A MEDICAL REVIEW OF SOVIET RUSSIA.

III.—SCIENTIFIC WORK.

BY

W. HORSLEY GANTT, B.Sc., M.D.,
FORMERLY CHIEF OF THE MEDICAL DIVISION OF THE AMERICAN
RELIEF ADMINISTRATION, PETROGRAD (LENINGRAD) UNIT.

SOVIET ATTITUDE.

WHILE the Soviet Government has attempted to make its institutions proletarian, it has at the same time endeavoured to foster science within its borders, and it has not entirely failed to accomplish its purpose in either of these respects. Although laboratories and schools are much poorer than formerly, and although scientists as well as others have undergone severe privations, science in Soviet Russia has kept up to its former high standard, and, paradoxically, has even prospered.

There are many who will take the view that scientific progress has been made in spite of the Bolsheviks, that they have hindered rather than furthered its advancement, and that all the progress has been due to the zeal of the Russian scientists. Of their zeal there is no doubt. However, from my contact with various Communist officials in different parts of Russia, I believe that they are fully aware of the importance of science, not only to humanity and materialistic achievement, but to the success of their government, and I found that nearly all of them took a genuine interest and pride in the scientific institutions of Russia. I have been impressed many times with the wholehearted support and sympathy which they give to these places. I do not mean that the scientists have not worked under enormous economical disadvantages. But my feeling is that the Soviet authorities have done what they could with their limited means to keep science alive and to encourage its growth when this has not conflicted with their political principles. The elevation of science, I might say its deification, is more or less part and parcel of their political philosophy; for the deification of natural science fits in well with the materialistic theories of Marxism. The present Government also desires particularly to increase the domain of applied science in Russia.

Like most other things in Russia, all scientific institutions are supported entirely by the State. In the process of "nationalization" they lost their former sources of income, and receive rations, salaries, fuel, etc., from the State.

As I was not in Russia before the revolution I am unable to give a first-hand comparison of the condition of science in Czarist Russia. The present actual financial resources are less than formerly, but certain new expeditions have been financed by the Soviet Government and researches in many domains have been undertaken. A few of the professors have been sent abroad for study or conference—for example, Pavlov and his son were given £350 for their trip abroad last summer. Being unfamiliar with conditions in Russia under the Czar, I shall give my impressions of the attitude of the Soviet Government towards science rather than an accurate comparison.

RECENT SCIENTIFIC PROGRESS.

In the following account I shall mention some of the lines along which science has made progress in Russia, and go into some details regarding the work of Pavlov, the greatest of all Russian scientists, on trophic nerves and on the sympathetic system; but before going into these scientific medical accomplishments it may not be out of place to mention briefly some of the scientific work being done in other fields.

Physics.—In physics Professor Rojdestvensky, Leningrad, working by means of spectral analysis on the construction of the atom, has reported the discovery of the construction of the atom of lithium.

Hydrology.—A polar expedition of thirty-two scientific explorers set out in August, 1921, and spent six weeks in cruising in the Arctic and making hydrological and biological observations. Cod and other fish were found in latitude 69 deg. longitude 57 deg. This locality was formerly supposed to be too far east and north for the codfish.

Marine temperatures and other observations of this nature were made, and found to differ from previous records.

Archaeology.—An archaeological expedition into Mongolia, to last three years, started in 1923 under the explorer P. K. Kozlov. Many objects of art, statues, paintings, and 2,000 MSS. have already been brought back into Russia from Khoro-shote; they are memorials of a desert culture now extinct.

M. Pokrovsky, assistant commissar of education, says of this expedition:

"In calling to life the sleeping consciousness of the people of the East, Tartars, Turks, etc., the October revolution has created a number of new interests in ethnographical and historical spheres. And now with the money of the Tartar Republic born after the revolution are being organized archaeological expeditions to the ruins of the capital of the Turco-Tartar empire. In the ruins of these capitals we find a picture which destroys the common notion of the 'savage nomad' capable only of plunder. Now the history of Central Asia will have to be written according to a new plan."¹

Wireless.—Progress has also been reported in wireless telegraphy. M. Pokrovsky, in his book on science in Russia for the last five years, says: "In general the development of the electrical industry of Russia is progressing speedily; it is as yet the only industrial sphere in which industry has risen 50 per cent. higher than it was before the war."

