NIH Blueprint for Neuroscience Research

Sleep Research Society®

Beyond the Symptom: The Biology of Fatigue

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Neuroimaging: PET, fMRI, MRS

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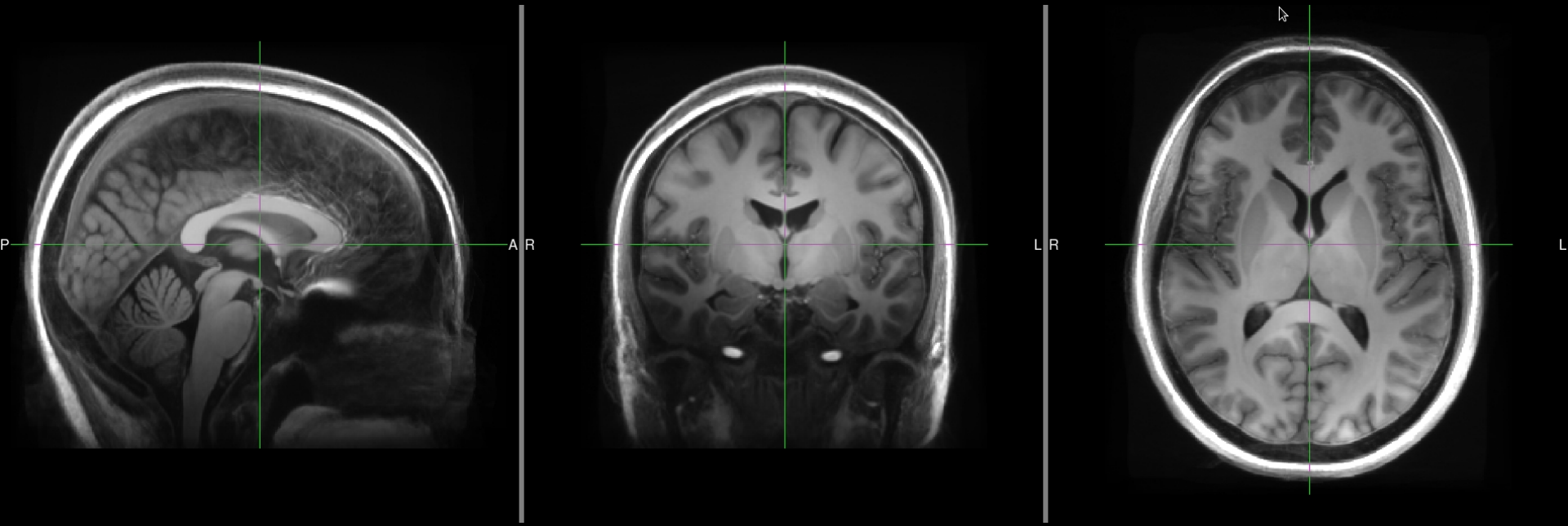
Disclaimer and Disclosures

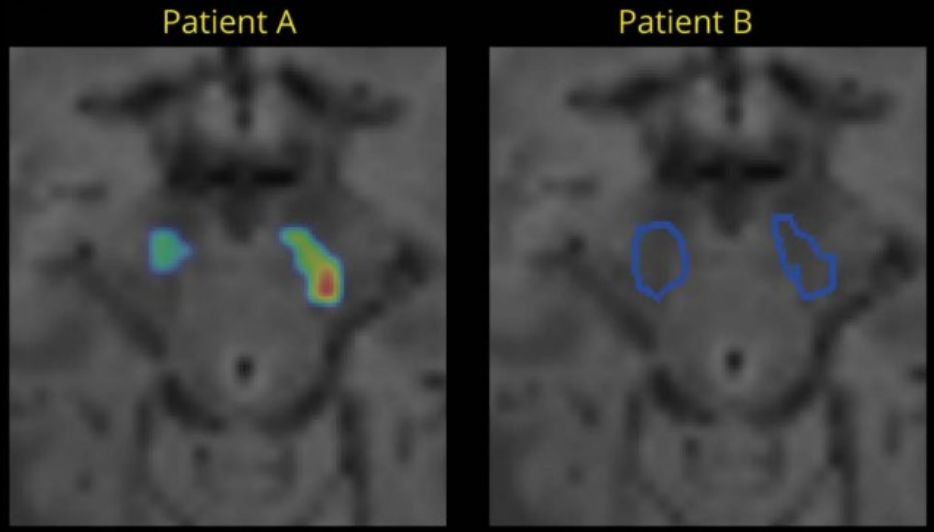
Disclaimer
This certifies that the views expressed in this presentation are those of the author and do not reflect the official policy of the NIH.

Disclosure
This certifies that I, Jarred Younger, have no financial relationship that is relevant to the subject matter of this presentation.

