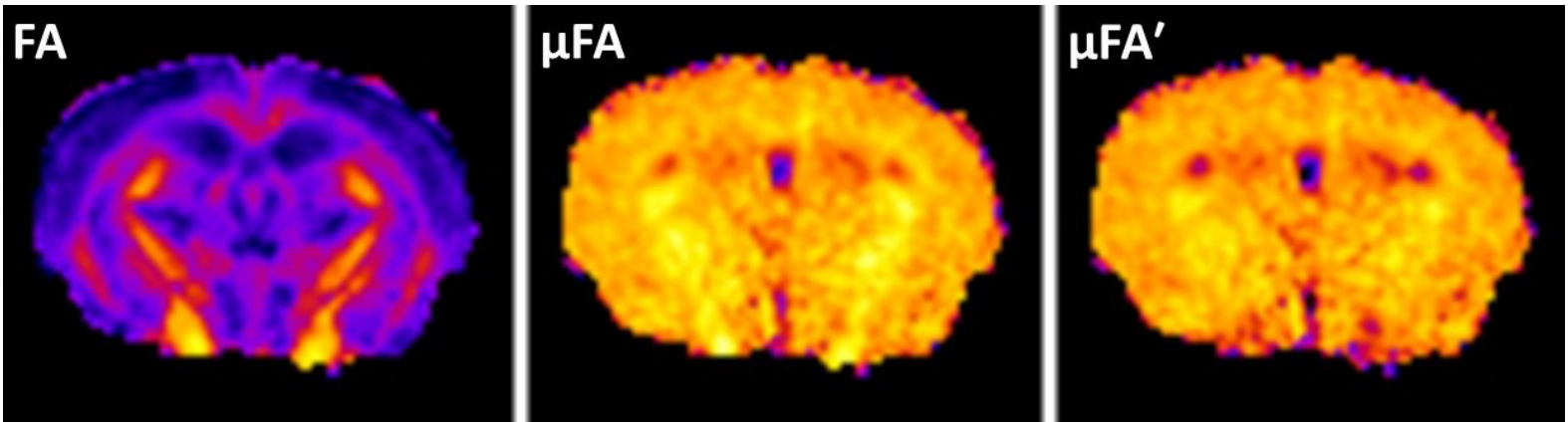
CBI Featured Image – Winter 2024

Courtesy of Jens Jensen, Department of Neuroscience



Three types of diffusion anisotropy illustrated for a single anatomical brain slice from a healthy mouse. The fractional anisotropy (FA) quantifies the macroscopic anisotropy associated with aligned axonal fibers in white matter and can be estimated using conventional diffusion tensor imaging or diffusional kurtosis imaging. The “type-I” microscopic fractional anisotropy (μFA) reflects all types of diffusion anisotropy including that arising from axons and dendrites with irregular intra-voxel spatial orientations. The “type II” microscopic fractional anisotropy (μFA′) is only sensitive to anisotropy with no preferred macroscopic direction. Both μFA and μFA′ can be estimated from double diffusion encoding MRI. In all cases, $\mu FA \geq \mu FA'$. The FA is low in gray matter regions due to lack of directional coherence for axons and dendrites and is therefore of limited value. By contrast, the μFA and μFA′ take on high values throughout the brain. In the white matter regions where FA is elevated, the μFA is noticeably larger than μFA′, but these two quantities are similar elsewhere. By using μFA and μFA′, diffusion anisotropy can be meaningfully assessed throughout the brain. Reference: Jensen JH, et al. NMR Biomed. 2023;36:e4816. doi: 10.1002/nbm.4816