THE TRIENNIAL INTERNATIONAL CONGRESS OF PHYSIOLOGISTS.

FOURTH MEETING.

THE fourth Triennial International Congress of Physiologists, held at Cambridge on August 23–27, was the largest assembly of the kind that has yet met. The third congress (Bern, 1895) defined the qualification for membership as "open to (1) professors and lecturers on physiology and their official assistants; (2) to members of the American Physiological Society; the Physiological Society, England; Société de Biologie, Paris; Physiologische Gesellschaft, Berlin; Physiologisches Club, Vienna; (3) to ladies and gentlemen proposed by their National Committee, and accepted by the International Congress Committee." This rule was strictly observed for the present congress, and the number of members attending was two hundred and twenty-six. The press were not officially admitted to the meetings. The different nationalities represented were as follows:—Austria-Hungary and Germany, 33 members; Belgium, 9; Denmark and Sweden, 3; Egypt, 2; France, 29; Holland, 3; India, 2; Italy, 9; Japan, 4; Roumania, 2; Russia, 7; Switzerland, 9; United States, 16; Great Britain and Canada, 98.

A larger number of communications were received than on any previous occasion, and it became difficult to transact the business in the allotted time. The rule awarding preference to communications illustrated by experiment was adhered to, and the meetings were as free from mere verbal or pictorial exposition as on any previous occasion.

The official work of the congress commenced on the morning of August 23 at 10 o'clock, with a few pithy words of welcome and direction from the President, Prof. Michael Foster, Sec. R.S.

Prof. E. J. Marey (Paris) urged the necessity of creating an international committee for the unification and the control of physiological instruments employed for graphic methods. The following were appointed to serve: E. J. Marey, Paris; M. Foster, Cambridge; H. Kronecker, Bern; K. Hüerthle, Breslau; V. Frey, Zürich; E. Weiss, Paris; H. Bowditch, Boston.

Prof. Mosso (Turin) made a communication regarding mountain sickness. Mountain sickness, in his opinion, does not depend on diminution of the tension of the atmospheric oxygen, but on diminution of the carbon dioxide of the arterial blood.

Prof. A. Kossel (Marburg) communicated an important paper upon albumens. Starting from the probability that a protamine-like group of atoms is contained in the proteid molecule, and that from it by decomposition the hexon-bases arginin $C_6H_{14}N_4O_2$, histidin $C_6H_9N_3O_2$, lysin $C_6H_{14}N_2O_2$ arise, he with Dr. Kutscher had sought for arginin and histidin in various proteids and quantitatively determined them. They had found the hexon-bases obtainable from all the proteid substances they had as yet examined, also from elastin. The amounts obtainable from the various bodies were very different; the largest proportion was obtainable from histon, the smallest from elastin; an intermediate proportion was yielded by casein and egg albumen.

Dr. J. Demoor (Brussels) gave an interesting demonstration and account of his researches upon the association centres and the cerebral localisation of the dog. He then proceeded to describe the changes found by Prof. Heger and himself in the form of the neurons of the cortex cerebri under various conditions of rest and excitation. In animals decapitated in sleep produced by ether, chloroform, morphia, &c., the cell-body of the neuron is retracted, the dendrites are moniliform, and the distribution of the spine-like appendages is irregular and in some places they are wanting. The altered neurons recover their normal aspect after elimination of the modifying agent.

Dr. J. Demoor then gave a statement of his views of the signification of the moniliform condition of the cortical neuron. He drew attention to the similarity between this condition of the brain-cells and that of the pseudopodia of certain of the protozoa. He concludes that the nerve-cell is plastic, and that the moniliform condition of its processes is a condition of contraction.

Dr. H. Wright (Montreal) contributed the account of recent observations on the effects produced on the microscopical appearance of the nerve-cell by the action of ether and of chloroform.

Prof. H. Hamburger (Utrecht) gave an account of his continued work on the influence of solutions of inorganic salts on the volume of animal cells. He finds that white blood-corpuscles and spermatozoa increase in volume when placed in hypisotonic, and shrink when set in hyperisotonic solutions. The volumetric proportion of the two component parts of the cell, its framework and the intracellular fluid, can be accurately ascertained.

Prof. Kronecker (Bern) communicated for himself and Mlle. Schilina the results of a comparison instituted between Ludwig's kymograph and Hüerthle's tonograph.

Prof. Kronecker, for himself and Mlle. Devine, reported the results of further investigation of the respiration of the heart of the tortoise. Blood free from or very poor in oxygen (saturated with H or CO) serves to nourish the perfused tortoise heart just as well, to judge by the pulse-volume, as does arterial blood. Blood saturated with CO_2 quickly reduces the performance of the heart.

Prof. Bowditch (Harvard, Boston, U.S.A.) demonstrated an ingenious apparatus for elucidating the movements of the human eye-ball. Even on the small scale on which the mechanism exhibited had been executed he succeeded in making clear his demonstration to the whole audience in the large theatre.

Dr. L. Asher (Bern) gave a communication, illustrated by experiment, on the theory of lymph production. He defended the thesis that lymph is a product of the work of the organs, no mere filtrate from the blood, and no mere secretion from the cells of the walls of the blood-vessels. The specific activity of the salivary glands, of the thyroid, and of the digestive organs, each and all occasion increased formation of lymph.

By Dr. W. M. Bayliss (London) a demonstration was given to show the non-antagonism of visceral and cutaneous vascular reflexes.

A canula in the carotid artery of a curarised rabbit is connected to an ordinary mercurial manometer, and also, by means of a side-tube, to a wide glass tube dipping under mercury contained in a tall cylinder; the depth at which the end of the tube is situated under the mercury is adjusted so that blood just begins to escape. The leg is enclosed in a plethysmograph, and its alteration of volume traced by means of a piston recorder. If now the central end of the anterior crural, or other sensory nerve, is excited, the arterial blood pressure is prevented from rising by the escape which takes place from the tube under mercury, so that there is no opposing force to be overcome by the vessels of the leg in constricting, and accordingly the volume of the leg is seen to *diminish*. In asphyxia a similar constriction occurs.

