

ward the attainment of clearly specified ends. To some extent this work has already been done for astronomy, and more than one observatory could exemplify what I mean. In a fully manned and equipped observatory great investigations, too large for one astronomer to handle alone, can be carried out systematically; and this is actually done. In mapping the heavens, even, several observatories can combine their forces, each one covering a definite part of the field; but in chemistry no policy of this kind has yet been possible. The extension of the observatory method to other departments of science is the advance for which I plead.

Suppose now we had a great laboratory, fitted up for chemical and physical work together, well endowed and well manned. What might we not expect from it? Great problems could be taken up in the most thorough and orderly fashion, methods of work might be standardized and groups of physical constants determined; the results would aid and stimulate individual students everywhere, and applied science, too, would receive its share of the benefit. There is to-day a growing commercial demand for accurately determined constants, and no institution in which the demand may be adequately supplied. At Charlottenburg, in Germany, there is a beginning; in London the munificence of Ludwig Mond has made possible a similar start; but nowhere is such a plan as I propose in full and perfect operation. The United States has great observatories, fine museums of natural history and flourishing universities; why should it not have institutions for physics and chemistry also? These sciences touch many industries at many points; their applications have created wealth beyond all possibility of computation; now let that wealth do something for them in return. Half the sum that the Nation spends in building one battleship would erect, equip

and endow a laboratory more complete than any now existing, whose influence would be felt throughout all civilized lands and endure as long as humanity. In this the United States might take the lead and set a great example to all other nations. The United States has long been a follower in science; may she soon take a higher place as teacher.

F. W. CLARKE.

U. S. GEOLOGICAL SURVEY.

#### THE AMERICAN PHYSIOLOGICAL SOCIETY.

THE ninth annual meeting of the American Physiological Society was held in Boston and Cambridge on December 29 and 30, 1896. The sessions of the first day were held at the Harvard Medical School, those of the second day at the University Museum, Cambridge. The following communications were presented and discussed:

*Studies in the physiology of the mammalian heart.* W. T. PORTER.

Cannulas were placed in the aorta and the innominate and pulmonary arteries of the cat. A thermometer was inserted in the right auricle through the superior vena cava. All other heart vessels were ligated, except the coronary arteries. Warm defibrinated cat's blood flowed into the aorta under pressure, passed through the coronary vessels and escaped, in drops as a rule, from the pulmonary cannula. A mercury manometer connecting with the innominate artery recorded the pressure at the mouths of the coronary arteries. A Hürthle membrane manometer, coupled with a tube that was passed into the left ventricle through the left auricular appendix, registered the force and frequency of ventricular contraction. Variations in the temperature of the blood and the volume of the escaping drops were too slight to affect the correctness of the conclusions.

Intraventricular pressure curves were presented to demonstrate the following

facts: A fall in the volume of the coronary circulation, *e. g.*, 73 %, caused a fall in the force of the heart beat of 49 %, while the frequency was altered but 9 %. Restoring the volume of the coronary circulation restores the force and frequency of the heart beat. The change in force follows the change in blood supply immediately. These and other related observations are about to be published in the *Journal of Experimental Medicine*, by J. B. Magrath and H. Kennedy.

Miss Hyde has studied by the same method the effect of distention of the heart on the volume of the coronary circulation. Distension of the left ventricle, *i. e.*, making a constant pressure in the ventricle through a side branch of the membrane manometer tube, diminishes *per se* the volume of the coronary circulation. Distention acts further as a stimulus to the cardiac muscle, causing the ventricle to beat more strongly. Strong contractions of the ventricle cause an increase in the volume of the coronary circulation. If the ventricle, having been distended, is placed again at atmospheric pressure, the force of contraction is much diminished.

Dr. Porter also showed curves recording the diminution in coronary flow occasioned by stimulation of the peripheral end of the vagus nerve. Increase in coronary circulation follows stimulation of the cervical sympathetic. These results indicate vasoconstrictor fibres in the vagus and vasodilator fibres in the sympathetic.

Later Dr. Porter demonstrated his method of isolating the cat's heart for purposes of physiological investigation.

