

LEON ABGAROVICH ORBELI

ON HIS 75TH BIRTHDAY

Among the prominent physiologists of our country, the name of the Academician Leon Abgarovich Orbeli, Hero of Socialist Work, is one of the foremost.

A catholic scholar, a brilliant experimental worker, the founder of a large physiological school, L. A. Orbeli made a large contribution to the physiology of his native land and of the world through his own work and the work of his students.

The extensive and many-sided studies of L. A. Orbeli in the field of the physiology of the central and peripheral nervous system, sense organs, digestion, and urination made possible the establishment of new laws regarding the activity of these systems, suggested important theoretical principles which pioneered in physiology and were the basis for the solution of a number of practical problems.

Particularly noteworthy are the merits of Leon Abgarovich in the elucidation of the autonomous nervous system, and also in the creation of an evolutionary trend in physiology which permits the consideration of complicated functions of animals and man in the light of the theory of development.

L. A. Orbeli was born on July 7, 1882, in Erevan. After completing the Tbilis Gymnasium in 1899 he entered the Army Medical Academy. As a student, L. A. Orbeli joined the scientific profession. Under the direct guidance of I. P. Pavlov he carried out his first scientific work "The Comparison of the Work of Pepsin Glands Before and After the Cutting of the Vagus Nerves" for which he was awarded a Gold Medal by the Army Medical Academy.

After completion of the Academy, L. A. Orbeli worked in the laboratory of I. P. Pavlov and became one of his assistants in the elaboration of the new studies concerned with higher nervous activity.

In 1908 L. A. Orbeli defended his doctoral dissertation on "Conditioned Reflexes of the Eye of a Dog" and in 1909 he received, on the recommendation of I. P. Pavlov, a two-year appointment abroad. Working in the laboratories of prominent Western European scientists (Langley, Barcroft, Garten, Hering, and others) L. A. Orbeli became familiar with the works and methods of these scientists and carried out a number of experiments in various fields of physiology.

After his return from abroad, L. A. Orbeli again worked with I. P. Pavlov in the Institute of Experimental Medicine and in the Army Medical Academy. He assisted I. P. Pavlov in the direction of many collaborators who were developing the theory of conditioned reflexes.

Having become the director of the Physiological Laboratory of the P. L. Lesgaft Scientific Institute in 1913 and having become a professor of physiology I LMI in 1920, L. A. Orbeli began his independent work as a teacher of science. In this period he studied, with a number of collaborators, the problems of digestive glands, cerebrospinal coordination, the autonomic nervous system and others.

The scientific activity of Leon Abgarovich became particularly broad and fruitful in the various fields of physiology from the moment he became the director of a large group of collaborators in the Physiological Institute of the USSR Academy of Science and the Biological Station (later Institute of Evolutionary Physiology and Pathology of Higher Nerve Activity) in Koltusha.

In a short essay it is difficult to throw light upon the many-sided scientific activities of Leon Abgarovich. We shall, therefore, note only the principal landmarks of his creative path.

The first works of L. A. Orbeli in the laboratory of I. P. Pavlov were devoted to the study of conditioned reflexes from the visual analyzer and the localization of the conditioned reflexes in the central nervous activity. He established the important fact that dogs do not differentiate colors and that conditioned reflexes are determined in dogs by changes in the light intensity; in his experiments involving removal of the upper half of the cerebral lobes in dogs new evidence was obtained that conditioned reflexes are a function of the cerebral cortex.

The work of L. A. Orbeli in the Pavlov laboratories (up to 1920) in the time of the burgeoning of the study of conditioned reflexes and his direct participation in the direction of collaborators in these laboratories enabled L. A. Orbeli to become one of the prominent workers in the field of higher nervous activity and to guide the elaboration of this study by a large number of collaborators. The results of the work on higher nervous activity and his own personal views in this field are presented in two monographs "Lectures Regarding the Problems of Higher Nervous Activity" (1954) and "Problems of Higher Nervous Activity" (1949).

For many years Orbeli studied the problems of the physiology of digestion. Well known are his studies of the physiology of the pancreas (together with K. M. Bykov), of bile as the stimulant of the secretion of intestinal juices, of the properties of the enzymes of intestinal juices in man, of the physiological role of organic acids, and others.



From 1921 L. A. Orbeli began the elaboration of the problems of the physiology of the sympathetic nervous system. As a result of a large number of investigations he formulated a totally new concept about the basic functional principle of the influence of the sympathetic innervation on organs and tissues. Investigating at first the influence of sympathetic nervous fibers on skeletal muscles, and later on receptors and the central nervous system and various organs, L. A. Orbeli established the adaptational-trophic role of the sympathetic nervous system in the integration of all tissues and organs. The discovery of the influence of the sympathetic nervous system on the somatic formations of the organism, which was the source of the wide reputation of L. A. Orbeli, required a revision of the whole physiology of animal functions from this point of view. The establishment of the adaptational role of the sympathetic innervation was not only a contribution to the development of experimental and theoretical physiology but also had great meaning for medicine. The works of L. A. Orbeli and his collaborators formed an experimental basis for numerous empirical observations on the influence of the

sympathetic nervous system on trophic processes in the organism.