Mr. W. M. Fletcher (Cambridge) showed the apparatus and methods employed by him in his investigation on the CO_2 discharge of excised tissues.

The titrations are performed in closed absorption chambers, and the necessary stirring and expulsion of the solutions are effected without contamination by atmospheric air. A reduplication of the apparatus allows an absorption of CO_2 to proceed in one part while estimation of that previously absorbed is conducted in the other, so that a given discharge of CO_2 may be kept under continuous observation.

The method has been used in following the survival respiration of excised tissues—mainly the leg muscles of the frog, the tortoise heart and some non-muscular tissues; and it has been found very suitable for the study of the respiration of insects.

Dr. Leonard Hill (London) brought forward interesting new experiments in pursuance of his well-known investigation of the influence of gravity of the circulation of the blood.

An eel or grass-snake is affixed to a board in the extended position, and the heart exposed. On turning either animal into the vertical position (tail downwards) the heart, after a few beats, becomes emptied of blood. On pressing the body from the tail upwards the heart immediately fills to repletion. On ceasing to compress the body the heart once more as completely empties. So soon as the animal is placed head downwards the heart engorges. This engorgement is limited by the inextensile pericardium, which in the eel is extremely strong. If a snake or eel be sunk vertically and tail downwards in a vessel of water the heart does not empty. The hydrostatic pressure of the column of water exerted on the surface of the body tends to counterbalance the hydrostatic pressure of the column of blood within the body. A chloralised tame rabbit is placed in the vertical position with the feet downwards.

Record of the aortic pressure is at the same time taken. After ten minutes or so the pressure begins to steadily fall, the respiratory pump, at first more active, gradually ceases, the animal passes into syncope, the heart is almost empty and death imminent. Compression of the abdomen will at this point immediately restore the circulation and remove the condition of syncope. The same end can equally well be attained if the body of the animal be sunk in a bath of water. In the wild rabbit, cat, dog, monkey and man, the power to resist the influence of gravity on the circulation is very perfect. The hutch rabbit is likewise restored by a bath, and in this fact it is possible to find a simple explanation of the beneficial influence of baths on the bodies of debilitated men. The hydrostatic pressure of the water not only acts on the blood vessels, but also causes the abdominal organs to float upwards. Thereby the diaphragm is raised, and the tension on the vena cava inferior relieved, that is to say, so soon as the dragging weight of the abdominal organs be removed.

Prof. Townsend Porter (Harvard, Boston, U.S.A.) communicated two important papers on the mammalian heart, entitled "The nutrition of the heart through the vessels of Thebesius," and "The beat of the isolated mammalian ventricle fed on blood-serum alone." His method was demonstrated and consists in the revivifying of the excised and washed out dog's heart by simply allowing a stream of defibrinated dog's blood to flow through it from the coronary artery.

A heart fed simply through the veins of Thebesius and the coronary veins will maintain strong, rhythmic contractions for many hours if supplied with oxygen at high tension. The absence of corpuscles was readily borne by the heart. Continued rhythmic contractions were obtained with the serum alone, so soon as the oxygen tension rose to about two atmospheres. It follows that the mammalian heart fed through the vessels of Thebesius and the coronary veins with blood-serum alone will maintain rhythmical contractions for hours when surrounded by oxygen at high tension. Isolated pieces of the ventricle beat if fed with serum through a branch of the coronary artery.

These experiments permit the conclusion that even isolated portions of the mammalian ventricle supplied through their nutrient arteries with a small quantity of serum at very low pressure will maintain rhythmical, long-continued, forceful contractions when surrounded by oxygen at high tension.

The influence of salts upon the electromobility of medullated nerve was the subject of a communication, illustrated by experiments and by lantern galvanograms, by Prof. A. D. Waller, F.R.S. (London). The method of investigation was that previously employed by the author.

Excised frog's sciatic laid across unipolar electrodes in moist chamber. Electrical response to electrical excitation at regular intervals photographically recorded before and after modification of the nerve by various salts dissolved in normal saline.

In the action upon nerve of a salt BA, the predominant moiety is B (the basic or electropositive element), *e.g.* any potassium salt is more effective than any sodium salt.

The acidic or electronegative element A is of subordinate action, *e.g.* KI> KBr.

	Strength of solution		Effect upon electrical response.
	%	*M.*	
NaBr	1·030	*m*/10	No effect.
KBr	1·190	*m*/10	Abolition in 30 mins.
KCl	0·744	*m*/10	Abolition in 30 mins.
NaF	0·840	*m*/5	No effect.
KF	1·160	*m*/5	Abolition in 8 mins.

Is the action upon nerve of a salt $\overset{+}{B}\ \overset{-}{A}$, or of an acid $\overset{+}{H}\ \overset{-}{A}$, or of an alkali $\overset{+}{B}\ \overset{-}{OH}$, that of dissociated ions?

Do *e.g.* HNO_3 act upon nerve by virtue of its electropositive H, and KOH by virtue of its electronegative OH?

Certainly not exclusively. Because *e.g.* the action of the highly dissociated *n*/10HNO_3 is not greater than that of the slightly dissociated CH_3, COOH, and the action of KOH is considerably greater than that of NaOH at equality of dilution and of dissociation. The action of the highly dissociated chlorides, bromides, &c., is not greater than that of the slightly dissociated acetates.

Data.

	Strength of solution			Effect upon electrical response.
	%	*M.*	*N.*	
H_3SO_4	0·490	*m*/20	*n*/10	Abolition in 7 mins.
HNO_3	0·630	*m*/10	*n*/10	Abolition in 15 mins.
CH_3, COOH	0·600	*m*/10	*n*/10	Abolition in 15 mins.
H_3PO_4	0·653	*m*/15	*n*/5	Abolition in 25 mins.
CH_3, CHOH, COOH	0·450	*m*/20	*n*/20	Abolition in 15 mins.
NaOH	0·200	*m*/20	*n*/20	Diminution.
KOH	0·140	*m*/40	*n*/40	Abolition in 8 mins.

