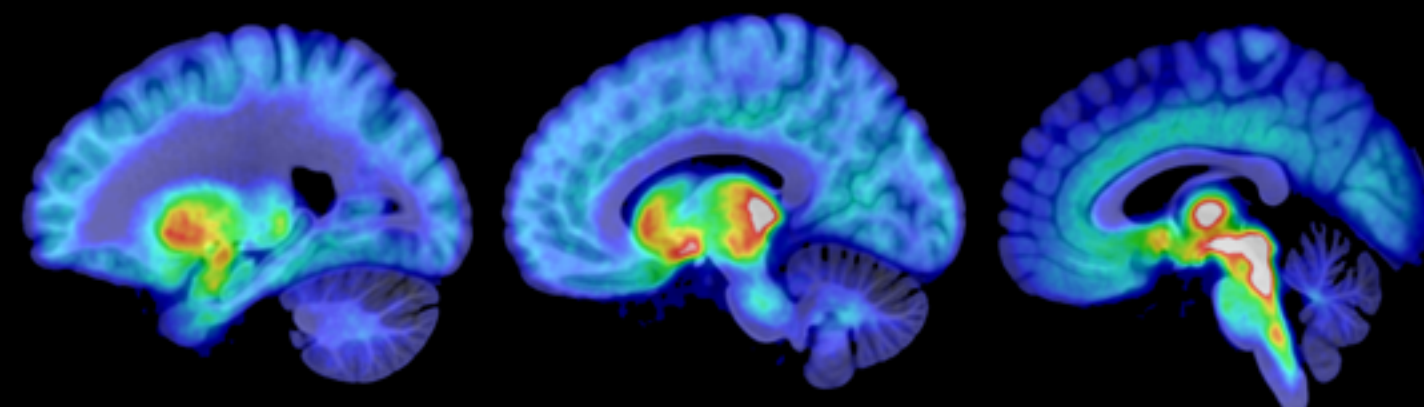




Basic Principles of Brain Imaging

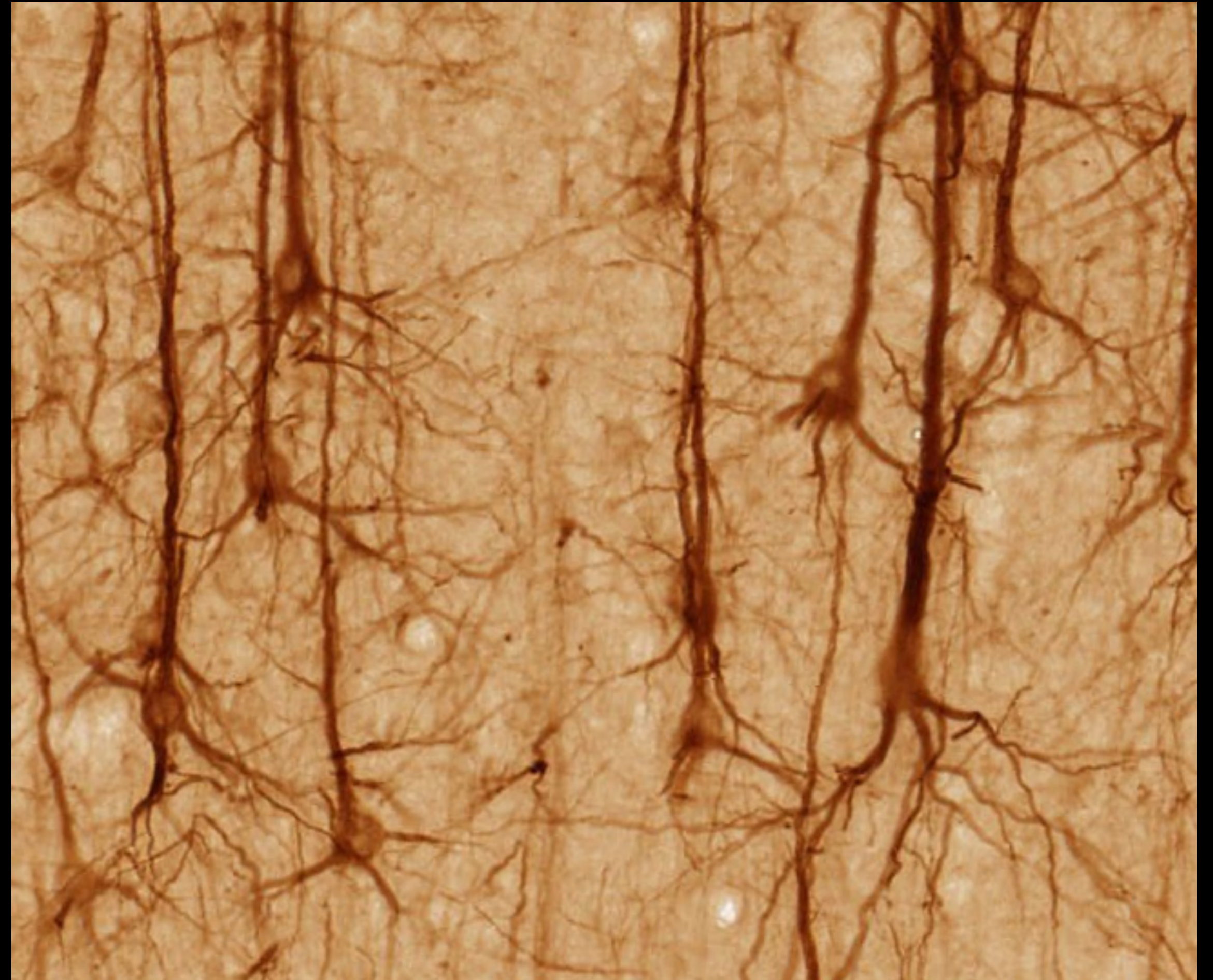
Lauri Nummenmaa

Turku PET Centre and Department of Psychology, University of Turku

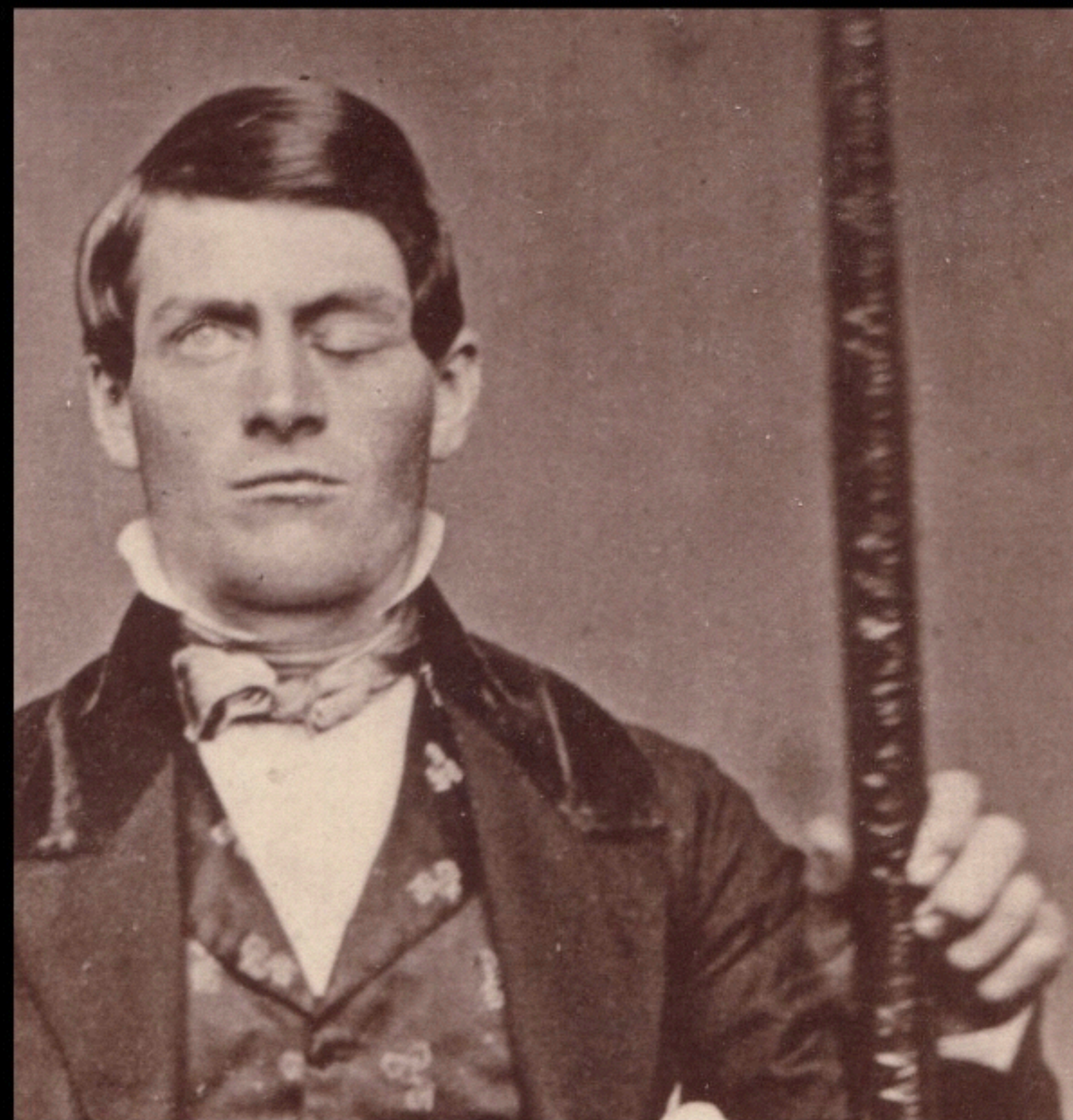
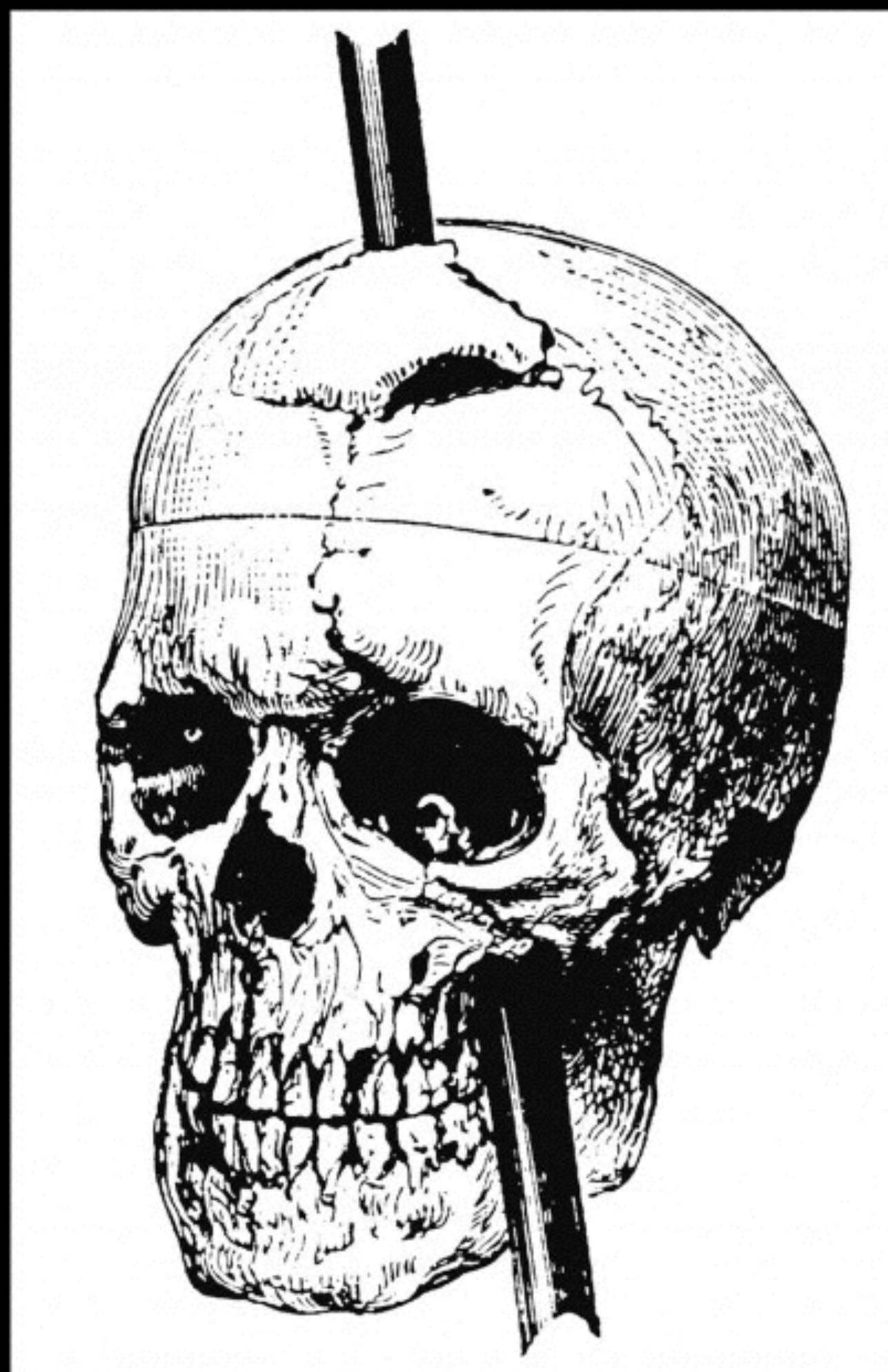


