Teleost Growth Hormones and Prolactins which Regulate Osmotic Pressure in Fish: Their Stuctures, Receptors and Signal Transductions

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Summary

Salt (NaCl) is an essential agent in the lives living on earth and exhibits various physiological functions. Particularly, in teleosts living in plane or sea water, NaCl has an important role to maintain osmotic pressure of the body regulating its concentration. Recent investigations have shown that pituitary growth hormone is involved in the adaptation of fishes to sea water excreting Na^+ and Cl^- from the body and that another member of the gene family, prolactin, is involved in their adaptation to plane water incorporating Na^+ and Cl^- into the body. The structure of teleost growth hormone or prolactin has analyzed in limited species of teleost, and the majority of the hormones in that kingdom are remained to be analyzed. Moreover, the structures, distributions and signal transduction mechanisms of these teleost hormones have not yet been elucidated.

In an effort to investigate the regulatory actions of growth hormone and prolactin on the maintenance of osmotic pressure by NaCl in teleosts, we have cloned and analyzed three teleost growth hormone cDNAs and two recombinant teleost growth hormones has been synthesized in the present study. Yellowtail and hard-tail growth hormones are composed of 187 and 188 amino acid residues, respectively, and exhibit 79% homology in their sequences. Flounder growth hormone, on the other hand, has been shown to have the minimal size of the known growth hormones, being composed of only 173 amino acid residues. However, flounder and other teleost or vertebrate growth hormones have been revealed to conserve five distinct domains. These conserved domains have been designated GD (growth hormone domain) 1 to GD 5.

Yellowtail growth hormone cDNA and flounder growth hormone cDNA have been integrated into E. coli expression vectors to obtain the recombinant hormone proteins, respectively. Expressions of these proteins have been successful reaching at the levels of 8 to 15% of the total proteins. The recombinant hormones have been fully activated by refolding in a glutathione red/ox buffer.