Prof. E. Wertheimer (Lille) demonstrated observations, made with M. Lepage, that the influence of the accelerator nerves on the heart is much less, in the dog, during expiration than during inspiration.

Prof. Grützner (Tübingen) demonstrated (1) a tambour by means of which the slightest alteration in the pitch of a sung note can be visually demonstrated before an auditorium; (2) a method of analysis of a compound note by means of interference established by stopped tubes of different lengths; (3) his graphic record of induction currents upon paper.

Dr. J. N. Langley, F.R.S. (Cambridge), demonstrated his discovery of the possibility of obtaining an experimental union between the nerve-fibres of the vagus nerve and the sympathetic nerve-cells of the superior cervical ganglia. The vagus and sympathetic nerves were ligatured with horse-hair. On August 23 sixty-four days had elapsed since the end of the vagus was joined to the sympathetic nerve. The vagus nerve was then cut near the skull, and its peripheral end stimulated. Regeneration had taken place; the stimulation of the vagus caused opening of the eye, retraction of the nictitating membrane, dilation of the pupil, contraction of the vessels of the ear, and more or less of the other effects ordinarily produced by stimulating the cervical sympathetic. The injection of 20 milligrams of nicotin temporarily prevented the vagus from producing any of these effects, but did not prevent stimulation of the superior cervical ganglion from producing them. This result shows in the clearest manner that the specific effect of the excitation depends upon the specific character of the peripheral ending, not on the character of the central conducting paths.

Prof. Heymans (Ghent), gave experiments upon physiological and artificial disintoxication. The simple nitrils are within the organism decomposed and eliminated in the form of sulphocyanide. This physiological disintoxication, acting under the intervention of sulphuretted organic bodies, is much increased by the administration of certain compounds of sulphur such as the hyposulphites, &c. These sulphur compounds prevent or remove the poisonous effects of a dose of the nitrils many times that sufficient to kill.

Prof. Sherrington, F.R.S. (Liverpool), demonstrated his discovery of inhibition of the tonus of a skeletal muscle by the excitation, either electrical or mechanical, of the antagonist muscle. The phenomena has bearing upon spinal coordination for volitional and other kinds of movement. The experiment shown dealt with the antagonistic flexors and extensors of the knee-joint. The stretching of a muscle produced by the contraction of its antagonist may excite (mechanically) the sensorial organs in the muscle that is under extension; in this way a reflex of pure muscular initiation may be started. The experiment proved that electrical excitation of the central end of an exclusively muscular nerve produces inhibition of its antagonist. (1) The central end of the severed hamstring nerve was faradised. This nerve contains sensory nerve-fibres from the flexor muscles of the knee. The effect of these on the extensor muscles of the knee was seen (α) in elongation of those muscles, (β) in temporary diminution of the knee-jerk. (2) The exposed flexor muscles detached from the knee, and therefore incapable of mechanically affecting the position of the joint, were then stretched or kneaded. This produced reflex elongation of the extensor muscles of the knee and a temporary diminution of the knee-jerk. It may therefore be that reciprocal innervation, which Prof. Sherrington has pointed out to be a common form of coordination of antagonistic muscles, is secured by a simple reflex mechanism, important in its execution being the tendency for a muscle to produce its own inhibition reflexly by mechanical stimulation of the sensory apparatus in its antagonist.

Prof. O. Frank (Munich) demonstrated methods of recording the action of the cardiac muscle both isotomically and isometrically.

Prof. Gotch, F.R.S., and Mr. G. J. Burch (Oxford) showed photographs of the electrical response of nerve to excitation. The results obtained have been: Biphasic effects indicated by a rapid displacement in one direction which is followed by one in the other. Examples of these are (1) effect in uninjured fresh nerve with both contacts upon the surface, (2) effect in excised nerve kept for twenty-four hours in 0·6 per cent. NaCl. Monophasic effects indicated by a rapid displacement returning very slowly and exhibiting a second effect of similar direction but of slow development, the negative after-effect obtained when the functional capacity of the tissue under the distal contact is so lowered that it is incapable of undergoing the change which produces the excitatory electrical response. Biphasic effects with prolonged second phase when the functional capacity of the tissue is low; the records show an initial small displacement followed by a prolonged one of opposite sign, *i.e.* a positive after-effect. The nerve when excited by a rapid series of stimuli gives a series of independent spikes; the injured nerve gives a series of displacements which are superimposed; the after-effect not having subsided when the second response occurs.

Prof. A. B. Macallum (Toronto) brought forward and illustrated by demonstration his method for detection and localisation of phosphorus in animal and vegetal cells, &c. The use of pyrogallol for this purpose is not free from objection, and a reagent was sought which would definitely distinguish between the molybdate and phospho-molybdate of ammonia. This reagent was found in phenylhydrazin hydrochloride in a 1–4 per cent. aqueous solution which gives a dark-green reaction with the phospo-molybdate compound, but none with molybdate of ammonia in the presence of nitric acid. The nitric-molybdate reagent is allowed to act for some hours at a slightly elevated temperature on the sections of tissue, which are then transferred to the solution of phenyl-hydrazin hydrochloride. To prevent the confusion which might result from the presence of lecithin, the latter must be extracted with hot alcohol, frequently renewed, for five hours, and the presence and amount of inorganic phosphates are indicated by the early appearance of the reaction and its extent.

The method has resulted in demonstrating the presence of "masked" phosphorus in the chromatin of all animal and vegetable cells, in nucleoli, in the anisotropic substance in muscle fibre, in the prozymogen and zymogen of pancreatic cells, in the colloid material of the thyroid, in the outer limbs of the rods and cones, in pyrenoids of the Protophyta, &c. It also shows that in non-nucleated organisms like the Cyanophyceæ and *Saccharomyces* the phosphorus-holding substance, or nucleo-proteid, although sometimes in the form of granules or spherules which have been taken for nuclei, is frequently dissolved in the cytoplasm.

