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Abstract:
One of the most prominent characteristics of the human neocortex is its laminated structure. The first person to observe this was Francesco Gennari in the second half the 18th century: in the middle of the depth of primary visual cortex in the occipital lobes, myelinated fibres are so abundant that he could observe them with bare eyes as a white line. Because of its saliency, the stria of Gennari has a rich history in cyto- and myeloarchitectural research as well as in magnetic resonance (MR) microscopy. In the present work we show the layered structure of the human neocortex with *ex vivo* diffusion weighted imaging (DWI). To achieve the necessary spatial and angular resolution, primary visual cortex samples were scanned on an 11.7 T small-animal MR system using 768 diffusion directions to characterize the diffusion properties of the cortical laminae and the stria of Gennari in particular. The results demonstrated that fractional anisotropy varied over cortical depth, showing reduced anisotropy in the stria of Gennari, the inner band of Baillarger and the deepest layer of the cortex. Orientation density functions showed multiple components in the stria of Gennari and deeper layers of the cortex. Potential applications of layer-specific diffusion imaging include characterization of clinical abnormalities, cortical mapping and (intra)cortical tractography. We conclude that future high-resolution *in vivo* cortical DWI investigations should take into account the layer-specificity of the diffusion properties.

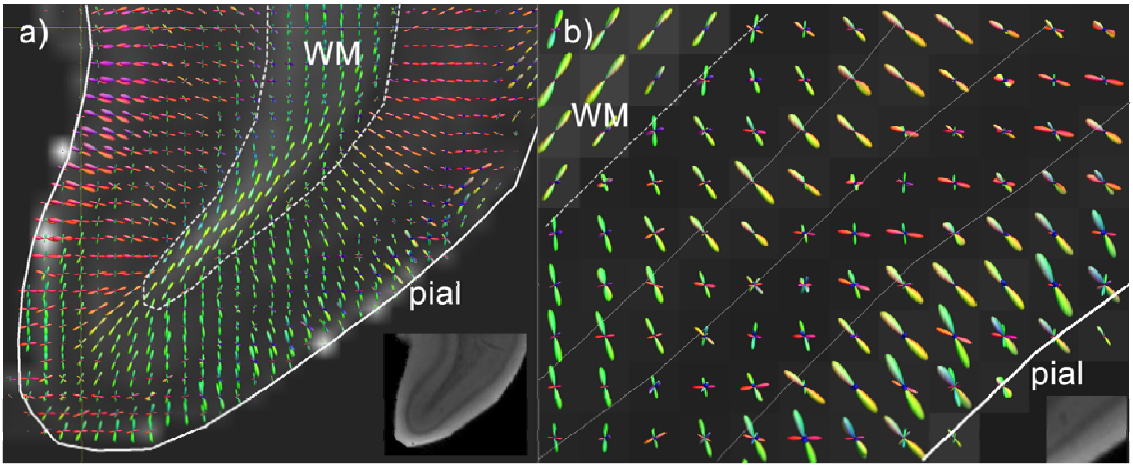

Figure 1. Fiber Orientation Distributions (MRtrix) in the primary visual cortex. a) in the cortex the orientation is predominantly radial throughout the sample; b) a pattern of various layers can be observed from white matter to pial, putatively: WM; u-fibers+VI+outer band of Baillarger; layer Va+IV; IVb (Gennari), III+II+I).