

# Meetings

## Brain Reflexes

The international conference commemorating the publication in 1863 of I. M. Sechenov's book, *Brain Reflexes*, was held in Moscow, 24–30 November, with over 50 scientists from 15 countries participating in three symposiums. The symposiums reflected the major areas of neurobiological investigations in the Soviet Union since the pioneering work of Sechenov.

The opening ceremonies of the conference, held at Moscow University in the Lenin Hills, were attended by approximately 1000 faculty members, scientists, and students. Welcoming addresses were presented by E. A. Asratyan (U.S.S.R. Academy of Sciences), H. Waelsch (executive secretary for the International Brain Research Organization-UNESCO) (1), and N. M. Sisakyan (U.S.S.R. Academy of Sciences). Reports on the significance of Sechenov's work to physiology and psychology were also given by Kupalov and Teplov (U.S.S.R.). Further reviews on the impact of Sechenov's work on the development of modern concepts of higher nervous activity were presented during the conference by V. N. Chernigovsky, I. S. Beritashvili, and D. A. Biriukov (U.S.S.R.).

The assassination of President Kennedy created an atmosphere of grief and bewilderment among the participants from all countries, and in his memory the audience rose at the beginning of the opening ceremonies. This was one of the many occasions where the American participants became aware of the impact this tragic event had on the members of the conference and the inhabitants of the city with whom they came in contact.

Sechenov is generally recognized as the first physiologist to have clearly demonstrated that inhibition of spinal reflex activity is, in part, under the control of supraspinal centers. In the hundred years since the publication of Sechenov's observations, inhibitory

processes have been examined in considerable detail in a variety of central neuraxial sites.

In the first 2-day symposium the historical development of current concepts of central inhibition was reviewed and examples were provided of the role of inhibitory mechanisms in higher nervous activities. Kostyuk (U.S.S.R.) reviewed evidence derived from studies of different central neurons which have revealed the operation of several different inhibitory mechanisms. Particular attention was devoted to the general properties of postsynaptic inhibition and to the ionic mechanisms involved in the production of inhibitory postsynaptic potentials. Among other "inhibitory" mechanisms considered by Kostyuk was the one resulting from depolarizing inactivation of spike-generation and presynaptic inhibition. Specific examples of the manner in which postsynaptic inhibitory activities contribute to synchronization and desynchronization of thalamic neuronal discharge and the production of different types of evoked cortical potentials were presented by Purpura (U.S.). Thus, this group of papers was concerned with the electrophysiological mechanisms underlying the production of inhibition in central neuronal organizations.

In discussing the distribution of inhibitory and excitatory neuronal activities in the cerebral cortex, Livanov (U.S.S.R.) summarized data based on statistical analysis of extracellular unit discharge patterns; such data are in accordance with his view that excitation and inhibition of neurons develop sequentially and may bear definite temporal relations to evoked activities. Findings on the relationship of electrophysiological and cytochemical manifestations of central excitation and inhibition were described by Kogan (U.S.S.R.). Studies of RNA content were undertaken in search for the existence of common physicochemical links in excitation and inhibition. These and other findings are viewed by Kogan

as indicating that central inhibition is not a purely diffuse inhibition of neurons of a given center, but a stochastic reorganization of the distribution of excitation and inhibition in a functional system. Investigations of other aspects of the expression of inhibitory activities in the central nervous system have included studies of the regulation of inhibition through conditioning mechanisms (Sokolov, U.S.S.R.).

Asratyan (U.S.S.R.) has attempted to characterize the relative strength of forward and backward connections of conditioned reflexes with two-way connections, by utilizing classical conditioning techniques with quantitative expressions of combinations of various stimuli. The data were discussed in terms of Asratyan's concept that conditioned inhibition appears first in the elements of the conditioned reflex connections and later extends to foci of the conditioned and unconditioned stimuli. Additional reviews covered (i) the effects of weak polarization of cortex and subcortical structures in the production of the dominant (temporally prevailing) reflex and its inhibition with strong polarization (Rusinov, U.S.S.R.); (ii) the possible relationship of the electroencephalographic alpha-rhythm to mechanisms of preventive inhibition of brain structures (Simonov, U.S.S.R.); and (iii) experiments utilizing Pavlov's classical method of salivary conditioned reflexes in studies of functional characteristics of excitatory and inhibitory stimuli (Abuladze, U.S.S.R.).