Prof. Boruttau (Göttingen) communicated a paper upon recent advances in electro-physiology. After speaking of the methods of investigating the course in time of the action-current of nerve, and especially of the use of combining photographic records with rheotom experiments, he discussed the biphasic and monophasic action-currents of frog's nerve, their modifications in electrotonus, their alteration and abolition under ether narcosis and in cold, their increase by CO_2, the alterations effected in the electrotonic state by ether and by CO_2, and the phenomena of the curare preparation.

Prof. J. B. Sanderson (Oxford) communicated a paper on the duration of the monophasic variation of the sartorius muscle of the frog.

Dr. Theodore Beer (Vienna) brought forward an important communication, richly illustrated by experiment, upon the accommodation of the eye in various species of the animal kingdom. In order to adapt an eye to a range of objects at different distances, *two* plans are employed. In the first the curvature of the refracting surface is made adjustable; in the second the distance of the refracting surfaces from the receptive screen is adjustable. The adjustment of the curvature is exclusively of increase of the curvature, affording thus an active accommodation for near vision. This exists in mammals, birds, lizards, crocodiles, tortoises, and in a few snakes. Throughout the above-named forms the means by which the adjustable increase of curvature is obtained is by the active contraction of a muscle slackening the suspensory apparatus that under the resting condition of the muscle keeps to some degree flattened the anterior surface of the lens.

In cephalopods and the bony fishes the eye is when at rest in focus for objects near at hand. In these forms the adjustment is for distant objects, and is brought about by the retreat of the lens towards the retina. In amphibia and snakes—or rather in such of them as possess any visual accommodation—there exists an active accommodation for near vision executed by an advance of the lens from the retina. In the bony fishes a special muscle (*Retractor lentis*, Beer) drags the lens backwards towards the retina. In the cephalopods, amphibia and snakes, alterations in intraocular pressure, brought about by contraction of circularly-arranged muscle-fibres, play an important part. Among mammals, reptiles, amphibians, and fish there are certain species that have no power of visual accommodation; these are for the most part nocturnal species and forms with narrow, even slit-like pupils (great sensitivity to light). Some of the tortoise-tribe, which dive under water, not only counterbalance the loss of the corneal refracting surface thus occasioned, but even under water accommodate for near vision.

Prof. Halliburton, F.R.S., and Dr. F. W. Mott, F.R.S. (London) demonstrated the influence of cholin, neurine, and some allied substances upon the arterial blood-pressure. In certain diseases of the central nervous system the cerebrospinal fluid becomes laden with toxic substances of this class, and it is in prosecution in that direction that the researches of Profs. Halliburton and Mott are especially suggestive.

Prof. E. Weymouth Reid, F.R.S., and Dr. J. S. Macdonald (Dundee) demonstrated experiments illustrative of their study of the electromotive changes in the phrenic nerve.

Electromotive changes in the phrenic nerve can be demonstrated to accompany the groups of nervous impulses periodically generated in the respiratory centre. By the cut end and a point about a centimetre central thereto, the nerves are suspended on "cable" non-polarisable electrodes, free of the tissues of the neck, and are led off to the galvanometer (without compensation) or capillary electrometer. A single nerve, or, taking symmetrical points on the two sides, both "in parallel" (galvanometer) or "in series" (electrometer) may be used for experiment. The characteristic effects have been seen as long as two hours after putting the nerves in circuit. Intermittent electrical discharges (negative variations of the demarcation current) are observed and can be abolished by ligature of the nerve with moist thread above the proximal electrode. If the animal is curarised and artificial respiration set up, it is found that the magnitude of the discharge is directly affected by the supply of air, so that with over-supply there is cessation of discharge, with under-supply or stoppage of pump, asphyxial increase.

Prof. Sherrington, F.R.S. (Liverpool), with Dr. Hering (Prague), gave a convincing demonstration in the monkey (*Macacus*) of inhibition of the contraction of voluntary muscle evoked by electrical excitation of certain points of the *cortex cerebri*. This inhibition, producing relaxation of volitional muscles, was shown to occur regularly in the evocation of co-ordinated movements from the cerebral cortex. The relaxation of a muscle is not obtained by excitation of the same point of cortex as that whence its contraction is elicitable, but is obtainable from the same point of cortex as that whence contraction of its antagonist can be obtained. A distance of more than a centimetre sometimes separates the points whence contraction and relaxation of one and the same muscle can respectively be obtained. Besides this reciprocal innervation of the true antagonists, evidence was demonstrated of a more complex relationship between different muscle groups; relaxation of some muscles and contraction of others was shown to exist in cases where the physiological connection between the two different activities is not obvious or easily intelligible.

Dr. Maurice Nicloux (Paris) showed that if carbonic oxide is made to pass over iodine anhydride maintained at a temperature of 100°–150°, the carbonic oxide is oxidised, and passes off in the form of carbonic anhydride at the same time that the iodine is set free in corresponding quantity. This reaction occurs whatever be the dilution of CO in the air, even if the dilution be 50,000. Search for traces of CO becomes, therefore, simple, rapid and exact. There is, therefore, a certain amount of CO normally in the blood. The average quantity seems to be 1·4 cc. per litre of blood. M. Desgrez has shown that chloroform in contact with an aqueous solution of potassium produces some carbonic oxide. The general reaction of the blood and tissue fluids being alkaline, Nicloux and Desgrez have inquired whether this decomposition does actually occur in the organism. Experiment has shown that it does.

Prof. Marey (Paris) showed a new series of studies in chronophotography.