Why do we study brains?

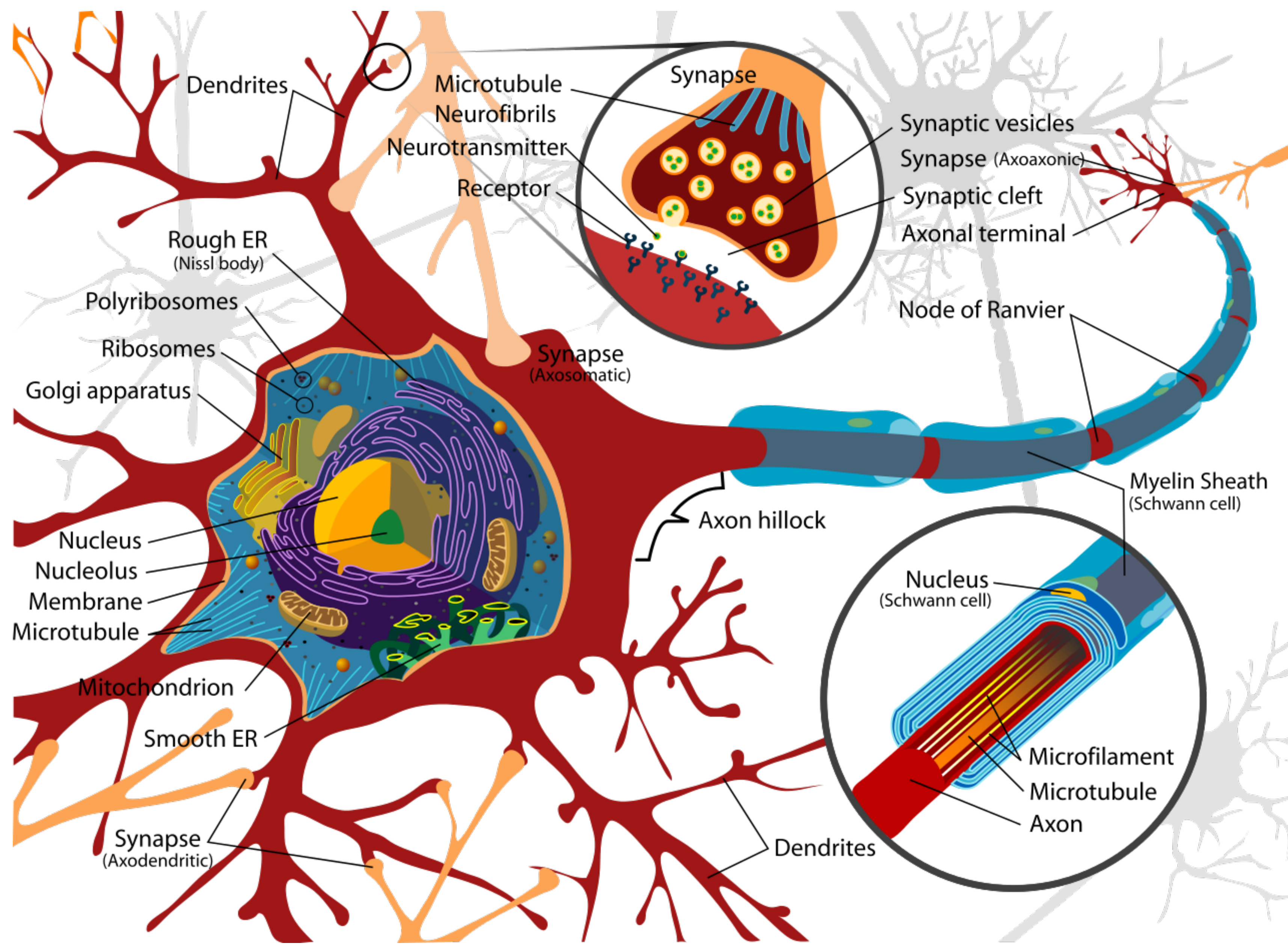
- To aid in clinical diagnosis
- To understand the physiology of the central nervous system
- To develop drugs that influence the central nervous system
- To understand how neurons support mental processes such as cognition and emotion