*On the duration of cardiac standstill with different strengths of vagus stimulation.* T. HOUGH.

A stimulus of uniform strength was obtained by the use of a storage battery in the primary circuit, which was interrupted by the revolutions of a small electric motor

run at a constant rate of speed; the strength of stimulus was varied by changing the resistance in a German silver rheochord placed in the primary circuit. It was found that when the inhibitory impulses, obtained by stimulation of the vagus nerve, are just strong enough to bring the heart of the dog to rest, the duration of standstill is not so long as with stronger stimuli; but that a very slight increase of stimulus above this point produces a standstill which is not lengthened by any further strengthening of the inhibitory impulses. The conclusions drawn from previous work on the same subject (*Journal of Physiology*, XVIII., 190) are, therefore, correct.

*Some experiments on the relation of the inhibitory to the accelerator nerves of the heart.*  
R. HUNT.

Some of the effects of stimulating the two nerves separately were first described; then the result of stimulating the nerves simultaneously. The experiments show that, contrary to the commonly accepted opinion of Baxt, the inhibitory and accelerator nerves are to be regarded as purely antagonistic; that the result of stimulating the two together is approximately the algebraic sum of the effects produced by stimulating them separately. In no case did one nerve completely overcome the effect of the other, though the two were stimulated for periods as long as twelve minutes. The experiments were performed upon dogs and cats.

*Exhibition of plethysmographic curves obtained during sleep, with remarks.* W. H. HOWELL.

Prof. Howell exhibited plethysmographic curves showing the changes in volume of the hand and wrist during the period of normal sleep. The apparatus was so arranged as to register the actual changes in volume without altering the pressure upon the parts under observation. The curves showed that from the beginning of the at-

tempt to go to sleep a gradual increase in volume took place, the unconsciousness of sleep appearing at some point during this increase. The volume reached its maximum within one or two hours after the beginning of sleep, and then for an hour or two remained practically constant. Following upon this there appeared a gradual constriction, which at first was very gradual, but increased more rapidly during the last half or three-quarters of an hour of sleep, and brought the volume curve at the time of awakening nearly or quite to the point shown at the beginning of sleep. The curves exhibited also throughout the sleeping period long periodic waves of constriction and expansion, lasting for an hour or more, and numerous shorter rapid constrictions and expansions, which were connected with the movements of the sleeping subject or with external stimuli such as noises in the street.

Upon the assumption that the increased volume was owing to a vascular dilatation, particularly in the skin, the author pointed out that upon the accepted view of the regulation of blood supply in the brain, the volume of circulation and the pressure within this organ during sleep must stand in reciprocal relations to the volume changes exhibited by the limbs, that is, during the period of sleep the blood supply to the brain and intracerebral pressure gradually diminish to a minimum which is reached within the first one or two hours; this condition remains practically constant for the following hour or two, and is then succeeded by a gradual increase in blood flow and intracerebral pressure, which may be said to reach the normal condition at the time of awakening. The author explained the vascular changes by a fatigue and subsequent resumption of tone in the vaso-motor center, especially in that part controlling the skin circulation. He pointed out the want of parallelism between the curves of inten-

sity of sleep and the curves showing the vascular changes, and developed a theory of sleep which referred the immediate cause of sleep and of spontaneous awakening to the conditions of blood supply and pressure in the brain, which are indirectly controlled by the state of the vaso-motor center.

*The relation between height, weight and age in growing children.* H. P. BOWDITCH.

Prof. Bowditch showed curves derived from his own observations on Boston school children, and those of Dr. Porter on St. Louis children, showing that the relation between height and weight varies with the age in such a way that older children are heavier in proportion to their height than younger children.

*On the contraction of the stomach produced by direct stimulation and by stimulation of the vagi with the faradic current.* S. J. MELTZER.

