historical times. This number, it will be observed, does not correspond with the one just given. Although we observe certain lacunæ in this catalogue, it is a very useful compilation for those interested in vulcanology.

Although geologists may object to Dr. Schneider's new terminology, they must not overlook the fact that they themselves have had many christening parties. Some thirty or forty years ago a distinguished president of the Geological Society, when he first heard of Belenites—a word not unlike Beloniten—interrupted the speaker by the remark, "Tut! tut! Belemnites in volcanic rocks indeed!" If we say nothing about the new language, then Dr. Schneider is to be congratulated on his work. JOHN MILNE.

BIOMETRICAL METHODS FOR PSYCHOLOGISTS.

The Essentials of Mental Measurement. By Dr. Wm. Brown. Pp. vii+154. (Cambridge: University Press, 1911.) Price 3s. 6d. net.

THIS volume is based on a research "devised for the purpose of determining to what extent correlation exists between certain very simple mental abilities, in cases where the individuals experimented on are, as near as may be, identically situated with respect to previous practice, general training, and environment; and how closely, if at all, these elementary abilities are related to general intellectual ability as measured by teachers' judgments, school marks, &c."

The groups of individuals tested were homogeneous as far as possible, and were selected from a London elementary school, a London higher grade school, from among women students of a training college, and men and women university students. The tests employed were fourteen in number. In two of them the subject was required to cross out as quickly and accurately as possible on a printed page certain letters (e and r in one case, and a, n, o, s in the other), in a third all the letters were to be crossed out. Speed and accuracy in the addition of single digits were measured in a fourth; while in the fifth, sixth, and seventh the ability to estimate the relative lengths of printed lines was tested in different ways, including conditions under which illusions are known to be produced. The power of memorising poetry and strings of nonsense syllables were examined in the eighth and ninth, while the tenth test was the *combinations methode* of Ebbinghaus. In this "the subject is shown a passage of continuous prose with one-third to one-quarter of the words replaced by blanks, and is asked to supply the missing word or words of similar significance." The eleventh and twelfth were marks obtained in the ordinary school curriculum for drawing, and the total school marks; in the thirteenth general intelligence was graded by the independent estimates of two different teachers, which were found to be very closely correlated together. In the fourteenth association time was measured by counting the number of words associated with a given word which the subject could write down in a given time.

The majority, but not all the tests, were applied

throughout each of the six groups, and the statistical treatment of the records is very complete and satisfactory. The results for each group were, of course, kept distinct, and correlation coefficients were calculated between the result of each test and the result of each of the others, while to estimate the trustworthiness of each the correlation between the results of two separate applications of the test on each subject was measured. In addition to this, certain groups of tests were taken and the partial correlation coefficients calculated, *i.e.* the correlation between any two members of a group for constant values of the remaining members. As the probable errors are given for all the coefficients calculated, comparisons between them can be satisfactorily made.

Limitations of space forbid us from giving an account of all the conclusions drawn by the author, but two at least can be stated very simply and are worthy of note; firstly, that the *combinations methode* of Ebbinghaus is a good measure of mental ability. It correlates with "general intelligence" almost as clearly as "scholastic intelligence" (school marks) "does"; and secondly, mechanical memory, *i.e.* the power of memorising a number of nonsense syllables, is also fairly closely correlated with general intelligence. This research was published in the *British Journal of Psychology* for October, 1910. Together with the chapters which appear in this volume on the mathematical theory of correlation and on the history of the use of the theory in psychology, it formed a thesis approved for the degree of doctor of science in the University of London. The thesis, with chapters added on mental measurement, psycho-physical methods, and on the significance of correlation in psychology, constitutes the bulk of the present volume. Its object appears to be not so much to instruct the beginner in psychology on the best way of measuring psychological characters, but to introduce the professed psychologist to the biometrical methods of Prof. Karl Pearson and his school. The author shows a considerable grasp of the subject, and does not perhaps realise the difficulties of less mathematically minded people than himself. Thus the chapter on the mathematical theory of correlation, if intended for an introduction to the subject, could well have been expanded, rendered more elementary, and more amply provided with examples. It is by examples rather than by precept that people who are confused by algebraical symbols are able to learn to use the methods. Those who can readily follow the notation will find the book profitable to read and useful for reference, particularly as a good bibliography is appended. E. H. J. S.

ELECTRIC CRANES.

Electric Crane Construction. By Claude W. Hill. Pp. xx+313. (London: C. Griffin and Co., Ltd., 1911.) Price 25s. net.

A LARGE measure of flexibility in the supply of power is an essential feature in all hoisting machinery. Not only must the point from which the load is suspended be capable of movement in different directions, but the whole machine must be able to travel, and these requirements render electricity a par-

ticularly well-adapted agent for the working of such machinery. A modern book on cranes becomes thus quite naturally a book on electric cranes.

