wind, followed by a quickly decreasing wind, the pilot can take advantage of both phases by pointing the machine into the rising wind, and with the falling wind. Quick manœuvring is, of course, essential, as well as an intimate acquaintance with the movements that are always taking place in the air.

With more complicated variations in the wind, more complex results are obtained. It is now clear, however, that the future of wind-flight is associated with three main lines of study:

(1) The motions that are continually taking place in the atmosphere need to be studied, not only the meteorological wind phenomena as ordinarily understood, but particularly the detailed air motions, the "internal structure of the wind."

(2) Motorless flight presents problems of design that are different from those of ordinary aeroplanes. This is because the glider is a much lighter machine than the aeroplane. Stability is essential, but easy control is a *sine qua non*, since so much depends upon taking as full advantage as possible of any temporary, and often unanticipated, motion in the air.

(3) The rigid dynamics of wind-flight is also an important factor in the progress of the art. Only in very exceptional circumstances can the motion of a glider be steady. Upward steady winds, or uniformly varying winds, are only of rare occurrence and brief duration, and in trying to perform real flight in an engineless machine the pilot must make use of any stray wind that comes to his aid. The motion in wind-flight must consequently be very variable. In this respect wind-flight must generally differ in essence from engine-flight. In the latter steady flight is the rule, in the former steady flight is bound to be a comparative rarity. The pilot must therefore learn from experience and from calculation to know what to expect from his machine under different conditions. The dynamics of wind-flight should be a fruitful subject of study both for the aviator and the mathematician.

The Influence of the late W. H. R. Rivers on the Development of Psychology in Great Britain.[1]

By CHARLES S. MYERS, C.B.E., M.A., M.D., Sc.D., F.R.S.

A MOURNFUL gloom has been cast over the proceedings of our newly born Section. Since its inauguration twelve months ago this Section, as, indeed, psychology in general, has suffered an irreparable loss through the sudden death, on June 4 last, of him who was to have presided here to-day. When, only a few weeks ago, it fell to me, as one of his first pupils, to occupy Rivers's place, I could think of little else than of him to whom I have owed so much in nearly thirty years of intimate friendship and invaluable advice; and I felt that it would be impossible for me then to prepare a presidential address to this Section on any other subject than on his life's work in psychology.

William Halse Rivers Rivers was born on March 12, 1864, at Luton, near Chatham, the eldest son of the Rev. H. F. Rivers, vicar of St. Faith's, Maidstone, and of Elizabeth, his wife, *née* Hunt. Many of his father's family had been officers in the Navy—a fact responsible, doubtless, for Rivers's love of sea voyages. The father of his paternal grandfather, Lieutenant W. T. Rivers, R.N., was that brave Lieutenant William Rivers, R.N., who, as a midshipman in the *Victory* at Trafalgar, was severely wounded in the mouth and had his left leg shot away at the very beginning of the action, in defence of Nelson or in trying to avenge the latter's mortal wound. So at least runs the family tradition; also according to which Nelson's last words to his surgeon were: "Take care of young Rivers." A maternal uncle of Rivers was Dr. James Hunt, who in 1863 founded and was the first President of the Anthropological Society, a precursor of the Royal Anthropological Institute, and from 1863 to 1866 at the meetings of this Association strove to obtain that recognition for anthropology as a distinct Subsection or Section which was successfully won for psychology by his nephew, who presided over us at the Bournemouth meeting in 1919, when we were merely a Subsection of Physiology.

