The Organum vasculosum laminae terminalis

A Cytophysiological Study in the Duck, Anas platyrhynchos *

O. Bosler

Laboratoire de Neuroendocrinologie, E.R.A. 85 du C.N.R.S., Université des Sciences de Montpellier, France (Professor I. Assenmacher, Director), and Département de Neurobiologie Cellulaire, I.N.P., C.N.R.S., 31 chemin J.-Aiguier, Marseille, France (Dr. A. Calas, Director)

Summary. The Organum vasculosum laminae terminalis (OVLT) of the duck is lined innerly by specialized ependymal cells (tanycytes) and outwardly by a well-developed superficial vascular network, the capillaries of which often show a fenestrated endothelium. The OVLT also includes glial cells, internal non-fenestrated capillaries, bundles of fine nerve fibers and three groups of axonal swellings. One type contains granulations of 1000–1400 Å in diameter as well as 300–500 Å clear vesicles. The second type exhibits granulations and dense core vesicles of 500–800 Å in diameter along with small electron-lucent vesicles having diameters of 300–400 Å. In the third type, exclusively clear vesicles 300–600 Å in diameter are found. Asymmetrical synapses on dendrites and neuronal perikarya are found at every level of the organ. In the most external zone, the interposition of tanycyte endings sometimes allows neurosecretory axons to reach the parenchymal basement membrane (basal lamina).

When tritiated molecules (amino acids or monoamines) are administered either in vitro by incubation or in vivo by intraventricular injections, radioautographic grains are observed over the tanycyte perikarya. Although this labeling is observed at every time point following the administration of the tracers, within three minutes only 3H-GABA appears to be concentrated in the cytoplasmic processes of the tanycytes. 3H-noradrenaline and 3H-serotonin are taken up and retained by some axons of the second type described above. Noradrenergic fibers are primarily localized in the inner zone of the OVLT where they display axodendritic synaptic contacts. Serotonergic fibers appear sparsely distributed in the OVLT but are more numerous in the lateral edges of the organ where synaptic differentiations on dendrites or on dendritic spines are also observed.

Send offprint requests to: Dr. Olivier Bosler, Laboratoire de Neuroendocrinologie, Université des Sciences, Place Eugène-Bataillon, F-34060 Montpellier, Cedex, France

It is concluded that the duck OVLT probably displays a neuroendocrine activity. Uptake and selective transport of exogenous molecules by tanycytes are also suggested by the present radioautographic observations. Finally, monoaminergic innervation is discussed at the OVLT level with special reference to the occurrence of serotonergic synapses.

**Key words:** Organum vasculosum laminae terminalis — Radioautography — Tanycytes — Monoaminergic innervation — Domestic mallard.

**Introduction**

The ventricular walls of the vertebrate brain include specialized regions which appear to constitute privileged sites of exchange between nervous tissue, blood and cerebrospinal fluid (CSF) (Oksche, 1973; Knigge et al., 1975). One of these highly differentiated structures is the Organum vasculosum laminae terminalis (OVLT) originally named the supraoptic crest (Wislocki and King, 1936). Morphological observations have suggested a neurosecretory activity in the OVLT as in other "circumventricular organs" (Hofer, 1958; Weindl, 1973), in mammals (Weindl et al., 1967, 1968; Röhlich and Wenger, 1969; Le Beux, 1972; Weindl and Schinko, 1975) and in birds (Mikami et al., 1976; Mikami, 1976). Moreover, recent studies with complementary techniques have suggested the possible intervention of this organ in pituitary gonadotropic function in mammals (Barry et al., 1973; Zimmerman et al., 1974; Sétáló et al., 1976; Kawakami et al., 1973; Kawakami and Sakuma, 1976; Brownstein et al., 1976; Wenger, 1976).

A suitable model system for the study of such a regulation has been the bird, especially the photosensitive species such as the duck (Benoit and Assenmacher, 1955). Following the works of Benoit and Assenmacher (1955) and of Calas (1974) on the median eminence (ME) of the duck and those of Vors (1970) and Alonso (1973) on the posthypophysis of the duck, a cytophysiological approach was employed for the study of the OVLT in the same avian family. Initially, this organ is considered from a histological and ultrastructural point of view. Secondly, the intra-organ distribution of exogenous radioactive molecules is studied since previous studies have demonstrated that specialized ependymal cells, the tanycytes (Horstmann, 1954), are capable of transferring substances across circumventricular organs (Horstmann, 1954; Knigge et al., 1975; Reese and Brightman, 1968; Weindl, 1969). In the present study, tritiated monoamines or amino acids were administered either in vivo by stereotaxic intraventricular injections or in vitro by incubation of the isolated organ. Since the cerebral monoamines are probably involved not only in hypothalamic neuroendocrine mechanisms (Kordon, 1970) but also in tanycyte function in the ME (Calas, 1975; Nozaki, 1975), the localization and possible function of monoaminergic innervation at the OVLT level is discussed.

**Material and Methods**

Thirty adult male Pekin ducks, *Anas platyrhynchos*, were used in this study. They were reared in natural temperature and photoperiodicity conditions and were sacrificed throughout the year.