

Multidisciplinary Dissection of Sleep Phenotypes in Animals and Humans

13 July 2011 - 14 July 2011

Workshop Report



This two-day workshop focused on the dissection of sleep phenotypes in animal and human basic research and in particular the development of relevant animal models for human basic and clinical studies. There is a growing recognition world-wide that there is a need to counteract the current decline in integrative physiological approaches to study sleep phenotypes. Thus, the major aims of the workshop were i) to revitalise the interactions between animal and human researchers; ii) to discuss the development and possible optimisation of animal models, as well as to identify the means to render data from these animal models directly usable for human basic and clinical scientists, and iii) to identify specific priority areas as the basis for developing translational research and thereby innovative collaborative interdisciplinary research programmes.

This international workshop was held at the Postgraduate Medical School of the University of Surrey (UniS). In total, there were 43 attendees, including 22 speakers from 13 different institutions.

Among the speakers, international leaders in the fields of sleep and circadian rhythms, using a wide-array of state-of-the-art methods and data analyses, were invited. This meeting was instrumental in the establishment of a novel research network, in-house, nationally and internationally, between Surrey researchers at FHMS and FEPS with researchers in the UK, USA, Brazil and Europe (Belgium, France and Switzerland).

The Papers

On the first day, Derk-Jan Dijk (Surrey Sleep Research Centre (SSRC), UniS) opened the workshop by giving an overview of the needs and challenges in the sleep/circadian research fields. In the first session discussing these challenges and how to address them, Prof. Dijk highlighted the importance of integrating sleep and circadian rhythm research whilst there is too often a division between these two research fields. Malcolm von Schantz (SSRC) then gave an account of the evolution of the PER3 circadian gene that has been shown to be involved in sleep regulation, within *Homo sapiens* and related species.

The first external speaker, John O'Neill (University of Cambridge) presented recent exciting data, recently published in *Nature*, monitoring metabolic rhythms in presence or absence of transcription in several organisms. Pierre Maquet (University of Liege, Belgium) gave an overview of the latest research using state-of-the-art imaging techniques to investigate sleep phenotypes and circadian rhythms. To close this first day, Jim Krueger (Washington State University, USA), a world-leader and pioneer in sleep research, gave the first keynote lecture, integrating at multiple levels (i.e., molecular, cellular, network) some of the mechanisms underlying sleep regulation.

On the second day, the first session, chaired by Derk-Jan Dijk, was centred on different animal models that have proved to be extremely useful to investigate sleep regulation and highly relevant for human basic and clinical research. Bill Wisden (Imperial College London) first discussed common neuronal networks involved in anaesthesia-induced loss of consciousness and sleep. Raphaëlle Winsky-Sommerer (SSRC) then illustrated how pharmacology studies can provide insights into the contribution of specific neurotransmitter systems to sleep regulation. Jenny Morton (University of Cambridge) talked about sleep-wake regulation in animal models in Huntington's disease. Simon Archer (SSRC) presented work on several PER3 animal models that can be used to mimic a known genetic variant in humans. In the fifth talk of this 'Models' Session, Pierre-Hervé Luppi (CNRS, Lyon, France) gave an account of the latest findings identifying the neurochemical networks involved in the regulation of paradoxical sleep. Finally, Mario Pedrazzoli (University of São Paulo, Brazil) discussed how latitude influences chronotypes using comparative studies in primates.

The second morning session, chaired by Raphaëlle Winsky-Sommerer, highlighted the numerous state-of-the-art methods and data analysis currently used in sleep research to dissect sleep phenotypes. June Lo (SSRC) reported on the effects of chronic sleep deprivation and acute sleep loss on cognitive performance, emphasising on the differential sensitivity across cognitive domains, circadian phase and individuals. Daniel Abasolo (FEPS, UniS) introduced novel non-linear methods to analyse the electroencephalogram (EEG) that can complement the traditional signal processing used by sleep researchers. Vlad Vyazovskiy (University of Wisconsin, USA) presented recent data obtained by simultaneously recording the EEG, local field potentials and local multi-unit activity, in sleep-deprived rodents, showing that some neuronal populations show evident electrical activity characteristic of sleep while the animals are awake. The final talk of this session was given by Nayantara Santhi who discussed how light intensity and spectral composition affects sleep and circadian rhythms.

The last session chaired by Simon Archer was dedicated to the circadian PER3 gene, and its contribution to the regulation of sleep and circadian rhythms, as an example of multidisciplinary research used by a collaborative effort between teams at the SSRC, the University of Liege (BE) and the University of Basel (CH). This session offered the opportunity to Ph.D students –Ana Slak, Fabian Le Bourdieu- and post-doctoral fellows –Daan van der Veen; Sibah Hasan; Alpar Lazar; Antoine Viola- to present some of their research projects and data that involve a wide array of state-of-the-art techniques, such as in vivo circadian and sleep recordings, molecular genetics, genomics, system biology, and modelling.

Mick Hastings (MRC Laboratory of Molecular Biology, Cambridge) gave a closing presentation, where he integrated some of his thoughts on where research should be moving to study the interactions between sleep and circadian rhythms, based on the many talks heard during the present workshop, as well as some of his most recent work.

Outcomes

The workshop showcased Surrey not only as a leading human sleep and circadian research centre, but also as an emerging major animal research centre. In addition, the workshop had a considerable impact on the Surrey post-doctoral fellows and Ph.D. students by providing them the unique opportunity to discuss their research to

internationally leading sleep and circadian scientists. The meeting also resulted in a number of specific outcomes between some of the attendees. These include:

- Strengthening existing collaborations.
- Exploring in-house research collaborations between FHMS and FEPS members, as well as within FEPS.
- Investigating opportunities for cross-institutional collaborations.
- Discussing the development, refinement and sharing of data analyses tools.
- Discussing potential future network grant applications.
- Exploring in-house opportunities to create MSc projects across faculties.

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