

## The Axonal Connectivity of Motor and Premotor Areas as Revealed through Fiber Dissections: Shedding Light on the Structural Correlates of Complex Motor Behavior

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**Abstract :** This study opts to investigate the intrinsic architecture, morphology, and spatial relationship of the subcortical pathways implicated in the connectivity of the motor/premotor cortex and SMA/pre-SMA complex. Twenty normal, adult, formalin-fixed cerebral hemispheres were explored through the fiber micro-dissection technique. Lateral to medial and medial to lateral dissections focused on the area of interest were performed in a tandem manner and under the surgical microscope. We traced the subcortical architecture, spatial relationships, and axonal connectivity of four major pathways: a) the dorsal component of the SLF (SLF-I) was found to reside in the medial aspect of the hemisphere and seen to connect the precuneus with the SMA and pre-SMA complex, b) the frontal longitudinal system (FLS) was consistently encountered as the natural anterior continuation of the SLF-II and SLF-III and connected the premotor and prefrontal cortices c) the fronto-caudate tract (FCT), a fan-shaped tract, was documented to participate in connectivity of the prefrontal and premotor cortices to the head and body of the caudate nucleus and d) the cortico-tegmental tract(CTT) was invariably recorded to subserve the connectivity of the tegmental area with the fronto-parietal cortex. No hemispheric asymmetries were recorded for any of the implicated pathways. Sub-segmentation systems were also proposed for each of the aforementioned tracts. The structural connectivity and functional specialization of motor and premotor areas in the human brain remain vague to this day as most of the available evidence derives either from animal or tractographic studies. By using the fiber-microdissection technique as our main method of investigation, we provide sound structural evidence on the delicate anatomy of the related white matter pathways.

**Keywords :** neuroanatomy, premotor, motor, connectivity

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