suffers somewhat in comparison with the New Jersey one through faulty editing; there are many more diagrams in the former than in the latter work, but they are sometimes too small for the matter they contain (p. 572); they are rather untidy in appearance, and are frequently inserted sideways in the text when they should be upright. The chemical portion is unnecessarily duplicated, and the important table of analyses (p. 344) is rendered useless for ready reference by the complete omission of silica.

Both books are provided with maps of the geological distribution of the clays, with abundant photographic illustrations of varying degrees of value, with a directory of the clayworkers in the State, and fairly numerous references to the literature of the subject. In each case the section dealing with pottery is weak.

Prof. Ries still maintains that the most generally useful way of expressing the chemical nature of a clay is through the ultimate analysis, though he admits the value of the so-called "rational" analysis in the case of the higher grade clays; with this view we are entirely in accord. Messrs. Beyer and Williams appear to lean somewhat towards the "rational" analysis, and have given the results in this form along with the ultimate analysis—a useful custom. Their method of dividing the ultimate analysis into "sand and clay," "total fluxes," and "moisture, CO_2 and SO_3," is convenient. The influence of titanium on the fusibility of clay is rightly emphasised by Ries; in this country it has been very generally neglected in analyses.

The physical tests applied to clay products were:—compression tests, transverse tests, absorption tests, and freezing and thawing (Iowa only); of these, the second is held in highest esteem; it is certainly far superior to the crushing test in most cases, but we are among those who do not agree with Prof. Marston that for *paving* brick it can take the place of the "rattler" test; the objections he urges against the latter may be applied with equal force to the former, while he admits that the action of the "rattler" approximates more closely to the kind of wear to which paving bricks are subjected in actual use.

From a multitude of councillors we expect wisdom; it is none the less true that if the councillors will not consult one another we are apt to get only confusion. Everyone who publishes some results of physical tests of clays and clay wares seems to think that these should become recognised standards at once. The two authorities here cited are no exception; each one stoutly believes that its own favoured methods should be adopted for general use. There is here a satisfactory unanimity as to the kind of test required, but when we come to details of application, we find considerable divergence of practice in precisely those points which together go to constitute a standard test.

Thus in obtaining the modulus of rupture in the "transverse" test of bricks, New Jersey employs rounded knife-edge contacts alone, while Iowa interposes steel bearing-plates between the brick and the knife-edges; in the crushing and absorption tests New Jersey uses half a brick, Iowa grinds out from the brick a 2-inch cube; again, the former measures linear shrinkage and calculates the cubic shrinkage, the latter reverses the process, using a Seger volumeter for the purpose. For estimating texture (fineness of grain) Iowa employs a modification of Whitney's method, New Jersey uses a centrifugal apparatus. Further, there is an important difference between the methods of collecting materials; Prof. Marston asks for a fairly large consignment to be sent by the manufacturer, and tests twenty or more bricks in the transverse way; on the other hand, members of the New Jersey Geological Survey staff pick out five to seven representative bricks on the spot, and send them to be similarly tested by Prof. Ries. Useful though these tests may be for local reference, it is evident that a standard series of tests will never be arrived at by such isolated endeavours; indeed, we cannot help feeling that in these and similar publications there is much duplication and waste of energy through the lack of a little coordination.

There will be diversity of opinion as to the expediency of the State taking upon itself the task of publishing tests of manufactured wares; it stands in the same relationship to producers as to consumers, yet, while such publications may be supposed to benefit the latter class uniformly, a considerable injustice might conceivably be done to one of the former the ware of which took a lower place in the scale. This danger is exemplified to some extent in the Iowa report, which mentions the names of firms in conjunction with the results, and the effect is too much like an advertisement. New Jersey adopts the plan of publishing the laboratory number of the test; the manufacturer has the result communicated to him privately. For our part we doubt the wisdom of such publication, except upon lines similar to those on which watches and thermometers are tested in this country.

But good maps of the distribution of the clays, the preparation and collection of comparable data of the physical and chemical properties of the *raw* materials, experiments on the results of blending hitherto unworked clays with one another and with known clays, and the coordination of the information and samples in a manner accessible to all, is the legitimate duty of a State department, and of the utmost value to all sections of the community.

