

brecciation in the magnesian limestone of Durham, showed that the beds have been thrust against a horst, the flexible beds have been deformed without being much broken, while the harder, brittle limestone has been highly brecciated. He estimates that the amount of lateral displacement has been about 100 yards, and by experimental tests he indicates the magnitude of the thrust to have been about 300 tons per square foot.

The president, in opening a discussion on mountain building, referred to recent investigations on mountain structure, which revealed the fact that in the overlap of recumbent folds the uppermost folds were of greater span than those beneath, and this could not be explained on the notion that horsts of the accepted type were responsible for the features observed. He calculated that at the depth at which the horsts were supposed to exist the rocks would be in a viscous condition owing to radio-active heating and incapable of transmitting a direct thrust. With rigid rocks overlying a viscous mass he showed that compressive forces would cause the rocks to bulge upwards, and lying folds would be produced. Sir Archibald Geikie described the two-fold types of mountains, one possessing the Alpine structure and the other taking the form of plateaux upraised without disturbance except at their margins. He could not accept the explanation offered by Suess for the latter type, that the sea had fallen. He reminded the audience that folding was not all of one age, and the forces which have produced the Alps in the past may be acting at the present day.

Prof. Lapworth, in describing the principal mountain ranges on the earth's surface, urged that in their distribution they follow the curves of harmonic motion. Those existing beneath the ocean or as festoons of islands fall in with the general scheme as illustrated by the law of curves. All the islands of the world and all the mountains are strung on a great circle which corresponds with the line dividing the land and water hemispheres. The northern and eastern hemispheres are above the node of the great curve, while the southern and western hemispheres are below the node. On the great master folds there are smaller corrugations bearing the same relations as the harmonics to the fundamental in a vibrating cord. In this way the central depressions of continents can be correlated with the submerged ridges in the ocean depths.

Prof. Sollas, in referring to the theory put forward by the president, showed that piled-up folds would blanket the deep-seated rocks, and a highly heated region beneath mountain folds might account for the lower value of gravity observed in the neighbourhood of mountain chains. The approximation of remote areas brought about by folding involved the transference of viscous material from one region to another. This would not only result in bulging up, but in the lateral traverse of material. The thrusting which built up the Alps and the Carpathians was felt in the British Islands, and the cracks produced in the splintered crust of Scotland and the north of England might have afforded a passage for the underlying lava, which perhaps originated under the Alps. Given the deformational figure of the earth, the position of mountain chains follows from it, since on Prof. Joly's theory they will arise where sedimentation has taken place, *i.e.* at the limit of land and water.

Prof. Cole suggested that the older opinion of Scrope regarding uplift and sliding was receiving confirmation in later days, and the festoon arrangement of islands and mountain chains was the result of the frontal movements of sliding masses.

Paleontology was represented in the section by papers dealing mainly with the fossil Reptilia. Prof. H. G. Seeley described a fossil reptile from the Upper Karroo of Cape Colony which possessed a proboscis or trunk, and in a second paper the dentitions of the Cynodontia and Gomphodontia were contrasted.

The occurrence of reptilian footprints in the Inferior Oolite of Whitby was announced by Mr. H. Brodrick, and in the Trias report Mr. H. C. Beasley described the tracks of invertebrates found in association with footprints in the Triassic rocks.

Mr. W. Whitaker, in describing a deep boring recently made on the Thames marshes at Cliffe, reported a fact

which has an important bearing on the character of the floor of older rocks underlying the Secondary rocks of Kent. At 1030 feet below Ordnance Datum Silurian rocks were penetrated. The practical bearing of the boring is that it puts a northern limit to the Kent coalfield.

#### PHYSIOLOGY AT THE BRITISH ASSOCIATION.

THE large number of individual papers presented this year made it necessary to hold afternoon sessions each day of the meeting, and even then it was difficult to find room for all the papers. Apart from the president's address, which has been published already (October 1, p. 553), the various communications are described herein, but owing to lack of space some of the papers, which cannot be conveniently summarised, are noted only by title.