Two reports on central inhibition were concerned with morphological properties of different neuronal and synaptic organizations. Polyakov (U.S.S.R.) discussed his hypothesis of the functional significance of different types of synapses (end contacts and tangent contacts) in the central nervous system. End contacts (axon terminal to cell body or dendrite) are regarded as the basic form of interneuronal connection, whereas tangent contacts (axon branchings and dendritic spines) are considered supplementary. This distribution leads further to the notion that the end contacts exert direct effects, whereas tangent contacts exert indirect influences of a modulatory character. Since internuncial neurons (stellate cells) are believed to have mostly end synapses with other neurons, they are considered the major elements which perform the coordination of excitatory and inhibitory influences on pyramidal neurons. A somewhat different ap-

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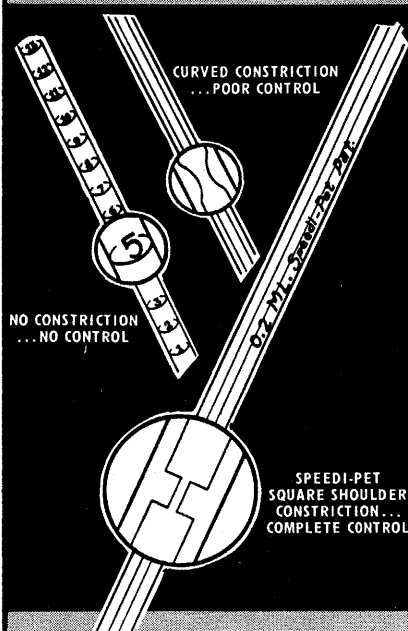
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proach to the study of synaptic relations in cortex was presented by Szen-tagothai (Hungary). Experiments on partially isolated cortex suggested that axosomatic synapses on pyramidal neurons come exclusively from local interneurons, whereas axodendritic synapses on the same neurons arise mainly from distant systems.

Several additional papers (Burês, Czechoslovakia, and Zanchetti, Italy) provided a broader perspective of the diversity and complexity of inhibitory mechanisms than is apparent in either studies of single neuron activities or the total behavior of intact animals. Storm van Leeuwen (Netherlands) showed an impressive film of the relation between behavior and electrical activity in various parts of the dog's brain.

The keynote address in the symposium on general principles of self-regulation in cortical-subcortical correlations was presented by Anokhin (U.S.S.R.), whose report on mechanisms of a functional system as a unit of self-regulation summarized 35 years of work along these lines. According to Anokhin, neurophysiological mechanisms of behavioral acts are elaborated through stages beginning with an afferent synthesis formed on the basis of ascending activating influences connected with the orienting reflex. This is succeeded by corticofugal activities, which in turn influence cortical neurons in accordance with the biological quality of the ascending activations. From this stage efferent mechanisms are brought into operation which initiate reverse afferentation. During the course of experiments on these factors, Anokhin and his collaborators have defined specific characteristics of ascending reticulocortical activations in terms of different biological and chemical processes. Ontogenetic studies were also cited in support of the view that different afferent pathways activate different types of synaptic organizations of cortical and subcortical neurons.

Self-regulation mechanisms in cortico-subcortical relationships were also discussed by Sager (Rumania), whose notion of cortico-subcortico-cortical reverberating circuits negates the necessity for the existence of special centers for sleep-wakefulness function. Less speculative reports of electrophysiological data on input-output relations at various levels of afferent pathways were offered by Gersuni (U.S.S.R.), Nari-kashvili and Kadjaya (U.S.S.R.), and Meschersky (U.S.S.R.). The latter two

papers dealt with cortical inhibition and modulation of transmission through specific thalamic relay nuclei.

It is noteworthy that in other communications dealing with the role of the meso-diencephalic activating system in higher nervous activity (Lissak and Endroczi, Hungary), particular attention was directed to the finding that all subcortical facilitatory and inhibitory systems form an inseparable unity with the cortex. Thus, while it may be argued that various subcortical circuits are primarily involved in reinforcement or facilitation of conditioned reflexes, it is at the level of the cortex where integrative closure of all behavioral activities takes place. The report of Rosenblith, Albe-Fessard, Maissou, and Hall (U.S., France) attracted considerable interest. In his introductory remarks, Rosenblith pleaded for the development and use of new analytical methods in neurophysiology that could conceivably provide new information on neuronal organization. The paper dealt with changes in averaged, evoked responses that were recorded during sleep and wakefulness from nonspecific and specific thalamic nuclei and cortex. Preliminary results of this study have indicated that the transition from sleep to wakefulness is accompanied by alterations in averaged, evoked responses to peripheral stimulation which are most prominent in mid-line components of the thalamic reticular system. Hugelin and Dell (France) reported on reticular regulation of peripheral and central reflex activities in the context of the general problems of vigilance.

A symposium on evolutionary physiology of the nervous system and brain ontogenesis opened with a general report on the evolution of afferent systems in vertebrates (Voronin *et al.*, U.S.S.R.), which stressed the progressive development of ascending activating systems in vertebrates, the manner in which specific systems develop relative to the specific ecology of different species, and the evolution of axosomatic and axodendritic synaptic pathways at different neuraxial sites. Kar-amyran (U.S.S.R.) continued this phylogenetic analysis in terms of experimental findings on the overt characteristics of specific and nonspecific effects of pharmacological agents on these evoked activities in different species.