Old school in vivo neuroscience in humans



Three main challenges for
human neuroscience



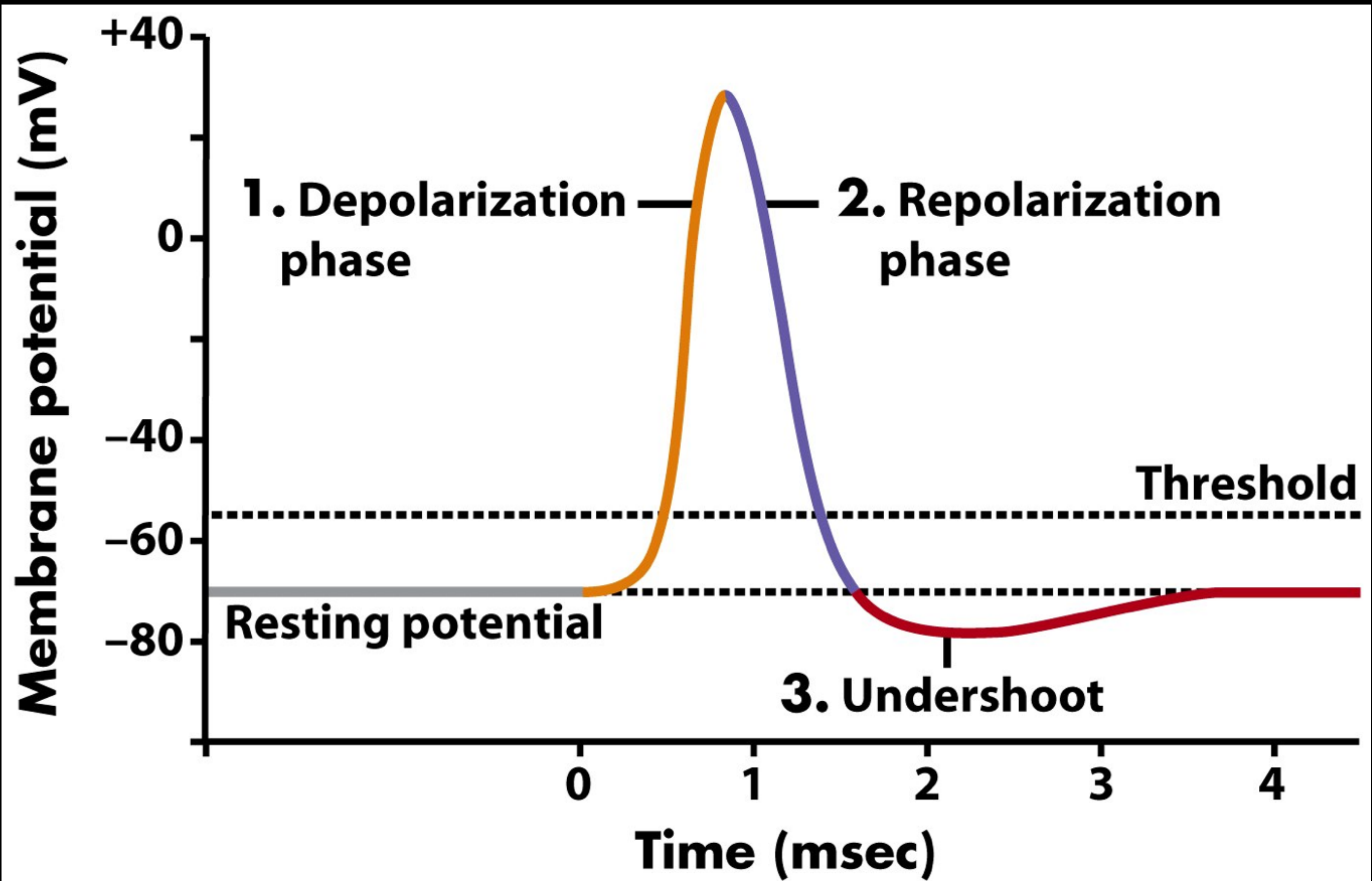
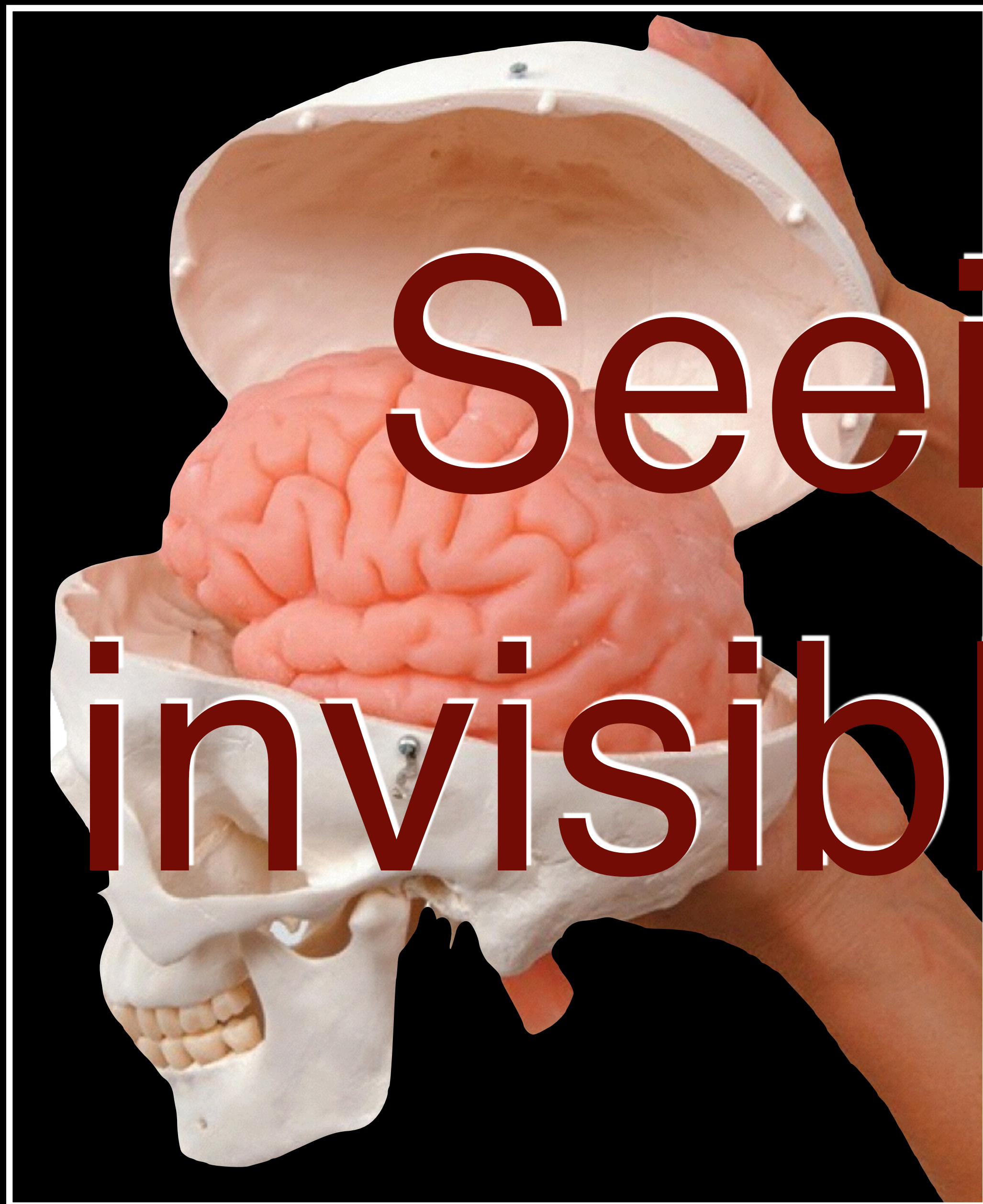
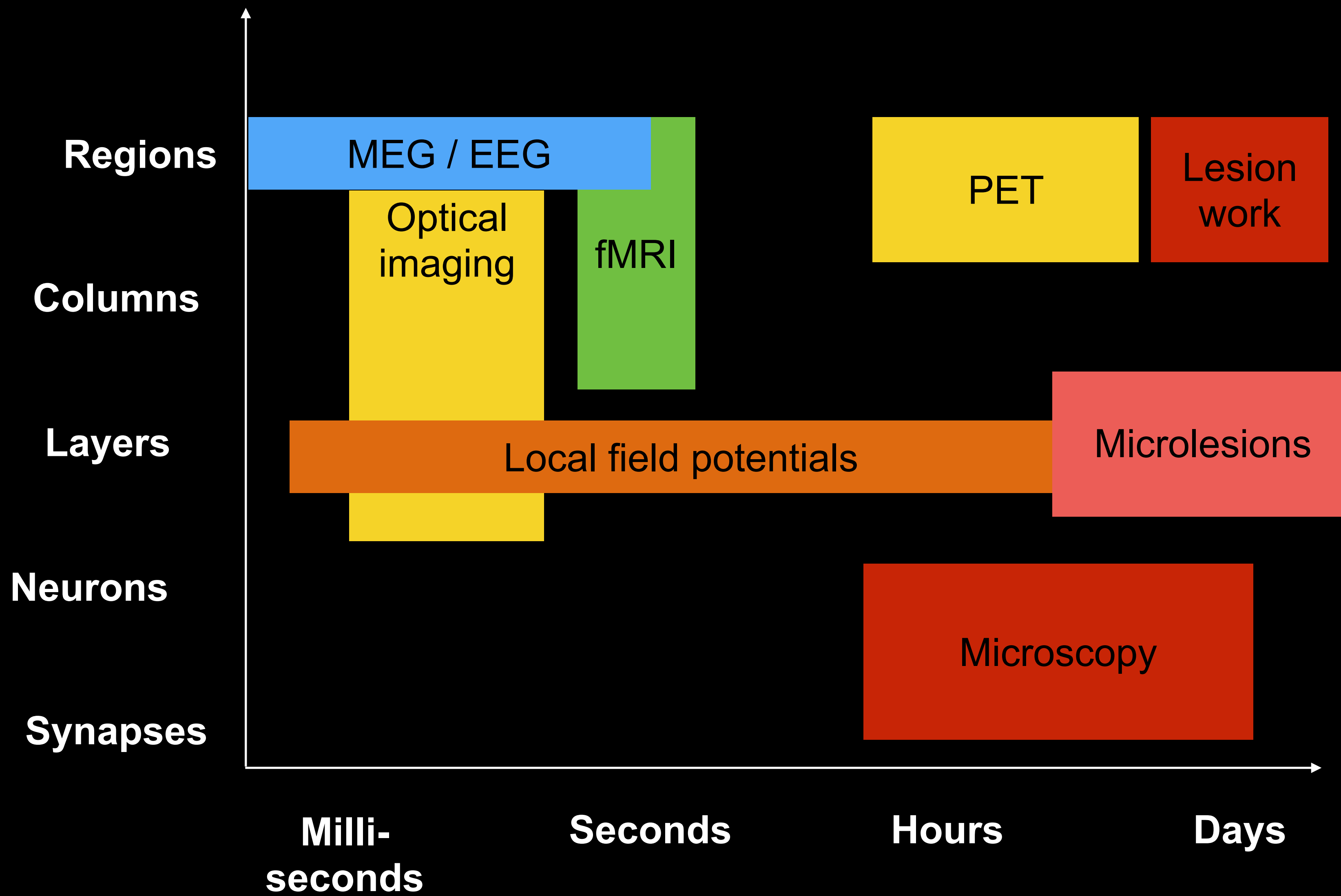


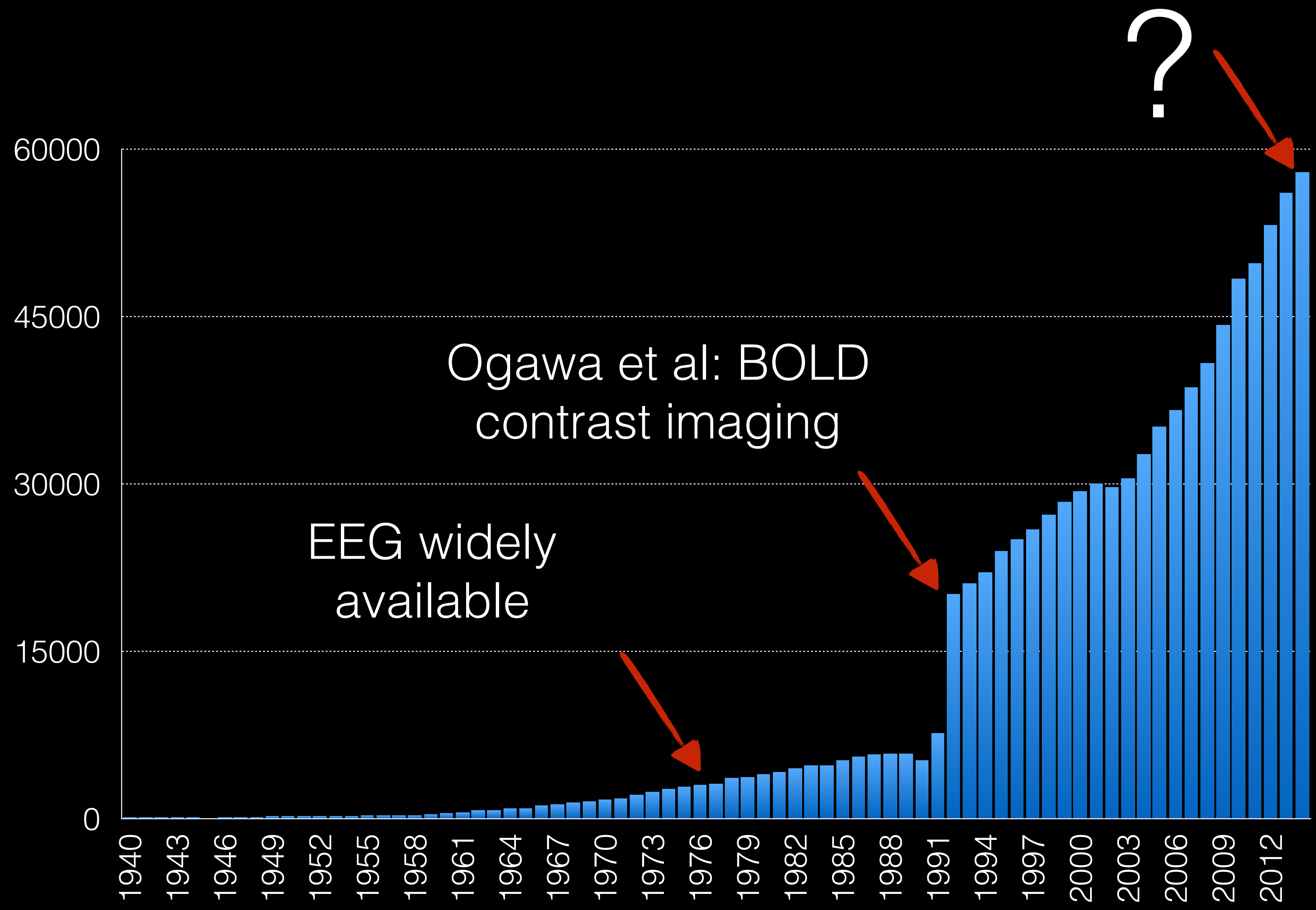
Figure 45-5 Biological Science, 2/e
© 2005 Pearson Prentice Hall, Inc.



