

## **Systems Analysis in Neuroscience Center - SyNC**

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Neuroscience Research in Mainz is centered on the investigation of dynamic processes across scales: from epigenetics and intracellular networks, to local ensembles and brain-wide networks in the context of behavior and social interaction. Both in health and disease, we are aiming at unravelling the mechanisms shaping and governing systems dynamics on each scale. Notably, we combine this approach with longitudinal assessments of system stability, and we do find metastable physiological and pathophysiological network states. We believe, that by causally understanding these functional state will lead us to neurophysiologically informed novel concepts of therapeutic intervention.

However, implementing these concepts leads to novel classes of multidimensional and complex data. This renders classical hypothesis-driven concepts of data analysis ineffective.

The Systems Analysis in Neuroscience Center (SyNC) provides a nucleus for data-driven analyses across scales for the neuroscience research community in Mainz.

For that, we implement three methodological columns permeating those scales of observation (Genes, Cells, Networks, Behavior). The first column, systems theory, provides the toolbox for studying the stability of functional set points on each scale. The second column, machine learning, will enable hypothesis-free un-biased discovery of hidden, state-determining variables penetrating scales. Lastly, the third column represents real-time intervention, only possible by applying the first two methodological columns, having achieved a drastic reduction of data complexity. Employing data-driven-classifiers of the respective functional state, we will conduct causal interventions, reacting upon the neuronal system in a closed-loop fashion.

SyNC will bundle the expertise of all neuroscience research groups in the field of the aforementioned systems analysis concepts. It will furthermore provide workshops on computational methods, and provide a platform for the interaction of Postdocs and PhD students, the SyNC-club.