CNS*2023 Leipzig

TYPE - KEYNOTE • JULY 15 • SATURDAY

K Keynote

JULY 15 • SATURDAY			
17:20 – 18:30	K	**Welcome and Keynote 1: Netta Cohen "The mind of a worm"** *Moderators: Thomas Nowotny*	Kongresshalle

K Keynote

JULY 16 • SUNDAY

09:00 – 10:10 K **Keynote 2: Gesa Hartwigsen "Using non-invasive brain stimulation to modulate cognitive functions"** Kongresshalle

The human brain is flexible. Neural networks adapt to changing cognitive demands by flexibly recruiting different regions and connections. I will discuss recent insight into functional network interactions and short-term plasticity based on combined neurostimulation and neuroimaging approaches. I will argue that short-term plasticity enables flexible adaptation to challenging conditions. My key hypothesis is that disruption of higher-level cognitive functions can be compensated for by the recruitment of domain-general networks in our brain. Example studies illustrate how non-invasive brain stimulation can be used to temporarily interfere with normal processing, probing short-term network plasticity at the systems level. These results challenge the view of a modular organization of the human brain and argue for a flexible redistribution of function via systems plasticity. I will also discuss recent attempts to improve targeting and dosing of non-invasive brain stimulation with electrical field modeling. A better understanding of the interaction between the induced electrical field in our brain and the current cognitive brain state helps to increase stimulation efficiency and may address the observed large variability in response to non-invasive brain stimulation.

K Keynote

JULY 17 • MONDAY

09:00 – 10:10 K **Keynote 3: Alain Destexhe "Mean-field approach to biophysical models of spiking networks"**

Moderators: Gennady Cymbalyuk Kongresshalle

Speakers: Alain Destexhe

I will speak about how to derive mean-field models for biophysical models of neurons (such as HH, AdEx), and how this approach allows us to evaluate the emerging consequences (at large scales) of changing biophysical parameters (at microscopic scale). I will illustrate of how changes in specific receptor types (GABA-A or NMDA) can lead to the emergence of slow-wave activity at the whole-brain level, which may explain how anesthetics switch the brain to slow-wave activity.

K Keynote

JULY 18 • TUESDAY

14:10 – 15:20 K **Keynote 4: Demian Battaglia "Function follows Dynamics: controlling system states to modify information processing"** Kongresshalle

Moderators: Maurizio De Pittà

Speakers: Demian Battaglia

The architect Louis Sullivan used to say that "Structure follows Function". Here, we will claim instead that "Function follows Dynamics", as both theory and data analyses suggest that self-organized collective dynamics shape information processing.

The dynamics of neural circuits give indeed rise to diverse and shifting patterns of coordinated activity, from assemblies of cells with correlated firing up to multi-regional networks of functional connectivity. Information theory and modelling can be used to track how the formation and reconfiguration of patterns of collective activity translate into different ways of propagating and integrating information through space and time. If the structure of the considered circuits constrains the types of dynamical states they can generate, it does not nevertheless fully constrain them, so that a multiplicity of alternative information processing modes can stem from circuits with a fixed connectome. These different processing modes can thus be selected by biasing the system to adopt the appropriate dynamical state.

We will focus specifically on oscillatory dynamics, considering models at different scales, but also analyses of different datasets. We will show that the haphazard variability of oscillatory patterns (ubiquitary both *in silico* and *in vivo*) does convey information about the presented stimuli or the task being performed. Despite their stochastic-like features, oscillatory bursts can coordinate between them revealing the existence of alternative system's states, modulated by behavior and cognitive processes such as working memory or attention. We will also find that the oscillatory patterns better predictive about the task being performed are not the ones with the strong power or coherence, dominating classic analyses based on extensive averaging over time and trials. On the contrary, the most informative patterns are the most "entangled", i.e. the ones exhibiting the larger degree of coordination between their components' fluctuations.

Such findings call for adopting "dynamics-aware" approaches to interrogate recordings of neural activity at different scales, since transient fluctuations, even the weaker ones, may be a computational resource rather than a disturbance, manifesting system's level complexity rather than noise.