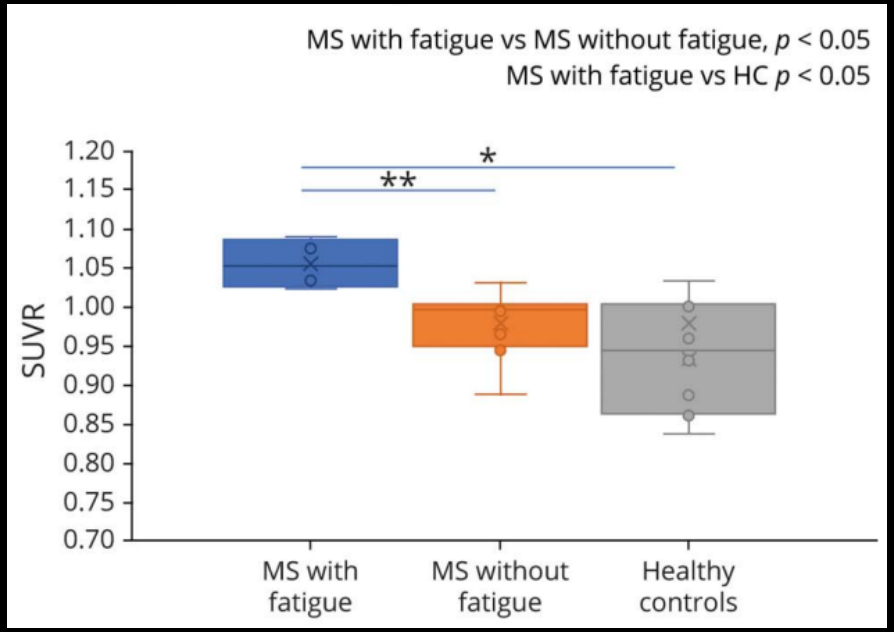
Translating basic science fatigue research to humans using neuroimaging



Positron Emission Tomography (PET) – using radioligands



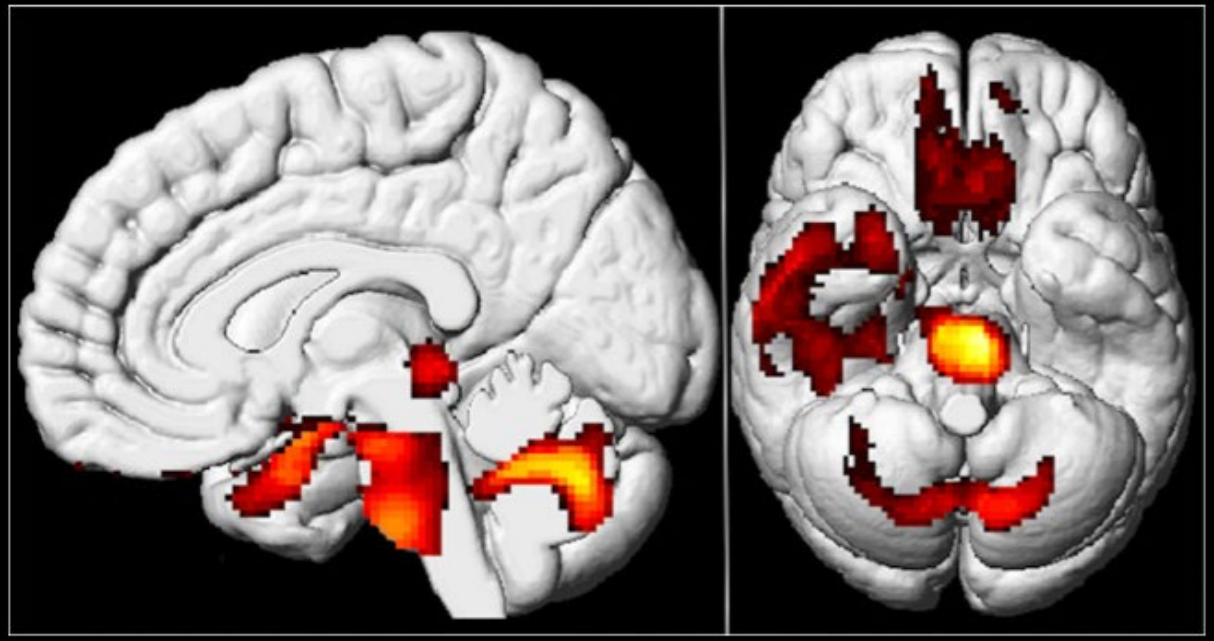
PET showing microglia pro-inflammatory "activation" in multiple sclerosis (MS) fatigue.



Microglia activation in MS group with significant fatigue versus MS without fatigue and healthy controls.