A conjoint communication was made by Prof. Waller, F.R.S., and Miss Sowton (London), on the action upon isolated nerve of muscarine, chlorine and neurine, commenced at the instance of Prof. Halliburton. Comparative experiments were made with the hydrochlorides of these two bodies. Occasion was taken to bring into the comparison the effect of muscarine, which in previous experiments at a strength of 1 per cent. had showed itself to be of doubtful action upon nerve. Choline as compared with neurine is inert in relation to nerve. 4 per cent. solution of choline produces no effect, whereas the electromobility of nerve is abolished by neurine at 4 per cent., at 2 per cent., at 1 per cent., and markedly diminished at 0·5 per cent. As regards the substance of cerebro-spinal fluid, if the issue be narrowed to an alternative between choline and neurine, there can be no doubt that neurine is absent, and therefore choline present. The muscarine used was less active upon nerve than neurine. As regards an action upon isolated nerve, the order of efficacy of the samples used was: (1) neurine, (2) muscarine, (3) choline.

Miss S. C. Sowton (London) gave an interesting report of a large series of galvanometric records of the decline of the current of injury in medullated nerve, and of the changes in its response to periodic stimulation. The work had been prosecuted chiefly in Prof. Waller's laboratory, and had for its object the study, by means of prolonged photographic records, of:—

(*a*) The progressive modifications of electromotivity described by Engelmann, viz. decline of current of injury with lapse of time, and its restoration by a fresh transverse section.

(*b*) The progressive modification of electromobility described by Waller, viz. decline of negative variation and appearance of a positive variation.

The curve of diminishing electromotivity falls convex to the abscissa. Time being taken in arithmetical progression, the residual electromotivity is in geometrical progression, with a ratio = ⅔ per 1 hour. The negative variation progressively diminishes during the first 2 or 3 hours, and gives place to a progressively increasing positive variation.

Dr. Bayliss and Dr. E. Starling (London) showed an influence of blood-supply on peristaltic movement. The cutting off of blood-supply from the intestine reduces the peristaltic movements after a variable interval. The intestinal inhibition due to the splanchnic may be only secondary to vascular constriction.

Dr. H. Ito (Bern) reported a research into the place of the heat-production evoked by cortical excitation.

Physical absorption of isotonic and anisotonic salt solutions was the subject of a communication by Prof. S. P. Budgett (St. Louis, U.S.A.). A dilute solution of egg-albumen placed inside the shell membrane of the hen's egg, and separated by it from a strong solution of sodium chloride, increased in volume at the expense of the latter. An explanation of this phenomenon may be of interest with regard to the intestinal absorption of hypertonic salt solutions. The membrane offers so little resistance to the dialysis of sodium chloride, that the osmotic pressure due to the latter is for the most part transmitted through, rather than exerted against, the membrane, and consequently can interfere but little with the absorption of its solvent. Added to these circumstances is the osmotic pressure exerted by the albumen on the inner side of the membrane; this force and the greater resistance presented by the membrane to the exit of water, together overbalance the lesser resistance offered by the membrane to the entrance of water, and the slight resistance to the dialysis of sodium chloride. The solution of egg albumen may be replaced by serum, by milk, by a solution of dextrin, or gum arabic, or by an even somewhat hypotonic solution of a crystalloid such as ammonium sulphate, which dialyses less readily than sodium chloride through the egg-shell membrane.

Dr. F. S. Lee (New York) gave a communication on the fatigue of muscle. He had studied the process of fatigue in the frog, the turtle, and the cat. The increase in the duration of relaxation that occurs in the frog is not found in the case of the two other species. The one essential factor in the phenomenon of fatigue is the diminution of the lifting power of the muscle. Of the two supposed causes of muscle fatigue, viz. decrease of contractile substance, and accumulation of fatigue-products with poisoning of the muscle thereby, the former plays no part in the phenomenon; the latter is the sole cause. Fatigue is a safeguard against exhaustion. Attempts to demonstrate histological differences between resting and fatigued muscle had yielded him only negative results.

Prof. W. H. Thompson (Belfast) reported observations on the diureric effects of small quantities of normal saline solution. Sodium chloride solution (·6 per cent. ·6 per cent. and ·9 per cent.) 2–4 c.c. per kilo was injected into the external saphenous vein. The quantity of urine was greatly increased, far beyond the amount injected. The urea and total nitrogen was increased when measured hour by hour, though the urine was more dilute. At first this might be thought due to absorption of water into blood-vessels causing a dilute blood. This cannot, however, be the explanation, since sp. gr. of blood in many cases is higher than normal during period of greatest diuresis. It is also not due to excretion of surplus NaCl—for in many cases this is diminished, though urine is increased, *i.e.* the two phenomena do not run parallel.

Dr. Brunton Blaikie (Edinburgh), with Prof. Gottlieb's co-operation (at Heidelberg), had examined the muscle of dogs which had been bled to death, the bleeding being of a very thorough nature. The estimation of urea was conducted according to von Schroeder's method, and *urea in crystalline form was conclusively demonstrated in all cases.*

Prof. Hagemann (Bonn-Poppelsdorf) gave an account of his researches on the actual nutritional value of the feed of the horse. Each weighed-out "feed" can be divided into *a* per cent. which is absorbed, and 100 – *a* per cent. which reappears in the fæces. The portion *a* per cent. is often regarded as digested, that is, completely usable by the organism for its nutrition. Such a view is only partly justified. From it there has to be substracted that digestion-work consumed in absorbing it, and also that part which is broken up by fermentation processes in the intestine.

Drs. F. G. Hopkins and W. B. Hope (London) dealt with the questions of the nucleo-proteids as dietetic precursors of uric acid. They confirmed Mares that after a meal the increase of uric acid in the urine is immediate and has a duration shorter than that of the increase of urea. They called attention to the difficulty of reconciling this fact with an origin from nucleins which are unaffected by the earlier (gastric) period of digestion. In testing this matter it was found that taking filtered pepsin-hydrochloric acid extracts of the thymus gland as test meals produces a large increase of uric acid, though the extracts could be shown to contain no more than traces of nuclein; whereas the administration of pure nuclein prepared from the gland gave (in the authors' experiments) no increase at all. The ascription of all uric acid production in the mammal to the breakdown of nucleins is over hasty.