Vaccines.—In the preparation of all medical equipment and pharmaceutical supplies Russia has always been far behind other civilized countries. Small-pox, cholera, and other vaccines and diphtheria antitoxin are, however, being manufactured on a large scale in Moscow and Leningrad. The quality of these was inferior to those manufactured in other European countries. In connexion with this the work of Belanofsky at the State Medical Institute is of interest. Working along the same lines as Fournieu at the Pasteur Institute in Paris he has perfected the preparation of a cholera and typhoid vaccine to be given by mouth in pill form. I hear from Dr. Belanofsky that this form has been tried in several thousand cases in the Red Army, and found to be as efficacious as the subcutaneous method of vaccination.

THE WORK OF PAVLOV AND HIS COLLABORATORS.

The greatest progress has been made in physiology by Pavlov and his pupils (chiefly Orbeli, Foorsikov, Savitch, Folborth, and Studenoff) in Leningrad.

CONDITIONED REFLEXES.

The recent work of this school on "conditioned" reflexes, sleep, and heredity have already received attention in the *BRITISH MEDICAL JOURNAL*.² Most of this work on the conditioned reflexes has been proceeding during the last twenty years, but, until last summer, when Professor Pavlov attended conferences in Europe and America, it did not receive general attention abroad, owing to Pavlov's reluctance to submit for publication work which he does not consider completely or thoroughly verified. His other important work on the trophic nerves and sympathetic innervation is generally unknown outside Russia.*

The information concerning the work of Pavlov's laboratories has been obtained from the following sources: (1) Bi-weekly visits to the Pavlov laboratories during eight months of my stay in Leningrad, in 1922 and 1923; (2) frequent conversations with Professor Pavlov in his laboratories and in his home; (3) a reprint of Professor L. A. Orbeli's work on sympathetic nerves, and a copy of a lecture by Professor Pavlov received from him in April, 1924, in response to my request to him for details of his work on these subjects; (4) frequent conversations in May, June, and July, 1924, with Dr. Babkin at University College, London, who worked in Pavlov's laboratories for ten years; to him I am indebted also for help in the translation of Pavlov's papers; (5) conversations in June and July, 1924, with one of Pavlov's pupils direct from Leningrad. I am indebted to Dr. J. W. McNee for various suggestions as to selection of the material which I have collected.

* As evidence of Professor Pavlov's reticence and modesty in regard to his work, he told the writer that he had prepared a book for publication two years ago summarizing his twenty years of experiments on the nervous system. Money was not available at the time for publication, and later, when it was, he objected to the book being published because he said that since it had been written he had found out some additional facts that made revision desirable.

SYMPATHETIC INNERVATION.

Langley and other physiologists had taught that the sympathetic system controlled only the viscera and involuntary muscles. The work of Orbeli, Babkin, and others of Pavlov's pupils has shown that the sympathetic has other important functions; Orbeli has demonstrated the sympathetic innervation of striped muscle, and Babkin the effect of the sympathetic on glandular secretion. Pavlov has recently come to the conclusion that all organs and tissues are under the control of special trophic nerves which are independent of the vasomotors.

