uninstructed person in physiological matters will scarcely understand at a first glance what is meant by lymph, epithelium and protoplasm, unless some explanation, other than that mentioned above, be given him.

The book opens with a four-page account of the structure, given necessarily in hasty outline, of the mammalian body; there follow eight or nine pages on minute anatomy, in which half a page is found for a description of "caryokinesis," and then, in less than forty pages, the blood and vascular system, the neuro-muscular system, digestion, absorption, dietetics and respiration are rapidly reviewed. Rather more than half the space is thus left over for the central nervous system and special senses, and here in his own special domain the author is peculiarly at home, and his imageries and analogies are at

times perfectly delightful. Take, for example, the analogy given to illustrate the perception of sensation on p. 61 :—

"An errand boy pulls a bell handle (he stimulates a sense organ); the pull is conveyed up the wire (an impulse travels to the central organ); the bell rings (a sensation is produced); the maid-servant hears the bell (the sensation is perceived); she decides that a person has pulled the bell handle (passes a sensory judgment). Perhaps she is able to infer, from the violence of the ring, that it was a telegraph boy who pulled the handle. Probably she goes to the door and opens it—this is equivalent to translating sensation into action with the acquiescence of consciousness."

There is a touch of genuine humour, perhaps unconsciously given, in the use of the word "probably" in the concluding sentence of this fine description.

Finally, it may be said that few will read Mr. Hill's little primer, with its great wealth of popular allusions and applications, without learning something new, even if they be trained physiologists, although it is somewhat doubtful whether the book is not a little too condensed for a beginner.

The illustrations, like the text, are original, and are in every respect worthy of it. Attention may here be drawn especially to the great simplicity of the diagrams of a sphygmograph on p. 20 and of the pendulum myograph on p. 33.

B. MOORE.

A PROTEST AGAINST VITALISM.

Mechanismus und Vitalismus. By O. Bütschli. Pp. 107. (Leipzig: W. Engelmann, 1901.) Price 1*s.* 9*d.*

THE work before us is a reprint of an address delivered before the International Congress of Zoology at Berlin in 1901, amplified by the addition of a preface and of explanatory and supplementary notes, which exceed considerably in bulk the original lecture. The author takes as his theme the most fundamental problem of biology, namely, the relation of life and living things to the inorganic world. With regard to this question, biologists fall, consciously or unconsciously, into two camps—on the one hand the vitalists, who do not believe that an ultimate explanation of the phenomena of life can be given in terms of the not-living; on the other hand, the "mechanists," as they are here named, who "consider it possible, even though feasible only to the most limited extent at the present time, to comprehend vital forms and vital phenomena on the basis of complicated physico-chemical conditions" (p. 8).

Prof. Bütschli, whose researches on the structure and properties of protoplasm have brought him into the closest contact with the problem of the nature of living matter in its simplest and most elementary form, approaches the question as a partisan of the mechanistic school of thought, and seeks to vindicate this position against the recent revival of vitalism which has been so prominent of late years, especially amongst physiologists. He commences with a brief exposition of his philosophical standpoint, and expresses himself "of the opinion that sensations (Empfindungen) accompany the processes (Vorgänge) of the entire world, but that consciousness, or conscious sensation, on the other hand, has come about through the building up of the nervous system, and consequently of memory, which is the foundation and corner-stone of the conscious object, or of the Ego" (p. 6). Memory is not to be regarded as a property of the living substance as such, but as possible only with a complicated nervous apparatus (p. 52). The author proceeds next to define the mechanistic position and especially to distinguish "Mechanismus" from Materialism, with which it has been confounded by Bunge and other vitalists. "The mechanistic conception does not imply that the psychical can be explained by the physical; to it these two fields appear separate, though not unconnected" (p. 8). This leads to brief discussions as to what is meant by "causal dependence," and as to how far it is possible to speak of an "explanation" of natural phenomena, after which the author passes on to review and criticise the objections raised by neo-vitalists to the possibility of explaining vital phenomena from a physicochemical standpoint.

It is not possible here to follow the author into the details of his arguments upon this abstruse theme, for which we must refer the reader to the original. Suffice it to say that the lecture makes interesting reading, but by no means of a light order, since almost every sentence requires to be pondered over before it can be assimilated, and we imagine that the inevitable butterfly element amongst the professor's audience must have found it difficult to gather honey from such very solid mental food. Perhaps the difference between the mechanists and the vitalists is nowhere brought out better than on p. 17. A neo-vitalist, Cossmann, having asserted that an artificially manufactured body, of the same materials and of the same structure as a plant, would nevertheless not be an organism, Bütschli replies that "a body, built up in exactly the same way, both as regards structure and material, as a given plant, cannot, under suitable external conditions, behave otherwise than would the plant in question, *i.e.*, it would live like it." So long as this ideal artificial organism has not been put together, it seems a little difficult for an unbiassed critic (if there be any such) to assert confidently, either with the mechanist, that it would behave as a living body, or with the vitalist, that it would be in the condition of a dead one. Incidentally, Bütschli declares his belief that the Darwinian theory of evolution, in spite of the many recent attacks upon it, remains the most probable of the various attempts at explanation, and "contains the possible general solution of the problem," especially if combined with the hypothesis of germinal variations, which alone are capable of being inherited (pp. 33 and 89). In conclusion, the author claims that, in vital phenomena, "only that can be comprehended which can be physico-chemically explained." As regards the merits of the vitalistic and mechanistic points of view, he is content to declare, "By their fruits shall ye know them!"

E. A. M.