After the presidential address, Prof. Sherrington, F.R.S., read a paper on proprioceptive reflexes of the limb. In a decerebrate animal the two hind legs are prepared so that all the muscles, except the extensor of each knee, are paralysed. Thus there is left on each side an afferent and an efferent nerve supply from a single muscle. The limbs are supported so that the knee can be extended by muscular contraction and flexed by gravity. Flexion at the right knee causes extension of the left leg, whilst extension on the right causes flexion on the left; that is, stretching the extensors causes a reflex contraction of the crossed extensors, and relaxation of the extensors produces reflex inhibition of the crossed extensors. The tone of the muscle depends on reflex impulses from itself, and when the extensor is passively stretched it does not return to its original length, but, being inhibited, remains more flexed than it had been; conversely, relaxation of the extensors leaves the limb in a more extended position. The final report of the committee on the "metabolic balance sheet" of the individual tissues was presented by Prof. Gotch, F.R.S. The object of the committee, namely, the development of sound and fruitful methods for investigating the metabolism of individual tissues, having been accomplished, it did not desire re-appointment. The report reviews the work that has been done by the committee during the past five years. The technique of various experimental procedures has been improved upon, and these improvements are dealt with as follows:—gas analysis, anaesthetics, prevention of clotting, measurement of rate of flow, and analysis of gases of perfusion fluids. The organs employed and a comparison of the results obtained are stated, and the report concludes with a list of the papers so far published as a result of the work of the committee. Sir Lauder Brunton, F.R.S., whilst presenting the report of the committee on the effect of climate on health and disease, read a paper on influenza, showing that epidemics of influenza are accompanied by an increased death-rate from pulmonary diseases, and he compared these outbreaks with various meteorological data. Dr. Grabham then gave a paper on the physics of high altitudes in relation to climate and health. From various measurements of humidity, wind pressure, and electrical potential he suggests that deficient electrical charge in the atmosphere is one of the conditions in a relaxing climate.

In the afternoon Prof. Swale Vincent presented the report of the committee on ductless glands. The view that the thyroid and parathyroids are intimately related is supported, and evidence is furnished that the suprarenal gland constantly pours its secretion into the blood stream, and thus regulates the blood pressure. Prof. Macallum, F.R.S., read two papers. In the first he recorded the analysis of urine in polyuria produced by the ingestion of large quantities of water. The total solids were so reduced that freezing-point determinations showed a very much reduced lowering. The percentage of chlorides decreased from the onset of polyuria, whilst that of potassium did not diminish until later on; thus at first the potassium showed a marked rise relatively to the sodium; at the same time, he could not find any appreciable dilution of the blood. These experiments are contrary to the view that urine is merely filtered from the blood, but they suggest that there is a selective action of the epithelial cells. His second paper dealt with the distribution of

potassium salts in the cell, and he ascribed their localised situation to surface-tension effects. Prof. MacDonald considered that these local appearances were explained by these points being stimulated portions of the protoplasm. Dr. Hewitt read a paper advocating improvement in the training of anaesthetists. He pointed out that the number of deaths from anaesthesia is increasing, and recommended that all medical students should be taught, by a qualified instructor, the best method of administering anaesthetics. Prof. Waller, F.R.S., demonstrated tracings obtained from muscles immersed in saline containing varying percentages of chloroform, ether, or alcohol. The relative toxicity of these drugs is that 1 molecule of chloroform=12 molecules of ether=100 molecules of alcohol.

On the Friday morning the first item was a discussion on mental and muscular fatigue, introduced by Dr. W. McDougall. He stated that fatigue is the change in ratio of two variable factors, one of which is the amount of available energy and the other the resistance which has to be overcome. As the resistance rises it is more difficult to do work until a point is reached where fatigue is manifested. This fatigue can be overcome by some more stimulating occupation, but in the end the subject is left more fatigued. He also discussed the effect of waste products and the removal of reserve food material on the activity of the cells. The resistance, which he supposed to take place at the synapse, is protective, as it prevents too great a drain of energy by continued action. Rise of resistance in one path diverts the impulse into another path, and this is exemplified by the difficulty of maintaining the attention on any one detail, as fatigue is delayed by minute variations in the object of attention. He then illustrated various nervous disorders as depending on the ratio of resistance to energy. Prof. MacDonald treated the subject of muscular fatigue, pointing out the change in distribution of salts and water during muscular contraction. Potassium salts are liberated in the central portion of the sarcomeres, thus causing a rise in osmotic pressure, and this attracts water from the neighbouring portions of the muscle fibre, causing this portion of the sarcomere to swell laterally. The contraction is the result of the shortening due to transference of water from the longitudinal to the transverse axis of the muscle. Prof. Milroy spoke about fatigue of colour sensations in simultaneous contrast. Mr. Sackville Lawson gave some measurements of skin sensation by the aesthesiometer, showing that mental fatigue diminishes the acuity of touch sensations. Several others took part in the discussion. Prof. Elliot Smith, F.R.S., then gave two communications. The first, in conjunction with Prof. Wilson, described the results of electrical stimulation of the cerebral cortex of certain lemurs. The second presented a map of the brain showing different areas which correspond to different naked-eye appearances of sections made transversely to the cortex.

