illustrations and linguistic scraps. Another paper,[1] by A. S. Gatschet, discusses his ethnologic and linguistic observations made among the Shetimasha Indians of St. Mary's parish, La.

Ethnologic results of a visit, made in 1883, to two Iroquois reservations in New-York state, are published in French and in Dutch by Dr. H. ten Kate, who in the same year made somatological and other researches among the Indians of the south-west of the United States and the north-west of Mexico, including the peninsula of California.

Wood-carvings of the Haida and other tribes of the north-west coast of North America are figured upon thirteen splendidly colored plates, with descriptive letter-press, in a folio volume entitled 'Amerikas nordwestküste; neueste ergebnisse ethnologischer reisen.' The objects represented consist of masks of human and animal shape; of implements, such as spoons, vases, rattles; of troughs, posts, idols, and other wood-carvings, — all of which are now exhibited in the collection of the Berlin royal museum. This folio was published by Asher & Co., in Berlin, under the auspices of the direction of the ethnologic department in the museum in 1883 (Dr. Adolf Bastian); and an English edition was issued in the same year.

The political and social condition of the Liberian negroes, an immigration from North America into western Africa, is discussed in a long and very elaborate article read to the Geographical society of Berne, Switzerland.[2] The capital of this Ethiopian republic is Monrovia: the population consists of two elements quite distinct from each other, — the aboriginal negroes and the immigrated settlers. Slavery is nominally abolished by the constitution of the republic; but a substitute has been found in the so-called 'bushniggers,' whose only toilet consists in a handkerchief worn about their loins. The Liberia constitution proclaims full liberty of religion, conscience, of speech and press, and gratuitous education of children; and one of the more noticeable paragraphs precludes white people from acquiring any real estate, and from being intrusted with any public office. J. Bütikofer, the author of the article, gives many observations and personal experiences from his travels in the interior and on the coast of Liberia.

An excellent ethno-archeological publication on Bavaria, which deserves more than a passing notice, is published under the title, 'Beiträge zur anthropologie und urgeschichte Bayerns.' These contributions are the organ of the Munich society of anthropology, ethnology, and prehistorics, being issued in four numbers to a volume of lexicon-octavo size, and profusely illustrated. Under the editorship of Joh. Ranke and Nic. Rüdinger, five volumes have been issued up to the present year. The most extensive and difficult topic now engrossing the attention of that scientific body is the publication of the archeologic map of Bavaria, — a land which covers an area of 75,000 □ kilometres, and has been in its more level parts thoroughly explored by archeologists for remains of antiquity. Of the fifteen sheets of the map, five have been issued by the editor in charge, Prof. F. Ohlschlager, who uses over twenty colored sign-marks for the objects discovered, and adds a statistical and topographic register of the finds. The occurrence of all the 'hochäcker,' a relic analogous to the 'gardenbeds' of the American north-west, has been represented on a separate map in the fifth volume: they are almost entirely limited to the southern parts of Bavaria, extending between Augsburg and Salzburg.

[1] *Trans. anthrop. soc. Wash.*, ii. p. 148.
[2] *Jahresb. geogr. gesellsch. Bern*, v. 75.

MENTAL EVOLUTION IN ANIMALS.

Animal intelligence. By GEORGE J. ROMANES. New York, *Appleton*, 1883. (International scientific series.) 498 p. 8°.

Mental evolution in animals. By the same. New York, *Appleton*, 1884. 384 p. 8°.

IN the wide range of interesting facts collected and published a year ago in 'Animal intelligence,' Mr. Romanes laid a broad foundation for his present work, 'Mental evolution in animals;' and these volumes, we find, are preliminary to a forthcoming work upon 'Mental evolution in man,' which will complete the most extensive study of comparative psychology ever attempted. This subject has not hitherto received the comprehensive treatment which its importance deserves. One of the most vital questions of our times is the genetic continuity of the mind as well as the physical structure of man with that of the lower animals: it marks the point where the views of Darwin and Wallace, and of many of their followers, diverge; and, whatever our own opinions may be, we must regard this as the crowning problem of animal evolution in its broadest sense. In the first few pages of these two works, it is easy to discern the author's personal standpoint, and to foresee that the third volume will contain an elaboration of the psychology of the 'Descent of man.' Reserving, however, a complete discussion of the final question for the later work, he carries us here to the summit of the lower animal scale, ably following every line of inquiry. Although not a profound thinker, Mr. Romanes is a thorough and original investigator; and his previous labors, both in biology and psychology, qualify him peculiarly for this line of research. While as a philosopher he generally follows Hume, Mill, Bain, and Spencer, his position as a psychologist is often very independent. As a follower of Darwin, he naturally inclines strongly to his views on many questions; attributing to natural selection almost unlimited influence in the development of instinct and intelligence.

