Age-related differences in brain function and connectivity in relation to motor behavior

Stephan P. Swinnen

Movement Control & Neuroplasticity Research Group, KU Leuven, Belgium

Bimanual skills are a useful vehicle to better understand motor control under normal and pathological conditions. Aging results in alterations in functional activation as well as structural and functional brain connectivity that have consequences for motor behavior. I will address the effects of aging on motor functioning in view of the compensation versus dedifferentiation hypothesis.

I will present a global and local view on age-related functional connectivity alterations. On one hand, functional brain connectivity under resting-state conditions will be addressed with respect to the motor network in interaction with the other brain networks. I will discuss age-related alterations in inter-network connectivity that may be a signature of the dedifferentiation hypothesis of aging. One the other hand, using noninvasive dual-site Transcranial Magnetic Stimulation (TMS) approaches, I will elaborate on functional connectivity mediated by pairwise interhemispheric interactions between motor cortex (M1), dorsal premotor cortex (PMd) and dorsolateral prefrontal cortex (DLPFC) during planning of bimanual movements with different degrees of complexity.
I will discuss evidence consistent with the hypothesis that left PMd shows inter-hand task-allocation-specific modulations in its interaction with the contralateral M1. Interestingly, this function is not observed for right PMd. These results support a model of bimanual movement planning in which left PMd is considered responsible for division of labor between both hands, a unique feature of bimanual skill. Overall, our approach reveals age-related interactions between brain structural/functional connectivity and motor behavior.