and Metabolic Diseases, NIH. The standards used for LH and FSH, respectively, were NIAMD rat-LH-RP-1 and NIAMD rat-FSH-RP-1.

Results and discussion. Analysis of variance indicated that the mean serum LH concentration in rats of the Long-Evans strain was higher than that in the Sprague-Dawley rats. The effect of treatment, when considered over both strains, as well as the interaction of strain with treatment were not significant. However, a separate analysis of LH values for Sprague-Dawley rats showed that animals subjected to sham surgery had lower ($P < 0.05$) LH levels than controls. In contrast to LH, serum FSH concentration did not differ between the 2 strains but a significant ($P < 0.01$) treatment effect was observed. Hemiovariectomized rats had elevated serum FSH levels when compared with either the controls or the rats subjected to sham surgery. These data extend the findings of HOWLAND and SKINNER[3] and suggest that hemiovariectomy, not only on the day of estrus, but also at later stages of the cycle causes a prompt rise in serum FSH levels. The lack of an effect of hemiovariectomy on serum LH in this study may indicate that a rise in the level of this hormone is not required for compensatory ovarian changes to occur. Our data also provide evidence that the LH levels as well as the changes in LH level in response to stress may vary with strain of rat[6].

Résumé. Des rates de lignées Sprague-Dawley ou Long-Evans ont subi une hémi-ovariectomie ou une hémi-ovariectomie simulée. Les niveaux sériques de LH et de FSH ont été mesurés sur des échantillons obtenus 21 h après le traitement. Une hémi-ovariectomie entraîne une augmentation des niveaux sériques de la FSH, mais pas de LH. Ils sont plus élevés chez les Long-Evans que chez les Sprague-Dawley. Chez ces dernières, une opération simulée abaisse les niveaux sériques de la LH.

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Neurosecretion in the Pineal Gland of *Macaca rhesus*[1]

It is well known that the mammalian pineal gland synthesizes and releases indoleamine hormones[2]. In addition, a group of polypeptides have been extracted from the pineal gland[3–8]. These peptide compounds have biological activity equivalent to or greater than that of the indoleamines and the peptides also may be pineal hormones. Speculative information only is available on the possible secretion site of the polypeptides[9]. Among mammals, neurosecretory fibres have heretofore been identified only in the pineal gland of the hedgehog[10–12].

The present report deals with neurosecretory material in the pineal glands of 9 adult male and female monkeys (*Macaca rhesus*). Our studies have established the following facts. The monkey pineal, 1. contains neural processes which stain for neurosecretion with a variety of staining and histochemical procedures; 2. this stainable material is also found in perivascular spaces and in the walls of blood vessels; 3. a similar stainable material is found primarily within the outer layer of the multilayered corpuscles, the so-called brain sand.

The neurosecretory material was most obvious in pineal glands that had been fixed in a mixture of glutaraldehyde and picric acid. The neurosecretion was found in nerve fibres in the vicinity of the pineal recess and in fibres lying between groups of pinealocytes. The fibres contained single (Figure A) or numerous globules (Figure B) of neurosecretory material. The presence of this material within neuronal processes sometimes caused localized dilation of the fibres resembling Herring bodies of the posterior pituitary. In some areas, fibres containing neurosecretory material were found to enter the perivascular space of a capillary. The stained fibres were usually associated with droplets of similarly stained material within the perivascular space and within nearby multilayered corpuscles (Figure C). It should be emphasized that the substance within the nerve fibres, and that in the perivascular spaces and in the outer layer of the multilayered corpuscles, stained identically with Gomori's chromium hematoxylin phloxine method.

The character of the stained material differs from that seen in the hypothalamo-hypophyseal neurosecretory system. The pineal neurosecretory substance was characteristically purple-red after the Gomori technique with the droplets in the perivascular space containing slightly darker cores. Tinctorially, the material resembles that found in the hypendymal cells of the subcommissural organ[13]. The pineal neurosecretion was also stainable with methods used to demonstrate endocrine polypeptide cells (see Pearse[14]). The substance was stained with aldehyde fuchsin after either permanganate oxidation or, more selectively, after hydrolysis in warm 0.2 *N* HCl. When aldehyde fuchsin was diluted with ethanol-McIlvaine