Two years ago it was pointed out by Professor Orbeli, who is chief of the physiological laboratory of the Leningrad (formerly Petrograd) Medical Institute, that there was a direct relation between striped muscle and the sympathetic nervous system, and that striped and cardiac muscle were related functionally, the chief difference being quantitative. The sympathetic nervous system produces the same effect on skeletal as on heart muscle—namely, inotropic, dromotropic, bathmotropic, and tonotropic results.* In heart muscle the sympathetic nervous system produces physical and chemical changes which express themselves in an alteration of the properties of the muscle—increased irritability and of the strength and height of contraction, increased excitability and conduction, a shortening of the period of refractability, etc. It is necessary to explain the effect of the sympathetic on increased heat production and also on the chemistry and function of the muscle. Although the task of finding answers to these questions has not been completed, Ginetsinsky, working under Orbeli, has furnished a tentative solution which Orbeli considers correct. The following account is the summary of a paper received recently from Orbeli on this subject.⁴

The Effect of the Sympathetic on the Function of Muscles.

Ginetsinsky⁶ used the isolated gastrocnemius of the frog, after depriving it of blood without destroying the nervous connexions. He recorded the effect of stimulation of the roots of the eighth and ninth spinal nerves, and at certain intervals he tried the effect of stimulation of the neighbouring fibres of the sympathetic at the level of the seventh ganglion. At the beginning of the work only threshold stimulation of the motor nerves on unfatigued muscle was employed, and the results were uncertain, but later better results were obtained by stimulating the sympathetic while fatigue was beginning to develop or had fully developed as a result of the stimulation of the motor nerve. He concludes that the function of greatly fatigued and contracted muscle is gradually restored by this sympathetic stimulation. The effect begins after a long period of latency, increases gradually, and reaches a maximum soon after the cessation of the stimulation of the sympathetic, and lasts a long time; in fact, in many cases the period of revived muscle ability continues longer than the initial period before fatigue. When fatigue has developed through the occurrence of several contractions, and has manifested itself by alternating, strong, and failing contractions, the sympathetic has a compensatory effect and causes both the disappearance of arrhythmia and uniform contractions of average strength. Equally impressive results were obtained regarding the isometric ability of the muscle.

In a series of control experiments he showed that when isometric tetani lasting five seconds with intervals of fifty-five seconds were repeated there occurred invariably with each contraction a diminution of the muscle tension. If, however, after the second or third tetanic contraction the sympathetic nerve was stimulated, during this stimulation, and for a long time afterward, there was either very slight diminution of tension, none at all, or even a greater tension than that shown in the earlier tetanic contractions; in addition, every contraction was characterized by greater stability. In other words, under the influence of the sympathetic the muscle develops contractions which are greater in both intensity and duration.

This furnishes a complete analogy to the heart muscle. In both the heart and striped muscle sympathetic stimula-

tion produces an increase in amplitude and intensity of contraction, an acceleration of the act of contraction, and a compensation of the dissociation between the rhythm of the irritation and that of the reacting contraction—that is, all the data necessary to the proof of inotropic, bathmotropic, and dromotropic effects. In both cases there is a long latent period, a gradual development, and a long after-effect, and in both the effect is weak in the fresh healthy organ, but is very marked in the hypodynamic tissue, and the strength of sympathetic stimulation, which is essential for restoration, is about the same in both. Summing up, Orbeli says:

"The direct influence of the sympathetic nerves on the skeletal muscle is fixed beyond doubt, the universal significance of the sympathetic innervation is proved, the relation of the autonomous nervous system to the generalized muscular formation is shown, and the ability of the autonomous fibres to alter the condition of the muscle and its contents become transferred from a small organ, the heart, to the whole skeletal muscle, thus fulfilling the prophecy of the 'chemical tonus' of E. Pflüger and of the 'trophic innervation' of Pavlov. The sympathetic system, which guides all the vital properties of the muscles and secures for them the greatest use of their reserve strength, must also affect their tone and metabolism."⁴

PAVLOV'S VIEWS ON TROPHIC NERVES.

Although the experiences of clinicians, and especially of surgeons, have for a long time tended toward a belief in trophic nerves, physiology has been unable to demonstrate their existence. The surgeon often sees such evidence of trophic disturbances, but physiology has lagged behind in the explanation of these phenomena. All that physiology could say was that these conditions were produced by changes in the blood supply effected through the vasomotor fibres. Pavlov has, however, leaned toward the view of the clinicians for many years, although he could not explain it in the laboratory, and recently he has demonstrated the existence of independent trophic nerves to several organs and tissues.