Singhal et al., 2020, Neurol Neuroimmunol Neuroinflamm

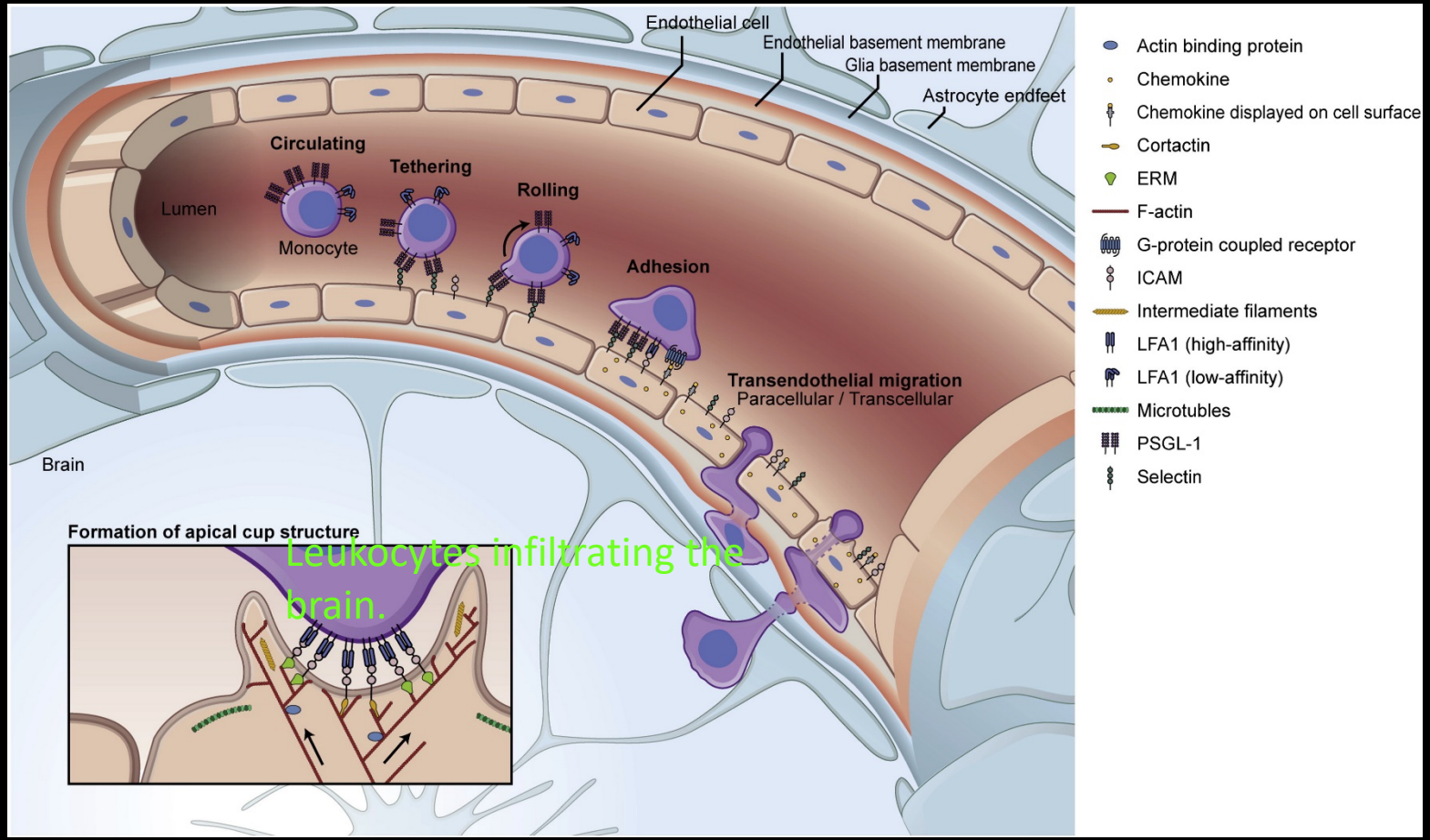
Positron Emission Tomography (PET) – using radiolabeled molecules



Using PET to image hypometabolism in individuals with Long-COVID.

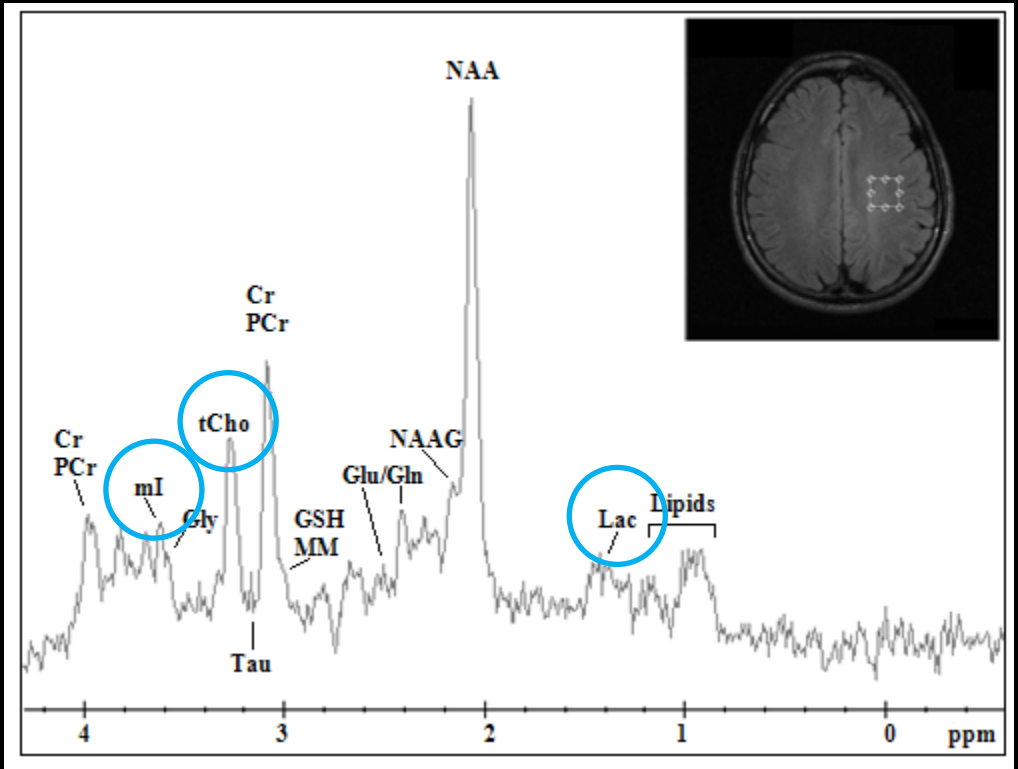
Guedj et al., 2021, Eur J Nucl Mol Imaging