In an attempt to broaden the scope of this symposium, attention was directed to several aspects of the development of different biochemical proper-

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ties of the nervous system during phylogenesis. Kreps (U.S.S.R.) discussed the qualitative and quantitatively different characteristics of phospholipids in vertebrates and invertebrates, on the one hand, and warm and cold blooded vertebrates on the other. Vinnikov (U.S.S.R.) considered the structural, chemical, and functional features in sense organs at cellular and subcellular levels of organization. In the only other paper concerned with metabolic properties of developing cell systems, Gutmann (Czechoslovakia) discussed the differentiation of metabolism in muscles of different function during ontogenesis.

The 6-day meeting closed with a series of papers on various aspects of the ontogenesis of morphological, electrophysiological, and pharmacological properties of the mammalian central nervous system and the postnatal development of conditioned reflexes. In considering the different rates of maturation of afferent functions, Scherrer (France) explained how an attempt was made to find out how the behavioral features of immature animals might be explicable, in part, in terms of the excitability and conductile properties of afferent pathways and the progressive elaboration of different synaptic organizations. Comparative studies by Volokov (U.S.S.R.) of the postnatal development of analyzers stressed the different time of appearance of orienting reactions to various stimuli. It was proposed by Sheveleva (U.S.S.R.) that in early stages of postnatal development adrenergic synapses predominate in the brain, whereas during maturation cholinergic synapses increase in number in association with changes in bioelectrical activity and in the reaction of neurons to pharmacologic agents. In presentations from Soviet workers, the importance of ecological factors as determinants of the ontogenesis of different analyzer functions in different species was repeatedly emphasized.

The last session on brain ontogenesis was opened by Mysliveček (Czechoslovakia) who reported on the differential rate of maturation of different components of the auditory pathway to neocortex in the kitten. Lindsley (U.S.) reviewed his long experience with the postnatal development of EEG and relationship to changes in neuronal structure as well as more recent data on evoked potentials in infants and newborn animals. The development of spontaneous and evoked activ-

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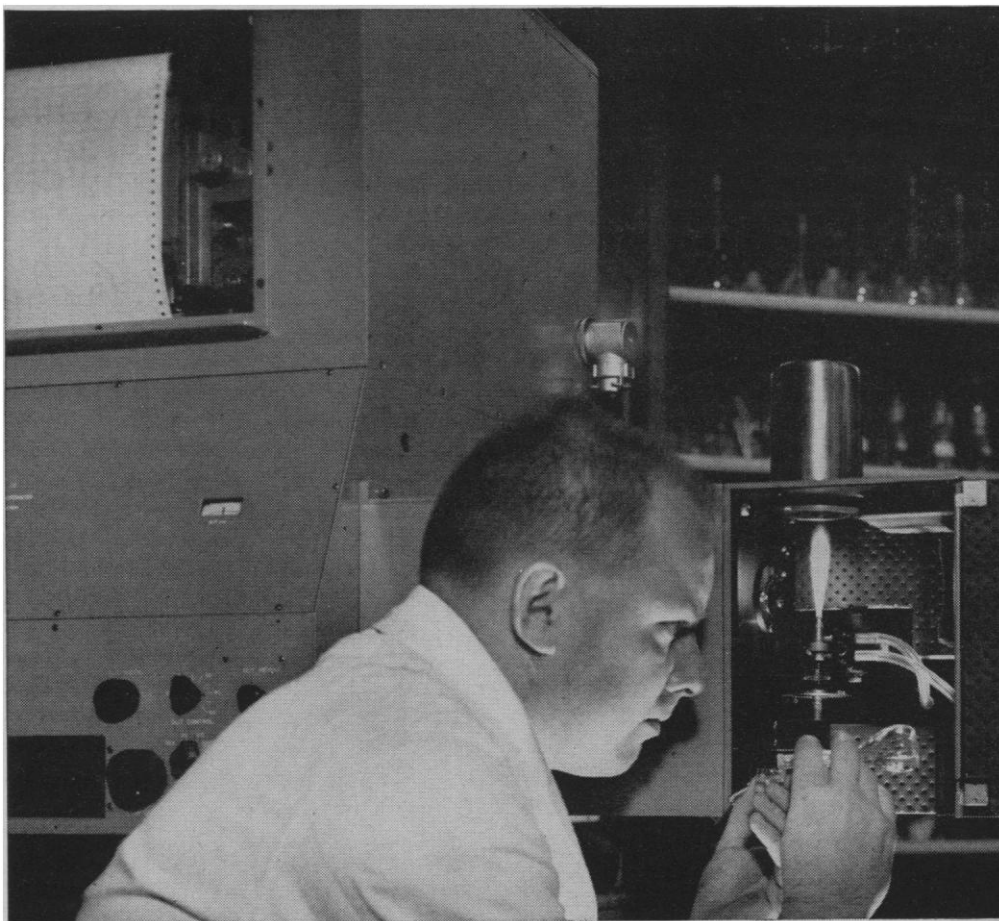
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ity in the rabbit hippocampus was analyzed by Dzidzishvili and Kvirkvelia (U.S.S.R.); they attempted to correlate the appearance of post-tetanic potentiation of evoked potentials with the appearance of convulsant activity in hippocampal neuronal organizations. Finally, Purpura and Shofer (U.S.) indicated how experimentally induced modifications of ontogenetic patterns in cerebral and cerebellar cortex may increase the value of developmental studies aimed at clarifying the origin and nature of evoked potentials.

