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ESSAYS ON THE PATHO-PHYSIOLOGY OF THE HIGHER NERVOUS ACTIVITY

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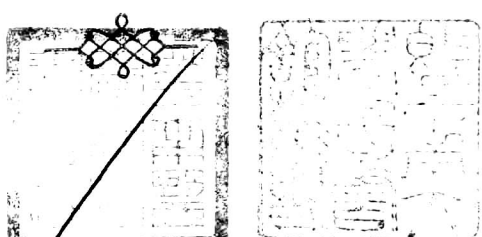
ACCORDING TO I.P. PAVLOV AND HIS SCHOOL



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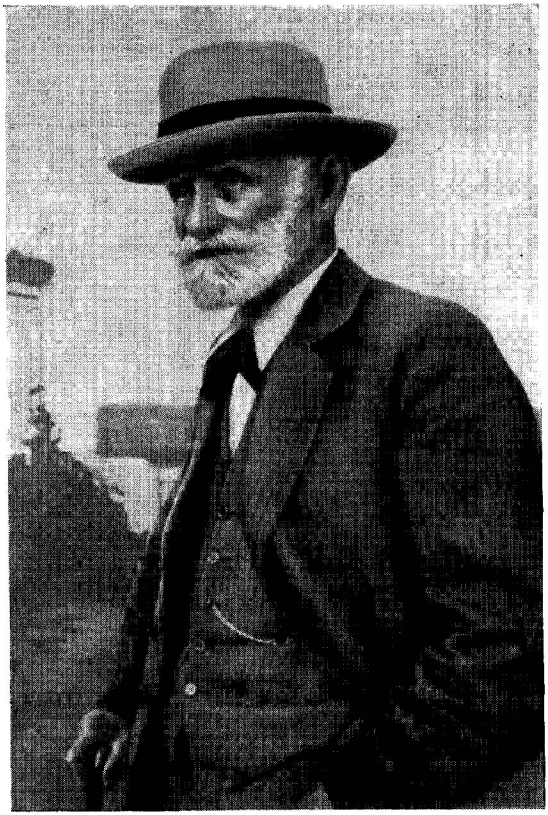

I. P. PAVLOV

PREFACE TO THE FIRST EDITION

Some forty-five to fifty years ago Ivan Petrovich Pavlov laid the foundations of the theory of the higher nervous activity, which has become one of the greatest treasures of Russian science.

Pavlov's theory is the result of collective work, unmatched for the way in which it was planned and organized, for its consistent purposefulness and which was carried on for almost thirty-five years by a large body of scientific workers—the Pavlov school—under his brilliant guidance.

Among Pavlov's immediate assistants, men and women who helped to create his theory, were I. F. Tolochinov, G. P. Zeliony, N. I. Krasnogorsky, L. A. Orbeli, Y. V. Volborth, M. A. Ussievich and M. K. Petrova. In subsequent years some of his closest collaborators abandoned the theory of the higher nervous activity and created their own trends and schools; others worked hard for decades on the further development of the physiology, and later, also of the pathology of the cerebral hemispheres.

But research in the field of the theory of the higher nervous activity directed by I. P. Pavlov developed in a particularly big way after the Great October Socialist Revolution.

Shortly before his death Pavlov, in the well-known address to the youth, stated: "Our country is opening up boundless vistas for scientists, and, let it be said, science in our country receives generous backing, the utmost backing."

A most active part in the elaboration of the theory of the higher nervous activity under Pavlov's direct

guidance was taken over a long period by G. P. Zeliony, M. K. Petrova, Y. V. Volborth, N. A. Podkopayev, Y. P. Frolov, D. S. Fursikov, O. S. Rosenthal, K. M. Bykov, V. I. Pavlova, V. V. Rickman, L. A. Andreyev, M. A. Ussievich, V. V. Stroganov, V. V. Yakovleva, B. N. Bierman and others.