Positron Emission Tomography (PET) – using radiolabeled cells



Edlow et al., 2018, Journal of Neurotrauma

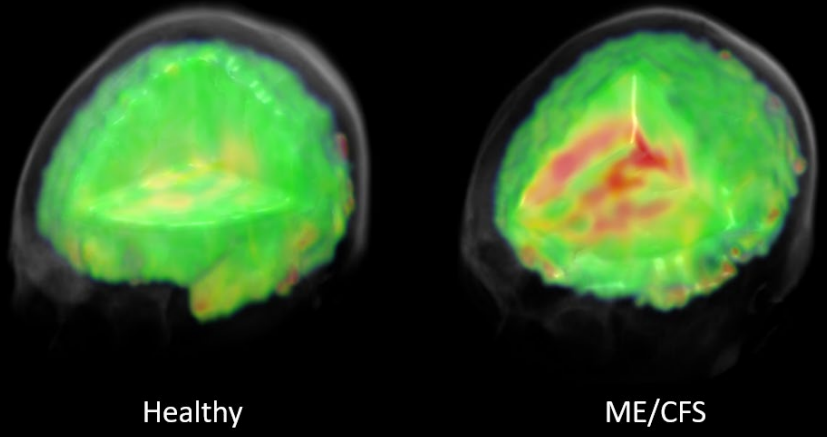
Magnetic Resonance Spectroscopy (MRS)



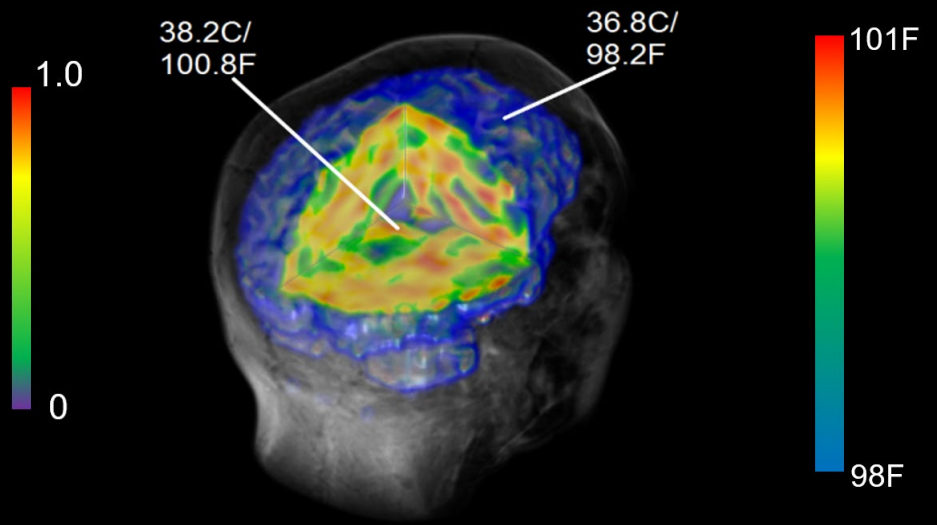
Metabolites available for MRS measurement.

Kousi et al., 2012, Proton Magnetic Resonance Spectroscopy of the Central Nervous System