Our "young Rivers" gave his first lecture at the age of twelve, at a debating society of his father's pupils. Its subject was "Monkeys." He was educated first at a preparatory school at Brighton, and from 1877 to 1880 at Tonbridge School. Thence he had hoped to proceed to Cambridge; but a severe attack of enteric fever compelled him to take a year's rest, and thus prevented him from competing for an entrance scholarship at that University. He matriculated instead in the University of London, and entered St. Bartholomew's Hospital in 1882, sharing the intention of one of his father's pupils of becoming an Army doctor. This idea, however, he soon relinquished; but, like his desire to go to Cambridge, it was to be realised later in life.[2]

When he took his degree of Bachelor of Medicine in 1886 he was accounted the youngest Bachelor ever known at his hospital. Two years later he graduated as Doctor of Medicine, and he spent these two and the two following years in resident appointments at Chichester (1888) and at St. Bartholomew's (1889) hospitals, in a brief period of private medical practice (1890), and in travelling as ship's surgeon to America and Japan (1887), the first of numerous subsequent voyages.

In 1892 he spent the spring and early summer at Jena, attending the lectures of Eucken, Ziehen, Binswanger, and others. In a diary kept by him during this visit to Germany the following sentence occurs: "I have during the last few weeks come to the conclusion that I should go in for insanity when I return to England and work as much as possible at psychology." Accordingly, in the same year he became clinical assistant at the Bethlem Royal Hospital, and in 1893 he assisted G. H. Savage in his lectures on mental

[1] From the presidential address delivered to Section J (Psychology) of the British Association at Hull on Sept. 11.

[2] For many of the above details of Rivers's early life and antecedents I am indebted to his sister, Miss K. E. Rivers.

diseases at Guy's Hospital, laying special stress on their psychological aspect. Meanwhile, at Cambridge, Michael Foster was seeking some one who would give instruction there in the physiology of the sense organs, McKendrick having, as examiner in physiology, recently complained of the inadequate training of the Cambridge students in this branch of the subject. Foster's choice fell on Rivers, and in 1893 he invited him to the University for this purpose. Rivers went to Germany for a short period of study under Professor Kräpelin, then of Heidelberg, whose brilliant analysis of the work curve and careful investigations into the effects of drugs on bodily and mental work had aroused his intense interest. At Cambridge he set himself to plan one of the earliest systematic practical courses in experimental psychology in the world, certainly the first in this country. In 1897 he was officially recognised by the University, being elected to the newly established lectureship in physiological and experimental psychology. But the welcome and encouragement he received from cognate branches of study at Cambridge could scarcely be called embarrassing. Even to-day practical work is not deemed essential for Cambridge honours candidates in elementary psychology; psychology is not admitted among the subjects of the Natural Sciences Tripos; and no provision is made for teaching the subject at Cambridge to medical students. Rivers first turned his attention principally to the study of colour vision and visual space perception. Between 1893 and 1901 he published experimental papers "On Binocular Colour-mixture" (Proc. Cambs. Philosoph. Soc., vol. viii., pp. 273-77), on "The Photometry of Coloured Papers" (*Jour. of Physiol.*, vol. xxii., pp. 137-45), and "On Erythropsia" (Trans. Ophthal. Soc., London, vol. xxi., pp. 296-305), and until 1908 he was immersed in the task of mastering the entire literature of past experimental work on vision, the outcome of which was published in 1900 as an article in the second volume of the important "Text-book of Physiology," edited by Sir Edward Sharpey Schafer. This exhaustive article of 123 pages on vision by Rivers is still regarded as the most accurate and careful account of the whole subject in the English language.

In 1896 Rivers published an important paper "On the Apparent Size of Objects" (*Mind*, N.S., vol. v., pp. 71-80), in which he described his investigations into the effects of atropin and eserin on the size of seen objects. He distinguished two kinds of micropsia which had hitherto been confused—micropsia at the fixation-point due to irradiation, and micropsia beyond the fixation-point, which is of special psychological importance. Rivers came to the interesting conclusion that the mere effort to carry out a movement of accommodation may produce the same micropsia as when that effort is actually followed by movement. In other words, an illusion of size may be dependent solely on central factors. His later work, in conjunction with Prof. Dawes Hicks, on "The Illusion of Compared Horizontal and Vertical Lines," which was published in 1908 (*Brit. Jour. of Psychol.*, vol. ii., pp. 241-60), led him to trace this illusion to origins still less motor in nature. Here horizontal and vertical lines were compared under tachistoscopic and under prolonged exposure. The amount of the illusion was found to be approximately the same for tachistoscopic as for prolonged exposure of the lines, but in the former the judgment was more definite and less hesitating—in other words, more naïve, more purely sensory, more "physiological"—than in prolonged exposure. Although this result is not inconsistent with the view that visual space perception depends *for its genesis* on eye movement, it compels us to admit that visual space perception, *once acquired*, can occur in the absence of eye movement; or, in more general language, that changes in consciousness, originally arising in connexion with muscular activity, may occur later in the absence of that activity. The provision of experimental evidence in favour of so fundamental and wide-reaching a view is obviously of the greatest importance.