Long ago both Gaskell and Pavlov showed that in the heart, besides the vasomotor nerves and the pair of accelerator and inhibitory nerves, there is another pair of trophic nerves. After years of observation, both clinically and in the laboratory, and his recent laboratory work, he now advances the view that there exists for other organs and tissues three classes of nerves; not only functional and vasomotor nerves, but a third class—the trophic nerves, which control the amount of material used in each organ of the body.

In Pavlov's own words—

"The medical observations of life have an extensive horizon, whereas the physiologists, having to go only by the figures that they find in the laboratory, have a much more restricted outlook. Hence the nonconformability between all that empiric medicine knows, sees, and makes use of and that which physiology can reproduce and explain. Here can be placed shock and trophic nervous phenomena. No explanation of shock is universally recognized; and trophic phenomena cannot be observed in the conditions of exact experiment.

"In my laboratory, though not experimentally, but clinically, I leaned toward the views of the clinicians about the existence of special trophic nerves. In the course of many years, while operating on the digestive tracts of animals, I often unexpectedly observed strange symptoms in the animals that lived. I noted trophic disturbances, tetany, paresis, ascending paresis, and shock which had two issues—either death or temporary lethargy.

"These observations confirmed my opinion that these symptoms could be explained as the reflexes from abnormally stimulated centripetal nerves of the alimentary tract to inhibitory nerves to different tissues. It was assumed that the metabolism of every tissue was regulated by special centrifugal nerves by two opposing principles. One set of nerves augments, the other diminishes its vitality, and if extremely irritated destroys altogether the resistance of the tissue."

Pavlov states that the manifestations of shock in his experimental animals substantiate this claim.⁹ Over a course of many years in his laboratory he noted that frequently after gastro-intestinal operations the animals

* These terms were introduced by Engelmann to designate the properties of strength, conductivity, irritability, and tone respectively of muscle.*

developed either one of two things—shock or trophic disturbances, such as tetany or paresis. Pavlov and Rosenthal have lately repeated these experiments in order to find out the cause of the phenomena of shock or trophic disorder. In their operations they produced the same tension as was produced before in the nerves by transplanting and fixing different parts of the alimentary tract, without, however, breaking its continuity. In this way gastro-intestinal secretions, which were lost in the previous operations, were retained, and thus the possible effect of loss of secretion on trophic disorder was eliminated. Under these conditions identical symptoms of shock or trophic lesions (for example, in the skin and oral mucous membrane) occurred. Pavlov explains these two sets of occurrences (shock and trophic) as reflexes; the abnormally stimulated alimentary nerves constitute the afferent arc, and the trophic (inhibitory) nerves to different tissues the efferent arc. He says: "The reflex irritation when it acts quickly on the inhibitory nerves produces the symptoms of shock; when this reflex irritation acts more weakly over a long period it produces chronic pathological changes (trophic) in the tissues."⁹

Heart.

Forty years ago physiologists proved that besides the inhibitory (vagus) and accelerator (sympathetic) nerves to the heart there is another pair of cardiac nerves, also antagonistic, which act on the vital activity of the cardiac muscle. One of these nerves makes the cardiac beat stronger by increasing the irritability, removing dissociation, and quickening systole; the other acts in a diametrically opposed way. These nerves cannot be vasomotors, because the action is seen if the heart is excised and, therefore, bloodless; the conclusion is that they are trophic nerves.

Salivary Glands.

The existence of a trophic nerve to the salivary glands, which was first proved by Heidenhain many years ago, has been recently confirmed by the work of one of Pavlov's pupils (Professor B. P. Babkin).¹⁰ These workers found that there were two kinds of nerves to the salivary glands: one excites its general excretory activity, and the other (trophic) affects the organic content of the saliva. In the salivary glands the trophic nerves act only to augment the organic content of the saliva, and there is no antagonistic or inhibitory nerve here.