Magnetic Resonance Spectroscopy (MRS) – whole brain

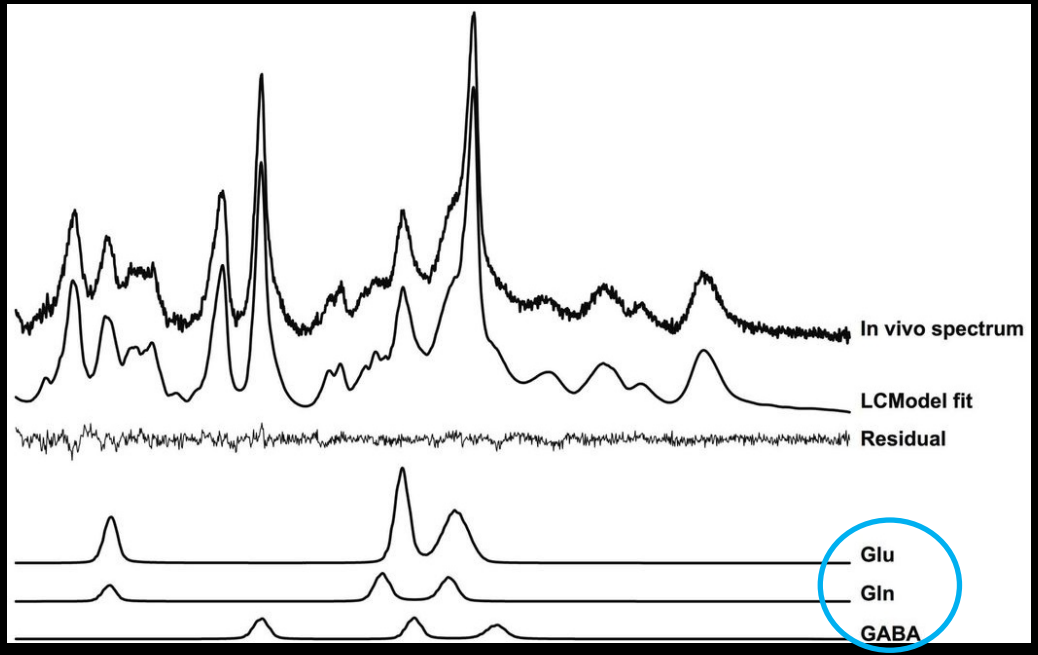


Whole-brain choline in healthy and ME/CFS groups.



Whole-brain temperature in a single participant.

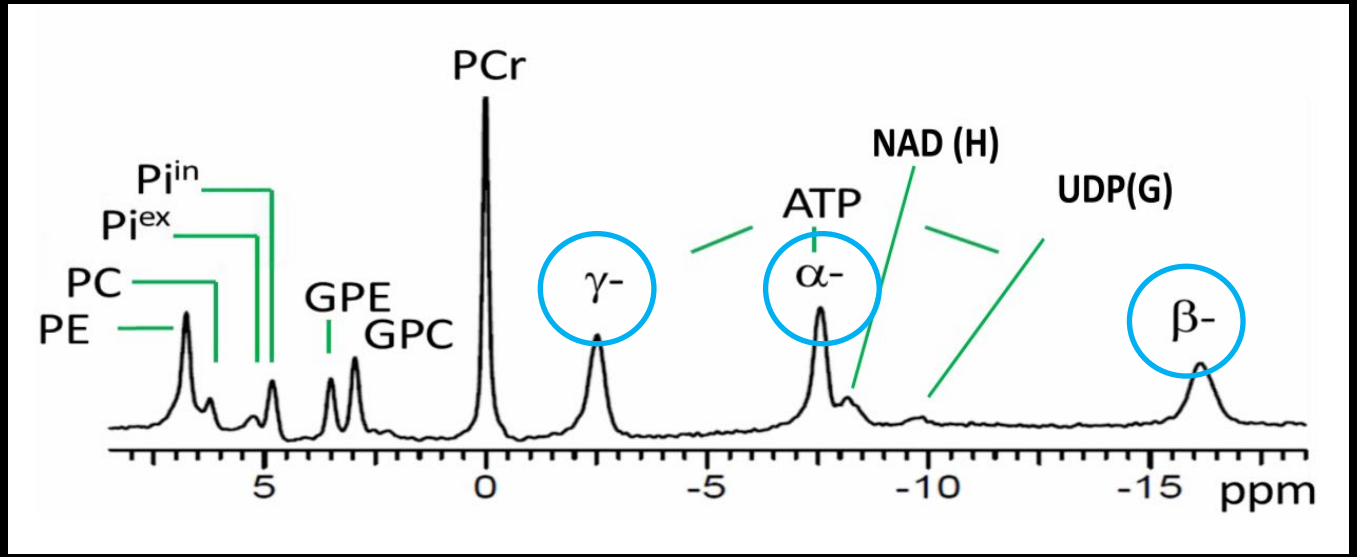
Magnetic Resonance Spectroscopy (MRS) – expanding the analyte list



Measuring glutamate, glutamine, and GABA from MRS.