During the afternoon session the following papers were read:—Prof. Gotch, F.R.S., showed tracings of photo-electric changes in the eye on exposure to light. The fundamental change is a prolonged electric current due to changes in the visual purple, because this current does not appear after the visual purple has been bleached. At the moments of exposure and cutting off of light there are more intense currents which are only of short duration, but they occur even after bleaching of the visual purple. These two rises are mounted on the more prolonged rise due to the visual purple. Repeated illumination causes the appearance of a precursor to the sudden rise due to illumination, and this precursor is a current in the reverse direction to the other currents. All colours of light can bleach the visual purple. Dr. Edridge-Green described methods for testing colour-blindness, and demonstrated apparatus for performing the various tests. Prof. Waller, F.R.S., presented the report of the committee on the electrical phenomena and metabolism of arum spadices. Dr. MacLean described experiments showing that all the nitrogen in lecithin is not present as choline, and Sir James Grant read a paper on the gastro-intestinal ganglionic nervous system.

Monday morning was commenced by a discussion on instruction of school teachers in physiology and hygiene, introduced by Prof. Sherrington, F.R.S. He pointed out

that school teachers, having the charge of so many children, should know how to take care of their health and be able to detect certain departures from the normal. Physiology is the basis of hygiene, and if physiology is known hygiene follows as a practical and common-sense application of its laws. Psychology is also important, as it gives the teacher an insight into the minds of his pupils; but here again physiology should be known first. The subject should not be taught by books alone, but by demonstrations and practical work, as that is the only way really to appreciate any science. Prof. Thompson detailed the steps that had been taken to teach physiology to school teachers in Ireland. Prof. Gotch, F.R.S., said that the teacher should learn physiology to apply it, but not to teach it. Any instruction to the children should be by example and not by precept. Dr. McVittie gave instances of the effect of neglect of hygiene in schools. Other speakers emphasised the importance of teaching physiology to school teachers in order that the general public might have a more enlightened view of hygiene, especially personal hygiene. Prof. Sherrington then presented the report on the conditions of health essential to the carrying on of the work of instruction in schools (prepared for Section L). After the closing of the discussion Prof. A. Kossel (Heidelberg) read a paper on amyloid, identifying the various radicals which enter into its constitution. Dr. Cathcart described experiments showing that various substances introduced into the pyloric portion of the stomach cause secretion in the fundus. Tap-water, although causing energetic movements of the pyloric segment, was about the only substance which did not cause secretion. It was not definitely determined whether the secretion is due to chemical or nervous stimulation. Dr. Ellison showed records illustrating the effect of intravenous injection of a substance isolated from commercial peptone. Dr. Dawson Turner read a paper on the hæmoral index, and demonstrated growth by osmosis after the method of Prof. Leduc.

At the afternoon meeting Dr. Copeman, F.R.S., presented the report of the committee on body metabolism in cancer. Dr. Page May gave lantern demonstrations showing (a) a hitherto undescribed (postero-septal) tract in the spinal cord, and (b) cells and tracts concerned in paralysis and recovery from paralysis. Mr. Walker read a paper describing the effect of two antisera prepared in rats by injecting in one case extract of testes and in the other carcinoma cells from an experimental tumour. These antisera, injected into mice infected with the same strain of experimental tumour used in preparing the second antiserum, appeared to interfere with the development of the growth. Prof. McWeeney described the technique used by him in carrying out the biological method of identifying blood stains, and he also testified to its value from a medico-legal standpoint. Prof. B. Moore read a paper, for himself and Dr. Roaf, on the action of acid and alkali on the growth and division of animal and vegetable cells. The sitting was terminated by a lantern demonstration, by Dr. Herring, of the changes in the pituitary after thyroidectomy. Removal of the thyroid causes a colloid-like substance to be formed in the pituitary, and this substance passes through into the third ventricle, thus reaching the cerebro-spinal fluid.

On Tuesday morning a joint meeting with Section D was held. Most of the papers are noted under the proceedings of that section, but the two following papers are of physiological interest. Dr. Nierenstein described experiments showing that atoxyl combines with proteins, but the diacetyl compound does not. *In vivo* the acetyl compound is hydrolysed, and acts like atoxyl. He compared the pharmacological action to the chemical process of dyeing, where the chromophore is represented by the arsenic and the chromogen by the amido-group in atoxyl, and the mordant is replaced by protein. Prof. B. Moore described the effect of many substances upon experimental trypanosomiasis. The combined treatment, using atoxyl followed by mercury, is the best, and the only other metal that can compare in action with arsenic is antimony.

The section closed by a meeting on Tuesday afternoon, with Lord Aberdeen in the chair. Sir Robert Matheson read a paper on the anti-tuberculosis campaign in Ireland.

H. E. ROAF.