In 1898, in which year he was given the degree of Hon. M.A. at Cambridge, Rivers took a fresh path in his varied career by accepting Dr. A. C. Haddon's invitation to join the Cambridge Anthropological Expedition to the Torres Straits. This was the first expedition in which systematic work was carried out in the ethnological application of the methods and apparatus of experimental psychology. His former pupils, Prof. W. McDougall and I, assisted Rivers in this new field. Rivers interested himself especially in investigating the vision of the natives—their visual acuity, their colour vision, their colour nomenclature, and their susceptibility to certain visual geometric illusions. He continued to carry out psychological work of the same comparative ethnological character after his return from the Torres Straits in Scotland (where he and I sought comparative data), during a visit to Egypt in the winter of 1900, and from 1901–2 in his expedition to the Todas of Southern India. His psychological investigations among the Torres Straits islanders, Egyptians and Todas (Reports of the Cambridge Anthrop. Exped. to Torres Straits, vol. ii., Pt. I., pp. 1-132; *Jour. of Anthrop. Inst.*, vol. xxxi., pp. 229-47; *Brit. Jour. of Psychol.*, vol. i., pp. 321-96) will ever stand as models of precise, methodical observations in the field of ethnological psychology. Nowhere does he disclose more clearly the admirably scientific bent of his mind—his insistence on scientific procedure, his delight in scientific analysis, and his facility in adapting scientific methods to novel experimental conditions. He reached the conclusion that no substantial difference exists between the visual acuity of civilised and uncivilised peoples, and that the latter show a very definite diminution in sensibility to blue, which, as he suggested, is perhaps attributable to the higher macular pigmentation among coloured peoples. He observed a generally defective nomenclature for blue, green, and brown among primitive peoples, both white and coloured, and large differences in the frequency of colour-blindness among the different uncivilised peoples whom he examined. In his work on visual illusions he found that the vertical-horizontal-line illusion was more marked, while the Müller-Lyer illusion was less marked, among uncivilised than among civilised communities; and he concluded that the former illusion was therefore dependent rather on physiological, the latter rather on psychological factors, the former being counteracted, the latter being favoured, by previous experience, *e.g.* of drawing lines or of apprehending complex figures as wholes.

In 1903, the year after his return from the Todas, and the year of his election to a Fellowship at St. John's College, Rivers began an investigation, continued for five years, with Dr. Henry Head, in which the latter, certain sensory nerves of whose arm had been experimentally divided, acted as subject, and Rivers acted as experimenter, applying various stimuli to the arm and recording the phenomena of returning cutaneous sensibility. The exact interpretation of this "Human Experiment in Nerve Division," published at length in 1908 (*Brain*, vol. xxxi., pp. 323-450), has been disputed by subsequent workers, whose divergent results, however, are at least partly due to their employment of different methods of procedure. Head's experiment has never been identically repeated, and until this has been done we are probably safe in trusting to the results reached by the imaginative genius and the cautious critical insight of this rare combination of investigators.