Strasser et al., 2018, bioRxiv

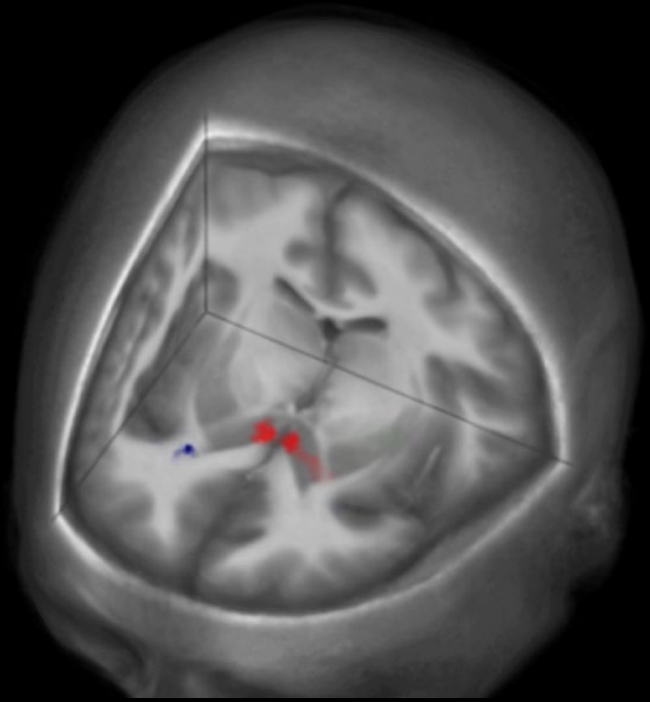
Magnetic Resonance Spectroscopy (MRS) – expanding the analyte list



New metabolites available when switching to phosphorus-tuned receiving coil.

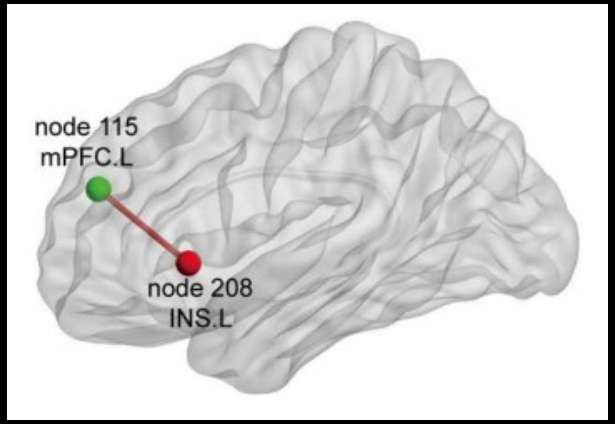
Das et al., 2020, Frontiers in Aging Neuroscience

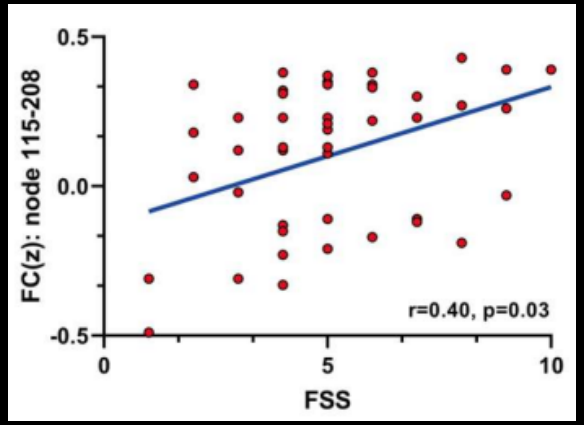
Functional Magnetic Resonance Imaging (fMRI)



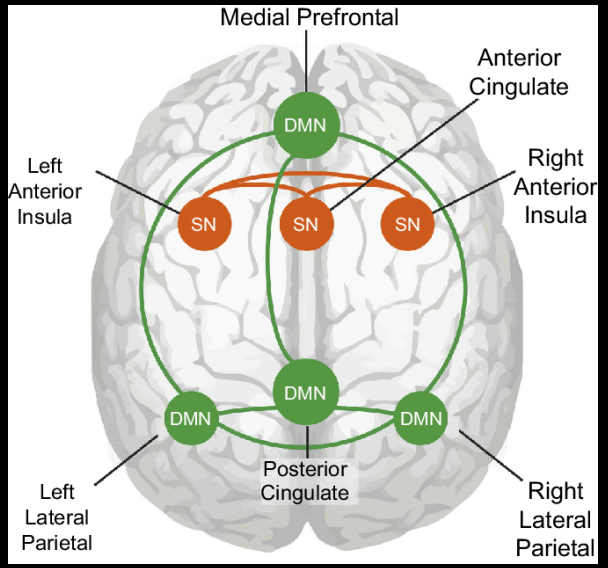
Romantic love reduces pain via the nucleus accumbens.

Functional Magnetic Resonance Imaging (fMRI) - connectivity





Increased connectivity between medial prefrontal cortex and left insula is associated with fatigue in ankylosing spondylitis patients.

