

on the body, and may produce fatal effects? For all that, fifty years ago no one suspected that the body itself produces drugs destined to influence its own functions, that certain organs pass chemical substances (chemical messengers, as they have appropriately been termed) into the blood to affect distant parts, and that many functions of the organism are regulated by these chemical agents and self-formed drugs, sometimes in conjunction with the nervous system, sometimes to the exclusion of its action.

The discovery of these internally formed drugs has led to the development of a new branch of physiology to which the term "endocrinology," or physiology of the internally secreting glands, has been applied. Fifty years ago the pituitary body, the thyroid gland, and the suprarenal capsules were mere names. Little was known of their structure, nothing of their functions. The account which we are now able to give of these organs reads like a fairy-tale. That one of the

smallest should by its secretion be able to influence the growth and stature of the body, rendering this man a giant, that man a dwarf; that another should produce a material without which the nervous system is not in a condition to perform its functions; that yet others should elaborate materials which when discharged into the blood exercise a profound influence upon the activity of totally distinct and distant organs of the body, are secrets of Nature which were unrevealed fifty years ago, although now amongst the commonplaces of physiological instruction.

The individuals who have been responsible for these advances—whether on the old or on the new lines—are too numerous even to be mentioned here; those who most deserve such mention would indeed be the last to desire it. But History will carve their names on the monument they have joined in erecting, and Science, no less mindful of her votaries than Religion of hers, will not fail to reward their services with the grateful encomium: Εὖ, δοῦλε ἀγαθὲ καὶ πιστὲ.

## THE MODERN SCIENCE OF PSYCHOLOGY.

THE progress made by psychology since 1869 may be justly described as unparalleled. In that year the subject had no laboratories, and it was regarded as a matter of philosophical study. To-day a psychological laboratory exists in nearly every important university, and psychology has become recognised as the youngest recruit to the natural sciences—the natural science of mental processes.

The modern science of psychology, while admitting the great value of the older purely introspective psychology of the philosophers (represented in this country by the writings of Ward and Stout), realises its dangers and its inadequacy, and seeks to remove it from all metaphysical implications and to study mental processes under known variable conditions. From experimental psychology, thus established, have arisen the sub-sciences of (i) physiological psychology, in which the relation of mental to nervous processes is investigated, (ii) animal psychology, which studies the relation of animal to human mentality and behaviour, and (iii) individual and racial psychology, which determines the mental differences between different individuals and races of mankind.

There have also developed various "applied" psychological sub-sciences—*e.g.* (iv) educational psychology, the results of research in which are now taught to teachers in their period of training; (v) social psychology, which includes the psychology of religion and other social institutions and characteristics; (vi) abnormal psychology, which forms a subject of examination for the post-

graduate diploma in psychological medicine now established in the Universities of Cambridge, Edinburgh, Manchester, and elsewhere; (vii) industrial psychology, which is concerned in discovering the best conditions for the highest mental efficiency of the workers, in connection with which applications for the services of psychologically trained investigators are now coming from pioneer industrial and commercial firms; (viii) the psychology of æsthetics, in which laboratory investigations of importance for art have been published in this country and elsewhere. Particularly in America, but also in Germany, many special journals have arisen devoted respectively to the psychology of education, abnormal psychology, individual psychology, animal psychology, industrial psychology, the psychology of evidence, etc. In this country we have the British Psychological Society, consisting of about 500 members, and publishing the *British Journal of Psychology*.

Fechner, who worked at Göttingen, and Wundt, of Leipzig, who in the 'seventies established the first psychological laboratory, may be reckoned the fathers of experimental psychology. Fechner was the first to formulate the psychophysical methods, a thorough grounding in which is indispensable for the avoidance of the many pitfalls of psychological experiment. To Wundt or to his pupils (especially Külpe) flocked students from other parts of Europe, and notably from America, who sought to be trained in the principles of the science. But in Italy, Austria, and Russia experimental psychology has attracted few workers. In Switzerland it has followed the

French guidance of Ribot and Janet, who laid the foundations of our modern conceptions of the disorders of memory and personality, and of Binet, who was among the first systematically to study individual mental differences and to devise tests of mental ability.