Seeing the invisible in vivo

Video courtesy of prof. Pirjo Nuutila

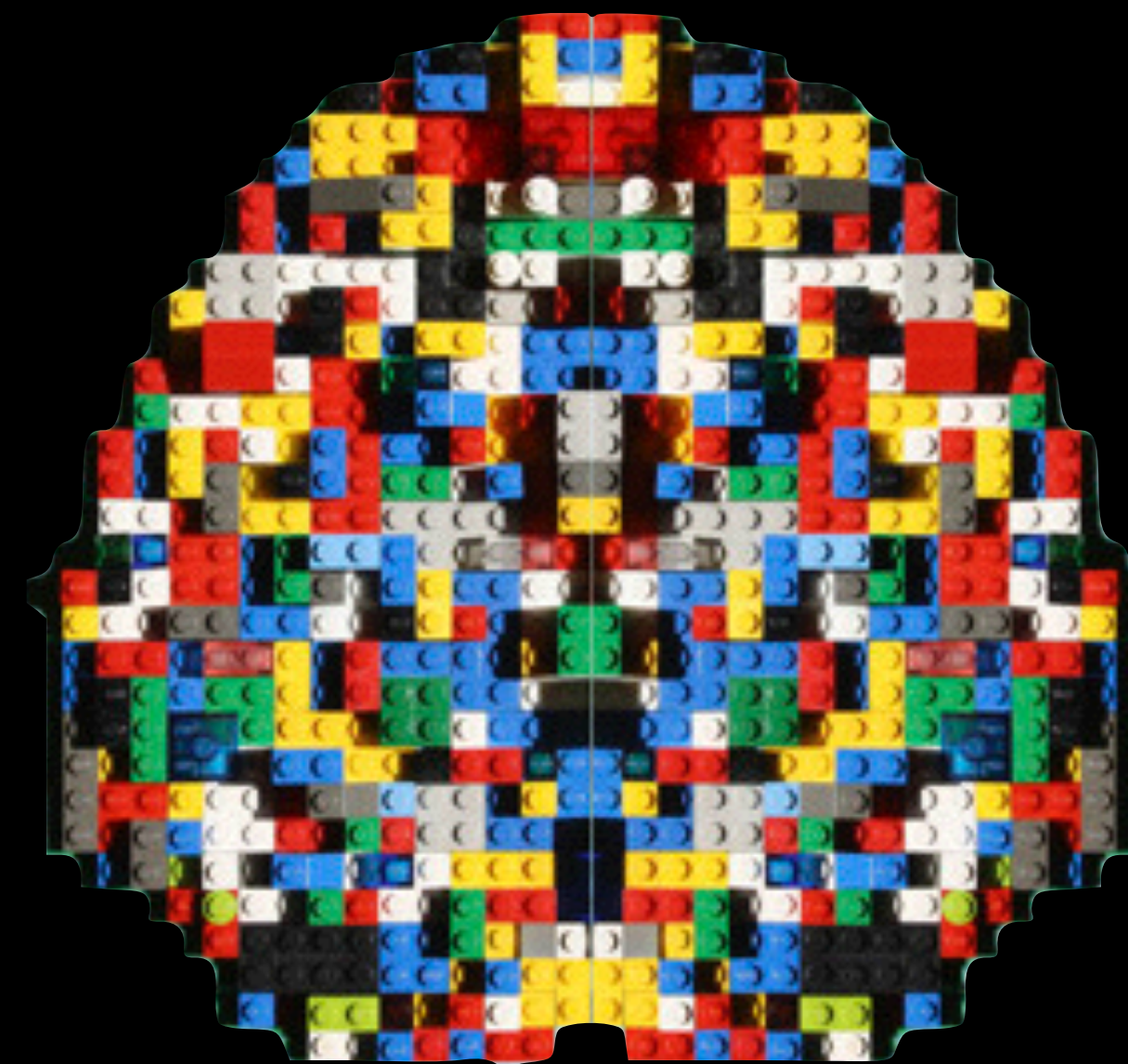


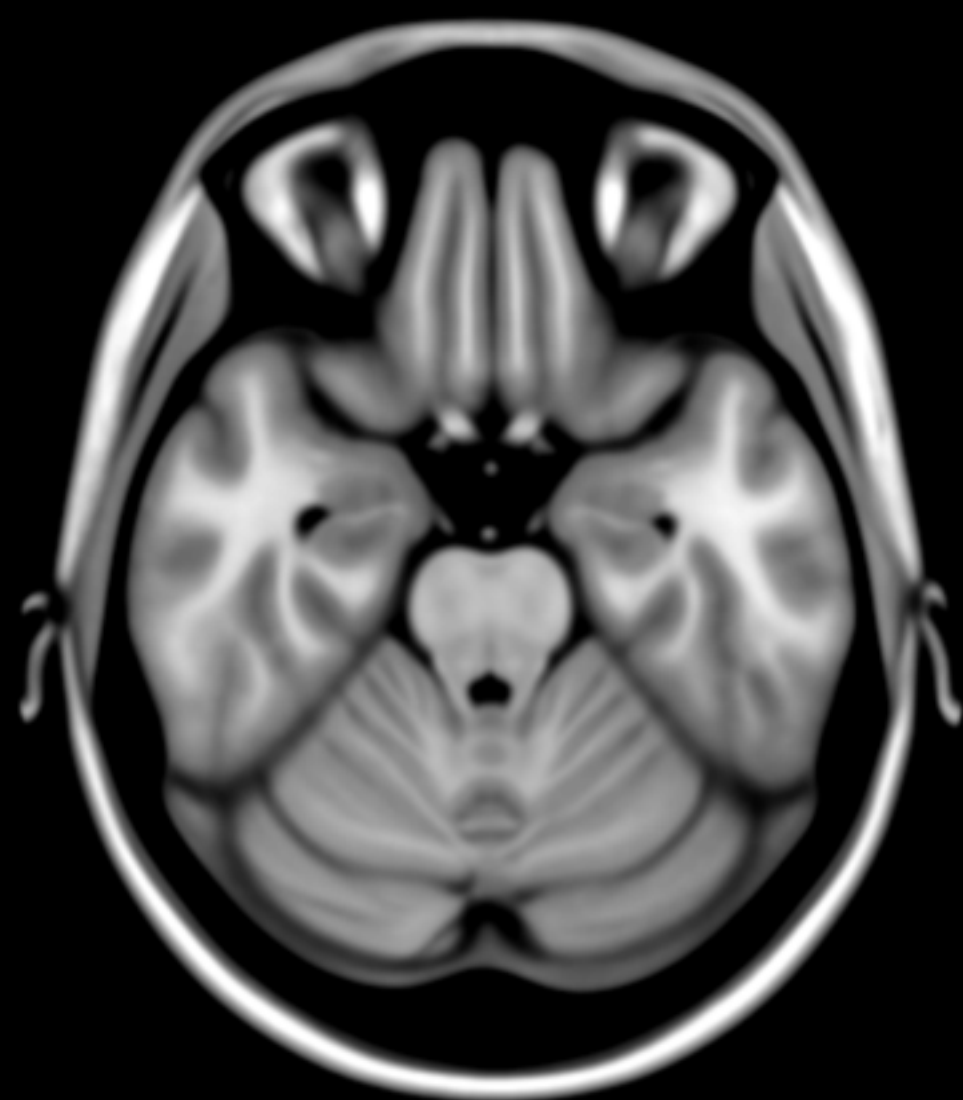
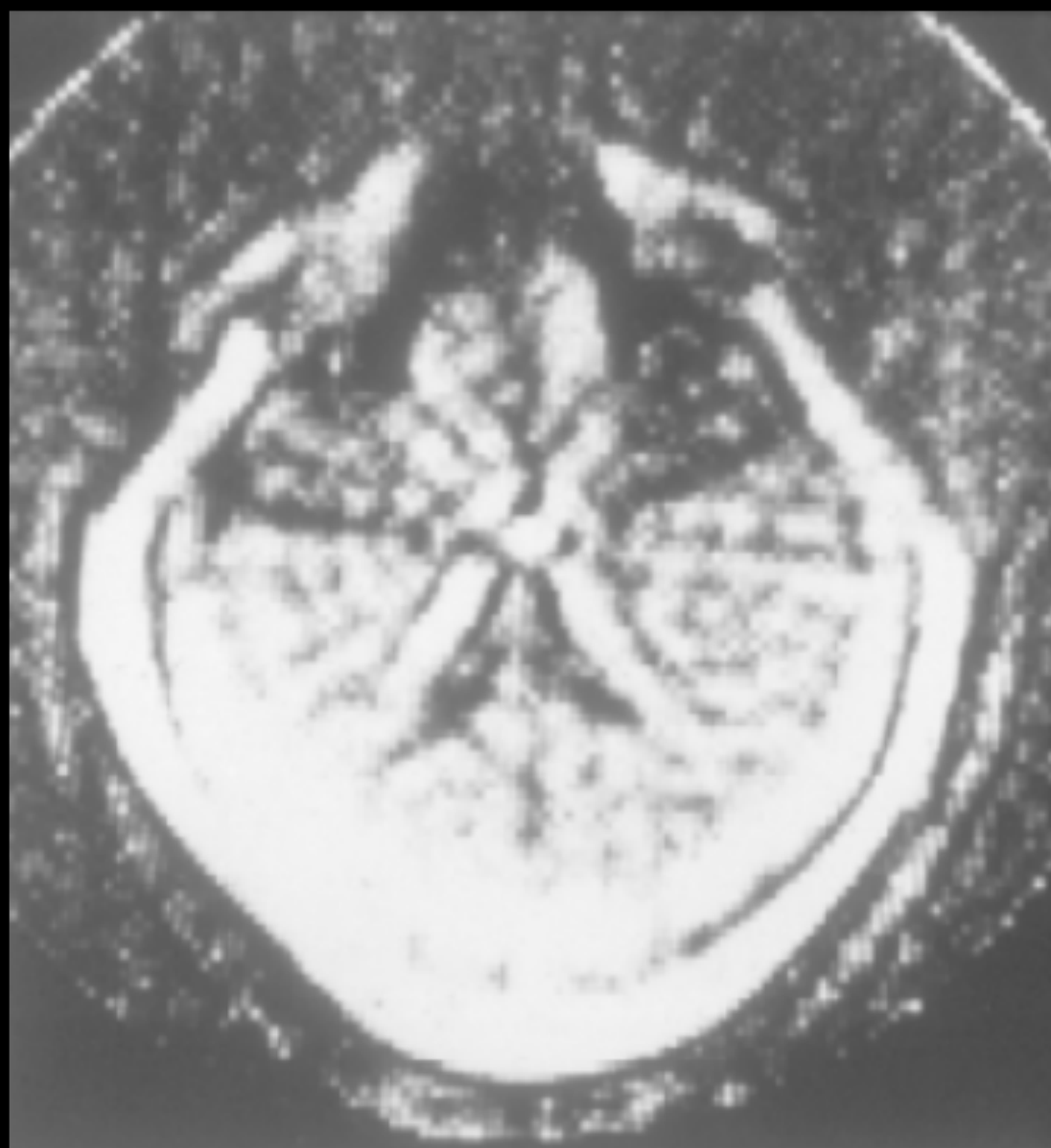