Clinical Evidence.

Professor Pavlov says that clinical medicine offers many examples of trophic disturbances which physiology cannot at present explain, but which in all probability will be shown to depend upon the existence of trophic nerves. He explains the following as reflexes through the trophic nerves: skin eruptions produced, especially in children, by alimentary disturbances, and, vice versa, the production of internal lesions of the pleura, lungs, kidney, etc., by certain skin injuries; softening of bones noted by Pavlov in his dogs when damp cold is continually applied to the skin; the favourable internal results from warm compresses, mustard plasters, cupping; the coating of the tongue from indigestion; the favourable balance of metabolism in the heart and brain and their preservation from wasting during starvation. He goes on to say:

"All the above mentioned would be understandable in their mechanism if we admitted an antagonistic pair of trophic nerves, which either augmented or diminished the metabolism of the tissues. Then those would be cases of reflex irritation of such nerves; when the inhibitory trophic nerve is excessively irritated the vitality of the tissue is lowered and disease results; when the positive trophic nerves are stimulated the vitality of the tissue is increased so that it may overthrow the pathological agent."⁹

In regard to the furring of the tongue he writes:

"There is not always an uninterrupted pathologic process from the stomach to the mouth. A disorder of the stomach or the alimentary tract may create an irritator for a reflex for the inhibitory trophic nerve of the mucous membrane of the mouth, especially of the tongue, whereby it is put into an abnormal state which leads by degrees to loss of taste. Loss of taste leads to abstention from food, which gives a rest to the alimentary tract and constitutes the chief therapeutical measure against such a disorder. Thus there might be here a self-healing process on behalf of the organism."

In starvation, "It may be supposed that in the heart and brain, by means of the necessary reflexes upon their positive

trophic nerves, the normal energy of the vital chemical processes is kept up, while in all the other organs it is limited and curtailed, which leads to their rapid atrophy. From this point of view a pair of trophic nerves would be the last direct distributor of the nutritive resources of the organism to its different parts."

"Thus we would suppose that every organ is under a triple nervous control: (1) functional nerves, which may be inhibitors or excitors—for example, those nerves which produce contraction of muscle or the secretion of a gland, or inhibition of both of these functions; (2) vasomotor nerves, which regulate the bulk carriage of chemical materials and the taking away of refuse by augmenting or diminishing the flow of blood to the organ; (3) trophic nerves, which determine in the interest of the organism as a whole the exact quantity of material utilized by every organ. Such triple control we can consider proved in the heart."⁹

BABKIN'S WORK ON THE SALIVARY GLANDS AND DIGESTIVE TRACT.

The work of B. P. Babkin (now of Washington University Medical School, St. Louis) on the salivary glands and digestive tract brings out some interesting facts about the sympathetic system. This work was carried on for ten years in Leningrad (Petrograd) under Pavlov. Babkin has worked out the meaning of double innervation of glands, the effect of sympathetic stimulation on secretion, and the idea of a relativity of function applied to physiological organs.*

As a result of his experiments on the innervation of the salivary glands, Babkin came to the conclusion that trophic impulses pass to the submaxillary gland of a dog through the sympathetic nerve as well as through the parasympathetic, showing that different impulses may pass through one and the same nerve. Normal amounts of the organic substances have been found in the saliva after extirpation of the superior cervical ganglion. This led him and his co-workers to investigate the meaning of the sympathetic innervation of the salivary glands. They found that for the work of the sympathetic nerve special conditions must be brought about in the gland. The effect produced by stimulation of the sympathetic is at its maximum when the gland has already been put in a state of excitation (by various methods, such as cutting the chorda tympani, stimulating other nerves, or using pilocarpin).