While working upon Head's arm, Rivers's indomitable activity led him to simultaneous occupation in other fields. In 1904 he assisted Prof. James Ward to found and to edit the *British Journal of Psychology*, and in that year he also received an invitation to deliver the Croonian Lectures in 1906 at the Royal College of Physicians, of which in 1899 he had been elected a Fellow. The study of drug effects had long interested him. So, reverting to the work he had done under Kräpelin many years previously, he chose as his subject for the Croonian Lectures, "The Influence of Alcohol and other Drugs on Fatigue" (Arnold, 1908). But although he utilised Kräpelin's ergograph and many of Kräpelin's methods, Rivers's *flair* for discovering previous "faulty methods of investigation" and his devotion to scientific methods and accuracy could not fail to advance the subject. Of no one may it be more truly said than of him,—*nihil tetigit quod non ornavit.* He felt instinctively that many of the supposed effects of alcohol were really due to the suggestion, interest, excitement or sensory stimulation accompanying the taking of the drug. Accordingly he disguised the drug, and prepared a control mixture which was indistinguishable from it. On certain days the drug mixture was taken, on other days the control mixture was taken, the subject never knowing which he was drinking. He found that the sudden cessation of all tea and coffee necessary for the study of the effects of caffeine induced a loss of energy, and that other mental disturbance might occur through giving up all forms of alcoholic drink. Therefore most of his experiments were carried out more than twelve months after the taking of these drinks had been discontinued. Instead of recording a single ergogram Rivers took several sets of ergograms each day, each set consisting usually of six ergograms taken at intervals of two minutes, and separated from the next set by an interval of thirty or sixty minutes. He arranged that the drug mixture or the control mixture should be taken after obtaining the first set of ergograms, which served as a standard wherewith subsequent sets on the same day might be compared. He worked with Mr. Webber on alcohol and caffeine, and was followed by the similar work of Dr. P. C. V. Jones in 1908 on strychnine, and of Dr. J. G. Slade in 1909 on Liebig extract.

With these vast improvements in method Rivers failed to confirm the conclusions of nearly all earlier investigators on the effects of from 5 to 20 c.c. of absolute alcohol on muscular work. His results with these doses, alike for muscular and mental work, were mainly negative, and indeed with larger doses (40 c.c.) were variable and inconclusive; although an equivalent quantity of whisky gave an immediate increase of muscular work—a result which strongly suggests the influence of sensory stimulation rather than the direct effect of the drug on the central nervous system or on the muscular tissues. Rivers concluded that alcohol may in some conditions favourably act on muscular work by increasing pleasurable emotion and by dulling sensations of fatigue, but that probably its most important effect is to depress higher control, thus tending to increase muscular and to diminish mental efficiency.

From the concluding passages of these Croonian Lectures the following sentences may be aptly cited: "The branch of psychology in which I am chiefly interested is that to which the name of individual psychology is usually given. It is that branch of psychology which deals with the differences in the mental constitutions of different peoples, and by an extension of the term to the differences which characterise the members of different races. . . . These experiments leave little doubt that variations in the actions of drugs on different persons may have their basis in deep-seated physiological variations, and I believe that the study of these variations of susceptibility may do more than perhaps any other line of work to enable us to understand the nature of temperament and the relation between the mental and physical characters which form its two aspects." Throughout his life Rivers was steadfast to this biological standpoint, correlating the psychological with the physiological, and hoping to discover different mental levels corresponding to different neural levels.

Now we approach the last phase of Rivers's psychological work, the outcome of his war experiences. In 1907 he had given up his University teaching in experimental psychology; for six years before the war he had published nothing of psychological or physiological interest. This was a period in which Rivers devoted himself wholly to the ethnology and sociology of primitive peoples. The outbreak of war found him for the second time visiting Melanesia for ethnological field work. Failing at first to get war work on his return to England, Rivers set himself to prepare the Fitzpatrick Lectures on "Medicine, Magic and Religion," which he had been invited to deliver to the Royal College of Physicians of London in 1915 and 1916. In 1915 his psychological and ethnological researches were recognised by the award to him of a Royal Medal by the Royal Society, of which he had been elected a Fellow in 1908. In July 1915 he went as medical officer to the Maghull War Hospital, near Liverpool, and in 1916 to the Craiglockhart War Hospital, Edinburgh, receiving a commission in the R.A.M.C. In these hospitals he began the work on the psychoneuroses that led him to his studies of the unconscious and of dreams, which resulted in his well-known book, "Instinct and the Unconscious," and in a practically completed volume on "Conflict and Dream," which is to be published posthumously. From 1917 he acted as consulting psychologist to the

Royal Air Force, being attached to the Central Hospital at Hampstead.