Ogawa et al: BOLD
contrast imaging

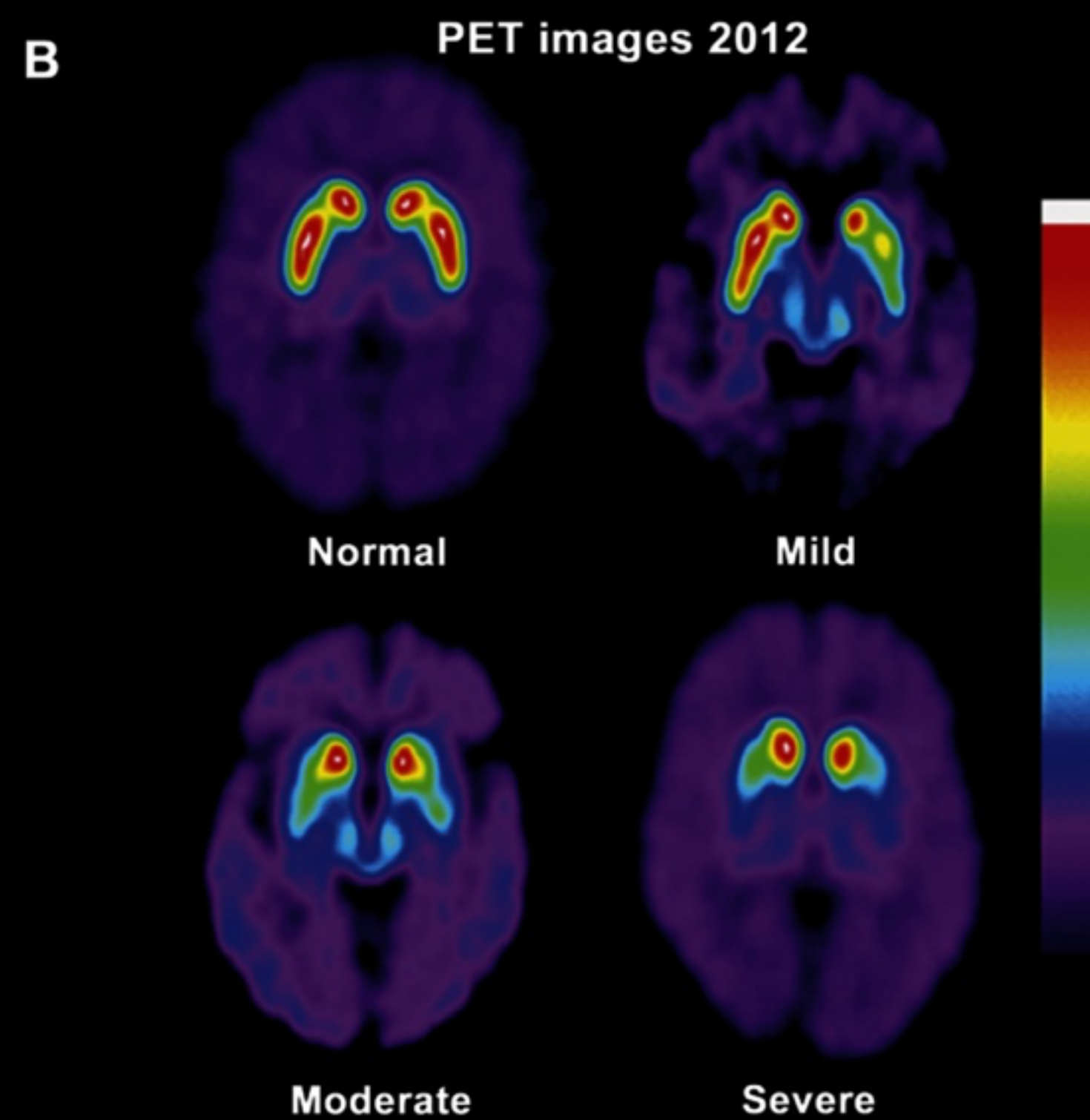
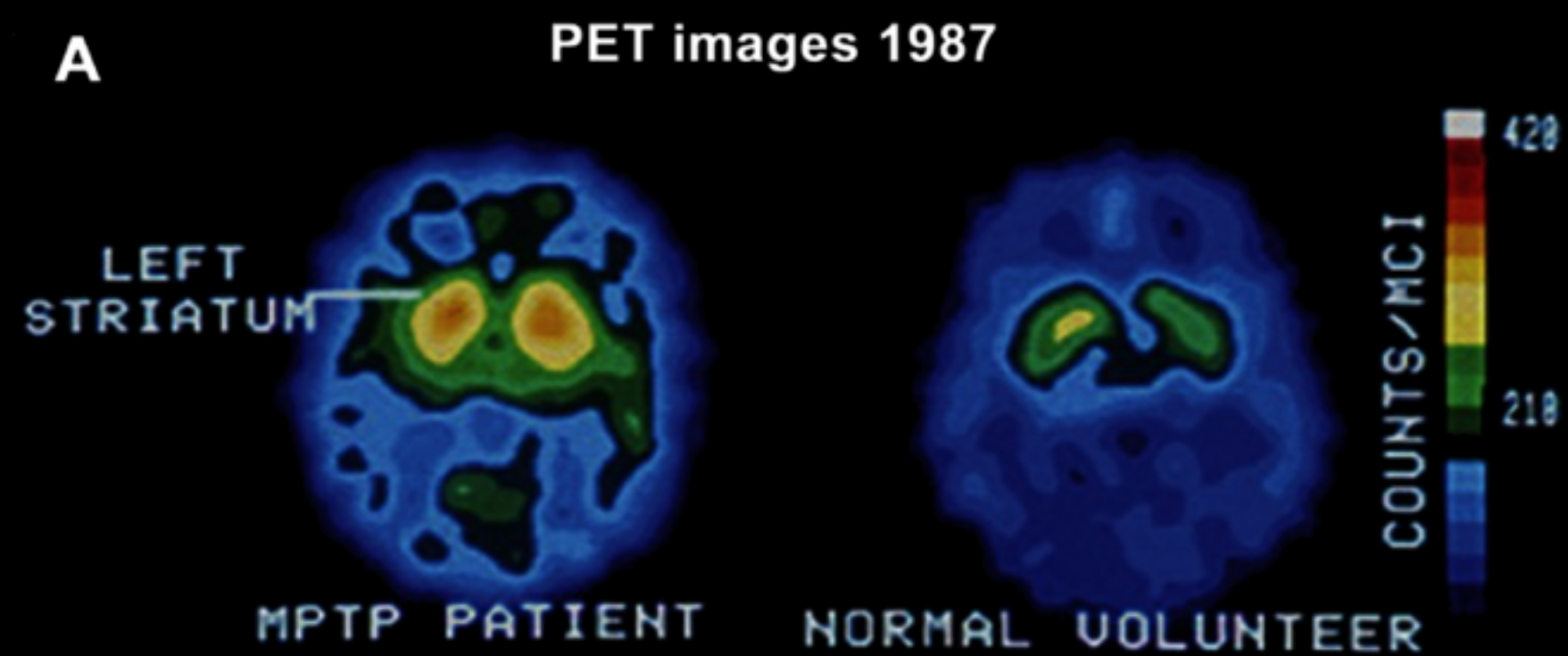
EEG widely
available

?



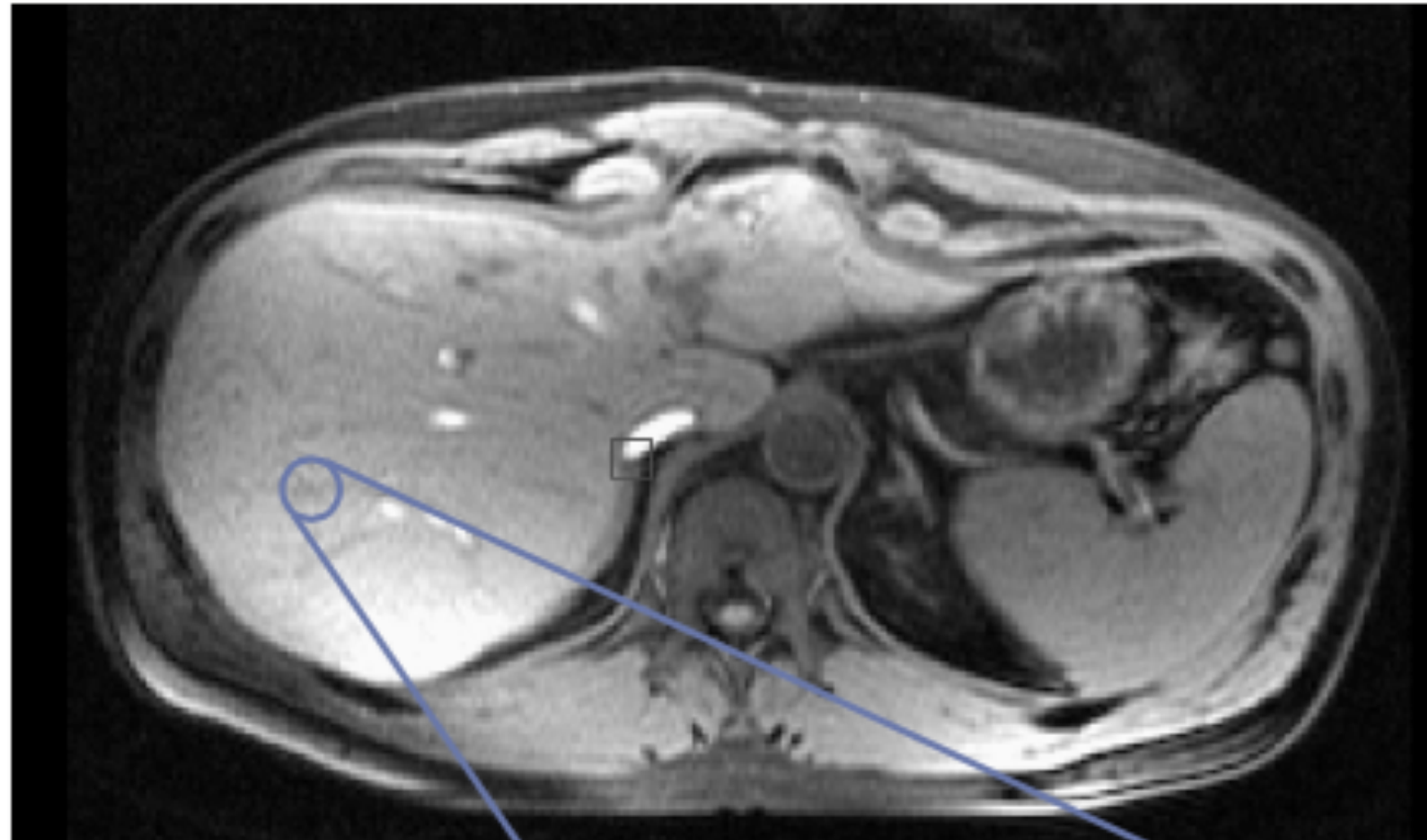


EMI central laboratories & MNI



Portnow (Neurology 2013)

