## Brain Research

The third visiting seminar of the International Brain Research Organization (IBRO/Unesco) was held in Budapest, Hungary, in August 1965. Previous visiting seminars had been held in 1963 in Warsaw, Poland, and in 1964 in New Delhi, India. Scientists from North America and Europe attended.

H. McIlwain (London) described his observations on related metabolic and electrical events in slices of cerebral cortex. Under suitable conditions the slices show a pattern of labile constituents similar to that in whole brain. Ion fluxes can be measured with labeled ions and resting potentials with intracellular micropipette electrodes. The problems of how energy-rich intermediates are utilized in maintaining cerebral ion gradients and excitability can be investigated in slices stimulated electrically. Metabolic changes and ion movements during stimulation and in the recovery periods have been measured.

The correlation of function with various aspects of structure in long-term organized tissue cultures was noted by M. Murray (New York). In rat spinal-cord cultures, explanted before the establishment of reflexes, synaptic networks develop which have typical fine structure and from which complex bioelectric responses of long duration can be evoked by single stimuli. Spontaneous firings can be recorded, especially in neocortex cultures, and expected effects can be obtained with drugs. With certain immune serums a reversible block to the spreading of impulses can be produced. Murray could follow the intracellular localization of chlorpromazine in sensory ganglia and of noradrenaline in sympathetic ganglia with the aid of fluorescent microscopy.

J. Passonneau (St. Louis) described the effect of ischemia on the substrate levels of the Embden-Meyerhof pathways as it was related to the kinetics of the enzymes involved. The increased rate of glucose utilization was interpreted as resulting from facilitation of phosphorylation at the glucose- and fructose-6-phosphate steps. When all the intermediates of the citric acid cycle in normal mice and in mice in which flux had been experimentally increased or decreased were measured, the changes found in the amounts of substrates suggested three coordinated, controlling steps in oxidative metabolism. These are at the points of oxidation of isocitrate and succinate and at some step between pyruvate and citrate.

K. Kelemen and L. Scultety (Budapest) demonstrated the procedure for analyzing bioelectrical potentials by tape recording and by the use of a frequency modulation converter that they have developed. Isoelectric as well as fast potential changes can be recorded, and a large amount of data from a large number of experiments can be processed. With this technique and with other original instruments (ball-and-socket-type micromanipulator, universal square wave stimulator, line-operated cathode-follower-type preamplifier of negative capacitance with built-in calibrator) the mechanism of action of the active cell membrane factor "celluline" (discovered in the Department of Pharmacology, Medical School, in Budapest) has been investigated.

J. I. Szekely, I. Desi, and B. Hajtman (Budapest) discussed new mathematical approaches to the more detailed and precise analysis of tracings of electroencephalograms, such as Fourier analysis and Brazier autocorrelation functions and their combinations. Such mathematical analyses can detect slight but constant changes otherwise missed.

A. Hugelin (Paris) reported on the origin of the autorhythmicity of the respiratory center. An analysis of air movement in man and of respiratory discharges in animals showed definite differences in the pattern of respiratory movements when they are modified by $CO_2$ inhalation or by arousing stimuli. The results suggested the existence of separate neuronic subsystems responsible for onset, growth, and cessation of inspiration.

A. Krnjevic (Montreal) presented evidence that a certain type of electrical stimulation which has a very pronounced and prolonged inhibitory effect on cortical cells is mediated by a widespread intercortical system of inhibitory neurons. The inhibition differs markedly from spinal inhibition in its pharmacological properties.

V. Csillik and collaborators (Szeged) measured the ultrastructural localization of cholinesterase in motor nerve endings, in ganglionic synapses, and in the cerebellar cortex. For this purpose, a more specific method was worked out with lead thiocholine, using frozen sections and light microscopy. Subsequent studies of the relevant details were made with electron microscopy.

M. Wolleman (Budapest) measured aromatic esterase, acetyl and butyryl cholinesterase, acid phosphatase, and lactic dehydrogenase isoenzymes with the aid of starch-gel electrophoresis, in various areas in normal human brain tissue and in brain tumors. The distribution of the various isoenzymes showed small differences in the various brain areas. Alterations in size and number of isoenzymes were characteristic for certain kinds of tumors.

J. Ovary (Debrecen) described his electron microscope studies of cultured explants from meningiomas and neurilemmomas. Other properties, such as nodule-forming tendency and reaction to cerebral white substance, were also studied.

A. Lundberg (Göteborg) discussed the control of reflex pathways from higher centers with particular reference to the facilitatory effects on inter-neurones from the corticospinal and the rubrospinal tracts and the inhibitory effect from the reticular formation.

Nerve endings from the central nervous system have been isolated by V. P. Whittaker (Babraham). In 1958 Hebb and Whittaker found a fraction from brain homogenates which was rich in bound acetylcholine and which was distinct from nuclei, mitochondria, and other known cell organelles. This fraction subsequently was found to consist largely of pinched-off nerve endings. From this preparation, Whittaker and his co-workers have recently succeeded in isolating synaptic vesicles, external presynaptic membranes, and cytoplasm from nerve endings. A new approach to the study of mechanisms of synaptic transmission has been opened up.