What causes the gland to work more actively under sympathetic stimulation during a state of excitation? It is probable that this is due to a change in the surrounding medium (blood or lymph) of the gland cells, produced by the "excitation" of the cells. In fact, he has shown this by injecting acid and alkali into the blood; under these conditions the secretion of the gland after sympathetic stimulation is different from what it would be if the blood had not been altered. Also peristalsis of the gastro-intestinal tract depends not only on the mechanical or chemical stimulus but on the condition of the blood; this Babkin demonstrated by injecting acid or alkali into the blood. By "relativity of function" he means that the function of an organ depends not only on the stimulus applied to it, but on the condition of the organ, and this condition depends in turn upon the composition of the surrounding medium. "Since in normal conditions (and especially in pathologic cases) changes of the surrounding medium occur, the idea of a relativity of function may be of use in physiology as well as in pathology."^{14 15}

IONIC THEORY OF STIMULATION.

Somewhat related to this work is the ionic theory of stimulation worked out by Professor P. Lasareff of the University of Moscow. This theory is based on the observations of Jacques and Nernst, made about twenty years ago. Working independently they found that "in the nerve and in the muscle the change from the state of rest to that of excitation is brought about by changes in the ionic concentration of the medium." Lasareff has demonstrated that in all organs, under all conditions, excitation is possible only as a consequence of changes in the ionic concentration of the medium. Whenever these changes are not present, excitation is not possible.

* For the statements in regard to this work I am indebted to Dr. Babkin for his extreme kindness in giving me access to an unpublished paper summarizing his entire work, and for his detailed personal explanations of certain parts of this work. Full details will be given later in his published account, to appear shortly under his own name.

From these facts a general law of excitation for the threshold of irritability was formulated. He says:

"Calculating in every case the possible changes in ionic concentration, we were able to explain the laws of Pflüger, to develop further a theory of nervous excitation, to formulate a theory of muscular excitation, a theory of vision, a theory of hearing and of taste, and very recently . . . to develop laws of the function of the central nervous system (of the brain)."¹⁹

FATIGUE OF THE EYE.

In his work on vision Lasareff found that in fatigue of the eye by stimulation there was no fatigue of the brain centres. This was tested directly by stimulation of the optic nerve electrically after the eye had been exposed to stimulation by light, and a second time when the eye had been left in darkness for some time and therefore at rest; the results were the same. This led him to the conclusion that the brain centres are indefatigable, and that in the absence of stimulation the organism will not become fatigued, although it may fall into a state of sleep from the prolonged absence of stimulation. This indefatigability of the centres bears an intimate relation to the periodicity of the function of the centres. This periodicity is caused by periodic chemical reactions taking place in the nerve centres, which give rise to periodic electromotive forces.²⁰

GASTRO-INTESTINAL TRACT.

Sirotinin, working in Pavlov's laboratory, has shown that subcutaneous injections of adrenaline have a marked effect on Heidenhain's pouch in the dog; the HCl content is greatly increased. Folborth, in Pavlov's laboratory at the Military Medical Academy, has also recently demonstrated that the sympathetic nerve has a direct secretory action on the gastric glands, by electric stimulation of the splanchnic nerve (cut five or seven days previously in order that the vaso-constrictors might have time to degenerate) in a dog with a Pavlov's pouch. Clinical results of adrenaline in cases of achylia gastrica were being tried out in the hospitals of Leningrad, but they had not borne out the physiological work at the time that I left (July, 1923).¹⁶

METABOLISM OF CHOLESTEROL.

