Application Note
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Golgi Cell Dendrites are Restricted by Purkinje Cell Stripe Boundaries in the Adult Mouse Cerebellar Cortex

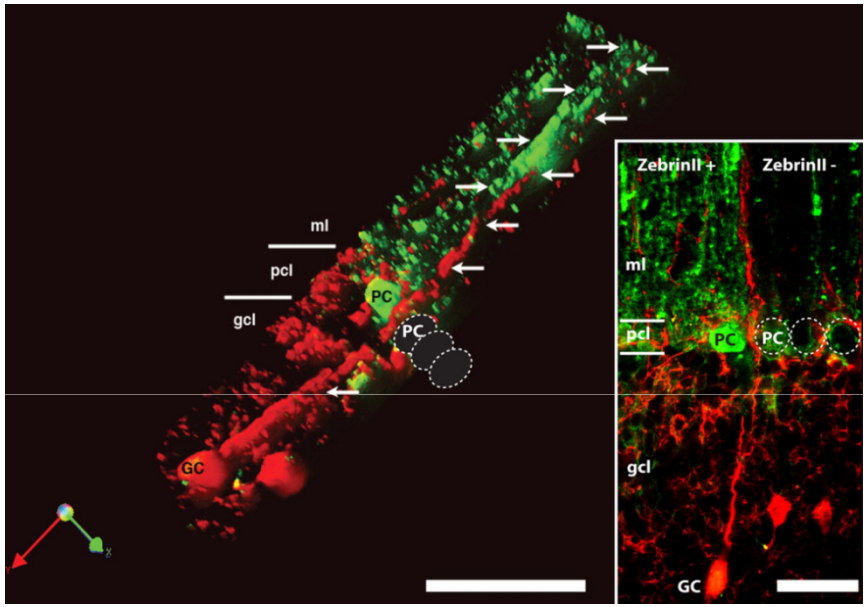
Dr Hawkes and colleagues at the University of Calgary are dedicated to furthering our knowledge of cerebellar function. There is currently a broad understanding of cerebella connectivity and a growing picture of the global architecture; Dr Hawkes' team is working towards discoveries that help bridge these two areas.

Specifically, Dr Hawkes' research focuses on how cerebellar inhibitory interneurons are arranged with respect to Purkinje cell compartments. There are multiple Purkinje cell classes in the cerebellum, which form an elaborate array of transverse zones and parasagittal stripes. In the work featured here, Dr Hawkes aimed to discover whether Golgi interneuron synaptic fields are constrained within compartments, or span compartment boundaries, or if their organization is independent of boundaries.

Using a wide field microscope controlled by **Volocity Acquisition**, images were captured from a 200 µm thick transverse sections through lobule VIII of an GlyT2-EGFP cerebellum that was immunofluorescently labeled using anti-zebrin II.

64 Z slices (0.25 µm step size) were acquired and deconvolved to remove out-of-focus haze using **Volocity Restoration**. The Z stack was then rendered in **Volocity Visualization** so that the sample could be viewed in 3D.

The main conclusion of this study is that the dendrites of cerebellar Golgi interneurons do not cross Purkinje cell compartment boundaries, the first time that this finding has been reported. The restriction of Golgi cell dendrites to within a stripe may allow patterns of inhibition to be customized to specific compartments. Understanding these compartmentalised pathways will help further understanding of the mechanisms involved in conditions such as long term depression.



GlyT2-EGFP-expressing Golgi cell dendrites are restricted at zebrin II$^{+/-}$ parasagittal stripe boundaries. Analysis of a 200 µm stained section cut transversely through lobule VIII of the adult GlyT2-EGFP mouse cerebellum and immunofluorescence labelled for zebrin II. The Golgi cell dendrites (red) respect the zebrin II$^{+/-}$ Purkinje cell boundary (green; arrows). In the 3D rendered image, the GlyT2-EGFP^{+} Golgi cell dendrite does not invade the zebrin II^{+} stripe. The 3D image has been rotated to better appreciate the relationship between the dendrites and Purkinje cells.

The positions of the neighbouring zebrin II^{-} Purkinje cell somata are outlined with dotted lines. ml, Molecular layer; pcl, Purkinje cell layer; gcl, granule cell layer; GC, Golgi cell; PC, Purkinje cell.
Scale bars, 50 µm.

The Journal of Neuroscience, March 12, 2008, 28(11):2820-2826