The Geological Surveys of Iowa and New Jersey have performed most of these duties in a manner which cannot fail to be appreciated. When we remember that in addition to this Geological Survey work there is in each State a well equipped ceramic laboratory for testing and for instruction in the manufacture of all grades of wares—the department of ceramics in the State College of New Brunswick has an outfit in the brick-making section capable of turning out 20,000 bricks per day—we are constrained to turn our eyes to our own State, where we see the capital pioneer effort of an individual, George Maw, nearly fifty years ago—and what beside? "Comparisons," as Mrs. Malaprop says, are "obvious."

THE CEREBELLUM: ITS RELATION TO SPATIAL ORIENTATION AND LOCOMOTION.[1]

AS the cerebellum is well represented in the lowest vertebrates and undergoes relatively little change in form with the higher development of the rest of the brain, it must be regarded as a fundamental structure of the vertebrate nervous system. This may be one of the reasons that much interest has centred in its study and in the attempt to define its functions in exact physiological terms. Though Willis (Oxford, 1660) noted the intimate connection between the cerebellum and pons Varolii, and recognised that the trapezial fibres of the latter are a cerebellar and not a cerebral system, and though Majendie laid the first foundations of our knowledge of its functions, it has only been of recent years that we have gained, chiefly from the work of Luciani and the workers who followed him, satisfactory insight into its anatomy and physiology.

In the lecture, Sir Victor Horsley analysed the conclusions on its functions which have been obtained by the destruction and stimulation methods of study, and in addition contributed from his clinical and laboratory experience some facts which help to elucidate the *rôle* it plays in our nervous economy.

In the first place all recent work confirms the conclusion formulated years ago by Edinger, that the cerebellum is essentially an organ for the reception of certain sensory impulses. Systems of fibres ascending from the spinal cord convey to it part of the sensory impulses which enter through the dorsal roots from the cutaneous and more deeply placed peripheral nerves. These tracts of fibres end in the cerebellum exclusively in its vermis or middle lobe. To the vermis also come direct root fibres of the vestibular nerves which collect from the semi-circular canals, the organs of the special sense of orientation in space, the sensations of change of position and of the position of the head in space. The lateral lobes of the cerebellum, on the other hand, are in connection through the pontine grey matter with the temporal lobes and with the kinæsthetic cortex of the forebrain. All these systems which conduct to the cerebellum end in its cortex, and

[1] Abstract of Boyle Lecture delivered by Sir Victor Horsley, F.R.S., before the Junior Scientific Club of the University of Oxford, June 5.

from the latter—and this is a new fact of great significance—no true efferent fibres arise. The efferent or motor mechanism of the cerebellum is contained in its nuclei, the system of roof nuclei being in connection with the cortex of the vermis, the nucleus dentatus with that of the lateral lobe. The cortex of the cerebellum is thus the special organ for the reception of sensory impressions, while its nuclear system may be regarded as its motor or efferent mechanism.

The functions of the cerebellum must be studied in relation to the sensory impressions it receives and to the activity of other centres. While it is the cortex of the forebrain which consciously appreciates and records our sensory impressions and initiates purposeful actions, it is the cerebellum which automatically preserves our equilibrium, guides our locomotion, and assists to regulate our finer movements. Thus its functions are in part reflex or involuntary, dependent on the sensory impulses which reach it directly or through the forebrain, and in part to coordinate and regulate the muscular contractions generated in the kinæsthetic cortex, especially those which result in movement in space and those on which the maintenance of equilibrium depends. The accuracy of equilibration is necessarily dependent on our knowledge of our position in space. This is obtained chiefly by vision, but as our visual fields are small in relation to the space in which we exist, sight must be supplemented by the power to turn the head and eyes in the three planes of space. There is conclusive clinical and experimental evidence that the coordinated execution of these movements is largely represented in the ponto-cerebellar centres. The sense of touch is also a valuable aid in spatial orientation, for though by touch the body can be aware only of the surface with which it is actually in contact, we can explore, as blind men do, our neighbourhood by the movements of our limbs. The memory of space so obtained is stored up in the kinæsthetic cortex, and disease of this region diminishes or destroys our knowledge of points on the surface of our body so far as their precise position in space is concerned, and consequently the effective movement of the limb. It has been long recognised that one of the most prominent signs of destructive lesions of the cerebellum is the inability to move a limb in a coordinate manner towards any point, but it appears probable from some not yet concluded observations of the lecturer that the faculty of localisation of points of the body in space is also defective with disease of the cerebellum. The touch sensations from the portions of our body resting on our base, the pressure sensations in our joints, and the sensations of tension in our muscles are also requisite for the automatic maintenance of equilibrium. These are some of the sense impressions which pass to the cortex of the vermis by the anatomical tracts referred to.

