MRI detects brain responses to amyloid plaque deposition and inflammation

L. Colon-Perez[1,4], K. R. Ibanez[2,5], M. Suarez[4], K. Torroella[4], K. Acuna[4], E. Ofori[1,6], Y. Levites[1,2,5,7], D. E. Vaillancourt[1,3,4,6], T. E. Golde[1,2,5,7], P. Chakrabarty[1,2,5,7], M. Febo[1,3,4,7]

1. Florida Alzheimer's Disease Research Center, 2. Center for Translational Research on Neurodegenerative Diseases, U. Florida; 3. AMRIS Facility, 4. Psychiatry, 5. Neuroscience, 6. Applied Physiology & Kinesiology, 7. McKnight Brain Institute

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Alzheimer's disease is a neurodegenerative disease which is linked to changes in the microstructure of the brain. Extracellular β-amyloid (Aβ) plaque deposits and inflammatory immune activation, mediated in part by interleukin-6 (IL6), are suspected to cause the altered tissue microstructure. *Quantifying early changes in brain microstructures via MRI could help to monitor and predict disease progression, as well as potentially suggest new treatment methods*.

Using a mouse model of Alzheimer's disease, researchers demonstrated that high-field diffusion MRI measurements can detect early changes in white matter due to increased levels of either Aβ or IL6. It is known that Aβ and IL6 have opposite effects on the fractional anisotropy (FA) of water diffusion in white matter: Aβ reduces FA while IL6 decreases FA. The reduction in FA with increased Aβ suggests hindered diffusion in the presence of high levels of this protein. IL6-induced increases in FA suggest a counteracting effect of inflammation such as clearance of Aβ. Researchers also observed reduced mean, axial, and radial diffusivity in several white matter areas as well as in the hippocampus. Using the neurite orientation dispersion and density imaging (NODDI) model, these researchers observed Aβ and IL6 significantly affected hippocampal, thalamic, midbrain and striatal networks

Facilities and instrumentation: 11.1 T MRI system, MagLab's AMRIS Facility

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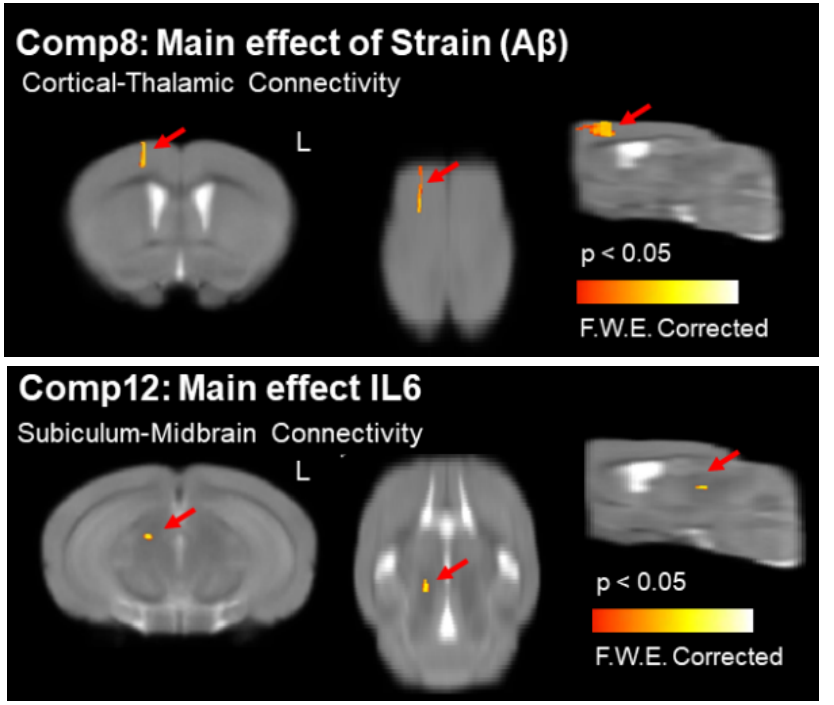

Resting state functional MRI at 11.1T revealed the effects on brain microstructures and intrinsic activity due to β-amyloid (Aβ) plaque deposits and inflammation, as indicated by the presence of the inflammatory protein interleukin-6 (IL6). By comparing normal, healthy mice to mice which either had elevated levels of β-amyloid (Aβ) plaque deposits and/or the inflammatory protein interleukin-6 (IL6), researchers found a significant main effect of Aβ on cortical-thalamic connectivity (top) and a significant main effect of IL6 on subiculum-midbrain connectivity (bottom). High-field diffusion MRI measurements also detected changes in white matter microstructures due to increased levels of either Aβ or IL6.