

only by nerve endings in the median eminence into the hypophyseal portal vessels but also by nerve endings elsewhere in the brain into the cerebrospinal fluid from which they are thought to be taken up by specialized cells ("tanycytes") at the base of the third ventricle and released into the portal circulation. However, convincing evidence for this hypothesis is still lacking.

The current interest in the function of specific peptides in the nervous system goes far beyond the hypothalamic releasing and release-inhibiting hormones. Hökfelt *et al.* present immunohistochemical studies of the distribution in the central nervous system of neurons containing substance P, vasoactive intestinal polypeptide, gastrin, prolactin, angiotensin II, and the enkephalins, and Snyder presents evidence for the existence of specific receptors in the brain for the latter two peptides and for neurotensin. At least in the hypothalamus a number of these peptides have been found to be concentrated in subcellular fractions containing pinched-off nerve endings, and several of the peptides have been found to affect the firing rates of neurons in various parts of the brain. Thus these substances have joined the excitatory and inhibitory amino acids (glutamate and glycine, for example) as neurotransmitter candidates.

One other major development in neurobiology that is well illustrated in this volume is the recent availability of histochemical procedures for mapping the distribution of a wide variety of substances in the nervous system. Perhaps the first such breakthrough was the development of the Falck-Hillarp fluorescence technique, which allowed the mapping of noradrenergic, dopaminergic, and (with somewhat less sensitivity) serotonergic neurons. More recently autoradiographic and immunohistochemical methods have been developed to measure the distribution of certain membrane receptors (for example opiate and muscarinic receptors), different peptides (for example, TRH, LHRH, the enkephalins), specific enzymes involved in the synthesis of neurotransmitters (for example, tyrosine hydroxylase, the enzyme that catalyzes the rate-limiting step in the synthesis of norepinephrine), and intracellular receptors for specific steroids (for example, estradiol). The power of these techniques is illustrated in chapters by Hökfelt *et al.*, Defendini and Zimmerman, Pfaff, and McEwen *et al.* For instance, figure 14 (p. 92) shows consecutive sections cut through the mediobasal hypothalamus and stained for LHRH, TRH, somatostatin, or tyrosine

hydroxylase, each of which shows a distinct distribution.

These methods show good anatomical resolution, but they are not highly quantitative. With the development of increasingly sensitive biochemical techniques for assaying these substances, many attempts have been made to complement these histochemical studies with biochemical measurements of individual cell groups (for example, the supraoptic nucleus). The main problem in interpreting such studies is that there is often a lack of verification of the anatomical identity of the region dissected. That this is a problem even in studies on larger blocks of tissue, such as the whole hypothalamus, is evident from the large variation in weights (sometimes as much as threefold) reported by different laboratories for what is supposedly the same structure. One wonders whether it wouldn't be useful for a group of neuroanatomists to attempt to standardize a set of landmarks for such dissection procedures.

*The Hypothalamus* is an extremely readable and interesting collection of papers. In general, the authors have summarized the state of research in their fields rather than simply describing research in their own laboratories. The book is well edited, and the micrographs are particularly well reproduced. Like the 1940 volume, this book will serve as a useful reference for students and researchers.

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