Based upon the generally accepted truth of the evolution theory, below the human scale,

the plan of the work is, first, the collection of a vast number of authentic observations upon the lower animals (this, with general comments, occupies the whole of the volume upon 'Animal intelligence'); second, a close analysis of the tests of mind, its physical basis, and the means we have of determining its presence; third, an examination of the mental faculties, such as consciousness, sensation and perception, instinct and reason, in their higher and lower manifestations; fourth, the application of actual observations to the determination of the various levels in the animal scale at which these phenomena of consciousness, sensation, and so on, appear; finally, a full discussion of the problem of instinct, as arising parallel with intelligence. The chief merits, as well as the special and almost insurmountable difficulties of Mr. Romanes' work, are met with in these last two sections. In the accumulation of well-ascertained facts, he has started in a sound scientific method: the interpretation of these facts is a most delicate task.

Is a certain act prompted by instinct, or intelligence? Does it indicate conscious choice, or merely the response of reflex action to a certain stimulus? Does it indicate a knowledge of the relation of means to end? These are subtle problems all along the line from the anthropoid ape to the Amoeba: their interpretation by the two schools of psychologists is often directly contradictory, yet upon this the whole argument must rest. The difficulties increase as we descend the scale. The minds of others can only be known as ideal projections of our own mental states. Here arises the doubt, in applying our criteria of mind to particular cases, which increases as we recede from minds like our own to those less so, passing into a gradual series to not-minds.

The observations in the first volume under consideration relate to members of all the larger divisions of the animal kingdom. Their number and variety are surprising; and, although the author has carefully endeavored to exclude all those in the least degree doubtful, many of them will appear incredible to persons unfamiliar with this class of literature. These anecdotes form a superb field for induction; yet many of them are marred for scientific purposes by the hasty conclusions of the observers, which are appended. In the closing chapter upon monkeys, there is a novel diary of the habits of a brown capuchin, which was written for two months by Miss Romanes.

In the second volume, before seeking to determine the levels at which we meet the lower and higher mental phenomena, the author tries to show very clearly his own conception of mind, and by what means we can legitimately infer its presence in an animal. "The distinctive element of mind," he says, "is consciousness, and the test of consciousness is the power of choice." The function of selective discrimination with the complementary power of adaptive response is regarded as the root-principle of mind; and it is found only in agents which are capable of feeling. These root-principles of feeling and choice may be traced down into the vegetable kingdom, where, for example, we find an insectivorous plant rejecting a bit of glass, but feeling and closing upon a fly. To the objection that plants are not in any proper sense capable of feeling, the author allows that at the bottom of the scale the terms have lost all their original meaning; yet the apparent abuse of terms serves well to emphasize the fact of the gradual dawn of these powers. The great stress of Mr. Romanes' argument, as a consistent evolutionist, is the universal gradation which we find throughout the scale, which he strictly maintains is one of *degree* only, although it may appear to be one of *kind*. With this principle of gradation constantly in mind, the reader will be less surprised at some of the author's conclusions.

We see feeling and choice acquiring the semblance of their higher meaning among the coelenterates, in the Medusae for example, where we first find definite sense-organs. In this group, accordingly, following Spencer, the author discovers 'the raw material of consciousness.' Here arises another difficulty in distinguishing between the mental choice of consciousness, and the apparent, but not real mental choice of reflex action; and the only distinction that can be drawn consists in the latter "depending on inherited mechanisms within the nervous system, being so constructed as to effect *particular* adaptive movements in response to *particular* stimulations, while the former are independent of any such inherited adjustments." Reflex choice is habitual and invariable: mental choice decides between one of two alternatives, in case of new experience. Sensation is feeling aroused by a stimulus, and always attended by consciousness; and, together with the rise of conscious choice, we meet the dawn of intelligence, or mind as we generally understand it. Does the organism learn by its own individual as distinguished from its race experience? If it does so, its mind is placed beyond the area of merely reflex action.

