water containing powdered carmine. It was noticed, that, although all the cells took up the carmine, the epithelium of the ciliated chambers soon ejected the granules, while the cells of the upper surface of the subdermal cavity gave them off to the amoeboid wandering cells of the mesoderm, which, after they had partly digested the carmine, transmitted it to the cells of the ciliated chambers for ejection. He concluded, therefore, that although all the cells had the power of absorption, as is the case in man, still the digestive function in the species upon which he experimented was centralized in the upper wall of the subdermal cavities. Other authors have held different views; and in a subsequent paper he himself has concluded that it cannot yet be decided whether sponges digest with the ectoderm or the entoderm, though he considers it not improbable that both layers may have that function. His papers will be found in the Proceedings of the Linnean society of New South Wales.

R. von Lendenfeld has also described in the *Annals and magazine of natural history* for December, 1884, a new variety of Medusa which may prove to be a new species evolved within the last forty years. The species is Crambessa mosaica, which Huxley in 1845 described from Sydney, Australia, as blue to gray, but which is now found in this locality distinctly brown in color, due to a parasitic alga which infests the flesh near the surface. The evidence is sufficient to cause von Lendenfeld to state that it is probable that this new variety has been born since Huxley described it in 1845. He also mentions the case of another Medusa (Cyanea annaskala) which has hitherto been found only at Port Philip, where it is abundant, but which has recently been found at Port Jackson in warmer water. Those in the latter place differ from the typical species in being much larger, and, besides, in possessing deep-purple pigment-cells around the mouth-arms, which he thinks may be able to perceive light. He makes a new variety from this variation of color.

THE ANATOMY AND PHYSIOLOGY OF THE BRAIN IN THEIR RELATION TO MENTAL DISORDERS.

Treatises upon insanity have been appearing recently in quick succession, both in this country and abroad. There is none, however, which will command more notice, and prove more suggestive, than this work.

Professor Meynert, who has been at the head of the department of psychiatry in the University of Vienna for the past fifteen years, was one of the first to advance the opinion that a study of mental disease must be preceded by an understanding of healthy mental action. Regarding mental action as the subjective side of a physiological process in the brain, he seeks primarily to ascertain the function of the organ from its anatomical structure. The logical order which is followed in this work is therefore, first, the anatomy of the brain; second, the physiology of the brain, that is, the mechanism of mind; and, lastly, disturbances of the mechanism, that is, mental disorder.

The first volume is devoted to the structure and functions of the organ of mind. The position which Professor Meynert holds as the founder of modern brain-anatomy entitles him to a respectful hearing on this subject. Since the appearance of his first articles in Stricker's 'Handbook of histology' in 1870, he has been the chief authority in Germany; and almost every one of the younger scientific men who have done original work in this department has been imbued with his enthusiasm by personal contact with him in his laboratory. Within a hundred and twenty-five pages he has succeeded in giving a clear statement of the complex subject of the arrangement and relations of the gray masses and white connecting-fibres which make up the brain. An important aid to the comprehension of the structure will be found in the numerous excellent drawings of dissections and of microscopic sections.

The gray matter of the nervous system is the part in which sensory impulses are received and registered, and in which motor impulses are initiated. The white matter is made up of threads which transmit the impulses without modifying them. The structure and functions of the gray matter differ in different parts; simple functions being performed by that in the spinal cord, more complex functions in the gray masses within the brain, the most complex and the conscious functions being assigned to the layer which is spread out upon the surface of the brain, and which is thrown into folds by its convolutions. Each part of the surface of the body is in anatomical connection, by means of nerve-fibres, with its own part of the surface of the brain; and thus it is not difficult to imagine a projection of a map of the body upon the brain-cortex. The fibres which act in this manner to bring the external world into consciousness are named by Meynert 'the projection system of tracts.' This 'projection system' was announced in 1870, and was the starting-point to which all the recent discoveries regarding the localization of functions in various regions of the brain can be traced. It is to-day the ground-work for many arguments in favor of the theory of localization, — a theory to which Meynert gives his hearty support.

