

fresh food, and that the deaths occurred from an insufficient and a poor dietary. To suggest other causes is to trifle with the issue.

105, Harley Street, London, W. I am, your obedient servant,
ROBERT ARMSTRONG-JONES.

[Soldiers' diet in hospital: Lowest caloric value sanctioned during the war,	2,700	
" " " " Highest " " " " " "	3,832	
Soldiers' diet—front-line troops .	4,000 calories	
L.C.C. Mental Hospital Dietary .	Males unemployed . 2,468 to 2,542	"
" " " " " " " " " " " "	" employed . 2,829 to 2,903	"
" " " " " " " " " " " "	Females unemployed . 2,025 to 2,255	"
" " " " " " " " " " " "	" employed . 2,476 to 2,646	"
Men—sedentary	2,500 to 2,800 calories	} E. I. Spriggs, M.D.
" labourers	3,500	
" heavy work	4,000	
Women—light work	2,000 to 2,200	
" heavy work	2,800	

Eds.]

OBITUARY.

KORBINIAN BRODMANN.

The death of Brodmann is a grievous loss to neurology and psychiatry, not only in Germany but throughout the world. From a memoir by Nissl in the first volume of the *Arbeiten aus der Deutschen Forschungsanstalt für Psychiatrie in München* we glean the following information about him. He was the son of a farmer at Liggersdorf, in Hohenzollern, and was born on November 17th, 1868. After studying medicine at Munich, Würzburg, Berlin and Freiburg, he gained his qualification in 1895. In 1896 he became an assistant at the Nervenheilstalt, Alexanderbad, then under the direction of Oskar Vogt. In 1897-8 he worked for a year at the Pathological Institute at Leipzig. He was an assistant medical officer at the Psychiatric Clinic at Jena (1898-1900), and at the Asylum at Frankfurt (1900-1). From 1901 to 1910 he was an assistant in the Neurobiological Institute of the Berlin University under Vogt. From 1910 to 1916 he was a medical officer of the Psychiatric Clinic at Tübingen, and during the war served voluntarily as a medical officer of a military reserve hospital at Tübingen until May, 1916, when he was appointed by Pfeiffer to a newly-created anatomical post at the Landesheilstalt, Nietleben, near Halle. To Pfeiffer belongs the credit of giving Brodmann such an appointment and such material means as would enable him to continue his researches: until now he had never had an assured social position. At Nietleben he married. In April, 1918, he moved to Munich, having been chosen by Kraepelin to be head of the Department of Topographical Histology in the new German Institute of Psychiatric Research. Happy in his recent marriage and in his new post, and full of plans for work, he was stricken with severe septic poisoning, and after a few days' illness died on August 22nd, 1918. "By his death," says Nissl, "the great hopes we had built on his appointment have been brought to nought. And the saddest thing is that in a certain sense his loss is irreparable. Germany has no second investigator possessing Brodmann's knowledge of the cell architecture of the cerebral cortex, or his ability to put that knowledge to use."

As an investigator Brodmann stands, of course, upon the shoulders of those who preceded him, first among whom must be mentioned Meynert (1868), Betz (1874), and Bevan Lewis (1878, 1880). But such technique as those men could command was so crude that for many years nothing more was discovered, and no further progress was possible until the introduction of a selective stain for nerve-cells. Nissl's method of staining with methylene blue opened the way for a fresh advance. The first investigations of the cell-architecture of the cortex by means of selective cell-staining were those of Hammarberg (1895) and Schlapp (1898). In 1900 Shaw Bolton described two different types of structure in the cortex of the human occipital lobe, mapped out the calcarine area, and made the observation that the line of Gennari with the granules immediately above and below it,

represents simply a threefold division of a single layer. This observation gave Brodmann the principal clue to the divisibility of the cortex of the whole neopallium into six laminæ, and so enabled him to clear up the confusion then reigning in the nomenclature of the layers.

When, on going to Berlin in 1901, Brodmann set himself the task of making a topographical survey of the human cortex according to the cell-architecture of its different regions, he saw that if his work was to lead to a knowledge of the structural laws of the cortex and to an explanation, on common principles of organisation, of the multiplicity of structural arrangements met with, it would have to be established on a broad basis of developmental and comparative anatomy. Some idea of the immensity of the labours he accomplished in the course of the next few years can be gathered from his celebrated book, *Vergleichende Lokalisationslehre der Grosshirnrinde*, published in 1909. An even more impressive insight into his activity is afforded by his series of *Mitteilungen* (1903-8), for in them we can follow the steps of his research in detail. Not only had he to amass and investigate a great quantity of anatomical material extending over the whole mammalian series, but he had to perfect a special technique. For his purpose he required complete uninterrupted series of faultless, thin and truly plane sections through the whole cerebral hemisphere. He worked out for himself a method of paraffin embedding, and he had a special microtome constructed to his design. The sections had to be selectively stained for nerve-cells and suitable for microphotography. The microphotographs illustrating his publications give no right idea of what microphotography meant for Brodmann's researches, not merely as proof of his statements, but as an essential means of investigation, permitting a simultaneous review, such as the visual field of the microscope can never afford, of wide regions of the hemisphere. Microphotographs show the limits and transitions of the different areas better, and the cortices of different animals can be more easily compared. With the further aid of outlines of the sections, drawn by means of the Edinger projection apparatus, he was able to prepare his famous maps. In 1905 he produced the maps for apes, showing twenty-six distinct areas; in 1909 the maps for man, showing fifty-two areas.

