SCIENTIFIC BOOKS

Handbuch der Vergleichenden Psychologie. Edited by GUSTAV KAFKA. Band I: Die Entwicklungsstufen des Seelenlebens, 526 pp. Band II: Die Funktionen des normalen Seelenlebens, 513 pp. Band III: Die Funktionen des abnormen Seelenlebens, 515 pp. Ernest Reinhardt, München, 1922.

COMPARATIVE psychology in this case is serviceably defined as a general method of inquiry. Too often the term has been used in this country for the study of the mental life of infra-human organisms.

Kafka's handbook, the most extensive work on comparative psychology ever published, consists of three volumes which represent and sample the abundant materials of the subject instead of exhausting them. The three volumes deal respectively with mental development, functions of the normal mind, and functions of the abnormal mind.

Volume I comprehends three parts: (1) Animal psychology, by Gustav Kafka; (2) Psychology of primitive man, by Richard Thurnwald, and (3) Child psychology, by Fritz Giese.

In Volume II there are five parts: (1) Psychology of speech, by Hermann Gutzmann; (2) Psychology of religion, by Georg Runze; (3) Psychology of art, by Richard Müller-Freienfels; (4) Social psychology, by Aloys Fischer, and (5) Vocational psychology, by Otto Lipmann.

The parts of Volume III are: (1) Psychology of the abnormal, by Hans W. Gruhle; (2) Criminal psychology, by M. H. Göring; (3) Psychology of dreams, by Sante de Sanctis, and (4) Psychology of sex, by Rudolf Allers.

The twelve parts of this important handbook differ extremely in method of treatment, inclusiveness and degree of adequacy. Each richly deserves special descriptive and critical comment, but in this brief review notice the work may be criticized only as a whole.

Each part is followed by selected bibliography. Naturally, and indeed inevitably, English and especially American contributions are less well represented than are European, in text and in bibliography. The handbook is the more valuable to American scientists because it presents in the main materials with which we are less familiar than with our own publications and which are relatively inaccessible because of language of publication or library deficiencies.

It is to be hoped that this admirable collection of special chapters in comparative psychology will encourage American teachers to extend their courses and to use more adequately, for instructional purposes as well as in supplementation of research, both the facts and the methods of such branches of the science as the psychology of primitive peoples, of children, of criminals, of social groups, of occupations, of defective and abnormal individuals, of speech, art—all these in addition to the data and methods of animal psychology which are so generally used as content of our courses in comparative psychology.

In the absence of any comprehensive English text on comparative psychology, a translation of this work is sure to be considered. Although its parts might with entire appropriateness be published separately in translation, it seems to the reviewer eminently desirable that the entire handbook be carefully rendered into English and published complete.

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SPECIAL ARTICLES

AN INTERPRETATION OF ORTHOGENESIS

THERE is probably no evolutionary process about which more obscurity hovers than that of orthogenesis. The occurrence of "directive" evolution in characters that can not be supposed to be of selective value is often held to be incompatible with the view that evolution results from the action of natural selection on random variations. It is variously argued that the occurrence of orthogenetic series proves that variations do not occur in a random manner, that natural selection can not be the directive agent of evolution, or that the Lamarckian principle of the inheritance of acquired characters must be true. Weismann tried to account for the facts by the now discredited hypothesis of "germinal selection"—which at least had the merit of being an attempt at a mechanistic explanation.

One not familiar at first hand with the paleontological evidence may wonder if there is sufficient proof that orthogenetic series really occur, rather than being made up afterwards in the museum by the selection of just the appropriate specimens. But, if it be granted that some such series are genuine, there remains a simple method of accounting for them without making use of germinal selection, Lamarckianism, or any other primary factors than random variations and natural selection.

As was pointed out by Morgan[1] (1923), mutations in single genes usually produce changes in several characters. The geneticist commonly studies the obvious somatic variations, yet he knows that these are associated with physiological variations. Morgan

[1] Morgan, T. H., 1923. The bearing of Mendelism on the origin of species. *Scient. Mo.* 16: 237–247.

pointed out that these physiological variations are the ones most likely to be acted on by natural selection, and that such selection would be expected to bring about changes in the associated somatic characters that are themselves of little or no selective value. This seems to be the most probable cause of the very general occurrence of specific differences that can not be supposed to have any selective value.

