CANADIAN ASSOCIATION OF ANATOMISTS SYMPOSIUM

Functional Morphology of the Hypothalamus: Introduction

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This symposium was deliberately organized to include the whole family of scientific investigators from internationally renowned neuroendocrinologists to the final year graduate student yet to submit his Ph.D. thesis.

The hypothalamus occupies a relatively small part of the mammalian brain. In the mouse it is a cube of neural tissue measuring 1.5 x 1.5 x 3.0 mm., in the rat 2.0 x 2.0 x 4.5 mm. and in man 8.0 x 15 x 15 mm. weighing about 4 gm. This small piece of tissue is composed of bilaterally symmetrical groups of nuclei and fibre tracts located on either side of the third ventricle between the lamina terminalis and preoptic area rostrally, the cerebral peduncles and interpeduncular nucleus caudally, the thalamus dorsally and the sub-thalamus laterally. The hypothalamus has a functional importance quite out of proportion to its size. Among the many functions that have been ascribed to the hypothalamus are the following: the regulation and control of food and water consumption, the control of water excretion, the regulation of gastrointestinal and cardiovascular activity, regulation of salt metabolism, the generation along with the limbic lobe of emotional behaviour, and the control and regulation of the secretion of trophic hormones of the adenohypophysis. It represents the "final common pathway" by which all neural impulses (wherever they may originate within the CNS) may affect pituitary function and is therefore the most decisive region in neural integration of endocrine and non-endocrine homeostasis.

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An historical introduction to the anatomy and functions of the hypothalamo-neuroendocrine system might well be appreciated by this audience. This is a most difficult type of presentation requiring a speaker well marinated in the subject for many years. I was therefore pleased when Dr. T. F. Lévêque, Department of Anatomy, University of Sherbrooke, accepted my invitation to do just this.

It is well known that the hypothalamus controls the functions of the adenohypophysis and much is known about just how this is accomplished. However, it is not yet well understood just which of the many hypothalamic nuclei are involved in this process. I have asked Dr. Lee L. Bernardis, Department of Surgery, State University of New York at Buffalo to summarize our knowledge as it now stands on the localization of neuroendocrine functions within the hypothalamus.

That the neural control of the adenohypophysis is effected by the production and the secretion into the pituitary portal vessels of neurohormones or releasing and inhibiting factors, is a widely accepted tenet. Physiological and biochemical endocrinologists have been active in this field for a long time, and we owe our present knowledge of the chemical nature and functional activities of the many hypothalamic neurohormones to their efforts. However, more recently, morphologists and particularly electron microscopists have returned to make their contributions to this field of research. Within a short period of time significant works have been published dealing with the ultrastructure of the several hypothalamic nuclei in an attempt to localize more precisely the specific nuclei responsible for the synthesis of these releasing factors. I have asked Dr. R. E. Clattenburg, a recent graduate from our laboratory at the University of Western Ontario, to describe a portion of these ultrastructural studies to us.

One of the more intriguing hypotheses in neuroendocrinology, which showed a glimmer of beginning with the work of Lofgren in 1959 but which has been taken seriously only within the past five years, is the possible contribution of the cerebrospinal fluid and the ependymal lining of the third ventricle in neuroendocrine phenomena. Function is inextricably linked with structure. Increasing numbers of morphologists are devoting their attention to the structure of the ventricular ependyma in attempts to deduce functional correlates. To this end, I have asked Mr. J. E. Bruni, a final year Ph.D. student in our laboratory to describe the structure of the ventricular ependyma as seen with the light, and both the scanning and transmission electron microscopes.

Finally, the role of the cerebrospinal fluid and ependyma in the hypothalamic regulation of pituitary function will be developed by our guest speaker, Dr. Karl M. Knigge, Department of Anatomy, University of Rochester. Dr. Knigge has been the main proponent of this hypothesis in recent years on this continent.

To all the participants I express my thanks for their time and their cooperation.