Having advanced thus far, the author first

discovers memory of a low order among the gastropods; experiments with the echinoderms and higher crustaceans having, up to this time, given rather negative results. The latter fact is the more surprising; because among some of the terrestrial arthropods — the ants, bees, and wasps — this faculty is so wonderfully developed. Memory of the higher kind, which depends upon the association of ideas by similarity, is met with among the fish and batrachians. This involves another faculty; namely, perception. Differing from Spencer in many particulars, and showing less confidence in himself as to the rise of perception than at other points, the author in general regards it as the faculty of cognition, and finds clear evidence of it among the insects, reaching the general conclusion that reflex action and perception advance together. Imagination is stated to rise step by step with memory and perception among the mollusks, insects, spiders, crustaceans; and the doubting reader is referred to the actual observations in 'Animal intelligence' which sustain these conclusions. As to the more complex mental powers, proceeding in the same line of argument, the author discovers reason, with a knowledge of the relation between means and end, among the bees and wasps; in this order he also observes communication of ideas; understanding of words, and dreaming, are found among the birds; tools are intelligently used by monkeys and elephants; an indefinite sense of morality is seen among dogs and anthropoid apes. The discussion of conscience, volition, and abstraction, is reserved for the last volume. The various approximate levels at which the signs of the emotions, the will, and the intellect appear, are presented in a large diagram, in which the faculties branching out from a single stem, neurility, are seen in a condensed view of the entire system.

Fully one-half of 'Mental evolution in animals' is devoted to the subject of instinct; and as it is treated with the utmost fulness and clearness, with a critical discussion of the theories of different writers, it forms an invaluable and standard contribution to this much mooted subject. In general, supporting the theory of Darwin in opposition to the contradictory views of Lewes and Spencer,[1] it is shown that the origin of instincts may be either primary or secondary; that is to say, —

"Instincts may arise either by natural selection fixing on purposeless habits which chance to be profitable, so converting these habits into instincts (primary), without intelligence ever being concerned in the process; or by habits originally intelligent becoming by repetition automatic (secondary)."

[1] In his Principles of psychology. This work was written before the publication of the Origin of species. Mr. Spencer now admits the wide influence of natural selection.

While either of these causes may work alone, yet frequently in co-operation they evolve instinct more rapidly by blended origin. Instinct is accordingly defined as "reflex action into which there is imported the element of consciousness;" and the point is ably sustained, that Spencer's derivation of instinctive from reflex actions merely, is inadequate for the higher animals, while Lewes's theory of the 'intelligence' origin is inadequate to explain the instincts of the lower animals. Darwin's essay on instinct, part of which only appeared in the 'Origin of species,' is published as an appendix to this volume. The author acknowledges his indebtedness to this, as well as to many manuscript notes left him by the great naturalist.

An outline has been given of these unusually interesting works; and there is little space left for extended criticism, although at many points it is richly deserved. We find, among other defects, that the candor of the author's preface is not sustained throughout. He disclaims the discussion of all philosophical questions, such as the causal relations between mind and matter, as apart from the objects of the book; yet, at several rough places where he feels called upon to explain the origin of faculties, he does it in terms of nerve fibres and cells. For example: in the origin of consciousness we find him groping after Spencer, and, with some hesitation, deriving this faculty from 'ganglionic friction;' while at another turn he reverses the causal relation, since it is convenient to do so, and suggests a psychical cause for some material change. Discussing the origin of nerve-fibres, he again quotes Spencer; although Balfour, in his address before the British association in 1880, gave the whole weight of his authority against Spencer's theoretical views. The accounts given of the evolution of the first germs of mind and nerves are necessarily obscure and assailable. It is true that pure speculation is unavoidable in such an intangible sphere of inquiry; but the intrinsic merits of the argument are dimmed, and we believe the truth is delayed, when the reader is so often left in doubt as to where the author's observation ceases and his imagination begins. As before stated, it is not the facts of actual observation brought forward, but the character of the inferences which are drawn from these facts, which will arouse controversy.