One further addition to this idea makes it apply also to orthogenetic variation. If we suppose that variation in a given direction in character A is usually associated with variation in a given direction in character B, then selection of variations in character A will cause character B to change also. An example may make this point clear. If we suppose that the antlers of the Irish elk were dependent for their size largely upon testicular secretions, then selection may have increased the testicular secretions for reproductive or other reasons, and thus have resulted in a purely incidental increase in size of antlers.

In the example given it is assumed that the character not subject to selection is directly dependent for its degree of development upon another character whose variations have selective value. This direct relation is not necessary for the orthogenetic series—all that is required is that there be in general a correlation between the variations in two characters, even in cases where the genetic basis for the variations is not constant. It is, however, likely that diverse genetic changes will not usually produce parallel effects on different characters unless these characters depend on some common developmental process, the primary effect then being on this common process. It is not to be supposed that multiple effects of genes will always show such a correlation—but if such correlated effects do occur where one of the characters concerned is subject to natural selection, orthogenesis is to be expected.

One clear case of the sort of correlation discussed has been reported by Morgan, Bridges and Sturtevant (1921).[2] A large number of small-bristled mutant types occur in *Drosophila melanogaster,* and numerous other effects—roughened eyes, long development period, female sterility, etc.—are more or less regularly associated with the small bristles, though the genetic bases of the different types are quite distinct. It seems likely that natural selection, by operating to eliminate sterile females or slow growing larvae, has kept the bristles of the species large and the eyes smooth.

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[2] Morgan, T. H., C. B. Bridges, and A. H. Sturtevant, 1921. Annual report, in Year Book No. 19, Carnegie Institution of Washington, pp. 329–331.

THE SURFACE EQUILIBRIUM OF COLLOIDAL SOLUTIONS AND THE DIMENSIONS OF SOME COLLOIDAL MOLECULES

THE use of a long discarded method, fallen into disgrace because of its very sensitiveness and inherent difficulties, has made it possible to disclose and study a large number of phenomena connected with the surface tension of solutions, mainly colloidal solutions. The ring method as used by Sondhauss,[1] Timberg,[2] Cantor,[3] Weinberg,[4] and a few others, was difficult to apply and, notwithstanding the soundness of its principle, was never practical. The drop-weight methods with their numerous modifications were considered as ideal, because of the simplicity of the instrument and the excellent results which they yielded in the case of pure liquids. However, when very volatile or viscous liquids were dealt with, they were difficult to handle. They are always time-consuming if any degree of accuracy is required and, above all, absolutely unreliable in the case of colloidal solutions. Surface phenomena are, of course, particularly interesting when substances in solution are adsorbed in the surface layer. As long as it was believed that this adsorption took place almost instantaneously—and this is the general belief even now—there was no fundamental objection to the drop methods, as Gibbs' equilibrium was supposed to have been reached long before the drop would fall. However, such was not the case, as has been shown in an article which appeared in 1922 and other papers.[5] Time must be taken into consideration and more than one hour is required to reach the equilibrium. An interesting fact is that the instantaneous equilibrium of Gibbs, which is function of the concentration,[6] follows the same law as this time-adsorption, and may be expressed by the same equation, $\gamma = \gamma_0 e^{-Kt^{1/2}}$ in which the time t is replaced by the concentration c, namely: $\gamma = \gamma_0 e^{-Kc^{1/2}}$.

It was only through the ring method that it was possible to observe and study this phenomenon, as it is the only procedure which permits the measurement of the surface tension of the same layer of liquid at very short intervals. For this purpose, an instru-

[1] Sondhauss, *Pogg. Ann.*, 1878, Ergbd. 8, p. 27.

[2] Timberg, G., *Ann d. Phys. u. Chem.*, 1887, xxx, 545.

[3] Cantor, M., *Ann d. Phys. u. Chem.*, 1892, xlvii, 399.

[4] Weinberg, B., *Zeitschr. f. phys. Chem.*, 1902, x, 34.

[5] du Noüy, P. J., *J. Exp. Med.*, 1922, xxxv, 575, 707; *Compt. rend. Ac. Sc.*, 1922, clxxiv, p. 962; *ibid.*, 1923, lxxxix, 1076.

[6] Lewis, W. C. McC., *Proc. Phys. Soc.*, 1909, xxi, 150; *Phil. Mag.*, 1909, xvii, 466, etc.