Among Pavlov's younger collaborators an especially big contribution to the theory of the higher nervous activity was made by E. A. Asratyan, G. V. Skipin, A. O. Dolin, L. O. Seewald, S. V. Klestchov, I. O. Narbutovich and K. S. Abuladze.

M. K. Petrova was Pavlov's closest assistant and the most active continuer of his teaching on the patho-physiology of the higher nervous activity; an enormous amount of work was done by her in this field. Being a clinician and therapist, she devoted much energy to bringing the experimental patho-physiology of the animal higher nervous activity into closer contact with the clinic, with practical medicine. Substantial facts were also added to the theory of conditioned reflexes by I. P. Razenkov and A. D. Speransky.

The human higher nervous activity has become the object of experimental study thanks to N. I. Krasnogorsky; a physiologist and pediatrist, Krasnogorsky has been working for more than forty years on problems of the physiology and patho-physiology of the higher nervous activity in the field of pediatrics, at first single-handed and later in collaboration with his numerous co-workers.

A number of Pavlov's disciples, who worked under his guidance, have created their own original trends and schools; however, in many cases these are but far-flung ramifications of the theory of the higher nervous activity, which Pavlov himself over a long period regarded as the main direction.

In his *Lectures on the Work of the Cerebral Hemispheres*, published in 1927, Pavlov summed up all the

experimental data relating to the patho-physiology of the higher nervous activity which had been obtained by that time; he also made the first steps in applying the theory of the higher nervous activity to man and in its utilization in clinical medicine.

Since then more than twenty years have passed, but still we do not see any review or summary (except Pavlov's last articles), even any attempt to sum up the rich and valuable material obtained by the laboratories and clinics of Pavlov during his lifetime and after his death.

On the occasion of the centenary of Pavlov's birthday (September 27, 1949) the author of this book takes the liberty of attempting to fill this gap in the patho-physiology of the higher nervous activity; his aim is to expound in a number of essays the basic achievements of this young branch of science and to give an outline of its development in the Pavlov school (including its ramifications) up to our time.

In the preface to the third edition of the *Lectures on the Work of the Cerebral Hemispheres* published in November 1935, Pavlov wrote: "My new systematic exposition of the *whole* of our experimental material in the shape of one book will require much labour, and I regard it as my last scientific task. It will take years to complete this work. If only fate will be so kind as to preserve for me at my age the vigour that will enable me to carry out this important duty of my life!"

Death prevented Pavlov from carrying out this desire.

In the *Essays on the Patho-Physiology of the Higher Nervous Activity* the author tries, to the best of his ability, to carry out, even in small measure, Pavlov's will; the author regards this as his duty to Russian science and to his late teacher.

April 27, 1949

INTRODUCTION

Pavlov is not only the creator of the physiology of the cerebral hemispheres, that is, of the physiology of the higher nervous activity, but also the founder of the pathological physiology of the higher parts of the central nervous system.

As we know, these parts

a) secure the adaptation, equilibration of the organism as an integral whole with the external environment and create the highest and most complex forms of its interrelation with the surrounding world;

b) effect the highest regulation and correlation of all physiological processes taking place in the internal medium of the organism, of all vegetative and metabolic functions, and finally,

c) effect the integration and the fluent and fluctuating co-ordination of the whole external and internal (somatic and visceral-vegetative) vital activity of the organism, i.e., secure its most complex functional unity.

These three basic functions of the cerebrum are closely interconnected. Consequently, in cases of pathological disturbances of the activity of the higher parts of the central nervous system, it is difficult to assume a fully isolated impairment of one of these functions; usually such disturbances spread, to a greater or lesser degree, in all three directions, concentrating mainly only in one of them.

An unceasing development and interaction of nervous processes take place in the wakeful, active cortex under the influences coming from the external world and the internal medium of the organism; at the same time there is a continuous change of the dynamic correlations between the cortex and the lower parts of the central nervous system.