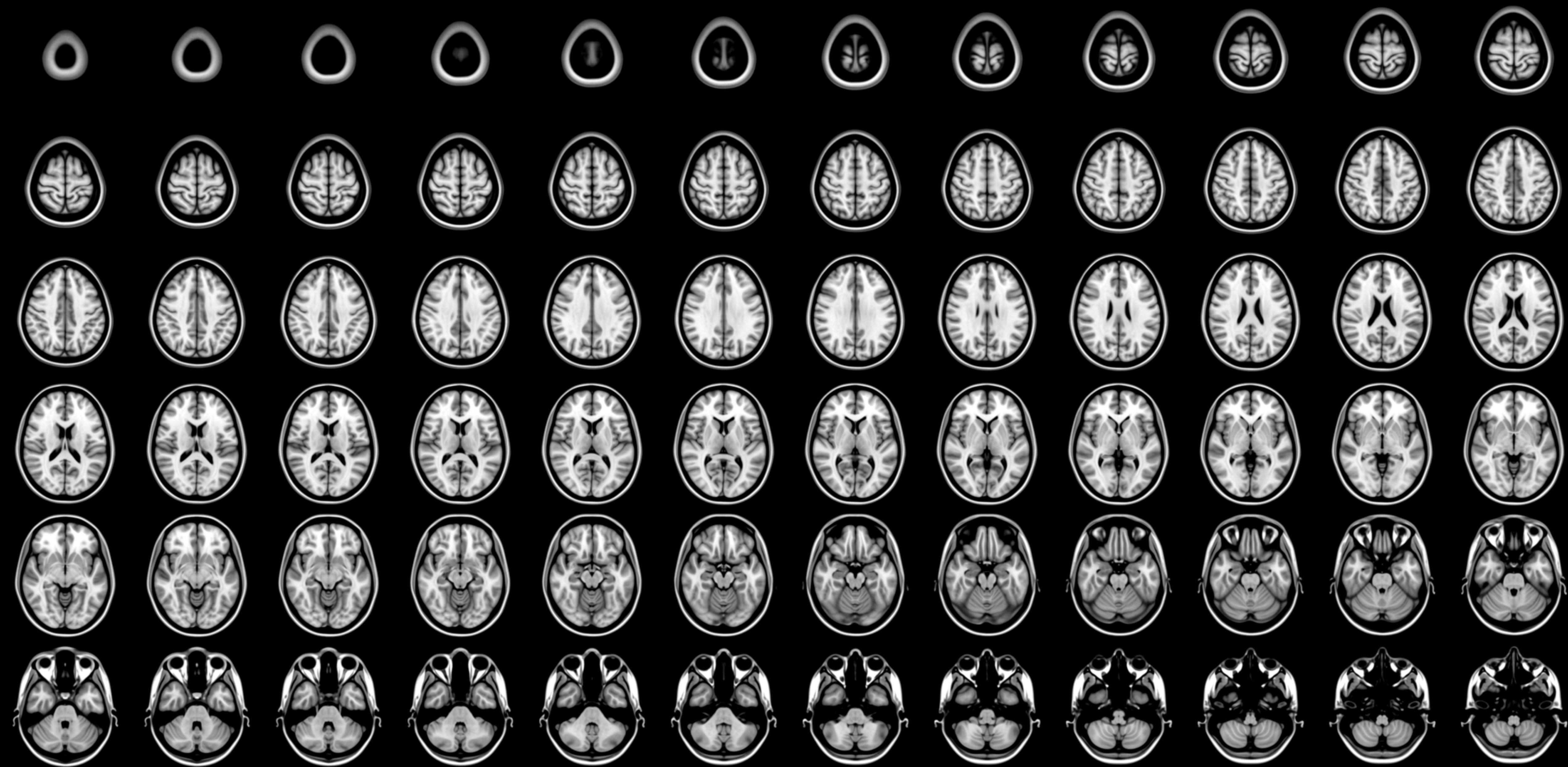
Basic principle of tomographic imaging



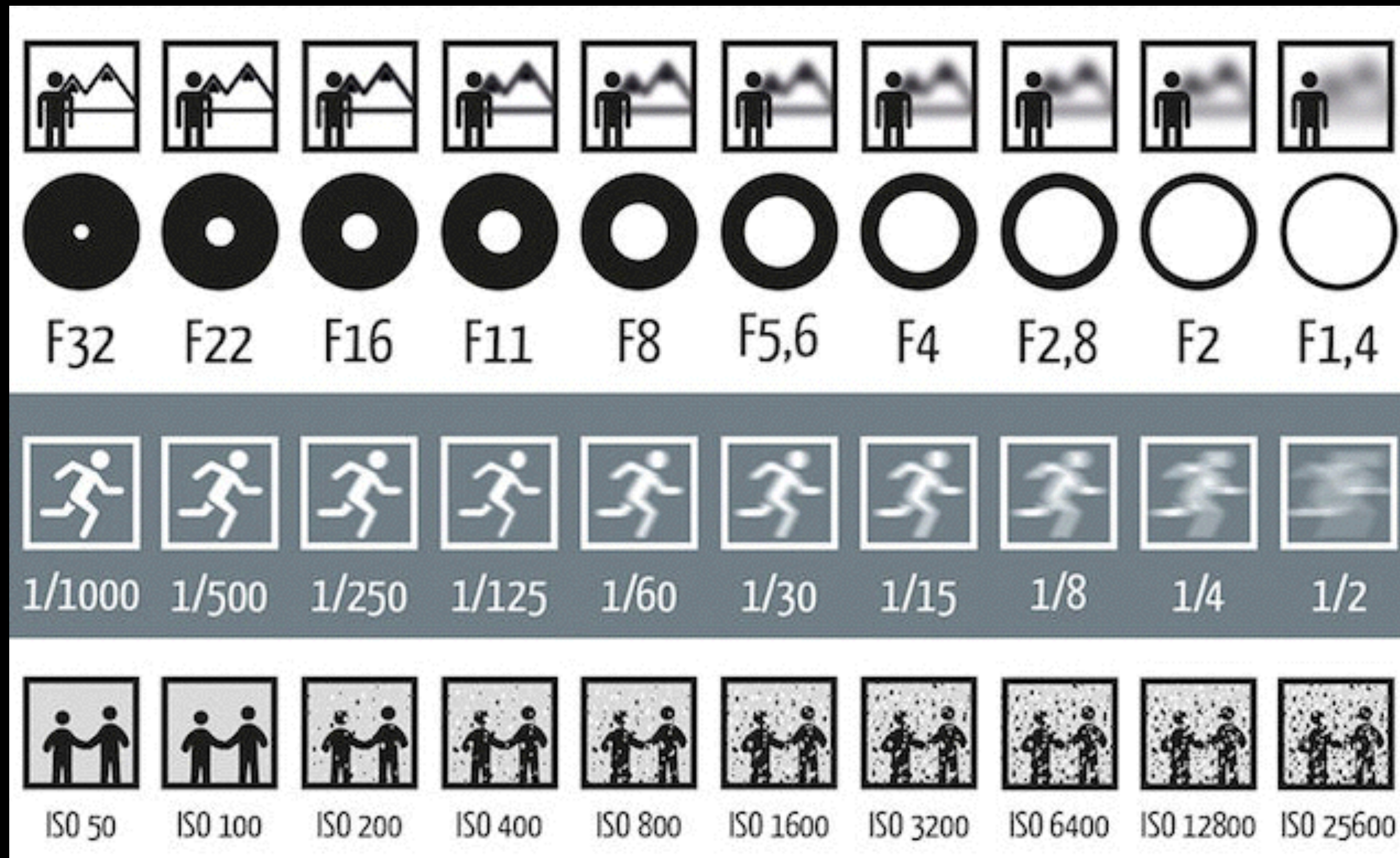
(a)



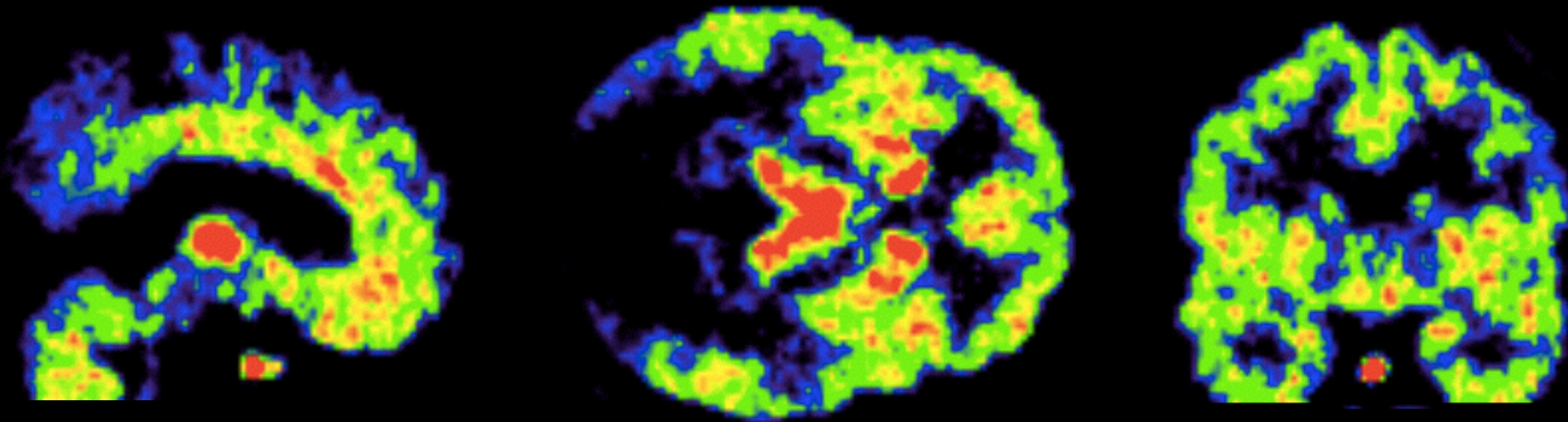
(b)



