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New Secrets Unveiled from the ‘Rosetta Stone’ of Neuroscience: Using Synchrotron Light to Study Fundamental Neurochemistry within the Hippocampus during Health and Disease

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The hippocampus is a key anatomical brain structure required for spatial learning and memory in all mammals. The structure of the hippocampus is highly conserved between mammalian species, which highlights a fundamental importance to higher order brain function. As such, the hippocampus is one of the most studied anatomical structures in the field of neuroscience. However, much remains unknown about the underlying neurochemistry driving hippocampal function, and many refer to this brain structure as the ‘Rosetta Stone’ of neuroscience. Unfortunately, the hippocampus is vulnerable to neurodegenerative conditions and disorders, with selective neuron damage occurring during Alzheimer’s disease, and after epileptic seizures, traumatic brain injury and stroke.

Techniques available at synchrotron light sources offer the ability to study at cellular and sub-cellular resolution the distribution of important biochemical and elemental markers of normal and abnormal brain function. Specifically, Fourier transform infrared (FTIR) spectroscopy can be used to study markers of oxidative stress, such as aggregated proteins and oxidised lipids, within individual neurons of the hippocampus. Complementary elemental information is provided by X-ray fluorescence microscopy, which is invaluable for providing a wealth of information at the cellular level on ion homeostasis (Cl⁻, K⁺, Ca²⁺) and metal homeostasis (Fe, Mn, Cu, Zn). A multi-modal approach incorporating FTIR and XFM, in combination with histology and light microscopy enables investigation of the mechanistic pathways through which excitotoxicity and disturbed brain metal homeostasis contribute to oxidative stress and neuronal injury during disease. Specifically, this presentation will discuss recent findings regarding the underlying neurochemistry of the hippocampus during health and disease in rodent models of Alzheimer’s disease, stroke, and schizophrenia.

Keywords or phrases (comma separated)

XFM, FTIR, hippocampus, neurodegenerative disease, metal homeostasis, protein aggregation, ions

Are you a student?

No

Do you wish to take part in the Student Poster Slam?

No

Are you an ECR? (<5 yrs since PhD/Masters)

No

What is your gender?

Male

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