This period marks not merely a new phase in Rivers's work, but is also characterised by a distinct change in his personality and writings. In entering the Army and in investigating the psychoneuroses he was fulfilling the desires of his youth. Whether through the realisation of such long-discarded or suppressed wishes, or through other causes, *e.g.* the gratified desire of an opportunity for more sympathetic insight into the mental life of his fellows, he became another and a far happier man. Diffidence gave place to confidence, hesitation to certainty, reticence to outspokenness, a somewhat laboured literary style to one remarkable for its ease and charm. More than forty publications can be traced to these years, between 1916 and the date of his death. It was a period in which his genius was released from its former shackles, in which intuition was less controlled by intellectual doubt, in which inspiration brought with it the usual accompaniment of emotional conviction—even an occasional impatience with those who failed to accept his point of view. But his honest, generous character remained unchanged to the last. Ever willing to devote himself unsparingly to a cause he believed right, or to give of his best to help a fellow-being in mental distress, he worked with an indomitable self-denying energy, won the gratitude and affection of numberless nerve-shattered soldier-patients, whom he treated with unsurpassed judgment and success, and attracted all kinds of people to this new aspect of psychology. Painters, poets, authors, artisans, all came to recognise the value of his work, to seek, to win, and to appreciate his sympathy and his friendship. It was characteristic of his thoroughness that while attached to the Royal Air Force he took numerous flights, looping the loop and performing other trying evolutions in the air, so that he might gain adequate experience of flying and be able to treat his patients and to test candidates satisfactorily. He had the courage to defend much of Freud's new teaching at a time when it was carelessly condemned *in toto* by those in authority who were too ignorant or too incompetent to form any just opinion of its undoubted merits and undoubted defects. He was prepared to admit the importance of the conflict of social factors with the sexual instincts in certain psychoneuroses of civil life, but in the psychoneuroses of warfare and of occupations like mining he believed that the conflicting instincts were not sexual, but were the danger instincts, related to the instinct of self-preservation.

Thus in the best sense of the term Rivers became a man of the world and no longer a man of the laboratory and of the study. He found time to serve on the Medical Research Council's Air Medical Investigation Committee, on its Mental Disorders Committee, on its Miners' Nystagmus Committee, and on the Psychological Committee of its Industrial Fatigue Research Board. He served on a committee, of ecclesiastical complexion, appointed to inquire into the new psychotherapy, and he had many close friends among the missionaries, to whom he gave and from whom he received assistance in the social and ethnological side of their work.

In 1919, in which year he received honorary degrees from the Universities of St. Andrews and Manchester, he returned to Cambridge as Prælector in Natural Sciences at St. John's College, and began immediately to exercise a wonderful influence over the younger members of the University by his fascinating lectures, his "Sunday evenings," and above all by his ever-ready interest and sympathy. As he himself wrote, after the war work "which brought me into contact with the real problems of life . . . I felt that it was impossible for me to return to my life of detachment." And when a few months before his death he was invited by the Labour Party to a still more public sphere of work, namely, to become a Parliamentary candidate representing the University of London, once again he gave himself unsparingly. He wrote at the time: "To one whose life has been passed in scientific research and education the prospect of entering practical politics can be no light matter. But the times are so ominous, the outlook both for our own country and the world so black, that if others think I can be of service in political life I cannot refuse." On several occasions subsequently he addressed interested London audiences, consisting largely of his supporters, on the relations between psychology and politics. It was one of these very lectures—on the herd instinct—at which it happened that I took the chair, which was to have formed the basis of his Presidential Address to you here to-day.