1. Bipolar faradic stimulation with a current strong enough to produce a maximal contraction when applied to the serosa usually fails to produce any local or peristaltic contraction of the muscularis of the stomach, when applied to the mucous membrane of any part of the stomach. 2. When the faradic stimulus is applied to the serosa the effect varies according to the part of the stomach which is stimulated. As regards contractility, the stomach possesses a negative and a positive pole; the extreme end of the fundus does not even with very strong stimuli contract, while the pyloric end responds to a moderate stimulus with a strong contraction. The parts lying between the poles show a gradual transition from one extreme into the other; the further from the left end of the stomach, the walls contract more readily and more strongly. 3. Stimulation of the pneumogastric nerves causes a distinct contraction, which is strongest after the cessation of the stimulation. This contraction is also

mainly limited to the right part of the stomach.

Later Dr. Meltzer demonstrated the above stated results on the stomach of a well anesthetized dog.

*An experimental investigation of some of the conditions influencing the secretion and composition of bile.* (With Mr. A. Balch.) FR. PFAFF.

The subject of the investigation was a female patient of the Massachusetts General Hospital. Dr. H. H. A. Beach had operated on the patient for distention of the gall bladder. As a result of the operation a fistula remained, through which all the bile secreted was discharged. The jaundice, which existed before, disappeared completely in the course of a few weeks, the urine becoming bile free. The feces remained completely clay-colored. At the time the investigation was begun by Dr. Pfaff and Mr. A. Balch, a student in the Harvard Medical School, the patient felt perfectly well. The bile escaping through the fistulous opening was collected in graduated jars, measured and analyzed every six hours. The specific gravity, the total amount of solids, and the ash of each sample of bile were determined.

The influence of human bile, ox bile, salol, sublimate, calomel and a mixture of pure bile salts on the daily excretion and the composition of the bile was studied. Human bile, ox bile and the mixture of the pure bile salts, dried and made into pills, increased the daily secretion and the amount of solids. Salol had scarcely any effect. Sublimate and calomel, if anything, slightly decreased the daily secretion. During the time of observation, ninety-seven days, the patient remained perfectly well, and has increased in weight from  $113\frac{1}{2}$  to 127 pounds.

*The production of sugar from gelatine in metabolism.* G. LUSK.

Experiments described at the last meet-

ing showed that subcutaneous injection of phlorhizin every eight hours into starving rabbits produced, after the first day, the removal of dextrose through the urine in a constant ratio to the nitrogen eliminated at the same time. The ratio may be represented thus: D : N :: 2.8 : 1. This condition the author terms 'total phlorhizin diabetes,' since the ratio is the same as obtained by Minkowski after the extirpation of the pancreas in dogs, in 'total pancreas diabetes.' If rabbits with total phlorhizin diabetes be fed with 5 grams of gelatine, there is a simultaneous rise in both sugar and nitrogen in the urine of the corresponding day, showing respectively the absorption of the gelatine and the production of sugar from it. The proportion between dextrose and nitrogen is represented in one case by 2.5 : 1. Further experiments upon dogs, to whom gelatine is obviously a more natural food than to rabbits, are in progress in the author's laboratory. According to Külz 'phloridzin' and 'phlorizin' are false orthography.

*Demonstration of a convenient form of apparatus to avoid explosions in gas analysis.* G. T. KEMP.

The apparatus is a new and simple form of grisometer for use with mercury. The gas mixture, instead of being exploded by the electric spark, is subjected to the action of a platinum spiral heated white hot by an electric current. This causes the complete combustion of gases in non-explosive proportions, obviates the addition of explosive mixtures, and allows the gases that are to be analyzed, when present in small amount, to be diluted with a neutral gas to a volume convenient for handling in the different steps of the analysis.

*The structure of the sympathetic ganglia of vertebrates, with demonstration of preparations.* G. C. HUBER.

Sympathetic ganglia taken from various

fishes, amphibians, reptiles, birds and mammals were studied by means of methylene blue and alum carmine as in the subsequent paper. The cells of the sympathetic system are multipolar, except in the amphibians, where large unipolar cells are found. The multipolar neurons have several protoplasmic branches (dendrites) and one axis cylinder (neuraxis); the unipolar cells have the neuraxis only. The cell body of the neurons is enclosed within a nucleated capsule. The dendrites break up into a system of finer branches which terminate between the ganglion cells; the plexus is extracapsular. Large medullated fibres and sympathetic fibres end in the ganglion.