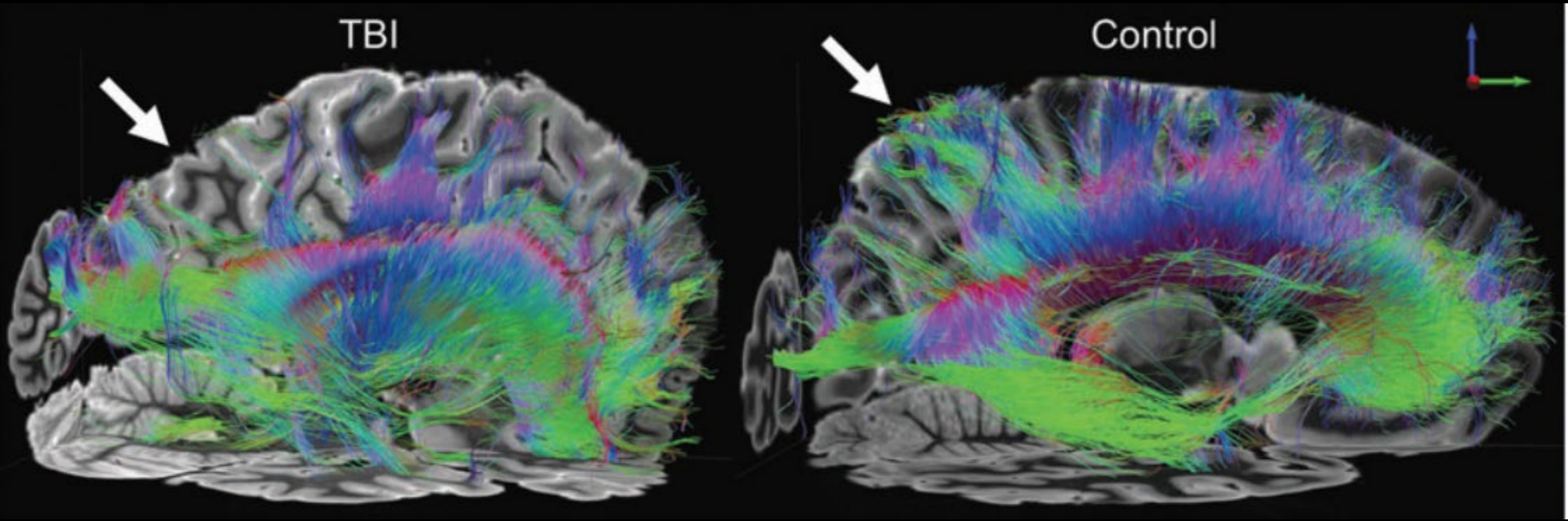


Default mode network (DMN) and salience network (SN).

Chen et al., 2020, Diagnostics

Van Ettinger-Vennstra et al., 2019, Journal of Pain Research

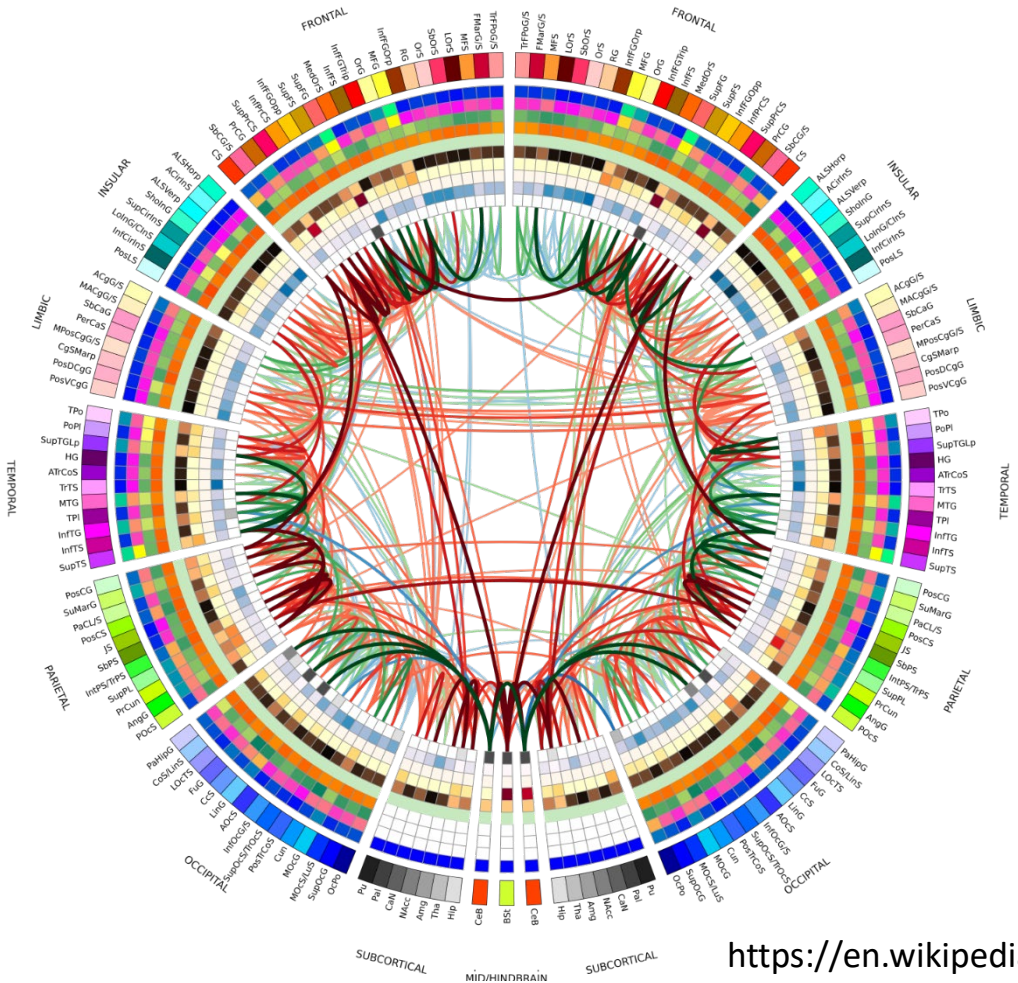
Diffusion Tensor Imaging (DTI)



DTI tractography in traumatic brain injury patient and healthy control.