In order to assess the significance of the Sechenov Conference it should be noted that this meeting was the first of its kind in which all aspects of neurophysiological and behavioral studies carried out in the Soviet Union provided the central themes of the 6-day international meeting. It may be appreciated, therefore, that the occasion of the Sechenov centenary prompted a major effort on the part of various members of the U.S.S.R. Academies of Sciences and Medical Science to indicate the general importance and development of neurobiological research in the Soviet Union in recent years. The papers presented by Soviet workers comprised more than 50 percent of the 6-day program. In broad outline they touched upon all aspects of neurophysiological investigation ranging from classical Pavlovian studies to microphysiological analysis of complex electrocortical potentials. Analytical methods currently employed in Western countries for obtaining quantitative descriptions of neural events are being applied increasingly in many of the larger institutions in the Soviet Union. There can be little doubt that the use of these methods in the studies of higher nervous activity has already yielded significant results and will supplement the traditional Pavlovian approach. Whereas little time was devoted during the meeting to other areas of brain sciences, present-day biochemical and biophysical concepts appeared to play a considerable role in the interpretation of the data.

In addition to the conference, two Sechenov lectures were presented, one in Moscow and one in Leningrad on 25 November and 2 December, respectively. The lectures were given by H. Waelsch on the subject of nitrogen metabolism and cerebral function. He defined the dynamic cytoarchitectonics of the brain in terms of metabolic compartments by the use of examples from the metabolism of ammonia. Fur-

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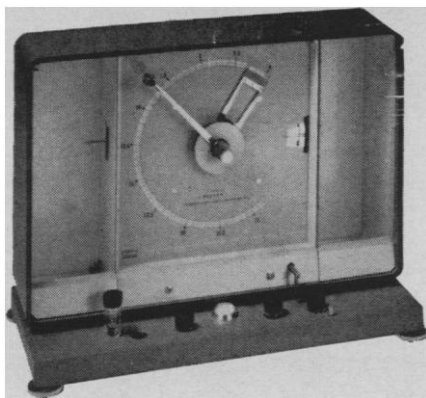
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thermore, he showed how ammonia metabolism, and with it the metabolism of glutamic acid and glutamine, is closely linked to the operation and rate of the citric acid cycle and of CO<sub>2</sub> fixation in the central nervous system. The role of CO<sub>2</sub> fixation as a possible link between function and metabolism of the nervous system was pointed out.

Among the institutes and laboratories both in Moscow and Leningrad visited by the participants during the week and the days following the conference was the Sechenov Institute of Physiology. The present director, P. K. Anokhin, holds the position which corresponds to the chair of physiology at the University held by Sechenov. Anokhin acquainted the participants with many of the original apparatus, manuscripts, and memorabilia of Sechenov's scientific life.

Much contact was established with the younger generation of Soviet scientists in the medical sciences and throughout all the discussions a strong desire for closer collaboration on the international and interdisciplinary level was apparent. The great general interest in brain sciences may be seen in the fact that on Friday, 28 November, Asratyan and Anokhin (U.S.S.R.), Dell (France), and Waelsch (U.S.) were invited to discuss international and interdisciplinary research in brain sciences on Soviet television.

The conference was sponsored jointly by the U.S.S.R. Academy of Science and the International Brain Research Organization.

D. P. PURPURA

H. WAELSCH

*College of Physicians and Surgeons, Columbia University, and New York State Psychiatric Institute, New York*

#### Reference

1. H. Waelsch, *Nature* 198, 344 (1963).

#### Magnetism

The fundamental and applied aspects of magnetism were discussed at the 9th Annual Conference on Magnetism and Magnetic Materials, Atlantic City, N.J., 12-15 November 1963. Approximately 20 percent of the 167 papers were delivered by representatives from foreign countries.

Most of our present knowledge of how magnetic substances behave is based on a model involving interactions between pairs of local magnetic