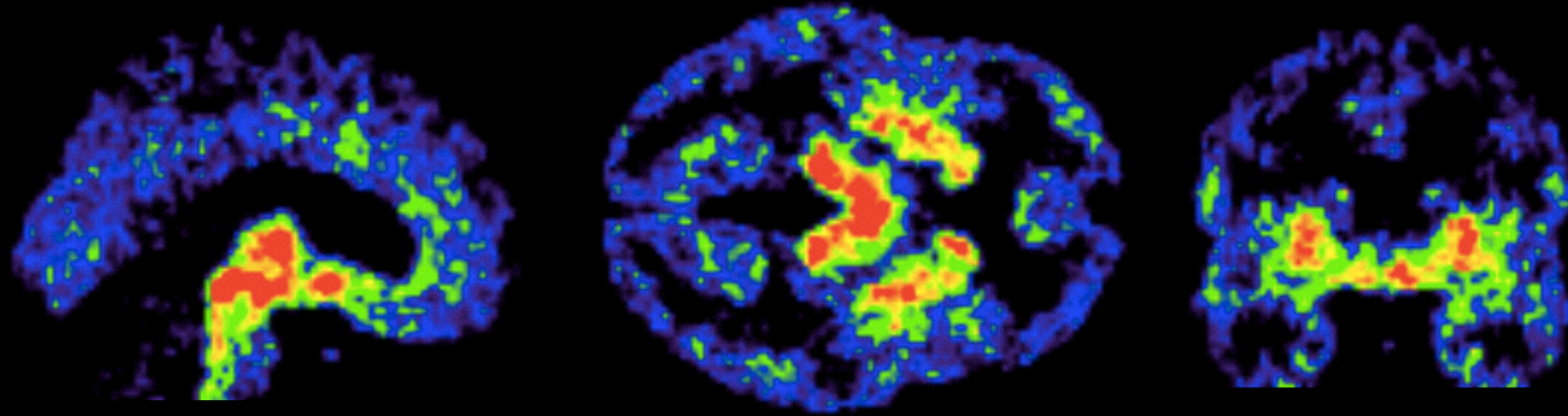
Means for contrast in images



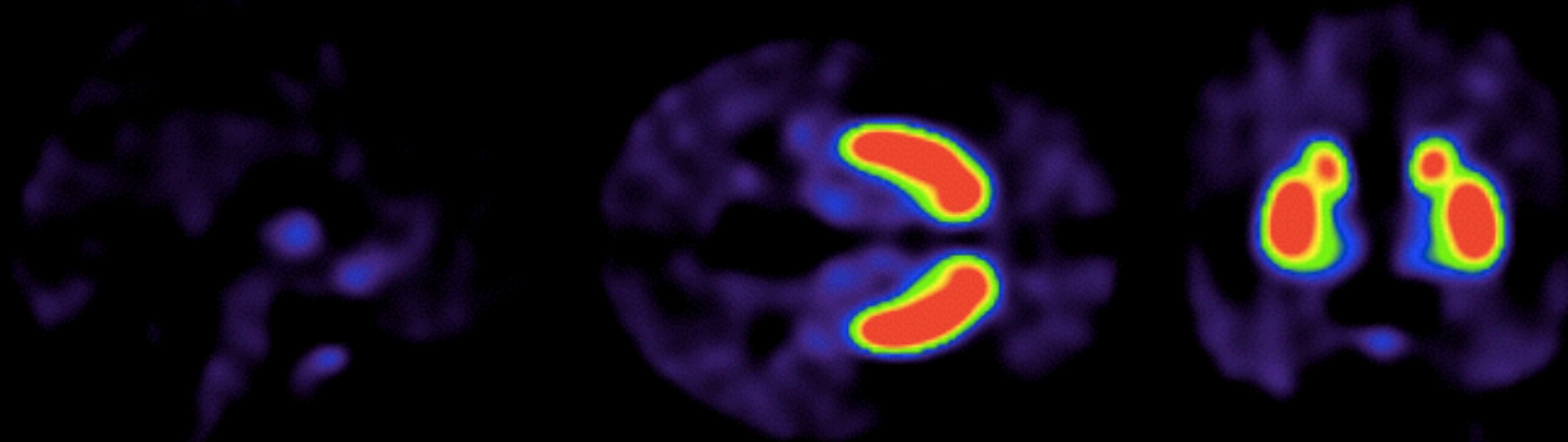
[11C] carfentanil
MOR tracer



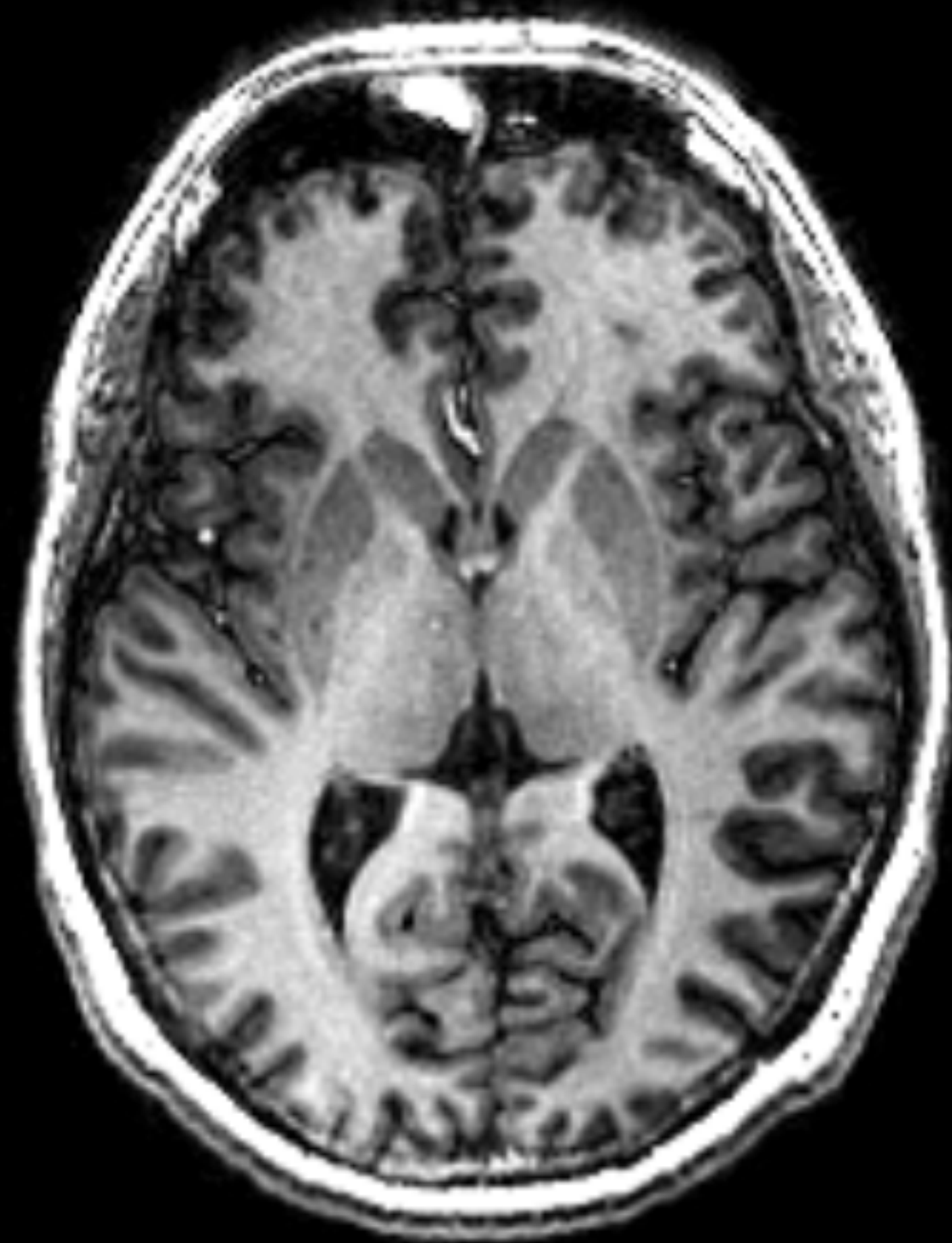
[11C] MADAM
SERT tracer



[11C] raclopride
D2R tracer

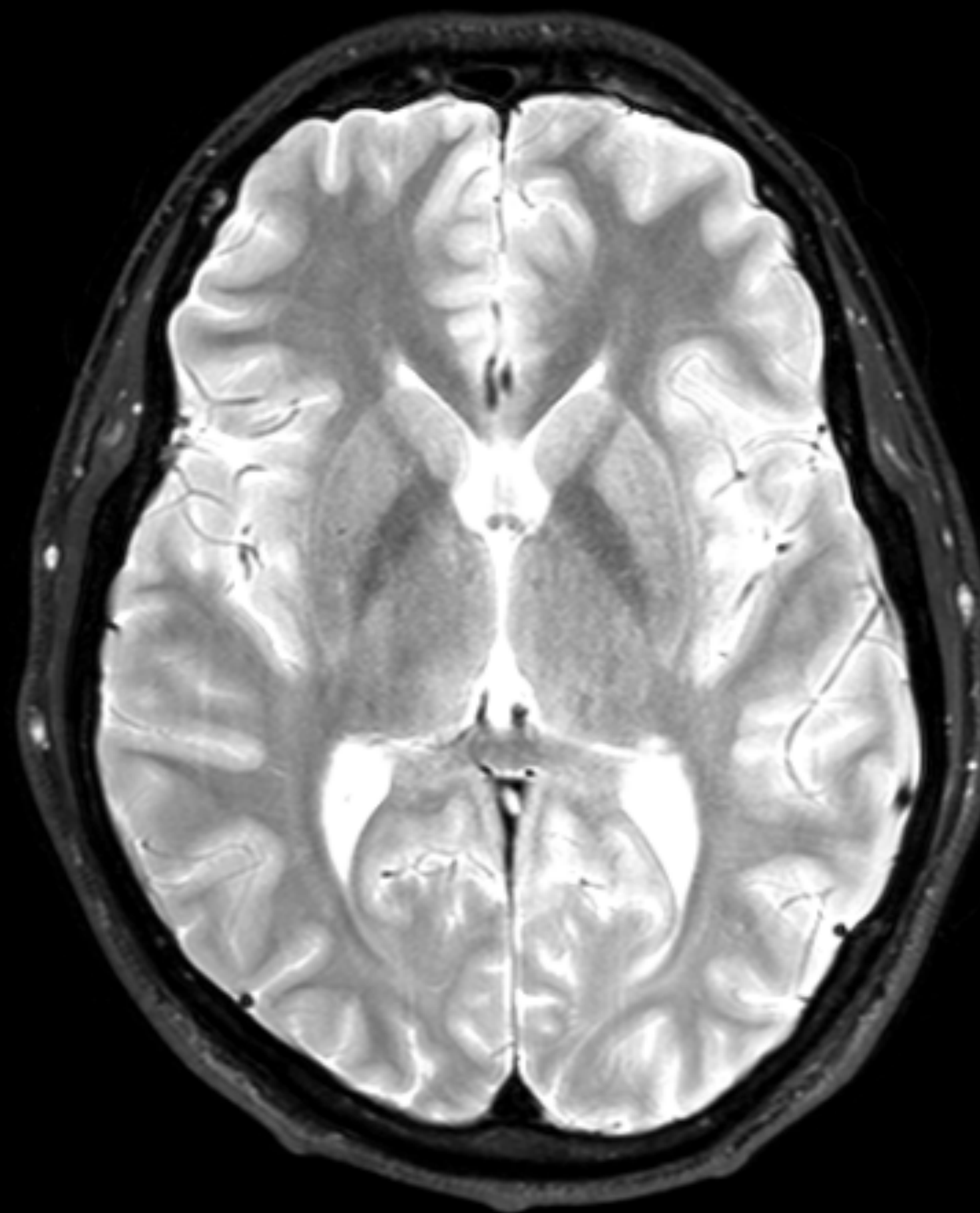


T1-weighting



1 mm isotropic voxel

