High Definition sFTIR Imaging of Tissue From Alzheimer Disease Mouse Models

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Fourier transform infrared microspectroscopy (FTIR) is a unique tool for biomolecular imaging in situ. We present results from the new mid-infrared beamline (IRENI - InfraRed ENvironmental Imaging) at the Synchrotron Radiation Center, University of Wisconsin at Madison.

In contrast to conventional synchrotron-based FTIR systems where one beam is used in a dual-aperture raster-scanning microscope, this novel system combines 12 brilliant synchrotron beams to homogenously illuminate the sample, which is then imaged onto a Focal Plane Array multi-element detector. High definition chemical images are obtained at 0.54 micron pixel resolution with an excellent signal to noise factor in minutes.

Research enabled by this system includes sub-cellular spatially resolved spectra of molecular changes in brain tissue induced by Alzheimer disease (AD) in mouse models. The hallmark characteristics of AD include formation of extraneuronal plaques (aggregated β-amyloid protein) and intraneuronal neurofibrillary tangles (NFT, fibrillar hyperphosphorylated tau protein). Our work is based on two mouse lines that express two familial AD mutations, K670N/M671L and V717F mutant form of human APP695, and a triply mutant mouse model, 3xTg, which carries the KM670/671NL mutation in APP, the presenlin mutation PS1 (M146V) and the human four-repeat Tau harboring the P301L mutation.

We show the importance of this high definition sFTIR imaging for the analysis of the spatial distribution of biomolecules in tissue from AD mouse models.

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