The large medullated fibres branch repeatedly in the ganglion, ultimately terminating in pericellular end-baskets, which enclose the bodies of the sympathetic cells. These end-baskets are always intracapsular, and show different degrees of complexity in the various classes of vertebrates. In fishes they may be either very simple, composed only of a few fibrillæ, or very complex; in the latter case some of the fibrils of the end-basket enclose the cell body of the neuron in question, while others seem to end between small cells, the nature of which has not yet been determined, but which are also within the capsule of the cell. In amphibians the medullated fibres are twisted spirally about the axis cylinders of the unipolar cells here found, before terminating in the end-baskets enclosing the bodies of the cells. In reptiles the appearances vary greatly in different ganglia and in different parts of the same ganglion. Here, also, very simple end-baskets may be found; again the medullated fibre may make one, two, three or four turns around the axis cylinder of a sympathetic cell before breaking up into the finer branches of its end-basket, and finally very complicated endings may be observed, where one or several medullated fibres are wound separately

around the axis cylinder and the adjacent portion of a sympathetic neuron before terminating in a very complex intracapsular end-basket. In birds and mammals the medullated fibres terminate in end-baskets which, as a rule, are rather simple, being composed of terminal fibrillæ, more or less loosely interwoven and always found between the body of a sympathetic ganglion cell and its capsule.

Sympathetic nerves ending in a ganglion break up into fine branches, which would seem to terminate in free endings on the protoplasmic branches of the sympathetic cells of the ganglion without forming end-baskets.

This conclusion has been drawn: The large medullated fibres ending in pericellular baskets come from the cerebro-spinal system and place the sympathetic ganglia in connection with the brain and cord, while the sympathetic fibres with free endings come from other sympathetic ganglia.

*Remarks on the ending of nerves in muscle tissue, with demonstrations.* G. C. HUBER.

The methods used in preparing the sections was the following: A 2 per cent. solution of methylene blue in normal salt solution was injected into a vein. Some time after the injection the tissues were exposed and developed in the air. As soon as the motor endings were recognized in the fresh muscle, the tissues were fixed in ammonium molybdate (Bethe), dehydrated in alcohol, embedded in paraffine, and sectioned. The sections were then fixed to a slide, stained in alum carmine and mounted in balsam. In order to determine with some degree of certainty the relation of the end-organs to the muscle fibres, the latter were cut in both horizontal and cross-sections. The conclusions are as follows:

A. Voluntary muscle (rabbit). The granular sole is an accumulation of sarcoplasma at the point of entrance of the nerve;

the nuclei of the sole are nuclei of the sarcoplasma. The axis cylinder of the motor nerve ends in an end-brush in the sarcoplasma. The neurilemma becomes continuous with the sarcoplasma.

B. Heart muscle (cat and dog). Axis cylinders of sympathetic ganglion cells terminate on the heart muscle cells either as very simple endings, namely, one or two very fine end-branches which terminate in small granules or bulbs, or in somewhat more complicated end-organs composed of several small twigs, these usually ending also in the bulbous enlargement.

C. Involuntary muscle (cat, rabbit and tortoise). The ending here is very simple. The terminal branches of the axis cylinders course along between the involuntary muscle cells, giving off in their course very fine side branches which end on the cells often near the nucleus.

*The functional development of the cerebral cortex in different groups of animals.* W. MILLS.

The dog, cat, rabbit, guinea pig, rat and mouse were studied. Only those animals were used whose exact age was known, and ether was the anæsthetic invariably employed. The research was carried on in connection with investigations on the psychic development of the same animals. The following are among the most important conclusions drawn :

