The vertical occipital fasciculus: a century of controversy resolved by in vivo measurements.

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Abstract:

The vertical occipital fasciculus (VOF) is the only major fiber bundle connecting dorsolateral and ventrolateral visual cortex. Only a handful of studies have examined the anatomy of the VOF or its role in cognition in the living human brain. Here, we trace the contentious history of the VOF, beginning with its original discovery in monkey by Wernicke (1881) and in human by Obersteiner (1888), to its disappearance from the literature, and recent reemergence a century later. We introduce an algorithm to identify the VOF in vivo using diffusion-weighted imaging and tractography, and show that the VOF can be found in every hemisphere (n = 74). Quantitative T1 measurements demonstrate that tissue properties, such as myelination, in the VOF differ from neighboring white-matter tracts. The terminations of the VOF are in consistent positions relative to cortical folding patterns in the dorsal and ventral visual streams. Recent findings demonstrate that these same anatomical locations also mark cytoarchitectonic and functional transitions in dorsal and ventral visual cortex. We conclude that the VOF is likely to serve a unique role in the communication of signals between regions on the ventral surface that are important for the perception of visual categories (e.g., words, faces, bodies, etc.) and regions on the dorsal surface involved in the control of eye movements, attention, and motion perception.

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