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Sympathoadreanal System and its Role in Fish

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Tyrosine-derived catecholamines, including 3,4-dihydroxyphenylalanine (DOPA), dopamine and norepinephrine are important stress hormones. Stress increases tyrosine hydroxylase (TH) activity and biosynthesis, which is known to affect the adrenergic nervous system. TH has a large molecular diversity, resulting from differential splicing of its mRNA, which is tissue specific and can end in long-term changes in the enzyme activity. Morever, it affects the availability of neuro transmitter matters at some synapses. DOPA, dopamine, norepinephrine and epinephrine are synthesized in the catecholamine pathway. Chromaffin cells in the adrenal medulla release catecholamines. Both synthesis and release of catecholamines rise in chromaffin cells as the end of the increase in TH activity and TH mRNA [1]. This editorial review presents an introduction information about sympathoadreanal system and its functions in fish.

TH is an enzyme which plays a central role in neurotransmission and hormonal function of catecholamines(dopamine, epinephrine and norepinephrine). Catecholamines are released from adrenergic nerves and chromaffin tissue. TH catalyses the first step in catecholamine synthesis and TH positive cells may thus be adrenergic, noradrenergic or dopaminergic cells [2].

Amines used as signal molecules in the fish gut include catecholamines, histamine and serotonin (5-hydroxytryptamine; 5-HT). Histamine is found in mucosal endocrine cells of the fish stomach andintestine. The presence in gut nerves and mast cells is morenot clear. It isnotified histamine in mast cells only in lungfish andperciform fish, the most advanced teleosts, and it was hypothesized that thisexpression first developed in reptiles and independently at a later stage in the two fish groups.5-HT represents an interesting situation. In cyclostomes, it is found in just nerve cells. In elasmobranchs,nerves are sparse, while endocrine cells containing 5-HT are common. Sturgeons(Chondrostei) have 5-HT in both endocrine and nerve cells. Teleosts show large interspecies variation in the relative proportion of 5-HT-containing nerves and endocrine cells.In cyprinids, 5-HT seems to be present in only nerves. Also, 5-HT is found in only endocrine cells of *Anguilla Anguilla*, while in a closely related species both endocrine cells and nerves contain 5-HT. The staining of neurons, however, is weak. At least seven classes of 5-HT receptors exist and members ofmost of the classes have been isolated from various fish species, although little is known about receptor distribution in the gut [3].

The gut of most classes of fish is densely in nervated by adrenergic nerves, surrounding myenteric nerve cell bodies and in nervating gut vessels. The origin of these nerve fibers is known to be basicly extrinsic (spinal autonomic). Also, it has been indicate that the presence of the synthesizing TH in enteric nerve cell bodies of several teleost fish. It is suggested that there are both dopaminergic and adrenergic nerve cell bodies in the gut of river lamprey, Lampetra fluviatilis, and some fluorescent nerves in the teleost intestine may contain dopamine. In elasmobranchs, as in mammals, birds and reptiles, noradrenaline is the dominating catecholamine in gut adrenergic nerves, while adrenaline is the predominating form in teleosts and holosteans [3].

TH is the rate-limiting enzyme in the synthesis of the catecholamines. Therefore, the regulation of TH represents the central means for controlling the synthesis of these important catecholamines [4]. The fish is reacting much as we do with the fight or flight mode. The fish can only maintain these altered states for a short period of time and then they will adapt or the stress will become chronic. Stress is accompanied by the release of the hormone cortisol, which is responsible for many of the negative health effects associated with stress. Short-term stress will cause an increase in heart rate, blood pressure, and respiration.Small amounts of stress can be harmless or even beneficial, but high levels of stress or prolonged periods of stress can create severe health problems.Stress is present in the lives of all living things and is the force that brings about physical change and adjustment. Also, having a negative effect on growth, reproduction,digestion and chronic stress

will also lower the ability of the immune system to respond effectively and fully.These decreased immune reactions are what allows parasites, bacteria, and fungi to infect a stressed fish and cause pathological conditions with disease and death in the end. Fish which is important aquatic organism and their products are an important source of protein for human consumption. However, their biochemical changes which causes substantial problems in distribution. Aquatic organisms can provide model systems for investigation of how stress damage cellular compounds,how cells respond, how repair mechanisms reverse this damage, and how stress can lead to diseases [3].

Increasing environmental pollution due to industrial and agricultural activities, is becoming a important problem in the modern world especially aquatic organisms such as fish. Because of the health problems induced by many environmental pollutants, many efforts have been undertaken in evaluating of stress related to environmental factors in fish. Stress increases TH activity and biosynthesis, which is known to affect the adrenergic nervous system. Therefore, it would be important to study TH activity in fish and aquatic livings about the stress conditions [5,6]. In conclusion, this paper provides a precious information for the the functions of tyrosine-derived catecholamines on the stress in the sympathoadreanal system in fish.

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