Melanin-Concentrating Hormone Signaling Systems

Hiroshi Kawauchi

Laboratory of Molecular Endocrinology, School of Fisheries Sciences, Kitasato University, Sanriku, Iwate, Japan

A dual hormonal control of body color by two antagonistic melanophorotropic hormones from the pituitary of lower vertebrates was first postulated by Hogben and Slome, University of Cape Town in the 1930s (1). Although melanotropin, responsible for melanin dispersion and skin darkening, was soon identified, a hormone antagonistic to melanotropin remained unknown until we identified melanin-concentrating hormone (MCH) in salmon in 1983 (2). Salmon MCH is a cyclic neuropeptide, consisting of 17 amino acids with a disulfide bond. MCH neurons occur in the hypothalamus of all vertebrates, from lamprey to human, and subsequent characterization of mammalian MCH reveals that this neuropeptide has been highly conserved throughout vertebrate evolution. Mammalian MCH neurons, localized at highest concentration in the lateral hypothalamus and zona incerta, project throughout the brain but, unlike teleost MCH neurons, do not extend abundantly to the neurohypophysis. Mammalian MCH has been shown to play an important role as a neurotransmitter or neuromodulator in regulating food intake, stress, reproduction, behavior, sensory perception, and neuroendocrine responses. The most active area of research on MCH has focused on its role in the regulation of food intake and energy homeostasis, while the recent characterization of MCH receptors in mammals has enhanced our understanding of its mode of action (3). Although the central functions of this neuropeptide have not been established in lower vertebrates, some data now exist to support the involvement of an MCH signaling system that regulates food intake also in fish (4).

(1) Hogben, L. and Slome, D. The pigment effector system. VI. The duak character of endocrine co-ordinattion in amphibian colour change. Proc. Roy. Soc., B, 108:10-53 (1931).

(2) Kawauchi, H., Kawazoe, I., Tsubokawa, M., Kishida, M., and Baker, B.I. Characterization of melanin-concentrating hormone in chum salmon pituitaries. Nature 305:321-323 (1983).

(3) Pissios, P. and Maratos-Flier, E. Melanin-concentrating hormone: from fish skin to skinny mammals. Trend Endocrinol. Metab. 14:243-248 (2003).

(4) Kawauchi, H. and Baker, B.I. Melanin-concentrating-hormone signaling systems in fish. Peptides 25: 1577-1584.