In the dog, cat, rabbit (and, in so far as the author's experiments go, in the rat and mouse) neither the brain cortex nor the underlying white matter is excitable by electrical stimulation at birth or for some days afterwards. The cortex is usually not excitable till about the period when the eyes open, though there are exceptions to this rule, most frequently in the author's experience in the cat, in favor of an earlier date. The white matter of the brain just beneath the cortex is generally excitable either at an earlier date than the cortex or

with a weaker stimulus. The reaction for the limb movements is obtainable invariably somewhat earlier in the dog and the cat, and generally so in the rabbit, than those for the neck, face, etc. Localization for the cortex, and still more for the white matter, is at first ill defined, but gradually, though rapidly, becomes more definite. In the cavy (guinea pig) the cortex and the white matter beneath are electrically excitable either at birth or a few hours afterwards, and perfection of reaction and localization is reached in a few days. Before the brain cortex responds to electrical excitation, ablation of the motor area (centers) leads to no appreciable interference with movements. The younger the animal, the stronger the current required to produce reaction up to the time that localization is well established, *i. e.*, the weakness of the current required to cause a movement is an indication of the degree of development of the center in question. Differences for breeds and individuals exist and constitute to some extent exceptions to the above general statements.

In the above, 'cortex' refers to the gray matter in or near the motor area, and 'white matter' to the brain substance immediately beneath.

*The restoration of coordinate power after nerve crossing.* R. H. CUNNINGHAM.

Read by title.

*The proteolytic action of papain.* R. H. CHITTENDEN.

The exact relationship of the vegetable proteolytic enzymes to the corresponding enzymes of animal origin has never been quite clear. The conditions governing the action of both papain and bromelain indicate a closer relationship to trypsin than to pepsin. The products found, however, appear to differ somewhat both chemically and physiologically from the corresponding products formed by animal enzymes. Brom-

elin, the ferment of pineapple juice, like trypsin, is unquestionably a typical peptone-forming enzyme. Quite recently, however, a number of investigators have stated that papain is unable to form peptone, *i. e.*, that its digestive action is limited to the formation of proteoses. The present experiments made mainly by Mr. McDermott, on the other hand, clearly show that papain is able to form true peptone quite readily from coagulated egg albumin, from blood fibrin and from the coagulated proteids of muscular tissue. This peptone-forming power is manifested in a few hours at 40° C., and in the presence of one per cent. sodium fluoride, thymol or chloroform water.

*Experiments on the physiological influence of alcohol.* C. F. HODGE.

The experiments reported have been conducted during the past three years for the Committee of Fifty, the purpose being to collect impartial data in the general physiology of the subject. Attention has been directed chiefly along three lines, namely, the influence of alcohol: 1st, upon growth, including reproduction; 2d, upon psychic development; 3d, upon animal activity and ability.

Experiments, already reported, upon the growth of yeast proved that in fresh cultures an addition of  $\frac{1}{1000}$  of one per cent. of pure alcohol retarded growth materially proportionately much more than larger amounts.

Experiments upon kittens and puppies were made as follows: Two pairs of kittens as much alike as possible, the males from one litter, the females from another, were selected. Alcohol in moderate doses was given to one pair, the other pair being kept on normal diet for comparison. At the end of ten days' administration of alcohol the alcoholic pair had contracted severe colds, and alcohol was discontinued until recovery should take place. This, however, did

not occur, so that the administration of alcohol was permanently discontinued. Curves of weight showed that the alcoholic pair had been dwarfed, the male and female attaining only 39 % and 63 % respectively of the weight of their controls. From later developments in the course of the experiment, it is probable that this stunting effect is to be ascribed chiefly to the disease rather than to the alcohol. The alcoholic kittens became very quiet, various psychic characteristics, notably playfulness, purring, fear of dogs and game instincts, dropping out with great abruptness. Disease becoming thus intercurrent, however, renders any definite interpretation of the experiment impossible.

Similarly two pairs of cocker spaniel puppies were carefully selected, the males brothers, the females sisters. Great care was taken to avoid pathological complications and to keep the experiment as strictly as possible on physiological lines. Accordingly non-intoxicant doses were used and were increased as the puppies grew. These now amount to 35 and 38 cc. of absolute alcohol for the female and male respectively; that is, about 4 cc. per kilo of body weight has been given daily since the puppies were nine weeks old. Growth has been practically normal, the alcoholic pair even growing a little faster than their controls at first. Possibly four dogs could hardly be found to grow more uniformly under normal treatment. Each normal animal is, however, about 5 % heavier than its alcoholic brother or sister. On the side of the reproductive functions, too, the puppies of the alcoholic pair are not inferior to those of the normals.

