**The Stress Physiology Research Group focuses on neuro-endocrinological and in particular stress physiological research across vertebrates, ranging from fish to humans.**

Besides fundamental research including biochemistry, immunology, genetics, and metabolomics also more applied research topics regarding aquaculture, husbandry, zoolife, and wildlife are covered. Hereby, the role of glucocorticoids as biomarker for acute and chronic stress stands central. Fish, in particular carp (*Cyprinus carpio*), is used as model organism to obtain crucial fundamental information on stress (molecules, pathways, regulation and actions), while vertebrates ranging from fish to humans are used in more applied research settings. Hereby, anelysis is performed in our 5S, ISO 17025, ISO 14001, and ISO 45001 compliant laboratories and includes mass spectrometry, molecular, biochemistry, and morphometry.

**The Stress Physiology Research Group encompasses 3 main areas of research.**

(1) Unravelling the fundamentals of glucocorticoid actions across vertebrates which includes 6 research topics:

(i) Mechanism(s) of glucocorticoid incorporation

How and to what extent are glucocorticoids synthesized and subsequently transported from the blood to other matrices focusing on fish scales, feathers, and hair in the framework of chronic stress quantification.

(ii) Chronic stress, target glucocorticoid receptor profiles and ligand binding kinetics

How and to what extent can glucocorticoids other than the active hormone bind to glucocorticoid and mineralocorticoid receptors.

(iii) Extra-interrenal and -adrenal glucocorticoids and alternative substrates for glucocorticoid biosynthesis

How and to what extent influence extra- interrenal and -adrenal glucocorticoid biosynthesis the level of HPI and HPA produced glucocorticoids.

(iv) Glucocorticoid-mediated developmental programming and early life stress

How and to what extent can glucocorticoids deposited in the egg due to maternal transition and early life stressors influence the ontogeny of the HPI axis in fish.

(v) Glucocorticoid-mediated bone (de)formation

How and to what extent do glucocorticoids affect bone (de)formation.

(vi) Individual variation in stress response

How and to what extent can individual variation in stress response and coping style be optimized to improve fish performance.

(2) Unravelling the impact of chronic stress across vertebrates which includes 5 research topics:

(i) Management as stressor in fish farms, in ornamental fish aquaculture, in home and public aquaria, in zebrafish facilities, in amphibian and reptile terraria, in avian farms, in pig farms and in cattle farms

Quantification of management related stressors such as animal density, light regime, water quality, etc. in order to reduce chronic stress and to optimize overall animal performance and welfare.

(ii) Feed as stressor focusing on invertebrates (e.g. *Artemia salina*), mycotoxins and fish feed constituents

The optimization of fish diets throughout the production cycle including but not limited to testing: (i) the influence of different combinations, concentrations, origins, etc. of single or multiple ingredients; (ii) new ingredients; and (iii) the effect of pre-and probiotics as well as other supplements on the stress level experienced by fish in time and subsequently on the overall performance of the fish in time.

(iii) Microbial endocrinology, interaction between bacteria, glucocorticoids and the stress level in fish

The interaction between bacteria and glucocorticoids in order to optimize RAS biofilter systems in relation to microbial content and glucocorticoids in the water produced by fish. Fish pathogens as stressor focusing on the interaction between bacterial pathogens and stress axis activity in fish.

(iv) Pollutants as stressor

The effect of natural glucocorticoids in the water and endocrine disruptors as chronic stressor in aquaculture, home and public aquaria, and wildlife, and their effect on growth, reproduction, innate immune system and subsequent susceptibility to disease and mortality.

(v) Stress in human related pathologies

The function and effect of glucocorticoids in human pathologies.

(3) Contributing to a more sustainable and animal welfare minded food production which includes 3 research topics:

(i) Development and validation of a biosensor for on-site glucocorticoid analysis in fish scale

Development of an accurate, precise, fast, financially and logistically feasible high-throughput quantification device for fish scale cortisol. Analytical, physiological, and biological validation of this device in aquaculture, ornamental fisheries, home and public aquaria, and wildlife.

(ii) Improving sustainability and animal welfare in aquaculture and husbandry

The identification, quantification and subsequent mitigation of chronic stress in aquaculture and husbandry to obtain a more sustainable and animal welfare minded food production. Contribution to an animal welfare label from an animal based stress physiological point of view.

(iii) Improving our understanding of the impact of anthropogenic activities on the health status of vertebrates in the wild

The identification, quantification and subsequent mitigation of chronic stress caused by anthropogenic activities on the health status of vertebrates in the wild.

**The conducted research contributes overall to**

1. an optimized and more sustainable aquaculture and husbandry
2. monitoring the impact of anthropogenic activities on wild stocks
3. objectively assessing welfare of (ornamental) species in aquaculture, wildlife, public aquaria and laboratory settings
4. the implementation of a welfare quality label so efforts of farmers investing in an animal friendly production can be valorized
5. providing the consumer with reliable product information with respect to animal welfare
6. helping governments to decide on sustainable production, environmental and welfare issues.

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