

Teaching NeuroImages: In vivo visualization of Eninger comb and Wilson pencils

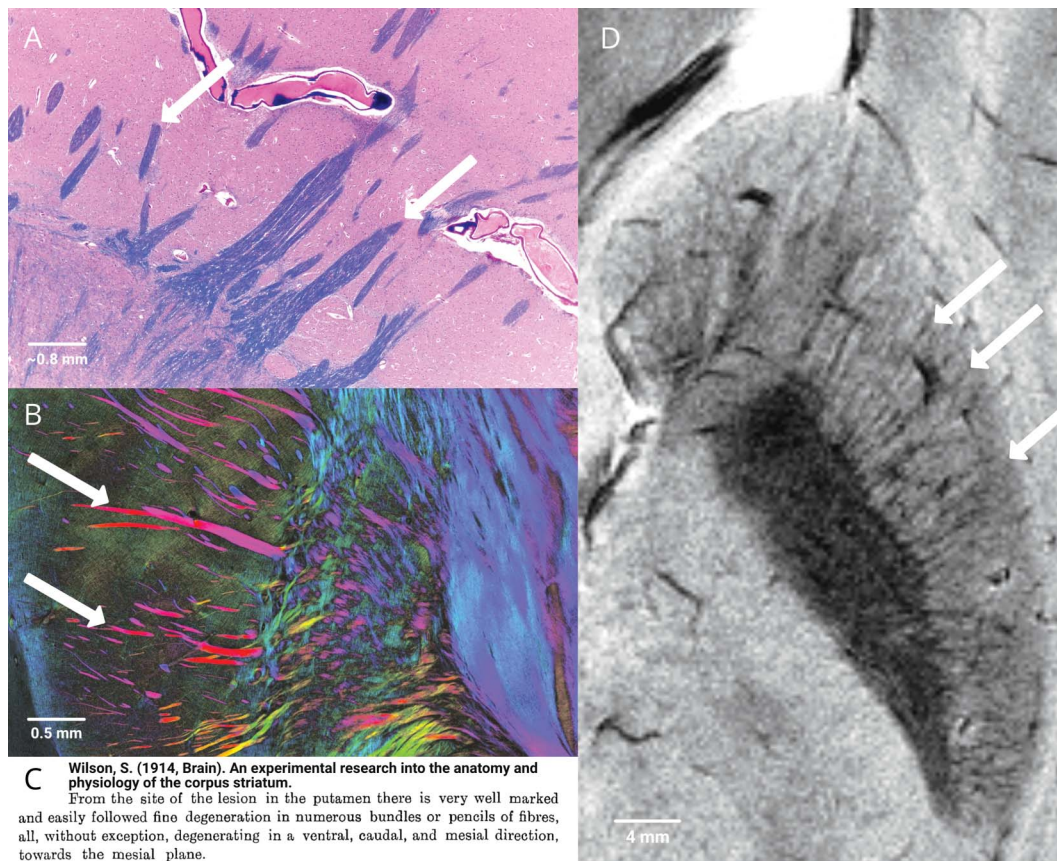
Andreas Horn, MD, PhD, Siobhán Ewert, MD, Eduardo J.L. Alho, MD, PhD, Markus Axer, PhD, Helmut Heinsen, MD, Erich T. Fonoff, MD, PhD, Jonathan R. Polimeni, PhD, and Todd M. Herrington, MD, PhD

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Figure 1 Wilson pencils



(A) Histologic depiction (image courtesy of Dr. Michael Bonert, McMaster University, CCBY-SA3.0). (B) Polarized light imaging in vervet monkey. (C) First description by Wilson (*Brain*), reproduced with permission from S.A. Kinnier Wilson. An experimental research into the anatomy and physiology of the corpus striatum. *Brain* 1914;36:427–492. By permission of Oxford University Press, available at: academic.oup.com/brain/article/36/3-4/427/309802?searchresult=1. For permissions, please email journals.permissions@oup.com. (D) Cardiac-gated T2*-weighted fast low angle shot sequence acquired using 7T MRI shows Wilson pencils.

