

## **RNA biology meets Sleep and Circadian Rhythms**

**June 26-27 2014**

**Oak Suite, University of Surrey, Guildford, United Kingdom**

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### **Event themes**

Our two day workshop was framed to explore how concepts and technologies in RNA biology can merge with sleep and circadian rhythms to understand and discover new principles of human physiology. Therefore, we invited international leaders in the field of RNA biology as well as in sleep and circadian research. The workshop provided a unique opportunity to discuss current knowledge in the respective fields and to elaborate how they can be integrated and establish new interdisciplinary collaborations.

In total, we had 22 attendees, including 12 speakers from 8 different institutions. Among the speakers, we were glad to welcome seven external international leaders in the fields of sleep and circadian rhythms (Frederic Gachon, Peggy Janich, Nicholas Lahens, Peter Meerlo), RNA biology (Anne Willis, Sinisa Volarevic) and proteomics (Kathryn Lilley). Our program was built on short oral presentations (four sessions) and two poster presentations (for details, see workshop program); and it was complemented with ad-hoc discussions to highlight priority areas and to explore potential for collaborative research.

The first session was chaired by Prof. Andre Gerber and framed to discuss the control of translation/protein synthesis. Prof. Anne Willis (MRC Leicester) presented results from a recent study investigating translational regulation upon cold-shock stress of cells, identifying a regulatory RNA-binding protein (RBM3) that also has a role in the circadian rhythm. Sinisa Volarevic investigates

the link between ribosome synthesis (e.g. ribosomal RNA processing) and activation of p53 expression (a tumor suppressor mutated in most cancers) in mice models that bear mutations in selected ribosomal proteins. Importantly, besides fundamental insight into these research areas, both speakers presented methodologies (translatome analysis, Willis) and reagents (mice, antibodies) that were of great interest by other attendees the research of other attendees.

The second session opened with a presentation from Raphaëlle Winsky-Sommerer and Derk-Jan Dijk (University of Surrey) reviewing and discussing a number of issues regarding the definition of sleep and circadian rhythms, their time scale, how they desynchronise and the confound associated with these physiological processes. Frederic Gachon (Nestle Institute of Health Sciences SA, Lausanne, Switzerland) and Peggy Janich (Center of Integrative Genomics, Lausanne, Switzerland) then provided two complementary presentations, making use of different techniques and protocols, to highlight the role of circadian rhythms in controlling the transcription of ribosomal proteins mRNAs and ribosomal RNAs, thereby underlining the key role of circadian rhythms in ribosome biogenesis.

The third session was chaired by Raphaëlle Winsky-Sommerer and focused on the effects of sleep on gene expression and behaviour. Simon Archer (University of Surrey) presented two recent studies revealing the effects of mistimed sleep on the human blood transcriptome, highlighting how sleep patterns can control the expression of circadian genes but also others involved in protein synthesis and immunity. Nicholas Lahens (Smilow Translational Research Center, Philadelphia) unravelled a circadian gene atlas in mammals with fascinating new insights on the contribution of small RNAs to this process, and its regulation by drugs. Finally, Peter Meerlo (Centre for Behaviour and Neurosciences, Groningen) described the consequences of sleep disruption on hippocampal function, memory and learning. Peter introduced a new diurnal animal model used to demonstrate the link between restrained sleep and hippocampal volume.

The last talk session chaired by Nicolas Locker was dedicated to methodologies and tools to study RNA biology and potential application to Sleep and Circadian Rhythms. Kathryn Lilley (University of Cambridge) presented a new methodology to study the dynamic subcellular localization of proteins in eukaryotes using Mass Spectrometry. Nicolas Locker (University of Surrey) presented recent data obtained by confocal microscopy highlighting the role of RNA granules in the response to viruses and how these phenomena might be of importance in other biological systems. Finally, Andre Gerber (University of Surrey) discussed the development of new tools to study RNA protein interactions and access the translatome in eukaryotic systems.

After the final session, participants were broken up in smaller groups for round-table discussion in order to identify new avenues for research. Raphaëlle Winsky-Sommerer, Nicolas Locker and Andre Gerber summarized these points in a final round-up, identifying new models systems and yet unexplored key process in RNA metabolism that could be of importance to the recent RNA biology/ Sleep and Circadian Rhythms community.

In conclusion, this meeting was instrumental in the establishment of a novel research network, in-house, nationally and internationally, between Surrey researchers at FHMS and with researchers in the UK, USA, and Europe (Croatia, Netherlands, and Switzerland). It also provided a platform for Surrey Postdocs to discuss their research to internationally leading RNA biologists and sleep and circadian scientists. The success of our workshop is also reflected by the very positive feedback from participants after the meeting.

## **Outcomes**

- Nicolas Locker will apply for BBSRC funding that will involve implementing the methodology developed by Kathryn Lilley who will be involved as collaborator.

- Andre Gerber intensifies collaboration with Sinisa Volarevic (Croatia). Reagents (antibodies, primers) and protocols have been exchanged between laboratories. A common grant application with other leading international scientists in the frame of EU Horizon 2020-PHC3-2015 Program. Working title “Protein, RNA and genome homeostasis networks in Obesity-associated Carcinogenesis – PROCuRE “ is planned for October 2014.
- Andre Gerber and Raphaelle Winsky-Sommerer and one PI from FEBS (Sub Reddy) have won a research grant from the Leverhulme Trust, entitled “Development of a novel translome analysis method and application in aging”. The project was born and further developed during preparation of this workshop.

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