

is not represented in a single reproductive cell, for the organism is always a double structure. On the other hand, we know that certain physical characters are definitely inherited upon Mendelian lines; for instance, colour in plants and animals, certain hair and feather characters, leaf forms, the presence or absence of horns in cattle, the shape of potato-tubers, are thus inherited; as are also brachy-dactyly, nyctalopia, and other conditions in man.

Although certain abnormal characters in individuals may be conveniently described as dominant or recessive, this is far from being a full explanation of neuropathic inheritance. The "coupling" and "repulsion" known to exist between different factors, the explanation of "sex-limited" diseases, and even the causation of sex itself, fail to be explained upon evidence which is founded upon Mendelian lines alone. In regard to Mendelism we think there is too much stress laid in the text-book upon the statement that "actual findings in mental disorders are alongside of theoretical expectations." As yet we know too little to be able to state that Mendel's law applies to all characters of all living organisms. Mental disorders in themselves are too vague as well as too subtle and complicated to be classified into definite heritable unit-characters. All we can say is that we must not expect simple Mendelian results from the study of insane inheritance, which is a product of many factors, each of which may possibly be independently heritable, but all of which have certain definite effects that must necessarily interfere with the practical application of Mendelism. The irregular dominance of some abnormal mental states shows that there is no definite segregation of mental characters.

The references to cerebral syphilis in the manual are the only long quotations from any English authority, and these do not point out that mental symptoms, such as cerebral irritation, restlessness, excitement, anxiety, and depression, occur in no fewer than 80 per cent. of all cases of syphilis, and mostly during the secondary stage! It is agreed by English authorities that these mental symptoms occur within six months from the date of primary infection. The author is too optimistic about the Wassermann reaction remaining negative after one or two injections of salvarsan. Exceptionally this may be so, but the present treatment of syphilis extends to more than one hundred days, and consists in the intravenous or intramuscular injection of salvarsan, neo-salvarsan, gallyl, luargol, or kharsivan, combined with mercury; and cerebral syphilis receives identical treatment. No reference is made to the numerous experiments made with salvarsanised serum, and we share the author's doubt as to the permanent arrest of general paralysis or of locomotor ataxia.

The Binet-Simon tests of mental deficiency are introduced and occupy about twenty pages, but it would have been more helpful if the author had added fuller comments upon their interpretation and practical utility. No mention is made of the

Montessori method of treating mental deficiency, for this would have been appropriate in a work purporting to cover all inherent mental weakness. A useful sub-section is given to the technique of the Wassermann reaction, but, although the hæmolytic system is used to explain the bacteriolytic, the description needs simplifying for the general practitioner, in spite of the fact that this reaction is in essence only a quantitative chemical test for the presence of "complement." Psycho-analysis finds a short place in the text-book; it is described as a "time-robbing task," and the author shows a dignified reserve in its discussion, merely indicating briefly the methods employed to carry it out. Figures of the dead neuron (Betz cells) are introduced from the drawings of Adolf Meyer, but no reference is made to the altogether different structure of the living neuron. On the whole, the manual is a trustworthy text-book for the psychiatric clinic, and the new edition brings the work fairly up to date, although there is no mention of "shell-shock" or the mental effects of the war. Probably the recent development in American politics will soon remedy this defect.

ROBERT ARMSTRONG-JONES.

PHILOSOPHY AND PARADOX.

- (1) *Fermat's Last Theorem*. By M. Cashmore. Pp. 63. (London: G. Bell and Sons, Ltd., 1916.) Price 2s. net.
- (2) *The Elements of Non-Euclidean Plane Geometry and Trigonometry*. By Prof. H. S. Carslaw. Pp. xii+179. (London: Longmans, Green and Co., 1916.) Price 5s. net.
- (3) *The Algebraic Theory of Modular Systems*. By F. S. Macaulay. Pp. xiv+112. (London: At the Cambridge University Press, 1916.) Price 4s. 6d. net.

(1) THE main fallacy of Mr. Cashmore's paradoxical tract is this:—"Let f , ϕ be polynomials in x , and λ a constant different from zero; then, if f , ϕ have a common factor $(x-a)$, $x=a$ may be regarded as a solution of $f/\phi=\lambda$. Conversely, if $f/\phi=\lambda$ has a root a , then $(x-a)$ must be a common factor of f and ϕ ." (See p. 18.)