Rivers's views on the so-called herd instinct were the natural outcome of those which he had put forward during the preceding five years and collected together in his "Instinct and the Unconscious." His aim in writing this book was, as he says, "to provide a biological theory for the psychoneuroses," to view the psychological from the physiological standpoint. He maintained that an exact correspondence holds between the inhibition of the physiologist and the repression of the psychologist. He regarded mental disorders as mainly dependent on the coming to the surface of older activities which had been previously controlled or suppressed by the later products of evolution. Here Rivers went beyond adopting Hughlings Jackson's celebrated explanation of the phenomena of nervous diseases as arising largely from the release of lower-level activities from higher-level controls. He further supposed that these lower-level activities represent earlier racial activities held more or less in abeyance by activities later acquired. This conception he derived from his work with Henry Head on cutaneous sensibility. Rivers could see but "two chief possibilities" of interpreting the phenomena disclosed in the study of Head's arm. Either epicritic sensibility is protopathic sensibility in greater perfection, or else protopathic sensibility and epicritic sensibility represent two distinct stages in the development of the nervous system. Failing to see any other explanation, he adopted the second of these alternatives. He supposed that at some period of evolution, when epicritic sensibility, with its generally surface distribution, its high degree of discrimination, and its power of accurate localisation, made its appearance, the previously existing protopathic sensibility, with its punctate distribution, its "all-or-nothing" character, and its broad radiating localisation, became in part inhibited or "suppressed," in part blended or "fused" with the newly acquired sensibility so as to form a useful product. He supposed that the suppressed portion

persisted in a condition of unconscious existence, and he emphasised the biological importance of suppression. He considered at first that the protopathic sensibility "has all the characters we associate with instinct," whereas the later epicritic sensibility has the characters of intelligence or reason. So he came to hold that instinct "led the animal kingdom a certain distance in the line of progress," whereupon "a new development began on different lines," "starting a new path, developing a new mechanism which utilised such portions of the old as suited its purpose."

Evolutio per saltus was thus the keynote of Rivers's views on mental development. Just as the experience of the caterpillar or tadpole is for the most part suppressed in the experience of the butterfly or frog, so instinctive reactions tend to be suppressed in intelligent experience whenever the immediate and unmodifiable nature of one becomes incompatible with the diametrically opposite characters of the other. Just as parts of the protopathic fuse with the later acquired epicritic sensibility, so parts of our early experience, of which other parts are suppressed, fuse with later experience in affecting adult character. "Experience," he explained, "becomes unconscious because instinct and intelligence run on different lines and are in many respects incompatible with one another."

From his point of view Rivers was naturally led, wherever possible, to interpret abnormal mental conditions in terms of regression to more primitive, hitherto suppressed activities. He held that the hysterias are essentially "substitution neuroses," connected with and modified by the gregarious instincts, and are primarily due to a regression to the primitive instinctive danger reaction of immobility, greatly modified by suggestion. So, too, he held that the anxiety neuroses, which are for him essentially "repression neuroses," also show regression, though less complete, in the strength and frequency of emotional reaction, in the failure during states of phantasy to appreciate reality, in the reversion to the nightmares, and especially the terrifying animal dreams, characteristic of childhood, in the occurrence of compulsory acts, in the desire for solitude, etc. He criticised Freud's conception of the censorship, substituting in place of that anthropomorphically-coloured sociological parallel the physiological and non-teleological conception of regression.