Of great theoretical value were the works of L. A. Orbeli concerning the study of the mechanism of cerebrospinal coordination. Proceeding from the conditioned reflex teaching of I. P. Pavlov, according to which it is possible to trace the rise of new reflex actions in a very short time, L. A. Orbeli advanced the view that the study of conditioned reflexes is the key to the elucidation of the development of reflex actions in general. In the early stages of the formation of conditioned reflexes, the cortex has a diffuse activity which is later replaced by the exact distribution of the centers of stimulation and checking in the cortex. In the opinion of L. A. Orbeli even the phylogenetically old sections of the central nervous activity (the stem region, the spinal cord) had to possess diffuse reactions from which, in the process of evolution, coordinated motor actions were developed. This was confirmed by the work of Kunstman and Orbeli which showed that by means of deafferentation of one extremity of the dog it is possible to expose the characteristics of diffusability of lower sections of the central nervous system. In general this diffusability is not observed because the system of afferent fibers hinders the excessive spreading of stimulation in the spinal cord. Thus gradual analysis brought L. A. Orbeli to the conclusion that the highly developed central nervous system has remnants of old functional relations and that not only were in the process of evolution old functional relations definitively destroyed but that they were also suppressed by new formations of the central nervous system.

L. A. Orbeli's studies of the cerebellum have an important place in the work about the physiology of the central nervous system. Experimental work in this direction made it possible to see the cerebellum as the higher adaptational-trophic center and an aid to the large hemispheres of the brain. It was possible to demonstrate that the adaptational-trophic influence of the cerebellum extends to the digestive organs, the cardiovascular system, muscular functions, metabolism in tissues, etc. These influences are carried out by means of nerves as well as hormones.

Noteworthy are the studies of the effects of nociceptive irritations which were carried out in the laboratories of L. A. Orbeli.

The solution of this problem — in reality the problem of pain — has great theoretical and practical meaning. In this work the somatic syndrome brought about by a painful irritation was studied. In particular, the participation of the adrenals and the hypophysis in the painful reaction was established, the meaning of axon-reflector connections between the sections which perceive pain and internal organs, and the central nervous system was clarified. The results of this work are of exceptional interest to clinical medicine, especially in the treatment of nervous and internal diseases.

Important are also L. A. Orbeli's studies of the physiology of urination. Having worked out the methodology of the separate removal of the openings of the ureter in dogs, L. A. Orbeli, together with his collaborators, analyzed the nervous and hormonal mechanism of the activity of the kidneys and made important contributions to the theory of Keshin-Reberg.

The large body of factual material obtained in various fields of physiology was valuable to L. A. Orbeli in his plan to apply the ontogenetic principle to the study of physiological functions. This was distinctly shown even in his basic general work "Lectures on the Physiology of the Nervous System" (1935).

The data concerned with ontogenetic physiology accumulated in the preceding years gave L. A. Orbeli the opportunity to concentrate his attention in recent time on the elaboration of the problems of the evolution of functions.

In the newly-created L. M. Sechenov Institute of Evolutionary Physiology of the USSR Academy of Sciences, directed by L. A. Orbeli, work towards the solution of two fundamental problems is broadly conceived and carried out: 1) the study of the patterns and mechanisms of development of function in separate organs and organ systems and of the activities of the whole organism in the ontogenetic process, their complications, refinements, and modifications as a result of the influence of various external factors, and 2) the elaboration of general laws of functional ontogeny, which lead to the rise of complicated adaptation phenomena. According to L. A. Orbeli, "the study of the ontogenesis of function should not only elucidate the history of the perfection of physiological mechanisms which are capable of coping with the complications of the interactions of the organism with the environment and which provide an increase in the level of functional organization of animals in the ontogenetic series," but permit one also, "to broaden the scientific basis of medicine and to promote the working out of practical measures directed toward the heightening of the stability of the human organism in the new working

conditions created by contemporary technology."

During his whole creative life L. A. Orbeli knew how to combine a large amount of experimental scientific work with a large organizational, pedagogical and general activity. He directs large institutes and departments, fulfills the duties of Director of the Army Medical Academy, works in the presidium of the USSR Academy of Sciences, edits a number of biological journals, organizes meetings and conferences, etc. At present L. A. Orbeli is the president of the Central Soviet of the All-Union Society of Physiologists, Biochemists and Pharmacologists.

L. A. Orbeli has a significant part in the training of scientific personnel. His excellent abilities as a pedagogue and leader, the ability to place scientific personnel correctly, to take into account the personal inclinations of each of his students and to direct him properly has always attracted a large number of young scientific collaborators to his laboratory.

Among his numerous students a large number became prominent scientists, known for their work throughout our country.

His great erudition, his great ability to work, and his accessibility, ready willingness to help a scientific worker or a physician in the solution of some problem, his constant desire to share his knowledge and experience with others, gave L. A. Orbeli a well-deserved reputation in the scientific and medical world.

For distinguished service to the Soviet fatherland and to science the Presidium of the Supreme Soviet of the USSR has three times awarded Leon Abgarovich the Order of Lenin and other orders and medals. He was awarded the highest honorary title—a Hero of Socialist Work.

On the day of his 75th birthday L. A. Orbeli, leading a large scientific group, is full of creative projects for the solution of new problems in the field of physiology. As usual, his inexhaustible striving toils constantly for the good of his fatherland and of Soviet science. We wish Leon Abgarovich good health and great success on this noble path.

Professor A. A. Volochov