"The infinite fluctuations in both the outer and inner mediums of the organism," Pavlov said in 1927, "each of which is reflected in definite states of the nervous cells of the cerebral cortex, may become separate conditioned stimuli."*

The cortical activity effects a most complex interaction of the highly mobile and changeable reflection of the surrounding environment with the reflection of the organism's internal medium, i.e., with the reception of all somatic and vegetative (proprioceptive and interoceptive) stimuli coming into the cortex from the skeleto-muscular apparatus and internal organs and constituting the principal foundation of "self-perception."

In the cerebral cortex in the course of such interaction there takes place a continuous development of new links, connections, associations between the external and internal influences, on the one hand, and various somatic and vegetative activities, on the other; there also arises a process of inhibition of these connections when, temporarily or permanently, they cease to comply with the demands which the external and internal mediums make upon the nervous system.

Whereas in animals the activity of the cerebrum described above is determined biologically, in man this de-

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* I. P. Pavlov, *Lectures on the Work of the Cerebral Hemispheres,* Russ. ed., State Publishing House, 1927, p. 48. (Hereafter this work is referred to as *Lectures.*)

termination is not only of a biological, but first and foremost of a social nature.

We shall deal with the question of the specific properties of the human higher nervous activity later on.

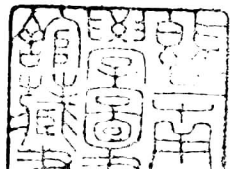
The study of changes in the activity of the cerebral cortex (as well as in its interaction with the lower parts of the brain, developing under the influence of noxious, morbific factors, i.e., changes that are observed under various pathological conditions, constitutes a most important task confronting the patho-physiology of the higher parts of the central nervous system.

In 1930 Pavlov said: "Three chief problems must be studied in the higher nervous activity, in the behaviour of the animal: 1) the unconditioned, most complex special reflexes, the work of the basal ganglia as the foundation of the external activity of the organism; 2) the activity of the cortex, and 3) the way in which these ganglia and the cortex are connected and interact."*

Consequently, when roughly detailing the tasks of the patho-physiology of the higher parts of the central nervous system, one can say that they include the study of pathological disturbances of the higher subcortical functions (disturbances which, however, are always closely connected with morbid changes in the cortical activity), the study of pathological disturbances of the cortical functions and finally, the study of pathological disorders in the interaction of the cortex with the lower parts of the nervous system (i.e., with the afferent systems of the brain stem and efferent systems of the motor-co-ordinating and vegetative-metabolic centres).

It should be pointed out in advance that no cortical or subcortical affection ever remains absolutely isolated;

* I. P. Pavlov, *Twenty Years of Objective Study of the Higher Nervous Activity (Behaviour) of Animals*, 6th ed., 1938, p. 492. (Hereafter this work is referred to as *Twenty Years of Objective Study*.)



on the contrary, it has a more or less pronounced and durable dynamic effect on the different parts and functional systems of the brain.

Having begun his research in the pathology of the higher parts of the central nervous system with the study of disturbances of brain activity experimentally induced in animals, Pavlov subsequently extended his investigations to clinical medicine: he subjected a number of human nervous and neuropsychical diseases to a patho-physiological analysis.

Pavlov's ideas of nervism have found here a new, vast field of application and further successful development, which steadily brings them into closer contact with practical medicine. It is noteworthy that even when he was working in the field of the physiology of the higher nervous activity in animals, Pavlov never lost sight of this work being closely related to medicine. For instance, in one of his early works (1906) he stated: "In their fundamental sense physiology and medicine are inseparable. If the physician is actually, and still more in ideal, an engineer of the human organism, then inevitably every new physiological discovery must, sooner or later, increase the physician's power over this extraordinary mechanism, his power to maintain and repair it."* Such a clearly worded tendency not only to investigate phenomena, but at the same time to learn how to govern them, was repeatedly, and at times even more vividly, expressed in Pavlov's subsequent statements.

"Already for many years the physiologist has persistently and systematically investigated, according to the strict rules of scientific thought, the animal organism. He has observed the vital phenomena which appear before him in time and space, and has endeavoured by means of experiments to define the constant and elementary con-

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* I. P. Pavlov, *Twenty Years of Objective Study*, p. 78.