DISSERTATION ABSTRACT

Johansson Viktoria (2004). **Behavioural effects and central nervous system actions of growth hormone in salmonid fish.** Department of Zoology/ Zoophysiology, Göteborg University, Box 463, SE-405 30 Göteborg, Sweden

Background and aim. Growth hormone (GH) is a multifunctional hormone, which apart from stimulating growth also regulates several physiological processes in vertebrates including metabolism, immune function, sexual maturation and osmoregulation. GH also affects behaviour, and in salmonid fish, GH increases swimming, foraging, aggression and risk-taking. However, the mechanisms behind these behavioural effects of GH are not fully understood. The aim of this study was to clarify how GH affects the central nervous system, and thus to attempt to elucidate the underlying mechanisms for how GH affects behaviour.

Materials and methods. Three salmonid fish species were used in this thesis; rainbow trout (*Oncorhynchus mykiss),* Atlantic salmon (*Salmo salar*) and brown trout (*Salmo trutta*). In most experiments included in the thesis, exogenous GH-treatment was used whereupon behaviour and/or different physiological parameters were studied. For peripheral GH-treatment, GH was administered intraperitoneally (i.p.) by injections, cholesterol-based implants (ovine GH) or sustained-release implants (bovine GH; Posilac®). For intracerebroventricular (i.c.v.) injections, salmon GH was used. The behaviour of the fish was recorded by direct observation. Brain monoamines and monoamine metabolites were quantified using high performance liquid chromatography with electrochemical detection and hormone levels were measured by radioimmunoassays. Heart rate was monitored in free-swimming fish, using submerged external electrodes, detecting the action potentials generated by the heart musculature.

Results and conclusions. GH is present in the cerebrospinal fluid (CSF) of Atlantic salmon, suggesting a possible action of GH in the salmonid brain. In rainbow trout, i.p. injected oGH is subsequently detected in the CSF suggesting a passage of GH from the blood to the CSF. I.c.v.-injected GH increases swimming activity in rainbow trout which demonstrates a central action of GH in regulating behaviour. Peripheral GH-treatment in rainbow trout increased swimming and feeding activity accompanied by a general increase in dopaminergic activity throughout the brain. Further, a selective dopamine D_1 antagonist eliminates the GH-induced stimulation of swimming and feeding, suggesting a functional involvement of the dopaminergic system in the mediation of the behavioural effects of GH. GH changes the heart rate response of brown trout when exposed to an initial predator attack suggesting that GH induces a change, centrally or peripherally, that affects the awareness/assessment of the predation risk. It is concluded that a direct central action of both centrally and peripherally administered GH in modulating behaviour is likely, and this effect appears to be mediated by the brain dopaminergic system.

Keywords: growth hormone, dopamine, central nervous system, cerebrospinal fluid, behaviour, rainbow trout, Atlantic salmon, brown trout, salmonids, teleosts, fish.
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