The chief difference is on the psychic side. Both the alcoholic animals are much quieter than their controls and both are abnormally timid. As tested by the pedometer method the alcoholic male was found to develop 71 % of the daily activity of his brother, the female only 57 % of her sister. Much severer

tests of ability were made by throwing a ball, the dogs competing on equal terms for its possession and for the privilege of bringing it back. In two series of tests made in this way, 1,400 and 1,000 balls being shown, the alcoholic male has shown an efficiency of only 32% and 44% as compared with that of his brother. On account of differences in condition, no satisfactory test has been possible as yet with the females.

A series of photographs taken at intervals during the research was exhibited.

*The physiological action of nitrous oxide.* G. T. KEMP.

It has been claimed that the supposed anæsthetic properties of nitrous oxide are due to its asphyxiating power. A careful comparison of its physiological action with that of a neutral gas, such as nitrogen, shows that in nitrous oxide separate anæsthetizing and asphyxiating powers may be demonstrated. To supplement this, a series of analyses of the blood gases of animals asphyxiated by nitrous oxide shows that anæsthesia may be obtained with this gas while the blood is still carrying sufficient oxygen to meet the demands of the system. Work with nitrous oxide and oxygen indicates that soon an anæsthetic may be recommended, which will be effective and yet avoid the objections applying to chloroform and ether.

*On bactericidal effects of lymph from the thoracic duct.* (With Dr. Charles Norris.) S. J. MELTZER.

In contrast to the surprising statements of Max Neisser that the lymph coming from the thoracic duct does not contain bactericidal properties, the authors find the lymph coming from the thoracic duct of dogs to be distinctly germicidal for the typhoid bacillus. The bactericidal power of the lymph differs from that of the blood in not becoming exhausted even after days.

Neisser apparently employed unreliable methods.

*On the interpretation of the so-called latent period of the motor nerve-endings, and on the supposed demonstration of their exhaustibility.* F. S. LOCKE.

The replacement by mere contact of the continuity formerly believed generally to exist between irritable structures would seem to necessitate more attention being given to the 'discharge hypothesis,' on which Kühne has especially insisted—namely, that the motor nerve-fibre stimulates the muscle-fibre by means of its action current, which acts as an electric stimulus. The author's experimental results favor the view that the so-called latent period of the motor nerve-endings, which has been held by Bernstein and others to be crucial against the hypothesis, may be due to the nature of the electric stimulation by the action current. It was found that the secondary stimulation of one frog's sartorius muscle by the action current of another is associated with a measurably longer latent period than is stimulation with an induction shock.

Another argument against the 'discharge hypothesis' might conceivably be founded on the supposed exhaustibility of the motor nerve-endings. It was found, however, that if the curarised sartorius be continuously tetanised by make and break shocks through one pair of electrodes, till 'exhaustion' is complete or nearly so, then sending the tetanising shocks through another pair of electrodes situated on different points of the muscles gives again good tetanus. 'Exhaustion' in consequence of electric tetanisation is, therefore, primarily polar, and the results that have been supposed to demonstrate the exhaustibility of motor nerve-endings are readily reconcilable with the 'discharge hypothesis,' local 'exhaustion' of the muscle substance immediately in



contact with the nerve-endings replacing fatigue of these themselves.

The 'discharge hypothesis' affords a new conception of the real nature of inhibition and accounts for the actual properties of inhibited muscle. The anelectrotonus of the muscle substance, which must necessarily accompany the more active katelectrotonus even in the case of the action current of the motor nerve-ending, may not inconceivably become by greater anodic current density the more active in the case of the action current of inhibitory nerve-endings, and be the essential factor in the production of inhibition.

*Gum arabic and the frog's heart.* F. S. LOCKE.

The author has again found, in contradiction to M. Albanese's recent statement, that sodium arabate, unlike gum arabic (from which it differs by containing sodium in place of calcium, magnesium and potassium), confers no special sustaining power on 6 per cent. sodium chloride solution, weakly alkalized with sodium carbonate and saturated with oxygen.

*The measurement of the output of the heart.* G. N. STEWART.