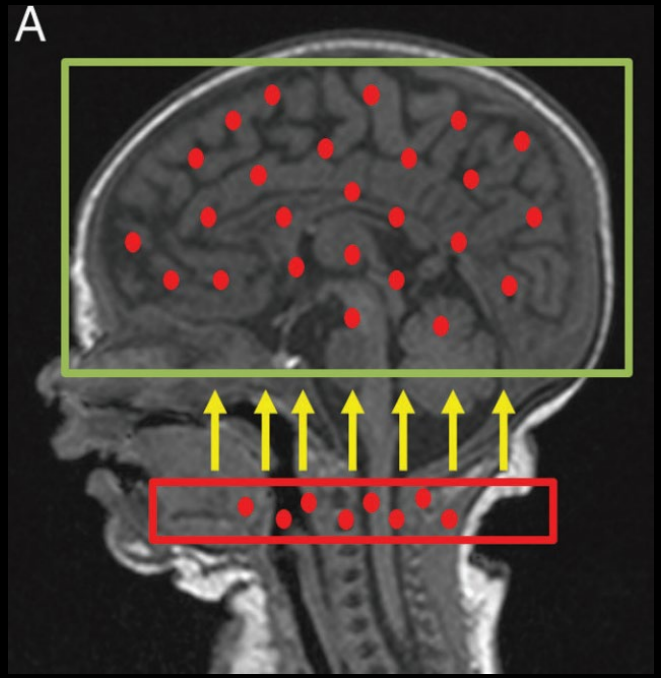
Edlow et al., 2018, Journal of Neurotrauma

Diffusion Tensor Imaging (DTI) – the connectome



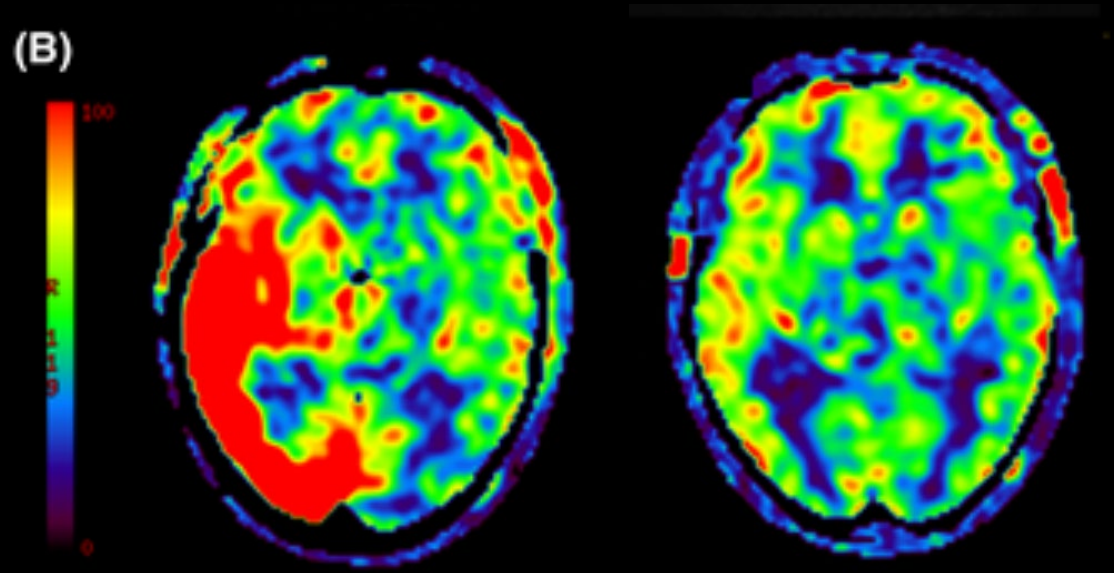
https://en.wikipedia.org/wiki/Connectogram

Other uses of MRI – e.g., Arterial Spin Labeling (ASL)



Prescribing ASL for cerebral perfusion in pediatric patient.

Proisy et al., 2016, AJNR Am J Neuroradiol



Hyperperfusion in single patient with sudden seizures, before and after anti-epileptic treatment.

Yamamoto et al., 2018, Acute Medicine & Surgery

And many others . . .

Electroencephalogram (EEG)

Functional Near-Infrared Spectroscopy (fNIRS)

Intracortical Neuron Recording (iEEG)

Magnetoencephalography (MEG)

Computed Tomography (CT-Head/CT-Brain)

Pharmacologic MRI (phMRI)

Single Photon-Emission Computed Tomography (SPECT)