Dr. Martin Hahn (Munich) gave a communication on the chemical and immunising properties of plasmines. By plasmines the author denotes the substances contained in animal cells. He pointed out that it is now possible to express from yeast-cells a cell-free juice or plasmine which ferments sugar. This yeast plasmine contains also a proteolytic enzyme. The injection of the plasmines of cholera and typhoid bacilli in the guinea-pig establishes a specific immunity against intraperitoneal infection with cholera or typhoid. The same immunity can be obtained by injecting an alcoholic precipitate of the plasmine, or a precipitate thrown down from the plasmine by acidifying with acetic acid.

Prof. Livon (Marseilles) communicated observations on the action of extract of the pituitary body upon the function of the vagus nerve, illustrated by a number of kymograms. The inhibitory action of the vagus on the heart he found to be distinctly weakened temporarily after the injection of doses of pituitary extract.

Dr. Medwedew (Odessa) reported his studies concerning the oxidation of salicyl aldehyde in tissue-extracts. The oxidising principle contained in the extracts seems to be one or several peroxidised substances that can give up their oxygen in a molecular form.

Drs. Bedart and Mabille (Lille) read a paper on the action of arsenic upon the intoxication produced by ingestion of the thyroid body. The acceleration and irregularity of heart-beat produced in the dog by feeding with thyroid gland are removed by treatment with arsenic.

Dr. de Saint-Martin (Paris) made a communication on the absorbent power of the blood for oxygen and for carbonic oxide. Setting out from the statement of Claude Bernard that carbonic oxide displaces the oxygen from the blood volume for volume, he makes use of the following method of analysing the oxygen content of the blood. In a glass bulb are placed the blood to be examined, pure CO_2, and a saturated aqueous solution of

sodium fluoride. These are well shaken, and then transferred to the gas-pump and extracted. The difference between the volume of carbonic oxide found and that introduced into the bulb gives the exact measure of the absorbing power of the blood. The addition of the sodium fluoride (Arthus, 1892) stops all consumption of oxygen, and is helped towards that end by the agitation of the blood with CO. The latter produces complete displacement of the oxygen, and thus ensures total extraction of the oxygen by the pump. Finally the carbonic oxide fixed by the hæmoglobin can be removed by adding to the residue an equal volume of saturated solution of tartaric acid. This method avoids the error due to the decomposition of the oxyhæmoglobin remaining incomplete, and to the consumption of a certain amount of oxygen by the blood itself during manipulation. By his new method De Saint-Martin arrives at the result; the power of hæmoglobin to absorb CO is very variable, altering even from day to day in the same individual. To estimate the respiratory power of the blood, it is necessary therefore not merely to determine the quantity of hæmoglobin in it, but to determine the absorbing power of the hæmoglobin. It follows, further, that according to De Saint-Martin estimations of the amount of hæmoglobin in blood based upon its absorbing power are quite untrustworthy.

Dr. C. Phisalix (Paris) demonstrated the existence of an oxydase in the skin of certain batrachians. The skin of the frog is macerated in saline, and the juice thus obtained is placed in three tubes. The first is heated to boiling, the second is sealed in vacuo, the third is left open to the air. The first and second preserve their original tint, the third turns brown, the brown colour commencing at and spreading from the surface of the fluid. At the end of five days the whole fluid is a deep brown. The fresh juice turns tincture of guiacum blue.

Prof. Moussu (Alfort) communicated a paper upon the functions of the thyroid and parathyroid bodies. Extract of parathyroid has no alleviative effect upon the symptoms of thyroid cachexia.

Prof. E. Schäfer, F.R.S (London), gave an interesting paper on the alleged sensory functions of the motor cortex cerebri. The conclusion drawn by Munk is that "Schiff was right in affirming that the parietal lobe is the tactile sphere as the temporal is the auditory and the occipital the visual sphere." Munk's view of the question has been adopted in this country by Mott, who states that his experiments "support Munk's conclusions that in the 'motor area' the sensation of touch and of pressure of the corresponding extremities is perceived." The chief method employed by Mott for testing tactile sensibility was the application of a steel spring clip to the skin (Schiff's clip test). This method is completely illusory. Schäfer found that an animal which will apparently disregard the constant pressure of even a strong clip on the skin of a paralysed limb, will, nevertheless, instantly take notice of a light touch, or of a light stroking with a straw upon the same limb. Experiments, thirty in number, have been made. The result has been to show that the assertions above quoted are entirely erroneous: that, in fact, complete voluntary motor paralysis of a part may be produced by a cortical lesion without perceptible loss of tactile sensibility. It cannot, therefore, be the case that the motor paralysis which is produced by a lesion of the Rolandic area is due to a sensory disturbance. And it also follows that tactile sensibility is not localised in the same part of the cortex from which voluntary motor impulses directly emanate. Hemianæsthesia sometimes results from an extensive lesion of the motor cortex; this is, however, not local but general, and is due to the vascular and mechanical disturbance produced upon the whole side of the brain by the establishment of the lesion. That this is the case is shown by the fact that it is generally accompanied by hemiopia. Five experiments were made in the following manner. Having exposed the upper Rolandic region in a monkey, the leg-area in the gyrus marginalis is completely severed by a cut passing as nearly as could be determined as far down as the calloso-marginal sulcus, and at any rate deep enough to sever all the fibres passing from the cortex to the centrum ovale. In no case did this lesion produce anything more than quite a temporary sensory disturbance, not to be detected after a day or two; and even this was exceptional. The opposite leg was always completely paralysed, and gave no sign of voluntary motion, although after a time "associated movements" returned. The animal would at once look round if the foot were touched ever so lightly with a straw, although it would usually not remove a clip. After a variable period a second operation was performed upon the same region. In this the cut was extended more deeply, so as to sever as much as possible of the gyrus fornicatus; which was in some cases removed, in others left *in situ*, but with its coronal fibres cut. *In every case no perceptible effect was produced* by this second operation. The amount of actual severance of the fibres of the gyrus fornicatus varied, but in two it was considerable; and since in none of these cases could any anæsthetic effect of such severance be detected, it must be admitted that the result militates against the view that the gyrus fornicatus is the centre for tactile sensibillty. The result is also fatal to the view which has been taken of the experiments on the gyrus fornicatus by H. Munk, and accepted by Mott, that the anæsthesia found was due to injury of the adjacent motor region. For in the experiments here described, the adjacent motor region was not only injured, but actually removed, without the production of any anæsthesia, although the lower limb was completely paralysed.