The American edition of 'Mental evolution'

is a careless publication. Besides numerous typographical errors, those who were unfortunate enough to purchase an early copy found two important diagrams omitted, one of which is absolutely essential to the understanding of the context.

FISKE'S ELECTRICITY.

Electricity in theory and practice; or, the elements of electrical engineering. By B. A. FISKE. New York, *Van Nostrand*, 1883. 270 p. 8°.

THAT the work of Lieut. Fiske meets in some degree a want felt by a considerable number of persons, is sufficiently shown by the fact that it has already reached a third edition; but we must nevertheless confess to a feeling of serious disappointment on reading it. The expectations raised by the title are hardly justified by the contents; since the discussions of theoretical points are very brief and unsatisfactory, while the portion treating of electrical engineering proper is somewhat ill-digested. In fact, there is a certain 'scrappiness' about the work as a whole, which is apparently due to over-haste in preparation.

The first five chapters, occupying about one-fourth of the book, are extremely elementary, and contain little that will not be found more fully stated in almost any work on electricity, while occasional loose statements also occur. Thus, in the chapter devoted to work and potential, the writer seems to overlook the exactness introduced into scientific measurements when Gauss first proposed an absolute system of mass and force measurement. Immediately after the definition of the foot-pound, we find the following statement: "This unit is, however, too large for measuring with convenience in many cases; and for this reason a much smaller one has been invented, called the 'erg.'" The only definition given of the dyne is "an extremely minute weight, being about $\frac{1}{981}$ of a gramme." Other examples are to be seen in the table on p. 214.

Such laxity of expression, although it may seem to simplify the subject, cannot fail to prove confusing as soon as the reader really begins to study the matter. Similar want of care in expression will trouble the student while reading certain parts of the chapter on the laws of currents. From the statements on p. 60, regarding the arrangement of battery-cells, the reader might erroneously infer that high internal resistance in a cell is in itself advantageous in increasing the strength of the current given by a battery.

Considering the portion of the work devoted to the applications of electricity, we find a great inequality in the space devoted to important matters. The subject of electro-metallurgy is allowed but a single page, and the extensive use of dynamo-machines in the electrical deposition of metals is not discussed at all. Of the ten pages given to storage-batteries, five are filled with a mere statement of the claims of certain recent patents, without any information regarding their value. On the other hand, neither the chemistry of the lead-battery nor the special advantages and disadvantages of the storage-battery are considered. The chapter on thermo-electric batteries contains no allusion to any form of thermo-battery whose use in the arts has been attempted; and there is not even a mention of the names of Farmer, Noë, or Clamond. Instead of this, five pages of patent claims are given, several of which are not, in fact, for thermo-electric batteries proper.

The remainder of the work deserves somewhat more praise. The chapter on electrical measurement contains a description of the earlier forms of ampère-meter and volt-meter of Deprez and Ayrton and Perry. There is no reference to Sir William Thomson's current and potential galvanometers. Under telegraphy we find the bridge duplex method described, but the differential method is not alluded to. The principles of the quadruplex, as well as those of the harmonic telegraph, are, however, explained. The chapter on the telephone is interesting. It is unfortunate that not even a passing mention is made of the Blake transmitter; while the rarely used transmitter of Edison, and his ingenious but unpractical electro-motograph receiver, are described at some length. The following chapters on electric lighting, dynamo-machines, etc., are, on the whole, the best in the book. The principle of the differential arc-lamp is explained, and brief descriptions are given of most of the leading types of dynamo-machines. The closing chapter on electric railways contains, among other matters, an account of the system of Field and Edison.

In justice to the work under review, we ought to say that many of the faults which we have criticised have their origin in the fact that our author has attempted the impossible feat of discussing the theory and practice of electrical engineering in a work of only two hundred and sixty-five pages. As a consequence, neither theory nor practice is described at sufficient length to meet the wants of the reader. Moreover, we are firmly of the opinion that any one