We are now in a position to examine Rivers's treatment of the gregarious behaviour of animal and human life, on which he was still engaged at the time of his death. In the gregarious instinct he recognised a cognitive aspect which he termed "intuition," an affective aspect which he termed "sympathy," and a motor aspect which he termed "mimesis." He used "mimesis" for the process of imitation so far as it was unwitting; "sympathy" he regarded as always unwitting. "Intuition" he defined as the process whereby one person is unwittingly influenced by another's cognitive activity. But I feel sure that the term "unwittingly" is not to be considered here as equivalent to "telepathically." All that Rivers meant was that the person is influenced by certain stimuli without appreciating their nature and meaning. He preferred to employ the term "suggestion" as covering all the processes by which one mind acts on or is acted on by another unwittingly. He supposed that in the course of mental evolution epicritic characters displaced the early protopathic characters of instinctive behaviour owing to the incidence of gregarious life, especially among insects, and owing to the appearance and development of intelligence, especially in man. The suggestion inherent in gregarious behaviour implies some graduation of mental and bodily activity—an instinctive and unwitting discrimination distinct from the witting discrimination of intelligence.

Were he here to-day Rivers would have carried this conception of the evolution of gregarious life still further by distinguishing between the more lowly leaderless herd and the herd which has acquired a definite leader. He would have traced the development of the new affect of submission and of the new behaviour of obedience to the leader, and he would doubtless have accredited the leader with the higher affects of superiority and felt prestige, with the higher cognition that comes of intuitive foresight, and with the higher behaviour of intuitive adaptation, initiative, and command. I expect, too, that he would have sketched the development of still later forms of social activity, complicated by the interaction and combination of intellectual and instinctive processes—the witting deliberations and decisions on the part of the leader, and the intellectual understanding of the reasons for their confidence in him and for their appropriate behaviour on the part of those who are led.

But it would be idle further to speculate on the ideas of which we have been robbed by Rivers's untimely death. Let us rather console ourselves with the vast amount of valuable and suggestive material which he has left behind and with the stimulating memories of one who, despite the fact that his health was never robust, devoted himself unsparingly to scientific work and to the claims of any deserving human beings or of any deserving humane cause that were made upon him. There are, no doubt, some who believe that Rivers's earlier experimental psychological work—on vision, on the effects of drugs, and on cutaneous sensibility—is likely to be more lasting than his later speculations on the nature of instinct, the unconscious, dreams, and the psychoneuroses. No one can doubt the scientific permanence of his investigations in the laboratory or in the field; they are a standing monument of thoroughness and accuracy combined with criticism and genius. But even those who hesitate to suppose that at some definite period in mental evolution intelligence suddenly made its appearance and was grafted on to instinct, or that epicritic sensibility was suddenly added to a mental life which had before enjoyed only protopathic sensibility—even those who may not see eye to eye with Rivers on these and other fundamental views on which much of his later work rested, will be foremost in recognising the extraordinary stimulating, suggestive, and fruitful character of all that he poured forth with such astounding speed and profusion during the closing years of his life. Above all, we mourn a teacher who was not merely a man of science devoted to abstract problems, but who realised the value of and took a keen delight in applying the knowledge gained in his special subject to more real and living problems of a more concrete, practical, everyday character. Rivers's careful methods of investigating

cutaneous sensibility and the *rationale* of his successful treatment of the psychoneuroses were directly due to his psychological training. So, too, his epoch-making discoveries and his views in the field of anthropology on the spread and conflict of cultures were largely due to the application of that training. Shortly before his death he was developing, as a committee member of the Industrial Fatigue Research Board, an intense interest in that youngest application of psychology, namely, to the improvement of human conditions in industrial and commercial work by the methods of experimental psychology applied to fatigue study, motion study, and vocational selection.

Unhappily, men of such wide sympathies and understanding as Rivers, combined with a devotion to scientific work, are rare. He himself recognised that "specialisation has . . . in recent years reached such a pitch that it has become a serious evil. There is even a tendency," he rightly said, "to regard with suspicion one who betrays the possession of knowledge or attainments outside a narrow circle of interests" (*Brit. Jour. of Psychol.*, vol. x., p. 184). Let his life, his wisdom, his wide interests, sympathies and attainments, and the generosity and honesty of his character, be an example to us in the common object of our meeting this week—the advancement of science.