F. Morrell (Palo Alto) discussed some possible neurophysiological mechanisms in memory and evoked electrophysiological responses during conditioning.

E. Roy John (New York) described the electrical rhythms of the brain in cats. When cats trained to perform conditioned responses to rhythmic stimuli of a particular frequency are presented with a new stimulus at a different frequency, generalization often occurs. During such generalization, some brain structures display electrical rhythms which correspond to the frequency of training rather than the test stimulus. However, this discrepancy is not observed if generalization fails to occur. Average response waveshapes, computed from some structures during generalization, contain a late component which is absent if generalization fails to occur. John related these phenomena to the problem of storage and readout of information in the brain.

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A. Hamberger (Göteborg) discussed the ability of nerve and glial cells to increase their respiratory enzyme activity during increased functional demands. The changes were not similar in size and time-course for the two cell types. The increased activity of succinoxidase seemed to parallel the increase in the mitochondrial mass. The enzyme changes did not necessarily follow the changes in proteins, RNA, or volume of neurons.

A. Lajtha (New York) described the properties of active mediated transport processes involved in the passage of amino acids into and out of the nervous system. If rates of influx and efflux and affinities are known, concentrations of compounds in the cerebrum can be predicted. Similarly, from effects on flux, effects on concentrations can be predicted. These results show the importance of uptake and exit processes in controlling the amount and distribution of cerebral metabolites.

Each visitor, through his assigned contacts in the host country's various institutes, arranged some demonstrations of important aspects of methodology at these institutes. In addition to visits to laboratories in Budapest, where the demonstrations by J. Szentagothai and his colleagues at the Anatomical Institute and those by G. Adam at the Physiology Department deserve special mention, two scientific excursions were organized, one to Pecs and one to Tihany.

On the excursion to Pecs the departments of the Pecs University Medical School engaged in brain research were visited. E. Grastyan showed a prototype of a 128-channel analyzer for bioelectric potentials developed in collaboration between this institute and the Hungarian Central Physics Department. E. Endroczy showed microinfusion procedures for the topographical study of chemical mediators in the conscious animal. G. Szekely discussed studies involving neuroembryological recombination of the central nervous system. Cinematographic records were shown of stepping movements performed by heterotopic legs (fore and hind legs) innervated by heterotopic spinal segment groups transferred to other places of the medullary tube at various embryonic ages, and also of segments recombined in order to increase neuroblast material available at a given level. The whole concept of neuron specificity was discussed. T. F. Merei demonstrated methods of measuring cerebral protein synthesis and of obtaining rapid


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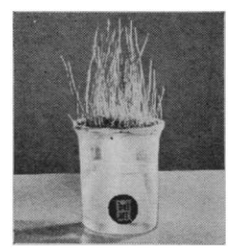

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serial blood samples from small animals. In Tihany (Biological Research Department of the Hungarian Academy) demonstrations of neurohormonal regulation studies were discussed by G. Salanky and his co-workers.

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## Forthcoming Events

### April

*28–29.* Electrical Conduction Properties of **Polymers**, symp., Pasadena, Calif. (A. Rembaum, Jet Propulsion Laboratory, California Inst. of Technology, 4800 Oak Grove Dr., Pasadena)

*28–30.* Central States **Anthropological** Soc., annual mtg., St. Louis, Mo. (G. H. Fathauer, Dept. of Sociology and Anthropology, Miami Univ., Oxford, Ohio 45056)

*28–30.* Economic and Social Aspects of **Technological Transfer**, conf., Airlie House, Warrenton, Va. (D. L. Spencer, Dept. of Economics, Howard Univ., Washington, D.C. 20001)

*28–30.* **Wildflower Pilgrimage**, 16th annual, Gatlinburg, Tenn., and Great Smoky Mountain Natl. Park. (A. J. Sharp, Dept. of Botany, Univ. of Tennessee, Knoxville)

*29–30.* Georgia **Acad. of Science**, Georgia Southern College, Statesboro. (J. T. May, School of Forestry, Univ. of Georgia, Athens)

*29–30.* Mississippi **Acad. of Sciences**, Mississippi State Univ., State College. (C. Q. Sheeley, Box 574, State College 39762)

*29–30.* **Population** Assoc. of America, New York, N.Y. (A. S. Lunde, Natl. Center for Health Statistics, U.S. Public Health Service, Washington, D.C. 20201)

*29–30.* American Assoc. of **University Professors,** Atlanta, Ga. (W. P. Fidler, The Association, 1785 Massachusetts Ave., NW, Washington, D.C.)

*29–1.* Association of **Clinical Scientists**, Chicago, Ill. (R. P. MacFate, 300 N. State St., Chicago, Ill. 60610)

*29–1.* American Soc. for the Study of **Sterility**, Chicago, Ill. (H. H. Thomas, 944 S. 18 St., Birmingham, Ala.)

### May

*1.* American Federation for **Clinical Research**, Atlantic City, N.J. (J. F. Bryan, 2000 P St., NW, Washington, D.C. 20036)