Cerebellar Dentate Connectivity Across Adulthood: A Large-Scale Resting State Functional Connectivity Investigation

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Introduction

• Cerebellar resting state networks show decreased connectivity in older adults relative to young adults[1].

• The cerebellar dentate nucleus is the primary cortical output region, and both non-human primate[2], and human conectiivty[3,4] work has suggested dissociable dorsal and ventral regions with distinct cortical connections

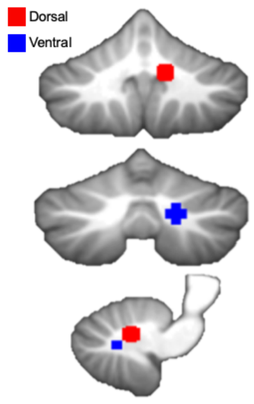
•It is unkonwn whether dentate connectivity changes are similar to cerebellar cortical connectivity. Here, we predicted declines in connectivity with age, across adulthood.

Methods

• Data from the Cambridge Center for Ageing Neuroscience (Cam-CAN)[5] from 591 adults aged 18-86 were used for analysis

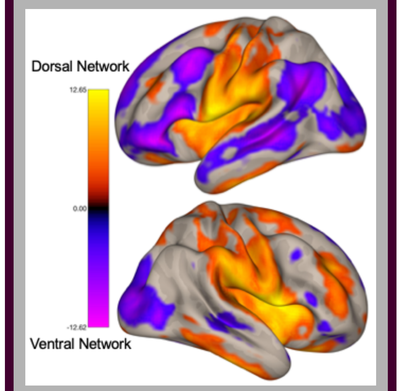
• All preprocessing and analysis was completed using the CONN toolbox[6]

• Using spherical seeds in the dorsal and ventral dentate (right), defined based on our prior work, we investigated connectivity across adulthood[3].



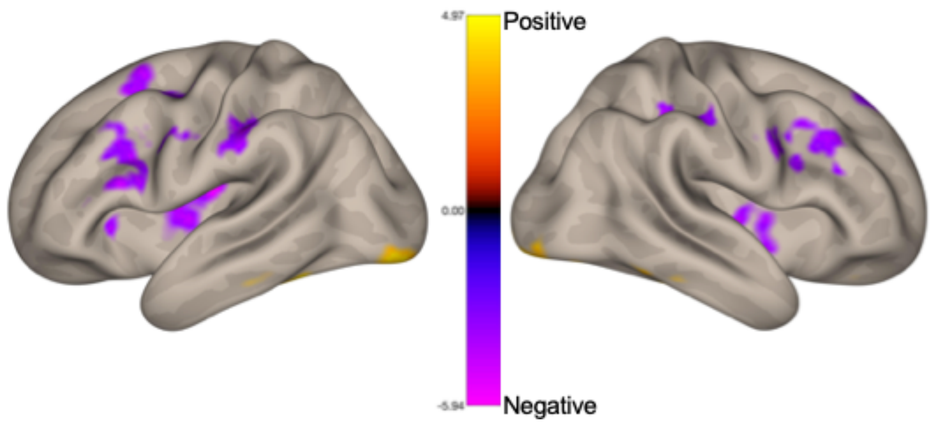
Dorsal and ventral cerebellar dentate show *significant decreases in connectivity across adulthood*, potentially impacting both motor and cognitive behavior.

Network Dissociation

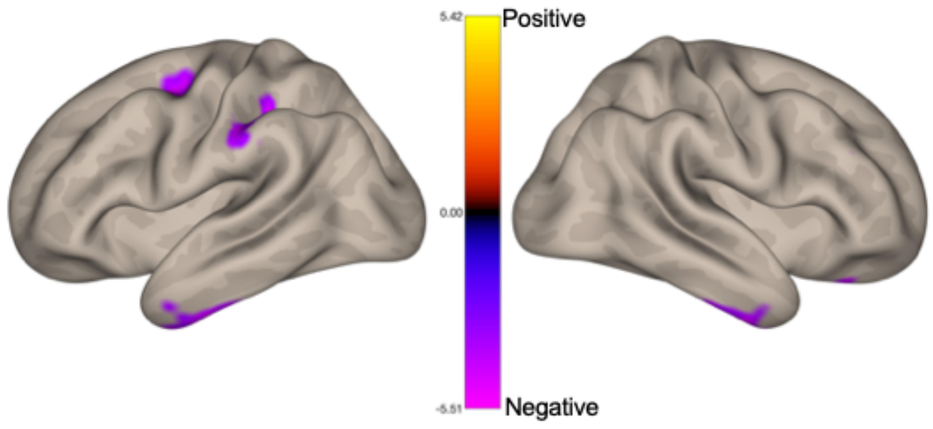


Above: Analysis of dorsal and ventral dentate connectivity in this large adult sample replicates the dissociable motor and frontal-association networks[3].
Right Top: Dorsal dentate connectivity decreases with age across adulthood in pre-motor, motor, and somatosensory regions of the network, though frontal cortical areas are implicated as well.
Right Bottom: Ventral dentate connectivity decreases with age are less extensive than dorsal and also implicate dorsal premotor cortex, as well as parietal regions, and the anterior temporal lobe.

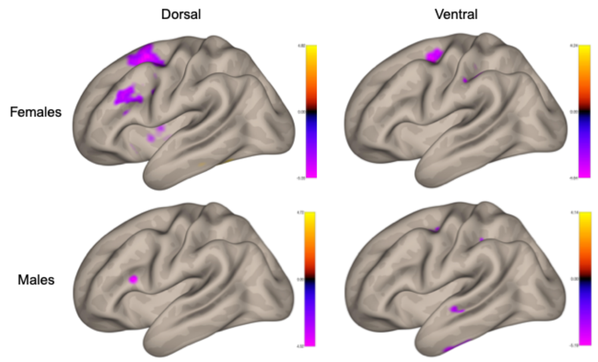
Dorsal Dentate



Ventral Dentate



Sex Differences



Decreases in connectivity between the dorsal dentate and cortex with age are more pronounced in females. Ventral dentate showed less pronounced sex differences.

Summary

• Dentate shows decreases with age, across adulthood, though decreases are more extensive for the dorsal region.

• Sex differences in connectivity patterns are also apparent, such that differences in females are more extensive.

•Such connectivity decreases may impact both motor and cognitive behavior, and contribute to a decreased ability to rely upon cerebellar scaffolding in advanced age.

References
1. Bernard et al. (2013), NeuroImage; 2. Middleton & Strick (2001), J Neurosci; 3. Bernard et al. (2013), Cer Cortex; 4. Guell et al., 2019, Cer Crotex; 5. Shafto et al., 2014, *BMC Neurol;* 6. Whitfield-Gabrieli & Nieto-Castanon, (2012), *Brain Connectivity*

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