Obituary.

PROF. F. D. BROWN.

WE regret to announce the death, on August 2, at Remuera, New Zealand, of emeritus professor Frederick Douglas Brown, at the age of seventy years. Prof. Brown began the study of chemistry in 1870, under Dr. Matthiessen, at St. Bartholomew's Hospital. On the death of Dr. Matthiessen, he continued his studies at the Royal College of Science, South Kensington and afterwards in Leipzig. On his return to England about 1876, he began research work at the London Institution with Prof. Armstrong, whom he had known at St. Bartholomew's. He then spent some time in Prof. Guthrie's laboratory and afterwards in the University Laboratory, Oxford. During this period, he was concerned in the teaching of chemistry at Cheltenham and Clifton Colleges and he also supervised the construction of the chemical laboratories in University College, Nottingham.

In 1883, Brown was appointed professor of chemistry and physics in Auckland University College, a post he held until 1914, when he came to England; but he was so upset by the conditions of the war, especially the bombing, that he gave up his intention of settling here and, in 1918, returned to the quiet of New Zealand. He did the greatest possible service to the cause of scientific education in New Zealand, where he was generally held in high esteem.

A man of original and independent, aristocratic mind but entirely unobtrusive though charming manner, firm and clear in his convictions and with a specially developed sense of accuracy and thoroughness, Brown's scientific work was of a classic character, though through force of circumstances it could not be large in amount: however, he not only made the best of the material that was at his disposal in Auckland but was also successful in inspiring those who studied under him with his own high conceptions of scientific duty. The work by which he is best known probably is that relating to fractional distillation, a subject on which he was an authority in early days; he also paid much attention to the cyanide process of extracting gold.

PROF. F. T. TROUTON, F.R.S.

AT Trinity College, Dublin, in the 'eighties of last century, there assembled under Prof. FitzGerald a small band of enthusiastic physicists of great ability and originality, brought together by a common admiration and affection for their chief. Names which will always be connected with this brilliant school of physics are Joly, Preston, and Trouton. FitzGerald himself did not live to be fifty, Preston died in his fortieth year, and now, to the great grief of all those who ever knew him, Trouton has left us at the age of fifty-eight, after having been kept by illness for the past ten years from the researches he loved.

Trouton was born in Dublin in November 1863, the son of a family well known in that city. As a student at Trinity College he gave early evidence of that versatility and quickness of grasp which characterised his scientific career. He studied both engineering and the physical sciences, and before graduating had already on one hand taken a leading part in surveying for a railway, and on the other enunciated that connexion between latent heat and molecular weight which is known as Trouton's Law.[1] He closed a brilliant undergraduate career by taking degrees in engineering and science at the same time, being awarded the coveted Large Gold Medal, rarely bestowed for science. He at once became assistant to the professor of physics at Trinity College, and until FitzGerald's death in 1901 he remained the cherished colleague and intimate friend of that great man. They carried out in collaboration many experiments, including an important series confirming, to a high degree of accuracy, Ohm's law for electrolytes. Trouton never spoke of FitzGerald without emotion characteristic of his generous nature.

The Dublin school was immediately struck with the importance of Hertz's experiments on electromagnetic waves, which were published in 1887 and 1888, and Trouton was one of the first to repeat them and to carry out original work on the subject. He settled the long-disputed question as to the relation between the direction of the vibration in the wave-front of an electromagnetic (light) wave and the plane of polarisation, by showing that the electric vector is normal to, and the magnetic vector in, the plane of polarisation. He demonstrated many analogies with optical experiments by suitably increasing the size of the apparatus to correspond to the great wave-length of the Hertzian waves—thus a wall built of bricks of paraffin wax was used to replace the soap film of ordinary light experiments. Trouton's work did much to establish the common electromagnetic nature of ordinary light and of Hertzian waves.

[1] If M be the molecular weight, L the latent heat, T the absolute temperature, then ML/T is constant.