During the past fifteen years a considerable amount of work has been done by Anitschkov and S. S. Chalátov of the Leningrad Medical Institute on the metabolism of cholesterol (in addition to what has been done in this country by Gardner, Dore, Ellis, McNee, and others). Chalátov showed that when the yolk of egg, brains, or pure cholesterol dissolved in sun-flower oil, is given to rabbits by the mouth anisotropic fat is deposited in various tissues, but principally in the intima of the aorta. In these animals the presence of anisotropic fat induces later pathological changes, such as hepatic cirrhosis and fibrosis of the spleen. Professor Chalátov found that these deposits did not occur in omnivorous animals (rats) unless there was some other toxic agent acting at the same time.²¹ Later investigations of Chalátov, since 1922, in human beings, using his new method of estimating the blood cholesterol, have shown that the cholesterol diathesis in man appears especially under the influence of syphilis.²² The conditions formerly described as atheromatosis is explained by Chalátov as due to deposits of anisotropic fats in the arteries, to which he applies the term "xanthomatosis."²³*

COLOUR VISION.

Another work which may be of great value to psychology and brain physiology is that being done by Krasnogorsky, a former pupil of Pavlov. During the spring of this year (1924) he showed that in hypnotized children real colours and suggested colours are blended to form the complementary colour. The experiments have been carried out in the following way: an uneducated child, knowing nothing of the laws of physics, is hypnotized and shown a certain colour—for example, yellow. It is asked to name the colour before it. This it does correctly. Then it is told that it has answered wrong, that the colour is not yellow but blue. In a few moments it is asked again to name the colour that it has been shown. It names neither the real colour nor the suggested colour, but the complementary colour of the

two. The work has been verified several times and brought to the attention of Pavlov, who, I hear, suggests that it may eventually be shown that the same chemical neural process is set up in the brain by the mental suggestion of the fictitious colour as is set up by the real colour through the optic nerve.¹⁸

CONCLUSION.

In these remarks about science in Russia I have given my impression of the official attitude of the Soviet Government toward science and cited some representative facts of scientific accomplishments, particularly in the field of medical science. A complete review of medical science has not been attempted. Also nothing has been said of the position of the scientists themselves, which will be discussed in a later article.

BIBLIOGRAPHY.

