



Collaborative Research Centre (CRC 1451) „Key mechanisms of motor control in health and disease“

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In January 2021, the German Research Foundation (DFG) established the Collaborative Research Centre (CRC 1451, Sonderforschungsbereich SFB 1451) "Key mechanisms of motor control in health and disease". An international and interdisciplinary team of scientists from neurobiology, neurophysiology, neurology, neuroscience, psychiatry, psychology, nuclear medicine, and functional neurosurgery collaborates in 19 subprojects. The speaker is Gereon Fink at the University of Cologne and the University Hospital Cologne. The CRC comprises scientists from the Medical Faculty, the Faculty of Natural and Mathematical Sciences and the Faculty of Human Sciences of the University of Cologne and the University Hospital Cologne, the Research Centre Juelich, the Max Planck Institute for Metabolism Research Cologne, the Universities of Frankfurt and Muenster, and the Hebrew University Jerusalem (Figure 1). <https://www.crc1451.uni-koeln.de/>



Figure 1: Team CRC 1451.

Relevance of the topic

The motor system allows us to interact with the environment. The variety of motor activity ranges from simple monosynaptic reflexes to complex behaviors, e.g., tool use, all of which rely on coordinated interaction between neurons and muscles. Motor control, i.e., the neural mechanisms that enable muscle activation in a coordinated and meaningful manner, ensures the stability and integrity of our body in its environment. Compared to sensory, cognitive, or affective-emotional systems, the performance of the motor system is particularly precisely quantifiable about the observable motor effect and thus comparable across species. In studying the neural mechanisms underlying motor control, comparing motor behavioral parameters across species offers an exceptional opportunity to bridge the gap between molecular, cellular, and systemic levels. This also has enormous clinical relevance: the motor system is affected in many, if not all, neurological and psychiatric disorders. Therefore, a more comprehensive understanding of the motor system will advance our knowledge of the neural basis of neurological and psychiatric disorders. Neuropsychiatric disorders provide new insights into the (dys)function of the motor system and targeted testing of models of motor control.

Aim

The CRC1451 aims to identify the essential mechanisms underlying motor control in health and disease. This will be investigated at all levels, from genes and molecules to large-scale networks and general motor control mechanisms, to deduce their changes across the lifespan and their perturbations beyond a single species or specific pathology. Another important goal is to train (clinical) neuroscientists who can think and work across the different levels of processes that contribute to the complexity of the motor system (Figure 2).

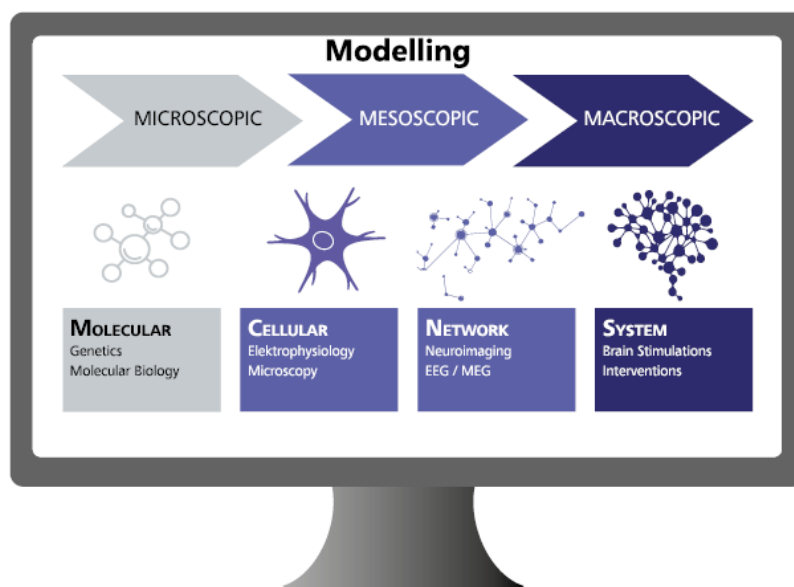





Figure 2: Concept and goals of the CRC 1451.

Expected results and future perspectives

The CRC1451 will provide new insights into the genetic, cellular, and systemic mechanisms contributing to motor precision, coordination, flexibility, and learning (Research Area A). The research will also be conducted on how these mechanisms develop or change across the lifespan (Research Area B). Finally, studies of disease-related disruption of motor control (Research Area C) will a) allow validation of models of physiological motor control and its development, b) improve our understanding of

neurological and psychiatric disorders that lead to motor impairments, and c) provide new perspectives for their treatment.

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