At present, investigations in brain-anatomy

Psychiatrie. Klinik der erkrankungen des vorderhirns begründet auf dessen bau, leistungen und ernährung. Von Dr. Theodor Meynert. Erste hälfte. Wien, *Braumüller*, 1884. 10 +288 p., illustr. 8°.

are directed to tracing the course of the tracts which unite the gray masses, and form the parts of the projection system. Owing to the discovery of new methods of investigation, progress has been rapid of late. It is not to be wondered at, therefore, that in regard to some details, the statements of Meynert, which were already in print three years ago, cannot now be accepted; e.g., as to the course of the lemniscus (pp. 94–97), and the connection of the tracts in the spinal cord with those in the cerebral axis (pp. 120–125). The diagram (fig. 58) is especially misleading. It is probably on account of these errors that an appendix is promised, to appear with the second volume, and to contain a review of the more recent discoveries. These minor defects do not, however, impair the usefulness of the work as a general text-book of brain-anatomy; and it is a matter of congratulation to those who are unable to master the very difficult style of the author, that an English translation is soon to appear.

It is by means of the projection system that impulses from without reach the brain-cortex, and become conscious perceptions. To associate these perceptions, and make connected thought possible, there exists a second system of fibres which unites the various regions of the brain-surface with each other. This is the 'association system.' Meynert illustrates the action of these systems by analyzing the simple act of winking. If a pin touches the eye of an infant, the lid closes. This is a reflex act, carried out by a simple mechanism independent of any act of consciousness; but, coincident with the reflex act; a number of impulses are sent along the projection fibres to the brain, which, on reaching the cortex, give rise to the conscious perception of the appearance of the pin, of the pain of the prick, and of the motion which has been performed. Each of these perceptions occurs in a different part of the brain, since each impulse reaches it by a different fibre. But the three occur simultaneously; and, as all parts of the cortex are joined by association fibres, the three perceptions are associated both in perception and in memory. Hence, when the pin is seen again, the memory of the pain arises, and also the memory of the motion which stopped the pain, and thus the mere sight of the object may lead the child to close the eye. The perception of the reflex motion has given the infant the knowledge of the possession of a muscle which will move; and the motion, having once become conscious, can be reproduced voluntarily by an effort which excites to action those cells which retain the memory of the motion (pp. 144–148). Every perception and motion has its appropriate cell; and, lest this should seem to demand too great a number of cells, Meynert has examined the cortex microscopically, and has found that it contains over a milliard of these bodies (p. 140). Each physiological action is attended by the acquisition of a new memory, and, as we go on in life, the number of cells unoccupied becomes less and less; so that it is probable that a physical limit to the power of memory, and consequently to the power of intellectual growth, is determined by the number of cells in the cortex (p. 140). This is the stand-point of an extreme materialist. But Meynert's materialism is not of the theoretical kind: it is based upon facts of observation which cannot be ignored. The structure of the brain, its comparative development in various species, the evolution of mind in animals, the growth of knowledge in children, the results of experimental physiology, and the symptoms of mental dissolution in a class of cases in which disease has reduced the individual to the level of the infant, or even to that of the brute, have been called on to furnish the data for Meynert's mechanism of thought. Psychologists are slowly coming to the conclusion that a wholly subjective method of research is inadequate to settle the questions which for so many years they have been unable to answer, and are beginning to pursue an objective method by studying the development of mind, and the disorders of mind which are associated with actual loss of brain-substance. To psychologists, therefore, this book is of great importance; for it opens up many new subjects, it throws light on many obscure subjects, it settles finally some disputed subjects.