A solution of a substance (*e. g.*, sodium chloride), which can be easily recognized and quantitatively estimated in the blood, is allowed to flow at a known rate for a measured time through the external jugular vein into the heart. When the mixture of blood and injection liquid has reached a convenient point of the arterial system beyond the heart, *e. g.*, the femoral artery, a sample is drawn off during its passage. From the composition of this sample, the amount of blood with which the injection liquid must have been mixed in the heart, that is, the outflow (or inflow) of the heart during the time of injection, is determined. The electrical resistance of the mixed fluid being different from that of the blood, a

telephone is employed to announce the time of arrival at the point of observation. So far the results seem to show that the more recent measurements of Tigerstedt, Stolnikow, etc., are too low, while those of the older observers (Volkmann, etc.) are too high.

As a preliminary to this investigation the author shows that when the time of injection is not too short it is approximately equal to the time of passage of the altered blood through a given cross-section of the carotid or femoral artery. The circulation time of the lungs, as determined by the injection of methylene blue in rabbits and of NaCl by the telephone method in dogs, is approximately the mean pulmonary circulation time and not the minimum. This is also the case for such artificial schemes as approach the condition of a vascular capillary tract.

*Demonstrations of apparatus.* G. W. FITZ.

1. A spring cylinder chronograph for spark records.
2. A lever system to illustrate the action of muscles in relation to joints.
3. A form of student's myograph.
4. A modification of the location reaction apparatus.

*Demonstration of preparations of the nerve cell under acute alcoholic poisoning.* C. F. HODGE (for C. C. Stewart).

Specimens to illustrate Mr. Stewart's recent paper (*Journal of Experimental Medicine*, Vol. I., No. 4, 1896) were demonstrated to the Society. In the experiment cats were used, one being held in alcoholic stupor for 54½ hours, a second 50 minutes, death being caused by alcoholic poisoning in both cases, and a third being killed by decapitation. From the three animals, thus dead at the same time, corresponding portions of the nervous systems were removed and immediately placed in the same dishes of the several fixing and hardening

reagents employed. The sections demonstrated were those obtained from the cerebrum, cerebellum and spinal cord by the alcohol-methylene-blue method. It was easily observable, even by the unaided eye, that the sections from the normal animal stained much more deeply than those from either of the animals killed with alcohol. Material from the animal killed in 50 minutes was also easily seen to be stained somewhat more deeply than that from the animal killed in  $54\frac{1}{2}$  hours. Methylene blue, as thus applied, has been found to be especially good for staining the granules in the cell protoplasm. Absence of stain in the alcoholic material would thus seem to indicate that alcohol, as above applied, had either destroyed the characteristic granulation of the cell protoplasm or so changed the cell contents that it is no longer able to hold the stain.

Prof. W. H. Howell proposed the following resolutions regarding the work of the late Prof. H. Newell Martin: "The members of the American Physiological Society have heard, with profound regret, of the death of Prof. H. Newell Martin. In commemoration of his distinguished services the Society adopts and places upon its official record the following expression of its appreciation and esteem. In the death of Prof. Martin the Society has lost a member to whom it owes an especial debt of gratitude. He was actively concerned in its foundation and organization, and during the critical period of its early history he gave much time and thought to its interests. He served for six years as its Secretary and Treasurer, and strove always with enthusiasm to make a successful beginning of an enterprise which he believed would foster the spirit of scientific research in physiology and bring its active workers into stimulating fellowship. For its present prosperous condition and its prospects of future usefulness the Society feels that it is largely in-

debted to his wisdom and energy. In a broader field his influence upon the science of physiology has been deeply felt. His own splendid contributions to experimental physiology will have an enduring value, while the stimulus given by him to others has been, and will continue to be, an influential factor in the development of physiological instruction and research in this country. As an investigator and teacher he was distinguished not only by his originality and ability, but by many noble traits of character. His modesty, his genuine interest in all kinds of biological work, his steady insistence upon the highest ideals of scientific inquiry, his chivalrous conception of the credit due to his fellow-workers, and the generous sympathy and appreciation always felt and shown by him for the work of younger investigators, are some of the qualities which will endear his memory to those who were so fortunate as to be brought into intimate association with him as teacher or as friend."