It would appear that the cortex of the vermis receives the sensory impressions necessary for movement in the anterolateral plane and for bending backwards and forwards; with lesions of this part there is a tendency to fall forwards or backwards. The lateral lobes, on the other hand, receive through the middle peduncles, as Majendie demonstrated, the stimuli necessary for rotation on the longitudinal axis.

From the cortex of the cerebellum, which is constantly receiving these waves of sensory impressions, the cerebellar nuclei collect the properly associated impulses which regulate and reinforce the purposeful movements and the automatic actions of the individual.

This latter position has been established by the researches of Dr. Clarke and the lecturer during the past three years.

Luciani's discovery that the cerebellum is also a source of energy to the muscles, which become asthenic and hypotonic on its destruction, is also fully confirmed by the lecturer's own work.

In conclusion, this sketch of the cooperation of the cerebellum and cerebrum was illustrated by a quotation from Boyle, who said:—"I consider the body of a living man not as a rude heap of limbs and liquors but as an engine consisting of several parts so set together that there is a strange and conspiring communication between them."

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE University of Melbourne has received a largely increased endowment from the Government of Victoria on condition of instituting a course for a degree in agriculture. The necessary arrangements for such a course have now been made, and the university is inviting applications in England and America for a professorship of botany and a lectureship in biochemistry in connection with the school of Agriculture. A new professor of anatomy is also to be appointed for the rapidly growing medical school.

THE Drapers' Company has made a further grant of 5000*l.* for an extension of the premises of the East London Technical College. In addition, the company has largely developed its scholarship scheme. Next year nineteen scholarships will be awarded of the value of 40*l.* per annum, tenable at the college for three years. Certain of these scholarships are reserved for women, while others will be awarded in the subjects of the London arts degree. The governors of the college have extended the work by introducing a course in languages and literary subjects. Students taking this course will study under recognised teachers, and be internal students of the University of London. As a consequence of this development, the governors have decided that the college shall, in future, be known as the East London College.

PROBATE has been granted of the will of Mr. John Innes, of Merton, Surrey, who died on August 8, 1904, leaving the sum of about 200,000*l.* for public and charitable purposes. Among other bequests he left his house, the Manor Farm, Merton, and two acres of ground, "to establish thereon a school of horticulture or such other technical or industrial institution as the law will allow, to give technical instruction in the principles of the science and art of horticulture and the necessary physical and mental training incidental thereto; to erect suitable buildings and furnish them, and to provide workshops, tools, plant, scientific apparatus, libraries, reading-rooms, lecture and drill halls, a swimming bath, and gymnasium. If this may not be legally carried out, then to establish in these buildings a public museum for the exhibition of collections of paintings and similar works of art, objects of natural history, or of mechanical or philosophic inventions, and to lay out land for a park."

MR. S. HERBERT COX has been appointed to the professorship of mining at the Royal School of Mines, South Kensington, vacant by the death of Sir Clement Le Neve Foster. In view of the changes in organisation that may be found desirable in the Royal College of Science and the Royal School of Mines after the completion of the investigations now in progress by the departmental committee, the appointment has been made a temporary one. Mr. Cox is an Associate of the Royal School of Mines. After experience as assistant geologist and inspector of mines in New Zealand, he was appointed instructor in geology, mineralogy, and mines in Sydney Technical College; concurrently with his tenure of this office he was employed to give technical lectures at various mining camps in New South Wales, and practised as a mining engineer. Since 1900 he has been entirely engaged in private practice, and has had experience of mining in England, France, Spain, Egypt, the United States, and Canada. Mr. Cox was president of the Institution of Mining and Metallurgy in 1899–1900.

THE *London University Gazette* (August 9) publishes the following announcement referring to the endowment of a chair of protozoology:—"The senate had before them a communication from the Secretary of State for the Colonies, offering the university the sum of 700*l.* a year for five years for the purpose of instituting a chair of protozoology. Of this sum, 200*l.* a year was stated to be a contribution from the Rhodes trustees, and 500*l.* a year to represent a moiety of a grant originally made from the tropical diseases research fund (established under the auspices of the Colonial Office) to the Royal Society for the promotion of research work, and by the Royal Society surrendered for the purpose of endowing the chair. Having considered reports upon this offer from the academic council, and from the board of advanced medical studies and the boards of studies in botany and zoology, the