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Computational modelling approach of nonlinear signalling networks in the fish endocrine system (CANCELLED)

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The hormonal communication networks between the brain (notably the hypothalamus-pituitary complex) and the peripheral glands (such as the gonads) build up the dynamic endocrine signalling pathways of the aquatic lower vertebrates, especially fish. The neuroendocrine controller involved in this circuitry can be effectively reduced to the hypothalamic-pituitary-gonadal (HPG) axis. In the classical HPG axis, the gonadotropin releasing hormone (GtRH) is produced in the hypothalamus, which reaches the pituitary gland to stimulate the gonadotropins, such as the follicle stimulating hormone (FSH) and the luteinising hormone (LH). These hormones regulate the steroidogenesis in the reproductive system, however, the fully quantitative and mechanistic understanding on the fish HPG dynamics has not yet been achieved.
In this presentation, a computational framework is shown as a model for the signalling pathway that governs the neuroendocrine dynamics of HPG axis in fish. A nonlinear system of ordinary differential equations was constructed to represent the metabolic networking structure. We analytically solve the equations to obtain approximate solutions for predicting the time-varying behaviours of the hormone (FSH and LH) biosynthesis in the fish HPG axis, by assuming environmentally relevant situations that affect the GtRH signalling. This theoretical model enables the quantitative data analysis and mechanistic prediction of the reproductive pharmacokinetics of fish in the context of comparative physiology.

Author: SUNG, Baeckkyoung (KIST Europe)

Presenter: SUNG, Baeckkyoung (KIST Europe)

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