Junior Research Day at the FMP

22 February 2019, 9:00 – 15:00 h

Workshops

1_Determinants of learning and neural plasticity: From mice to men - an interdisciplinary project on Healthy Ageing

Room	tba
Head	Dr. Oliver Kobald (IfADo)
Thematic focus	The overarching aim of this interdisciplinary project is the investigation of learning processes and neural plasticity across the life-span and their dependency on different internal and external factors. Researchers from (Cognitive) Neuroscience, Cellular Biology, Psychology, and Sport Science, and from different universities and research institutes are involved in this project. Human ageing is associated with deficits in goal-directed learning and reduced (but enhanceable) neural plasticity. Age-related learning impairments have been attributed to changes in the integrity of the prefrontal cortex and its connectivity to other brain areas. Yet, our understanding of the underlying computational and neural mechanisms remains inconclusive as most age-comparative human studies rely on correlational designs. It is thought that external (e.g. environmental enrichment) and internal, e.g. (epi-)genetic factors as well as interventions (cognitive and/or physical training) influence the capacity of learning and neural plasticity in ageing. After establishing species-comparative paradigms and methods for the analysis of learning strategies and neural plasticity, we will conduct parallel human experiments and behavioral studies on mice using cutting-edge monitoring systems (e.g., IntelliCage). These will examine the effects of environmental conditions/lifestyle, motivation to learn, learning strategies and training interventions as well as their interaction with age and genetic background. Based on the aggregated data we will develop a cognitive model of age-related changes in learning and neural plasticity and identify critical factors/time points for preserving/stimulating plasticity and learning. Finally, these findings will be applied in the development of training, pharmacological and stimulation interventions aimed at improving cognitive flexibility in older adults, based on the variety of expertise from the involved research areas. The workshop will give an introduction to the project and its interdisciplinary challenges. Further on the participants will develop a management schedule for the project. They will discuss the study design, will search for funding opportunities and for possibilities to publish interdisciplinarily generated results. This way the

workshop will give a quite practical experience in the challenges of interdisciplinary research on the basis of a current project in the Leibniz Research Alliance Healthy Ageing.

2_Health information literacy" - Some practical recommendations for work in interdisciplinary teams

Room	tba
Head	Dr. Martin Merkt (DIE)
Thematic focus	Cooperation in scientific research alliances is often characterized by an interdisciplinary approach. Because scientific progress comes with an increased differentiation and depth of knowledge, it becomes more and more necessary to cooperate with other scientific disciplines in order to answer complex questions on a bigger scale. In particular, interdisciplinary research may foster understanding the "bigger picture" by combining the strengths of the individual disciplines to ensure that research holds the current state of the art from multiple different perspectives. However, there are several challenges that may complicate the successful implementation of interdisciplinary work in the scientific routine. These challenges are mainly associated with disciplinary differences regarding theoretical approaches, methodology, and publication practices. The workshop aims at sensitizing the participants for disciplinary differences, providing recommendations that may facilitate work in interdisciplinary teams, and illustrating the added value of interdisciplinarity. Examples are discussed based on the participants' and the referent's own professional experience in interdisciplinary teams covering instructional psychology, educational sciences, computer sciences, and didactics.

3_Synaptic Ageing - Challenges for Translational Neuroscience

Room	tba
Head	Dr. Camilla Fusi, Dr. Michael Kreutz (LIN)
Thematic focus	Translational Neuroscience facilitates a closer interaction between basic and clinical neuroscience: expanding our understanding of brain structure, function and disease, and translating this knowledge directly into clinical applications and novel therapies of nervous system disorders. The classical 'bench to bed side' approach for brain disorders has staggered for a number of reasons: Target identification and validation have lagged in comparison to other diseases (metabolic dysfunction/infectious diseases/cancer) and the use of animal models to predict efficacy is confounded by several variables. The key scientific challenges for the future are to understand the mechanisms of disease, develop more effective target identification and validation, generate predictive disease models, to establish biomarkers for patient stratification and, perhaps most significantly, to identify druggable pathways. Given the large number of cell types in the brain, their diverse connections, and the complexity of neural circuit structure and function, a deep understanding of the disease mechanisms is still lacking. Thus, the identification and validation of promising molecular targets is severely confounded. This, in turn, makes the construction of predictive animal models even more difficult. Nonetheless, in recent years we have gained new insights into the underlying molecular and cellular mechanisms of brain diseases, and significantly developed

our understanding of how these mechanisms regulate circuit function and consequent behavioural abnormalities. Current research suggests the cause of the pathogenic mechanisms in neurodegenerative and neuropsychiatric disorders is the disturbance of complex protein networks, via both genetic and environmental influences. Proteostasis- the equilibration of the biogenesis, folding, trafficking and degradation of proteins- is therefore a central concept to understand the cause of diseases. Loss of proteostasis is associated with protein misfolding, mis-localization and degradation leading to loss/gain-of-function phenotypes as well as aggregation-associated degenerative disorders. Interestingly, proteostasis is a key mechanism in memory consolidation and, not only by analogy, early impairments in cognition in several brain disorders might indeed be explained by maladaptation of regulatory pathways resulting in synaptic dysfunction. The restoration of proteostasis may therefore be an efficient way to combat pathology. In fact, at an early stage in many neurological and neuropsychiatric disorders (including AD, autism spectrum disorders (ASD), schizophrenia and others) there is no structural damage, rather an impairment of synaptic function.

It is nowadays widely accepted that synaptic diseases, or synaptopathies, cause major psychiatric and neurological disorders. Accordingly, interventions targeting preservation or restoration of synaptic function by adaptation of proteostasis may delay the onset, or provide a cure for, such disease states, respectively. Moreover, ageing and cognitive decline are highly correlated in the elderly population even in the absence of neurodegenerative diseases. Despite the high burden for each individual and the society as a whole the molecular, cellular, and behavioral underpinnings of cognitive decline are barely understood. Research in this area is already characterized by a multidisciplinary approach involving studies at different levels ranging from singe molecules to whole animal experimentation. Thus, researchers are needed that will be able to adopt multidisciplinary approaches to work on brain disorders and normal aging. We believe that this is of utmost importance because compared with other disease areas, failure rates in late-stage clinical trials are disproportionately high for neurologic and psychiatric diseases. Success rates for new drugs in phase 2 clinical trials have fallen below the 20% mark and the number of preclinical drugs needed to yield one approved drug has more than doubled. Despite the substantial commercial opportunities that exist, attempts to discover effective, mechanistically new medications to treat nervous system disorders have proven so difficult that many companies have retreated from the field.