(2) By this time it is fairly well known among mathematicians that ordinary geometry is a sort of border-line between two equally consistent theories, in each of which Euclid's axiom of parallels is false. In one of these the sum of the angles of a "rectilinear" triangle exceeds two "right" angles; in the other it falls short of it, and may even converge to zero. If "similar" triangles are defined by parallelism of sides, we have the sums of their angles differing according to a fixed law; and, similarly, if we define them by proportion of sides (generally according to a different law). These non-Euclidean geometries apply to three-dimensional space as well as to the plane, and the question for teachers is to make them intelligible to the student by intuitional methods. As regards the case when the sum of the angles of a triangle is less than two right angles, nothing can be better than to take as

"straight lines" circles which cut a fixed ordinary sphere orthogonally, and to regard all points outside this sphere either as non-existent or as "images" of accessible points within the sphere. The *plane* version of this is given by Prof. Carshaw (pp. 153-75) in the clearest manner conceivable; but he does not seem (in this book) to have considered the analogous theory *in solido*. There is no satisfactory theory of three-dimensional non-Euclidean geometry, *from an intuitive point of view*, unless it gives us a clear three-dimensional image in our ordinary space, assuming, of course, that our powers of "intuition" are confined to ordinary space.

One of the great merits of Prof. Carshaw's book is that he gives a good account of the history of the subject. In a certain sense Saccheri is the great pioneer, and as much justice seems to be done to him as the scope of the work permits. The next is presumably Gauss, but, as usual, he lost his claim by delay in publication.

It should be noticed that theories of parallels and theories of distance are, or may be made, essentially distinct. Thus, if we define *parallel lines* as those which cut the fundamental sphere orthogonally in the same point, they may or may not be continually at the same *distance* from each other, according as we define the measure of the distance of two parallel lines.

Altogether, we think Prof. Carshaw's book is one of the best introductions to the subject that we have seen. He ought to have given a reference to Mr. Somerville's bibliography.

(3) Let F_1, F_2, \dots, F_n be n assigned polynomials in m variables; then $[F_1, F_2, \dots, F_n]$ is defined to be the set of polynomials $X_1F_1 + X_2F_2 + \dots + X_nF_n$, where X_1, X_2, \dots, X_n are arbitrary polynomials in the same variables. We also speak of $[F_1, F_2, \dots, F_n]$ as a "modulus" or "module," this term being due to Kronecker, who first emphasised the importance of *algebraical moduli*. The importance of *arithmetical moduli*, in the wider sense, was discovered by Dedekind, and the whole theory of algebraic integers in a given field may be reduced to that of moduli *contained in that field*. The algebraic theory is analogous, but much more difficult, and Dr. Macaulay has done a real service to mathematics by his original and critical tract. Even men such as Kronecker and Lasker seem to have made mistakes (in detail) in this peculiarly difficult field of research.

The originality and conscientiousness of this tract are so great that the reader must forgive the author for occasional obscurities. For instance, the "array" on p. 7 is fundamental, but we fear that many readers may fail to see precisely what it means, and the "reverse" notation (p. 4) for F_1, F_2 is not justified by any remark in the text.

The main result, illustrated by well-chosen examples, is that whereas, in the arithmetical theory, a modulus is uniquely expressible as a product of prime moduli, and all moduli are, so to speak, homogeneous in the sense that numbers

of the natural scale are homogeneous, the same is *not* true of algebraic moduli in general, and we have to introduce technical epithets to distinguish one kind of modulus from another. In fact, it seems clear that the problem of classifying algebraic moduli according to their essential properties is at least as complicated as the corresponding problem in group-theory; and if we attend to the arithmetical nature of the coefficients (e.g. if, instead of taking them as *umbræ*, we take them as integers in a given finite field), additional difficulties present themselves. We hope that Dr. Macaulay will continue his researches; meanwhile this tract ought to be welcomed as one of the most valuable in the series to which it belongs. G. B. M.

SOME ASPECTS OF TEXTILE MANUFACTURE.

Dyeing in Germany and America, with Notes on Colour Production. By S. H. Higgins. Second edition, rewritten and enlarged. Pp. viii+143. (Manchester: At the University Press; London: Longmans, Green, and Co., 1916.) Price 5s. net.

THE first edition of this book was reviewed in NATURE for November 7, 1907. Since the completion of his work as a Travelling Scholar under the Gartside Foundation scheme, the author has gained much practical experience in dye and bleach works, the results of which are embodied in the new volume. This has added considerably to its value, particularly in the sections dealing with mercerisation and bleaching.

In a new chapter the German and English methods of manufacturing flannelettes are contrasted. This is of interest as raising the general question of the relative efficiency of the British and German methods of textile manufacture. Generalisation on such a topic is, of course, open to many pitfalls, and an adequate discussion of the matter would be impossible in this review; but, broadly speaking, the British textile industry has developed along the lines of specialisation of *processes*, whilst the German specialises in *products*. This contrast is seen very acutely in the worsted industry, in which it is quite usual here for at least five distinct firms to be concerned in the production of a piece of cloth—the comb, the spinner, the weaver, the dyer and finisher, and the merchant. Each of these carries out its section of the work with the maximum amount of skill and at the minimum cost, but there is an obvious, and very real, danger that the various processes are not sufficiently co-ordinated. On the other hand, the usual German practice is to carry out all processes in one works and under one general control, when it is much easier to correlate the various stages of manufacture and subordinate each process to the final result desired. The ultimate aim should be to combine the advantages of both systems.

The author of the book has also added a new chapter on "Instruction in Dyeing," and gives it