The “direct” and “indirect” pathways play crucial roles in movement disorder pathophysiology. Both traverse from the striatum to the internal pallidum and substantia nigra, the latter detouring to external pallidum and subthalamic nucleus. Anatomically, the pathways manifest within the striatofugal bundle that passes radially through the pallidum in the form of pencil-like tracts (first described by Wilson¹; figure 1) before leaving the pallidum toward the substantia

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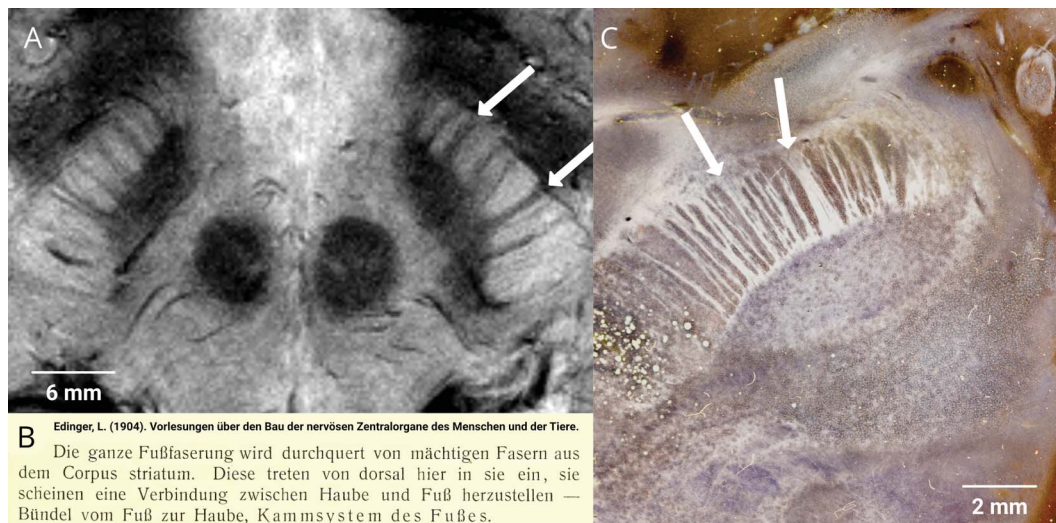
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Figure 2 Edinger comb



(A) Cardiac-gated fast low angle shot sequence shows Edinger comb. (B) First description: “The pedunculus cerebri is traversed by striatal fibers that enter dorsally and connect peduncle and tegmentum—bundle between peduncle and tegmentum, comb system of the peduncle.” (C) Axial histologic section in dark-field microscopy demonstrates the human comb system.

nigra in the form of a comb described by Edinger in 1896² (figure 2). A century later, these structures can be visualized in the living human brain (figures 1D and 2A).

Author contributions

A. Horn: drafting/revising the manuscript, data acquisition, study concept or design, analysis or interpretation of data, accepts responsibility for conduct of research and final approval, acquisition of data, study supervision. Siobhan G. Ewert: drafting/revising the manuscript, data acquisition, accepts responsibility for conduct of research and final approval, acquisition of data. Eduardo Joaquim Lopes Alho: drafting/revising the manuscript, accepts responsibility for conduct of research and final approval, acquisition and analysis of the dark field microscopy footage. M. Axer: data acquisition, accepts responsibility for conduct of research and final approval, acquisition of data, interpretation of measurements. H. Heinsen: drafting/revising the manuscript, data acquisition, analysis or interpretation of data, accepts responsibility for conduct of research and final approval, acquisition of data. Erich Talamoni Fonoff: drafting/revising the manuscript, data acquisition, accepts responsibility for conduct of research and final approval, acquisition of data. J.R. Polimeni: drafting/revising the manuscript, data acquisition,

accepts responsibility for conduct of research and final approval, acquisition of data, study supervision, obtaining funding. T.M. Herrington: data acquisition, drafting/revising the manuscript, study concept or design, accepts responsibility for conduct of research and final approval, study supervision.

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2. Edinger L. Vorlesungen über den Bau der nervösen Centralorgane des Menschen und der Thiere. Für Ärzte und Studierende. Leipzig: F.C.W. Vogel; 1896.

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