NEUR-CT09

NEUR Subgroup Contributed Talks

Thursday, June 17 at 06:45am (PDT)
Thursday, June 17 at 02:45pm (BST)
Thursday, June 17 10:45pm (KST)

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Wednesday (Thursday) during the "CT09" time block.

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Dr Paul A Roberts

University of Sussex

"What the Zebrafish's Eye Tells the Zebrafish's Brain"

While basic retinal architecture is conserved across vertebrates, each species' retina is unique, having evolved to detect and interpret the visual scenes particular to its environment. It is therefore important to build towards a broad understanding of the types of computations performed within the eyes of different species. Here, adult zebrafish are of particular interest. While considerable work has gone into studying the structure and function of the larval visual system, we know comparatively little about visual function in adults which differ vastly in size, swimming speed and visual-ecological niche. Anatomically, the mere 4,000 retinal ganglion cells (RGCs) of the larval eye increase to around 150,000 in the adult, all crammed into an eye that remains substantially smaller than that of the mouse with its 50,000 RGCs. What do all these “extra” RGCs encode, and how uniformly are any computations performed across different parts of the eye?In this work we take a truly interdisciplinary approach, combining cutting edge experimental techniques with the latest theoretical methods. In this way, we aim to build towards a first overview of the major visual computations performed by the adult zebrafish eye.

Ana Georgina Flesia

Universidad Nacional de Córdoba

"boosting confidence in detecting time-dependent ultradian rhythms using wavelet analysis"

Recently, biologists have shown fractal and oscillatory characteristics in animal behaviortime series. Aspects so different can be explained by a model with added components thatinclude deterministic cycles (ultradian and circadian rhythms), polynomial tendencies, and anunderlying nonlinear process with stationary increments. Such components can be extractedfrom the data using wavelet analysis by selecting the transformation appropriately. In this talk, we will discuss a five-step method that describes the data without making any parametric assumptions about trends in the frequency or amplitude of the components signals and is resilient to noise.1. Visual inspection by Continuous wavelet transform based on real Gaussian motherwavelet in the Cartesian time scale plane2. Visual inspection by Continuous wavelet transform based on complex Morlet motherwavelet in the Polar time scale plane.3. Modal frequency detection by Synchrosqueezed wavelet transform, a linear timescale analysis followed by a synchrosqueezing technique.4. Modal frequency corroboration by Empirical wavelet transform, a wavelet analysis in theFourier domain followed by frequency segmentation to extract the modal components.5- Quantification of coherence and phase difference between different series.

Euimin Jeong

KAIST

"Different oscillatory mechanisms between LN and DN in drosophila clock"

In Drosophila, circadian rhythms are regulated by about 150 pacemaker neurons. In each pacemaker neuron, circadian gene expression is driven by a transcriptional-translational feedback loop (TTFL). Interestingly, with dCLK-Δ mutation, which has impaired binding with PER, the amplitude of PER rhythms is greatly reduced in small ventral lateral neurons (sLNvs), but not in dorsal neuron 1s (DN1s). We investigated this unexpected difference between LNvs and DN1s by developing a mathematical model describing the TTFL. Our model predicted the differences in the molecular stoichiometry and regulatory mechanism of clock proteins between sLNvs and DN1s, which were validated by the experiments. We will discuss the biological significance of those differences between LNvs and DN1s for circadian clock system to work.

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Virtual conference of the Society for Mathematical Biology, 2021.