Introductory Remarks to Symposium 5

How cellular clocks spanning multiple time scales orchestrate biological timing

Monika Stengl and Martin Garcia, Kassel

Geophysical rhythms like the dominant 24 h cycles of light and temperature or annual changes in the duration of light per day shaped organismic life on earth. Environmental oscillations selected for the evolution of endogenous biological clocks that allowed for survival-relevant predictions of environmental changes. An endogenous clock is an oscillator that generates rhythmic outputs like membrane potential oscillations and oscillations in gene transcription under constant conditions. The clock´s receptors detect cycling external signals allowing the organisms to embed into environmental rhythms and to predict environmental changes. It is not resolved yet how an organism´s biological clocks with different speeds interact to generate the organism´s "presence – past – and future" as a common, continuous biological time axis robustly embedded into environmental oscillations. Best studied are circadian clocks in insects and mammals that orchestrate sleep wake rhythms entrained to the 24 h light dark cycles. Less understood are clocks in other species and it is unresolved whether and how multiscale clocks interact. Thus, it remains an important research question to determine how biological clocks across different time scales functionally interact to orchestrate a biological web of timing in physiology and behavior. To resolve this challenging research question of biological timing the concerted interdisciplinary efforts of experimentally and theoretically working scientists are required.

Therefore, in our symposium we will cover multiscale timing in different species, studied by experimental and theoretical scientists. We cover the mammalian circadian system orchestrating sleep-wake patterns across the year, learn about multiscale clocks in the central pattern generators of the stomatogastric ganglion in crustaceans, hear about neuropeptides as important multiscale coupling factors in insect brains, and are introduced to the various timescales in the phototactic behavior of larval zebrafish. Thus, in our symposium "multiscale clocks" interdisciplinary speakers will present their studies in search for evolutionary conserved principles of biological timing.

Symposium 5

Wednesday, March 22, 2023
15:15 - 17:15, Lecture Hall 104

Chairs: Monika Stengl and Martin Garcia, Kassel

15:15 **Welcome and Opening Remarks**
Monika Stengl / Martin Garcia

15:20 Johanna Meijer, Leiden, The Netherlands
NEURONAL NETWORK ORGANIZATION OF THE CENTRAL CIRCADIAN CLOCK (S5-1)

15:45 Wolfgang Stein, Illinois, USA
ORCHESTRATING THE TIMING OF CHEWING AND DIGESTION - MECHANISMS, MODULATION, AND STABILITY OF NEURONAL COUPLING BETWEEN FAST AND SLOW STOMATOGASTRIC OSCILLATORS (S5-2)

16:10 Anna C. Schneider, Kassel
MULTISCALE RHYTHMS IN THE EXCITABLE MEMBRANE OF HAWKMOTH OLFACTORY RECEPTOR NEURONS (S5-3)

16:35 Hans-Peter Herzel, Berlin
ENTRAINMENT AND SYNCHRONIZATION IN COUPLED CIRCADIAN OSCILLATORS (S5-4)

17:00 Maxim Quirijn Capelle, Konstanz
THE VARIOUS TIMESCALES IN LARVAL ZEBRAFISH PHOTOTACTIC BEHAVIOR (S5-5)

multiscale clocks

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