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Physiological markers of environmental chronic stress in rainbow trout

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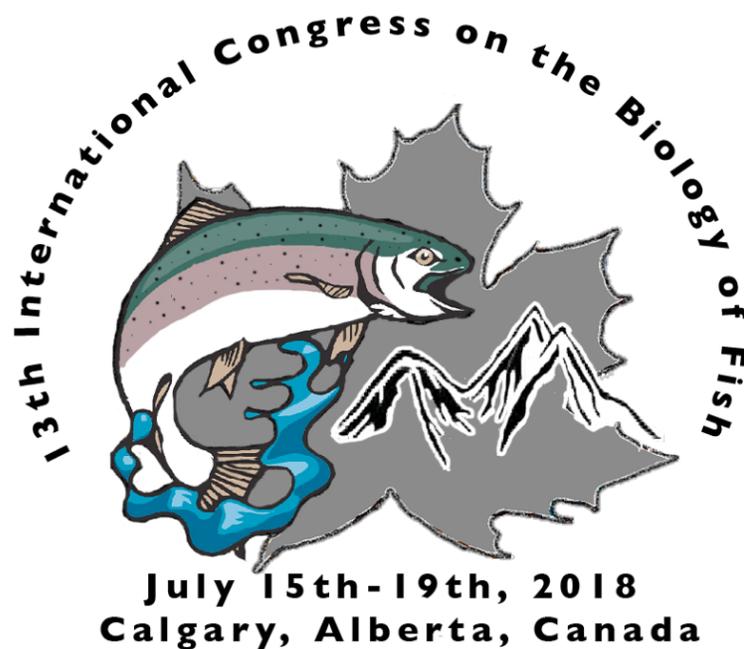
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observed during early development in unstressed fish suggesting presence of a chronic stress. However, these increases were consistently related to dietary shifts indicating an important, as yet undetermined development role for cortisol post embryogenesis.

S16-5) Lars Ebbesson (Norway)

CAN WE FIND RELIABLE BIOMARKERS OF CHRONIC MILD STRESS IN FISH?

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Chronic mild stress (CMS) is one of the most difficult stressors to measure and today there is no consensus as to how to assess whether an animal is exposed to CMS. While physiological homeostasis can be maintained under chronic mild stress, an additional challenge can push the animal over to allostatic overload, resulting in compromised welfare, through physiological and cognitive dysfunction. Identifying assessment markers across vertebrates can give important insights as to the conserved mechanisms by which CMS acts. This information is important in general but also in aquaculture to identify the environmental and physiological limits to avoid situations that reduce the animal's capacity to respond to new challenges and compromise welfare. We will review what is known about CMS in different vertebrates, how this is assessed, in particular in fish. New results will be presented that link cognitive capacity to gill reporter genes, in search of convenient and reliable biomarkers of CMS.

S16-6) Patrick Prunet (France)

PHYSIOLOGICAL MARKERS OF ENVIRONMENTAL CHRONIC STRESS IN RAINBOW TROUT

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Aquaculture conditions promote exposure of farm fish to stressful factors and water quality is considered as one of the primary stressors in fish aquaculture. A common effect is a reduction in fish growth which can be interpreted as a trade-off between energy necessary for growth and energy requested for maintenance of homeostasis in fish exposed to daily challenging conditions. In that context, we developed studies in freshwater rainbow trout aiming to give a proper assessment of impact of environmental chronic stress on physiological parameters related to coping ability. In fish chronically exposed (or not) to low water quality (mostly hypoxia) we carried out a multivariate analysis of important functions related to health and welfare, i.e. stress responsiveness of the corticotropic axis (HPI) and acclimation (gill functions). Altogether, our data show that such assessment using HPI axis and gill functions is relevant to characterize chronic stress in fish. These results will be discussed in term of interrelated physiological functions leading to effective coping ability and compared to similar approach developed with other stressors

S16-7) Nick Bernier (Canada)

GLUCOCORTICOID CATABOLISM AS A NEUROPROTECTIVE MECHANISM AGAINST CHRONIC CORTISOL EXPOSURE IN ZEBRAFISH

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Chronic exposure to stressors can lead to a condition of allostatic overload that has negative consequences for neurological welfare. To isolate the effects of chronic stress-induced elevated cortisol on neurogenesis in fish, we used a flow-through system to continuously expose zebrafish to a range of waterborne cortisol levels for 5 days. We found that waterborne cortisol elicits small, transient increases in forebrain neurogenesis-related genes but has no sustained effects. Though whole-body cortisol levels did not change, the exposure regime resulted in distinct, rapid, dose-dependent, and sustained increases in the forebrain gene expression of the cortisol catabolic enzymes *hsd11b2* and *hsd20b2*, and in whole-body levels of the inactive cortisol metabolite 20b-dihydrocortisone. Dynamic changes in the forebrain expression of the corticosteroid receptors *gr* and *mr* also implicate these genes in the response to chronic stress. Therefore, in zebrafish, our results suggest that cortisol catabolism and the dynamic regulation of corticosteroid receptor expression protect the forebrain from the detrimental neurological effects of chronic stress.

S16-8) Michaiiah Leal (USA)

PHYSIOLOGICAL DIFFERENCES IN WHITE STURGEON OF DIFFERENT PLOIDIES IN RESPONSE TO CHRONIC AND ACUTE STRESSORS

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In aquaculture, ploidy (number of chromosome sets) is often manipulated to achieve sterility to increase growth rates and reduce mating with wild stocks. However, previous studies have demonstrated reduced performance in triploid fish when reared under suboptimal conditions, which may be the result of differences in susceptibility to stressors. White sturgeon triploids are fertile, a characteristic that is unique compared to other triploid fishes, allowing for ploidy levels intermediate of diploid (8N) and triploid (12N), such as 10N sturgeon. We investigated differences in the capacity of 8N, 10N, and 12N white sturgeon to respond to chronic warming and acute stressors common in aquaculture through bioindicators of the generalized stress response, hematology, and cellular energy metabolism. Our results suggest