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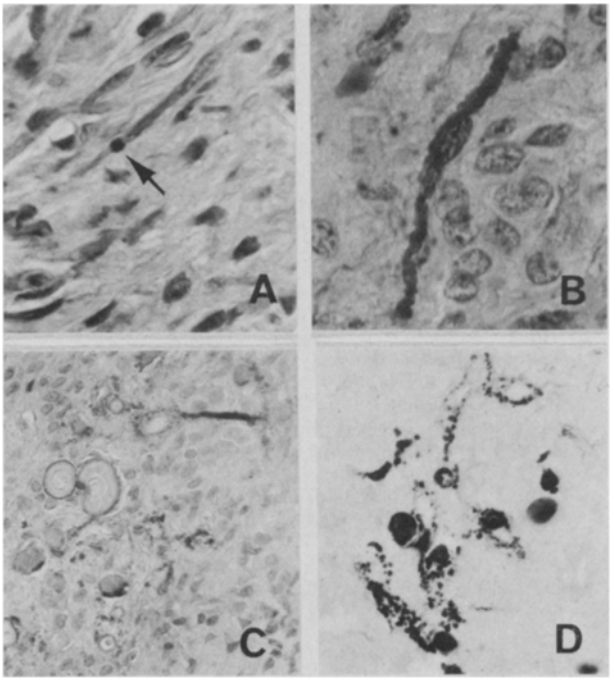
buffer (pH 5.0) and used to stain the hydrolyzed slipes, the granules in the walls of the capillaries were especially apparent. The latter technique was also effective in staining all layers of the multilayered corpuscles, but especially the most superficial layer. The observed Gomori positive material was visualized after treating the tissue for the PAS reaction and with the basic dye procedure of SOLCIA et al.[15] for endocrine cells. These techniques also stained droplets in glial cells and in an occasional pinealocyte. After 1 to 1.5 h hydrolysis with warm HCl, the basic dye procedure yielded well stained droplets on a background of unstained tissue (Figure D). Each of the dyes recommended by SOLCIA et al.[15] stained the above-mentioned material. One of the most important features was that the material also gave a masked metachromatic reaction with toluidine blue in McIlvaine buffer.

Generally, the histochemical observations reported here are consistent with a 'peptidergic' type of neurosecretion. The presence of stainable droplets in the perivascular space and in the endothelium of the capillary may represent hormone being secreted into the blood. The similarly stainable material in the multilayered corpuscles indicates that these structures somehow participate in the secretory process, possibly by acting as a site at which certain by-products are deposited. As is the case with the hypophyseal neurophysin[16–19] the neurosecretory material which stained with the methods reported here probably represents the carrier molecule (as a carrier-hormone complex) for the polypeptidic hormones. This may explain the presence of the stainable material (carrier protein ?) in the multilayered corpuscles; the carrier may normally be a by-product of the secretory processes and possibly deposited on the multilayered corpuscles. A pineal peptide-binding protein has been biochemically identified by KRASS et al.[20]. This protein is similar to neurophysin of the posterior pituitary but is almost devoid of amino acids containing SH groups and is incapable of binding the posterior lobe hormones. The origin of the axons which contain the neurosecretory material is presently unknown. Although there were some neuron cell bodies found in the pineal parenchyma they were never seen to contain neurosecretory material. The findings prompt the conclusion that (at least in the monkey) neurosecretion may be one of the mechanisms responsible for secretion of polypeptide hormones by the pineal gland.



A) A single globule (arrow) of neurosecretory material (stained with Gomori's method) in a nerve fibre in the monkey pineal gland. ×720. B) Multiple globules in a nerve fibre. ×720. C) Neurosecretory fibre entering a perivascular space. Stainable material also present in the vicinity around the blood vessel and in outer layers of multilayered corpuscles. ×290. D) The substance stained by the metachromatic reaction with toluidine blue after hydrolysis with warm HCl. ×290.

Zusammenfassung. In der Epiphyse von Rhesusaffen (*Macaca rhesus*) wurden Neurosekrete histochemisch nachgewiesen und gezeigt, dass die Affenepiphyse Nervenfortsätze mit färberisch und histochemisch mannigfach darstellbarem Neurosekret enthalten, was ebenso für den perivaskulären Raum und die Wände der Blutgefässe gilt.

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COGITATIONES

On the Regulation of Lactate Dehydrogenase Isoenzyme Concentrations in Mammalian Cells

The five lactate dehydrogenase (LDH) isoenzymes (A_4, A_3B, A_2B_2, AB_3 and B_4) found in most mammalian tissues are produced by the association of two different subunit types (A and B) into tetrameric combinations[1]. It was previously assumed that the tissue specific concentrations of the isoenzymes were directly dependent on the synthetic activities of the structural genes for A and B subunits and that the in vivo association of