In the United States, under the influence of Stanley Hall and Titchener, and in Scandinavia, the German tradition was at first faithfully upheld. Most American, like most German, psychologists had their earlier training in philosophy, and the work published generally followed along German lines, consisting often in "maiden" papers written by candidates for the doctorate of philosophy. In this country, especially through the influence of Rivers, who went to Cambridge in the early 'nineties at the invitation of Michael Foster as lecturer in the physiology of the sense-organs, experimental psychology has developed on rather different lines. It has seldom received more than lukewarm support from philosophy, and it has been taken up by maturer workers, fewer in number, who in several instances came to it from physiology and medicine. Thus, Rivers and MacDougall began their psychological work on vision, and Myers on hearing, while later Spearman, who had graduated under Wundt, specialised in the correlation of mental abilities. In this country scientific psychology has never suffered, as in America, from the dangers of excessive popularity. Here stress came to be laid on one or other of the aspects of comparative psychology, rather than on the pure experimental psychology of the German laboratory. For it was quickly recognised that the mental differences found under different experimental conditions in any given individual are generally less in degree and less in significance than those observed under the same conditions in different individuals. True, both in England and in Germany there have been important investigations carried out upon the effects of alcohol and other drugs on the mental processes of a given individual. But even here, as also in the striking researches of Ebbinghaus and G. E. Müller on memory, the special interest has been found to lie in the study of the behaviour of different individuals. The Cambridge Anthropological Expedition to the Torres Straits, under the leadership of Haddon, which included in its *personnel* three psychologists, and the later rapid growth of the applied sciences of educational, industrial, and medical psychology, have likewise helped to stimulate the study of comparative psychology in this country.

But in Germany and in America there have also been signs of a breaking away from the initial, less fruitful (though fundamental) themes of research. Stern's work on individual psychology, following the pioneer investigations of Francis Galton in this country, and the work on animal behaviour by Jennings, Thorndike, and Yerkes in America, based on the foundations laid here by Romanes and by Lloyd Morgan, are examples in point.

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The insufficiency of the older introspective psychology, whether studied in the laboratory or outside it, has since been growing more and more obvious. Watson and others have vainly sought to establish a psychology expressed merely in terms of behaviour, Loeb and Pawlow in terms of purely mechanical or physiological processes. Head and his collaborators have shown the impossibility of analysing and tracing the evolution of sensory and higher processes save by studying the effects of lesions in the peripheral nerves and the central nervous system. Freud and his foremost pupils and critics have indicated the enormous importance of the study of the emotional, instinctive, and sub-conscious processes which are inaccessible to introspective examination. Whether or not we accept Freud's views in their entirety, his work has given an enormous impetus to psychology by laying stress on the conflicts arising from rival incompatible mental (especially emotional) processes, and by indicating the different principles which Nature and the physician may employ to combat such conflicts. The published experiences of MacCurdy and others of the American Army, and of Brown, Hart, MacDougall, Myers, Pear, Rivers, Rows, and other psychologists engaged in the treatment of functional nervous and mental disorders in the British Army during the recent war, have also shown how much can be done by the early application of appropriate psycho-therapeutic methods to the cure of such disorders.

The war has likewise emphasised, both in this country and especially in America, the great value of psychological tests in the selection of candidates for the work to which they are best fitted. The importance of psychological experiment is now becoming recognised not only in regard to vocational guidance, but also in regard to industrial fatigue, the effects of different lengths and distributions of periods of work and rest, etc.

There was a time now past when in the popular view psychological research was supposed to be limited to reaction time experiments, or was confused with "psychical research" into spiritualistic phenomena. It is true that the enormous amount of labour spent in Germany on reaction time experiments promises at length useful results in the study of emotional complexes and of vocational selection. And only by the narrow-minded can psychical research be excluded from psychological science provided that it be conducted by workers systematically trained in experimental methods and freed from personal bias and prejudice. But the most promising future developments of psychology may be looked for along quite other lines, which have been already briefly indicated in the foregoing account of its present position, more especially in the study of the effects of nervous lesions and of mental and nervous disorders, and in the examination and recognition of individual mental differences.