In delimiting areas he relied, not on the behaviour of any single lamina or group of cells, but on the structural arrangements throughout the whole thickness of the cortex. The areas thus delimited he designated by numbers, and he applied identical numbers to homologous areas in different animals of the mammalian series. Designation by numbers is not merely convenient; it has the advantage of avoiding premature assumptions as to the functions of the areas. But Brodmann never regarded descriptive anatomy as an end in itself; for him it was simply a step towards the elucidation of function. Function creates form; therefore if two portions of cortex differ in structure they must differ also in function. This is the justification for his reliance on the totality of the structural characters throughout the whole thickness of the cortex, as the principle upon which his delimitation of areas was to be based. But as there is no light that does not cast some shadows, his insistence on this very sound principle led him rather to under-estimate the importance of another aspect of his problem. Are we to regard the whole thickness of the cortex as constituting the functional unit? How if two portions of cortex structurally differ in respect of a single lamina only? Must there not be some localisation of function in the laminæ taken severally? Bolton (1900, 1903) and G. A. Watson (1907) showed that there is, and to a considerable extent what kinds of functions are thus localisable. Ariëns Kappers (1909) gave additional significance to their observations by relating them with new facts in comparative anatomy. And Brodmann himself, besides confirming Bolton's observation that the inner layers mature earlier than the outer, showed that in lower orders, in contrast with man, they frequently exceed the outer in thickness. But unfortunately, though quite naturally and excusably, he felt he must needs enter into a comparison of the merits of his principle of total structure and the principle of localisation according to layers. His principle has its own great value and use, but, as Nissl says, it is not "superior to" this stratigraphic principle.

The most striking instance of the value of Brodmann's principle is seen in its application to the cortex of the frontal lobe. He showed that the frontal lobe is divisible into two main parts, developmentally different and structurally delimitable; a posterior portion, the regio præcentralis, situated immediately in front of the

Rolandic sulcus, and coincident, according to modern physiological knowledge, with the motor area; and an anterior portion, the regio frontalis, which extends to the frontal pole and orbital surface, of whose precise function, even in man, hardly anything is yet known. While in lower mammals this frontal cortex proper is almost entirely wanting, it develops in the animal series in increasing degree, not only in superficial extent, but in respect of differentiation of its component areas. In the rabbit, for example, it constitutes only 2·2 *per cent.* of the total cortex; in man, 29 *per cent.*

How is Brodmann's work to be continued, and what new inquiries arise out of it? Some of the areas that he distinguished are not sharply demarcated, but fade into one another gradually; the limits assigned to these will have to be adjusted by other criteria, *e.g.*, the results of anatomical experiment. The cortex is directly connected with the thalamic nuclei; what particular cortical areas, then, are connected with particular thalamic nuclei? "I can see still," says Nissl, "the gleam in Brodmann's eyes as I showed him my preparations proving that his areas '24' and '32' in the rabbit are exclusively and directly connected with a certain thalamic nucleus of very characteristic structure." Clinical experience and pathological observations will doubtless help to clear up many points not yet settled. But the greatness of Brodmann's work, carefully and elaborately detailed as it is, does not lie in details; it lies in his thorough investigation of the cortex through the entire mammalian series from one unvarying standpoint. Whatever the future may have to tell us about the details, his fame as a chief creator of the science of the cyto-architectonics of the cortex is assured for all time; the practical usefulness of his principles is absolutely established. In comparative anatomy their usefulness for ascertaining homologies in different animals needs no further indication here. For anthropology his work opens a great vista: he himself, only a few days before his death, was working on Herero brains. The promise that it offers for neurology is obvious; his last published paper, for example, dealt with individual variations of the visual cortex and their clinical significance in cases of bullet-wound of the occiput. The promise for psychiatry is equally great, not only in the way of correlation of particular disease forms with particular distributions of cortical lesions, but in reference to arrests of cortical development and the persistence of fetal stages in lamination.

SYDNEY J. COLE.

NOTICES OF MEETINGS.

Annual General Meeting.—(Provisional), July 13th, 1921, London.

Quarterly Meetings.—February 24th, 1921; May 26th, 1921.

South-Western Division.—April 24th, 1921.

Northern and Midland Division.—April 21st, 1921, Gateshead Mental Hospital, Stannington.

APPOINTMENTS.

WALKERS, ENID M., M.B., B.S.Lond., Assistant Medical Officer, Dorset County Mental Hospital, Dorchester.

WILSON, A. C., M.R.C.S., L.R.C.P.Lond., Senior Assistant Medical Officer to Peckham House.

NOTICE TO CONTRIBUTORS.

N.B.—The Editors will be glad to receive contributions of interest, clinical records, etc., from members (whether these have been read at meetings or not) for publication in the Journal. They will also feel obliged if contributors will send in their papers at as early a date as possible in each quarter.

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Papers read at Association Meetings should not, therefore, be published in other Journals without such sanction having been previously granted.