mostly to the posterior neurohypophysis (NHP), with a few terminating more rostrally near the pars distalis. Bipolar cells in the NLT appeared to send additional projections to other brain areas: anteriorly via the preoptic area in the medial forebrain bundle or dorsally via the lateral hypothalamus to the posterior commissure and midbrain. Electron microscopic immunogold staining of eel and molly sections demonstrated that MCH in NLT cells and NHP fibers was in dense-cored vesicles up to 140 nm diam., which may be released from terminals near NHP capillaries and, at least in molly, between pars intermedia cells. Similar staining patterns were observed in holostean fishes (Amia, Lepisosteus), but in the dogfish and frogs MCH cells were found in a postero-lateral hypothalamic nucleus, with the median eminence and neural lobe containing no immunoreactivity. Thorough examinations of brains of a bird (chicken) and mammals (rat, cat) with the same antisera have not yet revealed positive results, suggesting that any MCH-related peptide present in these groups might be immunologically quite different. Overall our results support the idea that MCH may function not only as a systemic hormone but perhaps also as a pituitary modulator and central transmitter.


In the pituitary, the PAS-positive cells of the intermediate lobe are strongly stimulated in goldfish (Cyprinus carpio L.) and eels (Anguilla anguilla L.) adapted to deionized water (DW). Cytological and ultrastructural studies show an active Golgi area, a highly developed endoplasmic reticulum, a loss of secretory granules, and a marked mitotic activity. This stimulation still occurs in buffered DW at pH 6.7, and in unbuffered DW having a pH of 5.3–5.5. However, in goldfish kept in 1/3 Ca-free seawater (SW) and in eels adapted to 1/3 or full-strength Ca-free SW, the response of the PAS-positive cells is either reduced or almost undetectable. Addition of 1 or 2 mM Ca2+ suppresses the stimulation of these cells which are also affected by external sodium. When goldfish are adapted for 8 or 16 days in DW supplemented with Na+ (50 or 140 mM), the stimulation of the PAS-positive cells is partly inhibited. The reactive cells are restricted to the area of the intermediate lobe close to the pars distalis. Peripheral cells remain partly granulated and slightly enlarged. Mitotic figures are rarely observed in DW + 50 mM Na++. They are never detected in DW + 140 mM despite the absence of external calcium. By contrast, magnesium up to 50 mM does not inhibit the hypertrophy and hyperplasia of the PAS-positive cells, even after 29 days of adaptation. The presence of sodium in SW then interferes with the effect of calcium deficiency. These cells react to the addition of low concentrations of calcium, or of high levels of sodium, but remain unaffected by that of magnesium. These differential responses to sodium, calcium, and magnesium are not due to pH differences in the solutions (pH 5.5–5.6) in the present experiments. In DW + Na+, MSH cells are stimulated. MSH is natriuretic in some mammals, but its influence on teleost osmoregulation has not yet been investigated.

31. The Role of α-MSH in the Regulation of Tilapia Interrenal Function. PAUL BALM, ANNE LAMERS, BRUCE JENKS, AND SJOERD WENDELAAR BONGA, Department of Zoology II, University of Nijmegen, Toernooiveld, 6525 ED Nijmegen, The Netherlands.

Traditionally ACTH is considered the pituitary component of the pituitary–adrenal axis in teleosts. We investigated the possibility that a product(s) from a second pituitary cell type—the pars intermedia MSH cells—is involved in the regulation of interrenal cortisol production in the freshwater teleost Oreochromis mossambicus (tilapia). To test this, we superfused both pars intermedia tissue and head kidney tissue in vitro and analyzed the superfusates by HPLC and RIA procedures. It could be demonstrated that tilapia pars intermedia cells released a product(s) which stimulated the interrenal cortisol production rapidly. The concentration of immunoreactive α-MSH remained below 2 nM in this experiment. Analysis of the superfusate from pars intermedia revealed the presence of three α-MSH immunoreactive products: desacylated-α-MSH, monoacetylated-α-MSH, and diacetylated-α-MSH. Subsequently, these three forms of α-MSH were tested on the interrenal cells separately. It was found that the diacetylated form was far more potent than the mono- and desacylated forms of the peptide, which is in contrast with the situation in higher vertebrates. CRF, which is usually associated with the regulation of ACTH release, stimulated α-MSH release by tilapia pars intermedia cells. It could be shown furthermore that cortisol exerted feedback effects on the pars intermedia cells, which lends support to the assumption that α-MSH might be an important component to the pituitary–adrenal axis in these fish. Finally, we exposed tilapia to acidic environments to investigate whether the pars intermedia MSH cells could be implied in the stimulation of interrenal cortisol production which occurs under these circumstances.