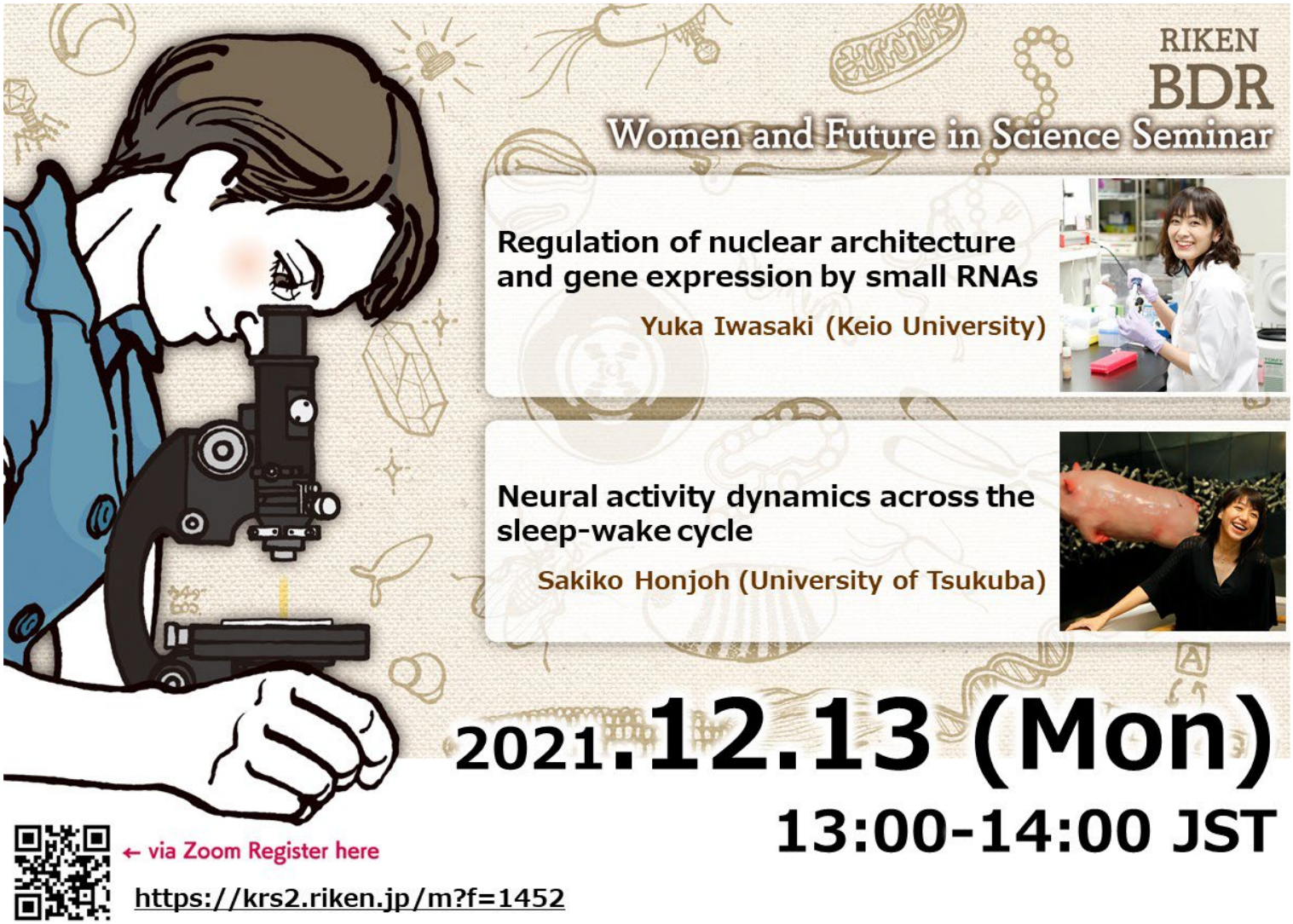

Regulation of nuclear architecture and gene expression by small RNAs

【Abstract】

RNA silencing involves various forms of sequence-specific negative regulation of gene expression, triggered by small non-coding RNAs. PIWI-interacting RNAs (piRNAs) are germline-specific small RNAs that form effector complexes with PIWI proteins to preserve genomic integrity by repressing transposable elements (TEs). Among PIWI-clade proteins in *Drosophila*, Piwi transcriptionally silences its targets via heterochromatin formation characterized by the H3K9me3 mark and the linker histone H1. Recently, we performed proteomics analysis and Lamin DamID-seq and identified that Piwi localizes chromatin regions that code piRNA target TEs to the nuclear periphery. Furthermore, Hi-C analysis revealed that the depletion of Piwi results in decreased short-range interactions at those regions. Ectopic targeting of the silencing complex to the reporter indicated that the regulation initiates by co-transcriptional repression of the target reporter coupling with the removal of active histone marks and nuclear periphery localization. Continuous silencing involves the increase of the H3K9me3 mark and H1 and the chromatin conformational change. In this seminar, we describe how Piwi–piRNA complexes promote heterochromatin formation by causing step-wise changes in nuclear architecture.

Neural activity dynamics across the sleep-wake cycle

【Abstract】

Sleep is a universal biological process across organisms with a nervous system. Prolonged wakefulness beyond spontaneous sleep/wake rhythm results in marked cognitive decline, showing that sleep is essential for the maintenance of normal cognitive functions. Although the detrimental effects of sleep loss have been long established, it still remains unclear why the brain cannot sustain waking cognition over a certain duration, and how sleep restores fatigue of the brain. Therefore, to better understand why we need to sleep, we started recording a very basic neuronal property, firing rate, across the sleep-wake cycle in freely behaving mice. We focused on the thalamocortical system that play critical roles in sensory information processing and higher cognitive functions. Our firing rate analysis revealed gradient in modulation of firing rate by sleep. We found that thalamic neurons show a consistent switch-like behavior, with the highest and the lowest firing in wake and in deep sleep, respectively. In contrast, cortical neuron activity is more heterogeneous and the cortex possesses a diverse population of wake-active, NREM sleep–active, and REM sleep-active neurons. Interestingly, neurons tend to fire more during sleep in higher cortical areas, suggesting that sleep is not just a resting state to save energy.

Contact information : bdr_diversity_po@ml.riken.jp