T2-weighting



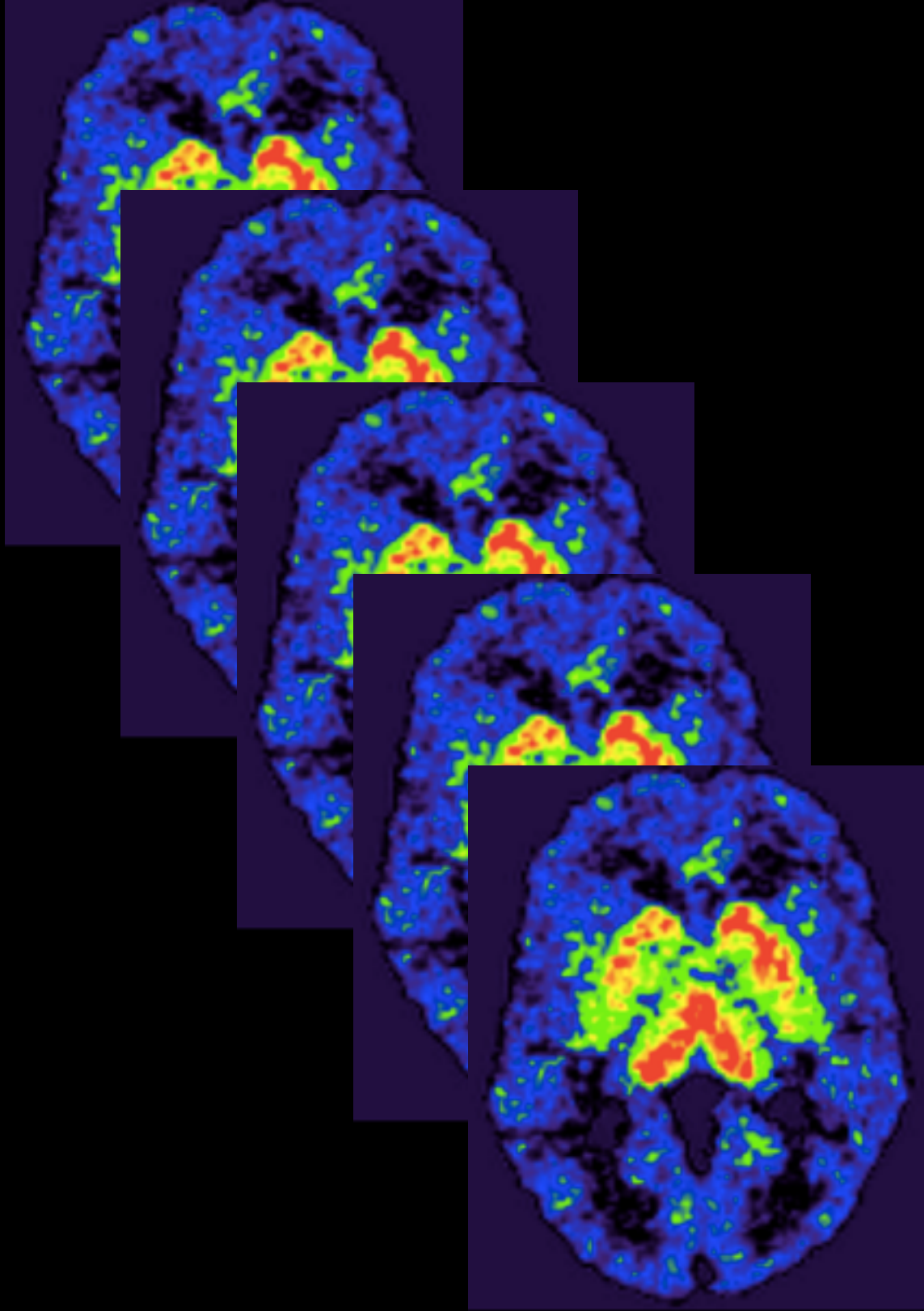
1 mm isotropic voxel

T2*-weighting (EPI)

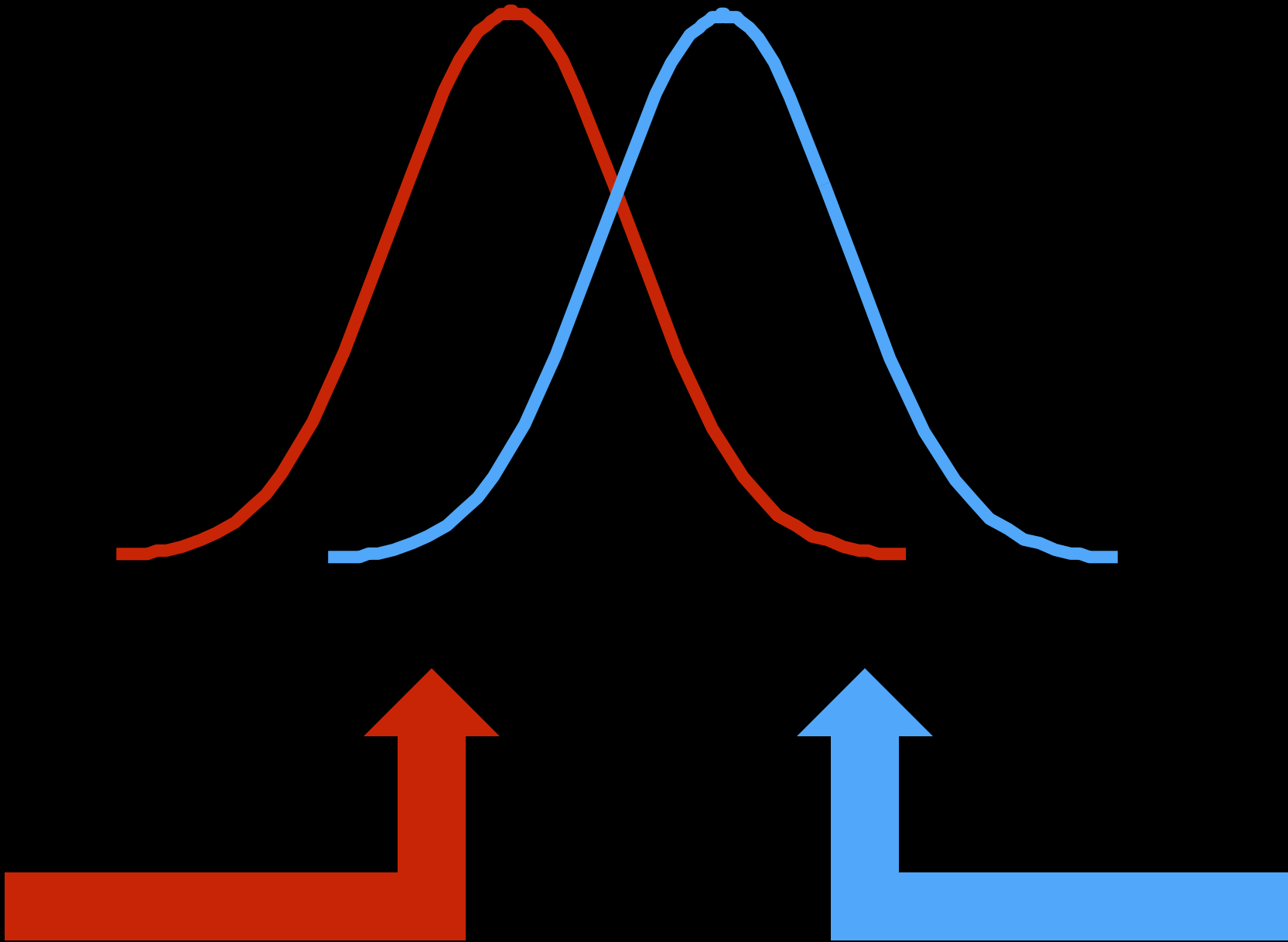


3 mm isotropic voxel

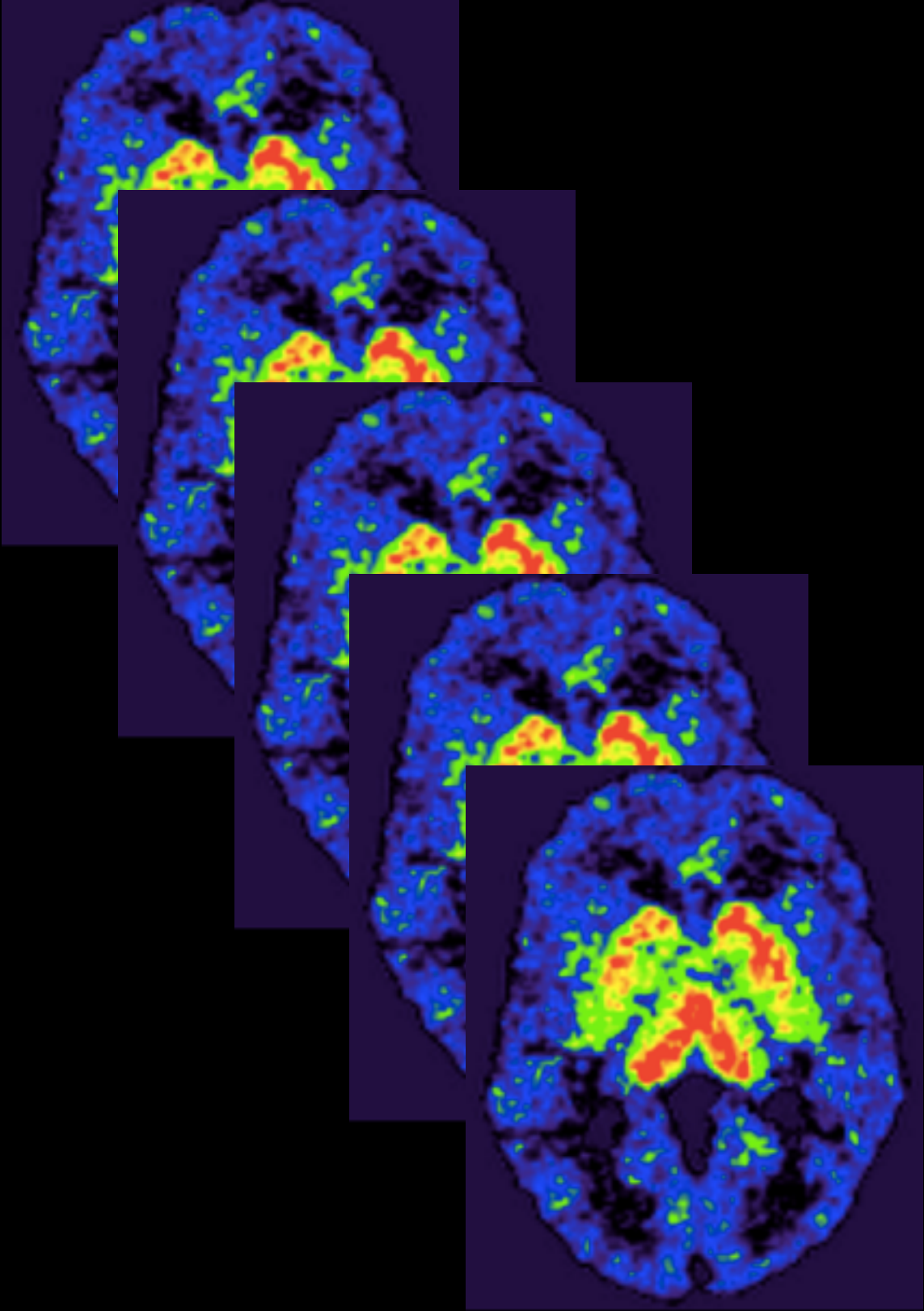
CONTROLS



ARE THESE BRAINS
STATISTICALLY
DIFFERENT?



PATIENTS



...but that's a different story
altogether