Dr. G. Mann (Oxford) gave a paper on higher and lower centres in the mammalian cerebrum.

Prof. A. Vitzou (Bucarest) reported recovery of sight in monkeys after total ablation of the occipital lobes. The blindness produced by the operation was only temporary, although at first complete. The chief evidence that the animals see is their power to avoid obstacles. The removal of the angular gyri renders the blindness longer persistent.

Drs. Moore and Reynolds (London) have examined the rate of transmission of nerve-impulses through the spinal ganglia. They find no appreciable delay caused by the interposed nerve-cell.

Prof. Verworn (Jena) addressed the meeting on the subject of so-called hypnosis in animals. Tonic contraction of muscles was, he maintained, the most characteristic symptom of the condition.

Dr. Wybauw (Brussels) found that continued perfusion of the heart with normal saline destroyed the inhibitory effect of the vagus.

Prof. Boyce and Dr. Warrington (Liverpool) gave an illustrated summary of the physiological structure of the brain of the fowl. Certain tracts degenerate from the pallium into underlying parts, namely, into the thalamencephalon and mesencephalon. The anterior commissure degenerates severely after removal of one hemisphere. Fibres arise from the thalamic nuclei and form a commissure comparable with Gudderi's commissure. From the mesencephalon an ascending tract was traced to near the junction of optic thalamus with corp striatum, and descending tracts into the ventral and lateral columns of the spinal cord. In the cord itself ascending tracts can be distinguished traceable into cerebellum and into the upper part of the cord, and descending in the ventral and lateral regions of the cord. Ferrier's results on excitation of the surface of hemisphere were confirmed.

Prof. v. Frey (Zürich) communicated the results of his work on the adequate stimulation of touch nerves. The intensity of the just noticeable stimulus depends upon the size of tactual surface; the pressure that has to be applied per unit of surface is greater the larger the continuous area of surface simultaneously tested. It is not the pressure *per se* which determines the stimulation, but the difference of pressure obtaining from point to point within the skin.

Profs. Langlois and Richet (Paris) gave an account of observations upon the resistance of diving animals to asphyxia. A hen dies after one minute's immersion, but a duck does not suffer from an immersion of even fifteen minutes. A duck with occluded trachea shows asphyxia in four minutes if left in the air; if plunged in water at 20° C. it shows asphyxia only after a quarter of an hour. After paralysis of the vagus by atropine, plunging does not delay the asphyxia. The plunging in water appears to reflexly restrain the respiratory combustions.

Prof. Lanlainé (Toulouse) brought forward experiments which show that in all cases and under all conditions the heat produced by an animal is equal to the heat calculated from the oxygen consumed by the animal in the time of the experiment.

Dr. R. Magnus (Heidelberg) reported an investigation upon the reaction of the pupil of the isolated eel's eye under various homogeneous lights. A Rowland's grating spectrum was used. The two isolated eye-balls from the same eel, the pupils of which under similar conditions are of similar size, were exposed for twenty minutes, and then photographed by a flash-light. The curve of the intensity of reaction agrees with the absorption curve of the eel's rod-purple. This argues against an effect

being produced upon the contractile tissue of iris mediately through its yellow-brown pigment.

Prof. Delezenne (Montpellier) answered the question whether the congestion of the limbs and skin produced in asphyxia is due to the active dilatation of the blood-vessels of those parts or mechanical dilatation by the blood driven out of the viscera by the asphyxial contraction of the visceral blood-vessels. The femoral vessels of a limb severed, with the exception of its nerves, from the rest of the animal are connected with the circulation of a second animal. Asphyxia, excitation of sensory nerves, &c., still produce under those circumstances increase in the volume of the limb and rise of its temperature.

Dr. O. Grünbaum (Cambridge), showed experiments demonstrating the impermeability of the salivary glands to molecules above a certain weight.

Prof. Bédart (Lille) read a paper on production of mammary secretion by cutaneous Franklinisation.

Dr. D. Noël Paton (Edinburgh) contributed a communication upon the distribution of nitrogen and of sulphur in the urine of the dog. In the course of an investigation on the influence of diphtheria toxin on metabolism it was found that the increase in ammonia nitrogen observed in febrile conditions in the human subject is absent. It was further found that the increase in the excretion of nitrogen was out of proportion to the increase in the excretion of SO_3 of sulphates. It was then proved that the neutral sulphur of the urine is increased, and that thus the total sulphur excretion is proportionate to the excretion of nitrogen. This absence of increase in the sulphuric acid production seems to explain the absence of increase in the formation of ammonia in the dog.

Dr. J. S. Haldane, F.R.S. (Oxford), showed his method of liberating and estimating the amount of oxygen in the blood by means of potassium ferricyanide.

Dr. Arthur Biedl (Privat-docent, Vienna) demonstrated that the blocking of the thoracic duct, or the removal of the lymph from it by a cannula, produces a glycosuria, even in fasting animals. This glycosuria can be set aside by the injection of lymph serum into the veins. Pancreatic diabetes is increased, not removed, by ligating the thoracic duct.

Prof. Denys (Louvain) brought forward experiments towards distinguishing distinct species among the leucocytes of mammals. Myelocytes ground up in serum warmed to 60° communicate to the serum an extraordinary bactericidal power. Lymphocytes, on the other hand, yield no bactericidal substance.