Physiological processes are attended by the consumption of material: hence the nutrition of the brain enters as a factor in mental action. When a part of the brain is exercised, more blood passes to that part than to other parts to supply oxygen as it is needed. The rapidity and quality of the mental process is dependent to some degree upon the proper blood-supply. These are facts determined by experiment on animals and man. Mental labor is attended with a rise of temperature in the brain, an indication of increased oxidation processes. If a dog's brain is laid bare, the vessels are seen to be less distended with blood during sleep than when it is awake. If the dog dreams, the vessels dilate. An abnormal flow of blood to the brain interferes with the natural action of the organ: it may cause an irritation of the cells containing memory pictures, and consequently a conscious perception of the object

remembered by the cells, i.e., hallucinations. So, too, an abnormal lack of blood may exhaust the brain, may render a person incapable of carrying on mental processes, and may even cause such a degree of hunger for oxygen in the cells as in turn to produce irritation, and thus again hallucinations, followed by loss of memory. It is evident that Meynert regards many forms of mental disease as dependent upon abnormal nutrition of the brain, either from hyperaemia or anaemia, — a position in which he by no means stands alone.

The description of physiological processes in the brain forms a fitting introduction to the study of its disorders. This division of the subject is to be taken up in the second volume, which will be eagerly looked for by those who have read the first. It will doubtless be as suggestive and original as this volume.

Meynert's book should be read both by medical men and those interested in the problems of psychology. Its technical parts will be of great service to those who study the minute anatomy of the brain. Its physiological portion is of general interest, and will excite much notice and comment. The facts and the conclusions are entitled to careful consideration, as they are the product of most mature and thorough work, even though the materialistic explanation is at times inadequate. Meynert is not to be placed in the ranks of German philosophers. He does not grapple with the problems of psychology, as Lötze or Wündt have done: he writes from the stand-point of an alienist who seeks to resolve a mental process into its simplest elements, and to detect in any given case of mental disorder the particular element which is lacking. The explanation of the manner in which we acquire the idea of space is unsatisfactory (p. 166). The causal relation is not sharply differentiated from the simple association of ideas by correlation in time (p. 164). The time element in memory is not exhaustively discussed. There are, doubtless, many trains of thought which are largely the simple rising into consciousness of associated memory pictures. There are others which are not to be so easily accounted for, and to which no clew can be gained by a study of association fibres and of variations in the blood-supply. To the psychologist, therefore, this work will be of service only as a collection of facts in one department bearing upon his science, — facts which he must consider, but which by no means carry with them the explanation of the problems involved.

The work raises many questions which the author does not attempt to answer. It would perhaps be unjust to demand from him the attempt, for he does not pretend to be writing as a psychologist. As a study of thought-mechanism, and as an introduction to a study of psychiatry, to which alone it lays claims, it is more satisfactory than any work which has recently appeared.

ENGINEERING GEOLOGY.

It is now generally admitted by mining and civil engineers that a knowledge of the principles of practical geology is necessary for the successful execution of those plans, depending upon a correct conception and understanding of the character of the surface of the earth and underlying rocks, where engineering works, such as bridges, railroads, canals, and even buildings, are to be constructed, and through which, as in the case of railroad-tunnels and mines, excavations are to be made.

The rapid progress which has been made in America during the past fifteen years in practical geology has so completely absorbed the active professionalist, that none of our field-geologists have found time to contribute a treatise to our literature such as Geikie's Field, Penning's Engineering, and Page's Economic geology, Burat's 'Géologie appliqué,' and the more recent work by Wagner, on 'The relation of geology to the engineering sciences.'

This last work is an elaborate and strictly technical discussion of the application of practical geology to tunnel-work and closely related subjects. It contains superior plate (quarto photolithographs) and text illustrations, and will prove a work of great value, not only to professional field-geologists, but to students in practical geology and engineering, in defining some of the more useful and economically important applications of geology to engineering work.

Some of the geological cross-sections in the text clearly illustrate the geotectonic principles referred to, but evidently perpetuate an abominable custom, long since abandoned by the best American geologists, of exaggerating the vertical scale. The chapter on explorations by boring is not up to the standard of our home practice.

The practical examples cited from Wagner's own experience add much value and interest to the work, which would be more useful to

Die beziehungen der geologie zu den ingenieur-wissenschaften. Von C. J. Wagner, ober-ingenieur und sectionsleiter des Arlberg-tunnels. Wien, *Spielhagen & Schurich*, 1884. 88 p., 65 figs., 24 pl. 4°.