Mr. Hill's work is a thoroughly practical treatise on electric crane construction. The subject is so complicated and so many-sided that any attempt to treat it in a general way must be unsatisfactory, and the author has wisely decided to represent his subject rather by means of well-chosen examples of successful work than by a general treatise. The importance of scientific principles is, however, not overlooked; interleaved with the descriptive matter we find the necessary calculations as to stresses, stability, power required, action of brakes, and other matters capable of scientific treatment. The examples chosen comprise various forms of overhead travelling cranes, locomotive and portable jib cranes, derricks, sheer legs, transporters, revolving cantilever cranes, and cableways. Then follows a chapter on the power required for crane driving. From tests quoted by the author, it appears that the efficiency in many cases is remarkably high, reaching nearly 70 per cent.

In discussing starting torque and acceleration, the author also quotes from practical experience for hoisting, lowering, travelling, and slewing. Chapter x. deals with the design of crane structures. Here we find discussed the strength of struts, both on the basis of Euler's and Rankine's formulæ, the strength of lattice girders and various types of beams generally, the construction of cantilevers and cognate matters, all exemplified by very full diagrams and working drawings.

The following three chapters deal with design of machinery, frames, bearings, axles, and drums, brakes and toothed gear. Especially the last-named subject is very fully treated, including the question of permissible wear and the use of worm-gearing. Most readers will be surprised at the high efficiency obtained by this mode of driving, when the worm runs in an oil bath. The explanation given by the author is that metallic contact between the teeth does not take place, since the film of oil between the surfaces is not squeezed out even at very heavy pressure. This has also been the experience of motor-car designers who find for worm-drive efficiencies well above 90 per cent.

After a short chapter on hooks, ropes, and chains, we come to the electric and magnetic details beginning with the design of magnets. It is to be regretted that the author has adopted the hybrid system of units where induction is given as so many c.g.s. lines per square inch. In working with such a system one loses completely the connection with first principles, and the solution of any problem becomes simply a matter of blindly applying certain formulæ. As regards motors, the author deals very fully with the question of rating as influenced by the intermittent service, and he shows that crane motors should, as regards mechanical strength and commutation, be designed for the full load, but as regards heating for a very much reduced load. Only D.C. motors are discussed, the author holding that A.C. motors are unsuitable for crane work. This is perhaps too sweeping a condemnation. In many docks on the Continent

polyphase motors are used, and with the advent of the A.C. commutator motor there is given every facility for using alternating current where no continuous current is available, and the author's recommendation of installing a converter for the power supply to the cranes becomes a useless complication.

A table on p. 302, giving from practical experience the annual working cost of seven different cranes, is very interesting. It shows that the cost of power taken at 1.5d. per unit is negligibly small. It amounts in the worst case to only 1.3 per cent. of the total cost, and in most cases it is about 1 per cent. Thus, with current purchased even at the usual lighting rate of about 4d. per unit, the cost of power is quite insignificant. This is due to the fact that the load factor of a crane is exceedingly small. The total energy given off by all the crane motors per annum only represents full output over about twenty to seventy hours per annum. The annual cost is almost entirely made up by interest, depreciation, and repairs, and the problem to be solved by the designer of cranes is not so much the saving of current as the production of a cheap and robust design.

GISBERT KAPP.

MORPHOLOGY OF THE VERTEBRATES.

Éléments de Morphologie des Vertébrés. Anatomie et Embryologie Comparées, Paléontologie et Classification. By Prof. L. Vialleton. Pp. xiv+790. (Paris: Octave Doin et Fils, 1911.) Price 18 francs.

THIS is an interesting and thoughtful introduction to the morphology of the vertebrata, very clearly written, well illustrated, and with several distinctive features. The author thinks, probably with justice, that the vertebrata are better subjects than the invertebrates for the illustration of morphological principles. Their structure is more thoroughly known and its relations to the conditions of life are more certain; the development of the chief types has been worked out in its main features; and we have, on the whole, more information in regard to the past history. Filiation is clearer among vertebrata than among invertebrates. For learning the lessons of morphology it is better to begin with one phylum than with many, and the most educationally profitable phylum is that with which students are likely to be most familiar—the vertebrata.

The plan of the book is as follows. After an introduction dealing with general concepts such as homology, the author devotes the first part to general embryology—the germinal layers, the early primordia, and the fundamental architecture of head and trunk and limbs. The second part deals seriatim with all the systems and organs, from the skin to the gonads, treating everything comparatively and embryologically. It is all very clear and careful, but in a book of the dimensions of this one we look for rather more criticism. To take but a single instance, we think Vialleton's conventional account of the pectoral skeleton of the Monotreme, with its episternum and absence of procoracoids, might have been improved without risk of dogmatism. We may notice here that