Prof. Graham Lusk (Newhaven, U.S.A.) pointed out that administration of phlorhizin to starving dogs produces elimination of the systemic sugars through the urine, and thereafter dextrose appears in the urine in the constant average ratio as regards nitrogen of 3·75 : 1. This removal of sugar is accompanied by a rise in proteid metalbolism as high even as 560 per cent. Such a rise has only been noted in phosphorus poisoning. The question arises, is not the high proteid metabolism due in both cases to the same cause—the non-burning of the carbohydrates? In the case of diabetes the sugar is removed, in the other perhaps converted into fat. If this be true, and if phosphorus be given in phlorhizin diabetes, then perhaps the urinary sugar might decrease in quantity, because the proteid sugar is being converted into fat. Experiment shows that this diminution does not take place.

Prof. G. Burch (Oxford) gave a communication on temporary colour-blindness produced by exposing the eye to sunlight in the focus of a burning glass, behind a transparent screen. After fatigue by red light, the spectrum appears green, blue, and violet, the green beginning in the part that usually appears orange. After green light, the spectrum consists of red, blue, and violet, the red meeting the blue near the *b* lines. After blue light, the spectrum consists of red, green, and violet, the green meeting the violet between the F and G lines. After violet light between H and K the spectrum consists of red, green, and blue only, the blue ending midway between G and H. After orange light from D the spectrum consists of two colours only, viz. blue and violet, the blue beginning at the *b* lines. After indigo light, the spectrum consists of two colours only, namely red and green, the green ending a little beyond F. After purple light, or after indigo light followed by red light, the spectrum consists of green only, from about D to F. After indigo light followed by green light, the spectrum consists of red only, and is visible from A to about the *b* lines.

Dr. René du Bois-Reymond (Berlin) communicated for Prof. N. Zuntz an account of the construction and performances of a new ergometer, of which a working model was exhibited.

Prof. A. B. Macallum (Toronto) communicated for Dr. F. H. Scott (Toronto) some points in the micro-chemistry of nerve-cells. The Nissl granules are found to contain "organic" phosphorus as well as "masked" iron; they, therefore, probably consist in part at least of something which, like nuclear chromatin, is an iron-holding nucleo-proteid.

Communications were also brought forward by Prof. Allen, Dr. Atwater, Dr. Cohnheim, Prof. Floresco, Dr. Johansson, Miss Huie, Dr. S. Fränkel, Dr. Barnard, Prof. Bohr, Dr. Lauder Brunton, and others.

On Thursday, August 25, the honorary degree of D.Sc. was conferred upon Prof. Bowditch (Harvard), Prof. Golgi (Pavia), Prof. Kronecker (Bern), Prof. Kühne (Heidelberg), and Prof. Marey (Paris). The speeches delivered by the Public Orator in the Senate House on the occasion have already appeared in NATURE (p. 428).

Among the members of the congress not actually contributing communications were the following:—Prof. Fredericq (Liège), Dr. L. Querton (Brussels), Dr. J. H. Cameron (Toronto), Prof. Gordon (Toronto), Profs. Sandwith and Wilson (Cairo), Prof. Dastre (Paris), Prof. Doyon (Lyon), Prof. Dubois (Lyon), Prof. Jolyet (Bordeaux), Prof. Lambert (Nancy), Prof. Lortet (Lyon), Prof. Morat (Lyon), Dr. L. Olivier (Paris), Prof. Weiss (Paris), Prof. Edinger (Frankfort), Prof. Garten (Leipzig), Prof. Jaffé (Königsberg), Prof. Kühne (Heidelberg), Dr. K. Mays (Heidelberg), Prof. Hans Meyer (Marburg), Dr. V. Uexküll (Heidelberg), Dr. Anderson (Cambridge), Dr. Brodie (London), Dr. Edkins (London), Dr. Elliot Smith (Cambridge), Dr. Ewart (London), Prof. Gamgee, F.R.S. (Lausanne), Dr. Garrod (London), Dr. Gaskell, F.R.S. (Cambridge), Miss Greenwood (Cambridge), Dr. Head (London), Dr. Leonard Hill (London), Dr. W. Hunter (London), Prof. Kanthack (Cambridge), Prof. Leech (Manchester), Dr. Pembrey (London), Prof. Ringer. F.R.S. (London), Dr. Shore (Cambridge), Prof. Stirling (Man, chester), Prof. Stockman (Glasgow), Prof. Einthoven (Leyden)-Prof. Stokvis (Amsterdam), Dr. Hankin (Agra), Prof. Purse, (Dublin), Dr. Treves (Turin), Prof. Amaya (Tokio), Profr Mislawski (Kasan), Prof. Wedenskii (St. Petersburg), Prof. Oehrwall (Upsala), Prof. Kocher (Bern), Prof. Prévos. (Geneva), Prof. Metzner (Basle), Prof. Sahli (Bern), Drt Billings (New York), Prof. Lombard (Ann Arbor, Michigan). Dr. E. Dupuy (Paris), Prof. H. C. Wood (Philadelphia), Prof. Wilson (Cairo), Prof. Fano (Florence), Prof. Peters (Toronto), and Prof. Golgi (Pavia).

NOTES.

THE recent meeting of the American Association at Boston was one of the largest and most successful in the history of the Association, the attendance numbering nearly one thousand members, representing almost every State in the Union. More than four hundred papers were read and discussed in the various sections, and a large proportion of them were of a very high order. The address of the retiring president, upon some points in theoretical chemistry, was referred to in last week's NATURE. Prof. Putnam, the new president, also delivered an address, and the following addresses were given by the sectional presidents:—Section A (Mathematics and Astronomy), development of astronomical photography, Prof. E. E. Barnard. Section B (Physics), on the perception of light and colour, Prof. F. P. Whitman. Section C (Chemistry), the electric current in organic chemistry, Prof. Smith. Section E (Geology and Geography), glacial geology in America, Prof. H. L. Fairchild. Section F (Zoology), a half-century of evolution with special reference to the effects of geological changes on animal life, Prof. A. S. Packard. Section G (Bötany), the conception of species as affected by recent investigations on fungi, Prof. W. G. Farlow. Section H (Anthropology), the advance of psychology, Prof. Cattell. Section I (Economic Science and Statistics), the historic method in economics, Mr. Archibald Blue. The following officers were elected for the ensuing year:—President: Mr. Edward Orton, President of