- ¹ Michael Pokrovsky: *Universities in R.S.F.S.R. and the New Students*. Moscow, 1923.
- ² BRITISH MEDICAL JOURNAL, August 11th, 1923, p. 256.
- ³ E. H. Starling: *Principles of Human Physiology*, p. 718. London, 1920.
- ⁴ L. A. Orbeli: "Sympathetic Innervation of Skeletal Muscle." *Journal of Petrograd Institute in the name of Losgaffa*, vol. vi, August 3rd, 1923.
- ⁵ Idem, Report on "Sympathetic Innervation" read at the 37th Physiological Congress in Petrograd, December 28th, 1922.
- ⁶ A. G. Ginetinsky: "Vliyane simpaticheskikh volokon na utomlennoou mishtoo" (Effect of the sympathetic fibres on fatigued muscle), read at the 37th Physiological Congress in Petrograd, December 28th, 1922.
- ⁷ J. N. Langley: "Hat der Sympatheticus eine direkte Einwirkung auf der quergestreiften Muskel?" *Die Naturwissenschaften*, Heft 38, September 22nd, 1922.
- ⁸ W. B. Cannon and L. B. Nice: Effect of Adrenal Secretion on Muscular Fatigue, *Amer. Journ. Physiol.*, vol. 32, 1913.
- ⁹ I. P. Pavlov: "On Trophic Innervation," read at Obokoff Hospital, Petrograd, December 31st, 1920, on the occasion of Professor Nichaev's jubilee.
- ¹⁰ B. P. Babkin: *Arch. f. Physiol.*, 1913, H. 149, p. 497; *ibid.*, p. 521.
- ¹¹ Idem, *Quart. Journ. Exper. Physiol.*, Supp. vol. 47, 1923; also vol. 14, 1924.
- ¹² Idem, *Bull. de l'Acad. des Sci.*, St. Petersburg, 999, 1916.
- ¹³ Koupalov and Dousko: *Vrachnebnnoje Delo*, 1924.
- ¹⁴ B. P. Babkin: Personal communication, July, 1924.
- ¹⁵ Idem, unpublished article, "Chemical Co-ordination of Secretary and Motor Functions of the Digestive Tract," 1924.
- ¹⁶ Work seen personally in Leningrad at Military Medical Academy and Leningrad Medical Institute, 1922, 1923.
- ¹⁷ Personal communication, 1923.
- ¹⁸ Oral personal communication through Dr. A. P. Zelheim, July, 1924.
- ¹⁹ P. Lasareff: *Science*, April, 1924.
- ²⁰ Idem, *Iontentheorie der Reizung*, Verlag Ernst Bircher, Bern und Leipzig, 1923.
- ²¹ E. Agdur: Sympathetic Innervation of the Muscles of the Extremities, *Verh. d. Koninklijke Akademie Wetenschappen te Amsterdam*, xx, 1920.
- ²² I. Boeke: Ueber eine ausmarklosen Fasern hervorgehende zweite Art von hypolemmalen Nervenendplatten, *Anatom. Anzeiger*, Bd. 35; also *ibid.*, Bd. 34, 1913.
- ²³ De Boer: *Folia Neuro-Biologica*, Bd. 7, 1913; *Zeit. f. Biol.*, Bd. 65, 1915.
- ²⁴ Jansma: *Ibid.*
- ²⁵ Dussier de Barenne: Ueber die Innervation und den Tonus der quergestreiften Muskeln, *Pflüger's Archiv*, Bd. 166, 1916.
- ²⁶ Negrin y Lopez und Brücke: Sympatheticus für den Tonus der Skelettmuskulatur, *Ibid.*
- ²⁷ Saleck und E. Weithrecht: Sympathetischer Nerven am Tonus der Skelettmuskulatur, *Zeit. f. Biol.*, Bd. 71, 1920.
- ²⁸ I. S. Beritoff: *Folia Neuro-Biologica*, Bd. 8, 1914. Idem: "Uchenie ob osnovnich elementach tsentralnoi koordinatsy skeletnoi muskulaturi" (Discussion of the elementary principles of the central co-ordination of skeletal muscle), St. Petersburg, 1916.
- ²⁹ S. S. Chalátov: Monograph on Cholesterol Metabolism, Gustav Fischer, Jena, 1922.
- ³⁰ Personal communication from Professor Chalátov, August, 1924.
- ³¹ *Ibid.*
- ³² G. Folborth: Personal communication.

ROYAL MEDICAL BENEVOLENT FUND.

At the last meeting of the committee thirty-five cases were considered and £507 10s. voted to thirty-four applicants. The following is a summary of some of the new cases relieved.

Daughter, aged 60, of M.R.C.S.Eng. who died in 1869. Has had no regular work since 1923 and is now considered too old for the posts she applies for. From 1915 to 1923 was nurse at a rescue maternity home, but lost her post owing to reorganization of the staff. Applicant has one month's temporary work in view at 15s. a week. Voted £26 in twelve instalments.

Widow, aged 72, of M.D. who died in 1894. An annuity of £40 from Liverpool Merchants' Guild is her only income apart from money received for knitting. She lives with two unmarried sisters who are not well off. Voted £26 in twelve instalments.

Daughter, aged 37, of L.R.C.P.Edin. who died in 1911. Suffers from epilepsy and is looked after by a sister whose only income is £17 10s. a year, the same as the applicant's. Applicant is only able to do temporary light clerical work at times, and the last twelve months only earned £8 10s. Voted £15.

Daughter, aged 82, of M.R.C.S.Eng. who died in 1892. Applicant opened a home of rest for young women and carried it on until 1922, when her health broke down. She now lives in one room in her sister's house and all she has to depend on is the old age pension 8s. a week and interest on £100 War Bond. Voted £10.

Subscriptions may be sent to the Honorary Treasurer, Sir Charters Symonds, K.B.E., C.B., M.S., at 11, Chandos Street, Cavendish Square, London, W.1.

*Dr. Chalátov has very kindly sent me a summary of his latest unpublished work, which I received during August, 1924.