Prof. H. P. Bowditch, in seconding the resolution, said: "Probably few of the younger members of the Society are aware of the great debt which we owe to Dr. Martin for establishing the high standard which the Society has always maintained with regard to the qualifications of the members. It was always Dr. Martin's contention that a candidate for admission to our ranks should be required to demonstrate his power to enlarge the bounds of our chosen science, and not merely to display an interest in the subject and an ability to teach text-book physiology to medical students. To his wise counsel in this matter the present prosperity of the Society is, I think, largely to be attributed. I trust that the resolution will be adopted and spread upon the records of the Society."

The resolution was unanimously adopted.

A cordial invitation to the members of the Society to join the British Association

for the Advancement of Science at its Toronto meeting in August, 1897, was received and accepted with thanks.

The following gentlemen were elected to membership: Prof. A. B. Macallum, M. B., Ph.D., Toronto University; Prof. W. S. Carter, M. D., University of Pennsylvania; L. B. Mendel, Ph.D., Yale University.

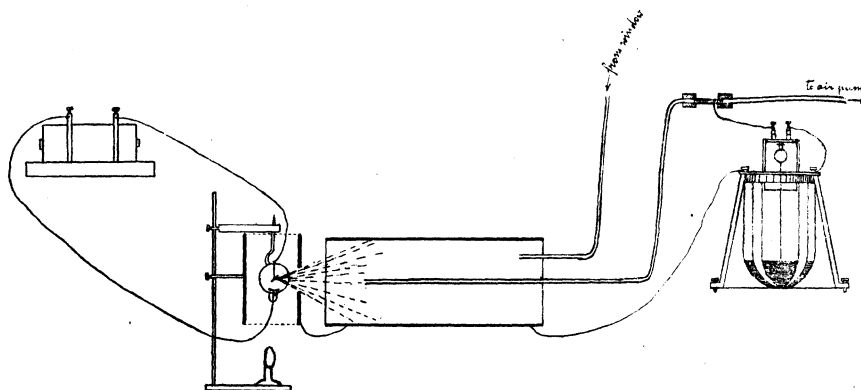
The following officers were elected: Council: R. H. Chittenden, Yale, President; F. S. Lee, Columbia, Secretary and Treasurer; H. P. Bowditch, Harvard; W. H. Howell, Johns Hopkins; W. P. Lombard, Michigan.

FREDERIC S. LEE,  
*Secretary.*

COLUMBIA UNIVERSITY.

#### ELECTRIFICATION OF AIR BY RÖNTGEN RAYS.\*

To test whether or not the Röntgen rays have any electrifying effect on air, the following arrangement was made.



A lead cylinder 76 cm. long, 23 cm. diameter, was constructed; and both ends were closed with paraffined cardboard, transparent to the Röntgen rays. Outside the end distant from the electrometer (see diagram) a Röntgen lamp† was placed. In

the other end two holes were made, one in the middle, through which passed a glass tube (referred to below as suction pipe) of sufficient length to allow the end in the lead cylinder to be put into any desired place in the cylinder. By means of this, air was drawn through an electric filter\* by an air pump. The other hole, at a little distance from the center, contained a second glass tube by which air was drawn through india rubber tubing from the open-air quadrangle outside the laboratory.

In one series of experiments the end of the suction pipe was kept in the axial line of the lead cylinder at various points 10 cm. apart, beginning with a point close to the end distant from the Röntgen lamp.

In every case the air drawn through the filter was found to be negatively electrified when no screen or an aluminium screen was interposed between the Röntgen lamp and the near end of the lead cylinder. The

air was found not electrified at all, or very slightly negative, when a lead screen was interposed.

When the Röntgen lamp was removed or stopped, and air was still pumped through the filter, no deflection was observed on the electrometer. This proved that the air of the quadrangle was not electrified sufficiently to show any deflec-

\*Read before the Royal Society of Edinburgh, Monday, December 21, 1896. From proof-sheets of *Nature*, contributed by Lord Kelvin.

† The Röntgen lamp was a vacuum vessel with an oblique platinum plate (Jackson pattern).

\* Kelvin, Maclean, Galt, Proc. R. S., London, March 14, 1895.