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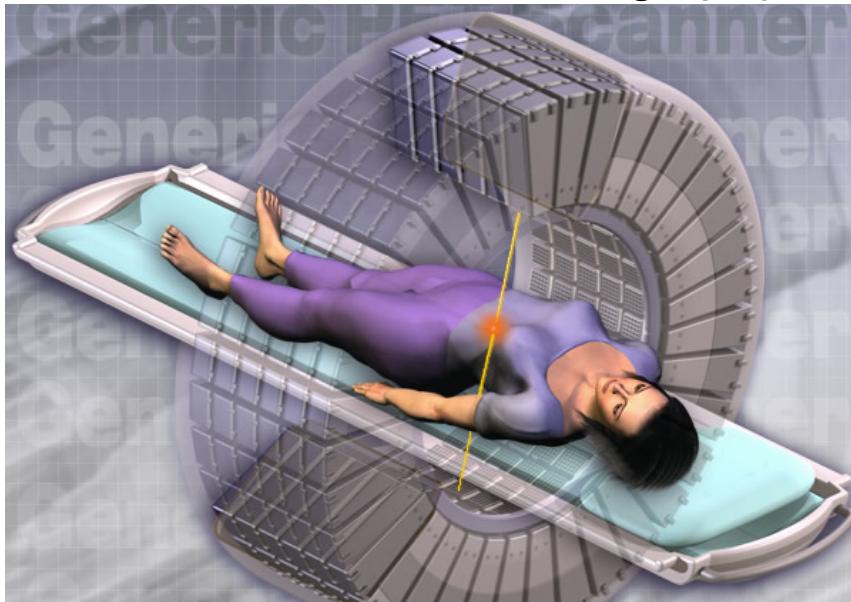
Introduction to fMRI

Neuroimaging

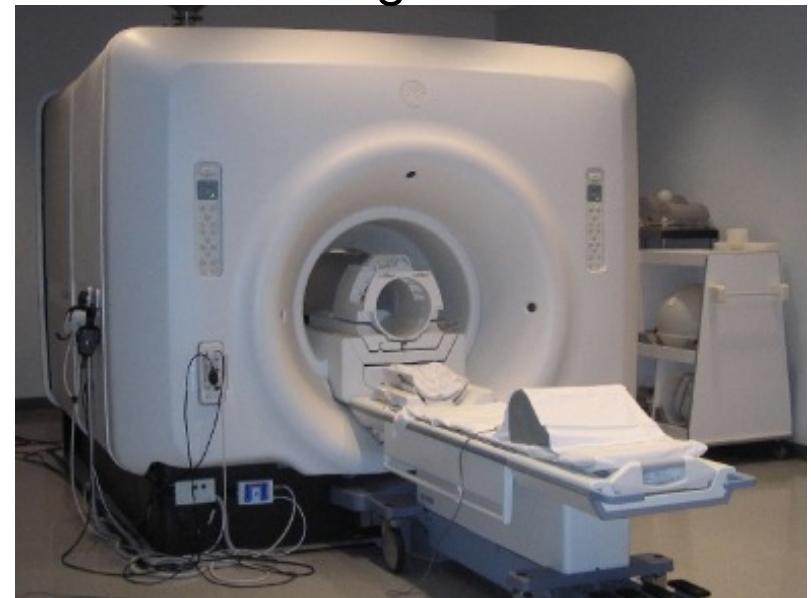
PET: blood flow, neurochemistry
opioids, dopamine

fMRI: brain structure,
brain dynamics
Whole brain in < 1 sec

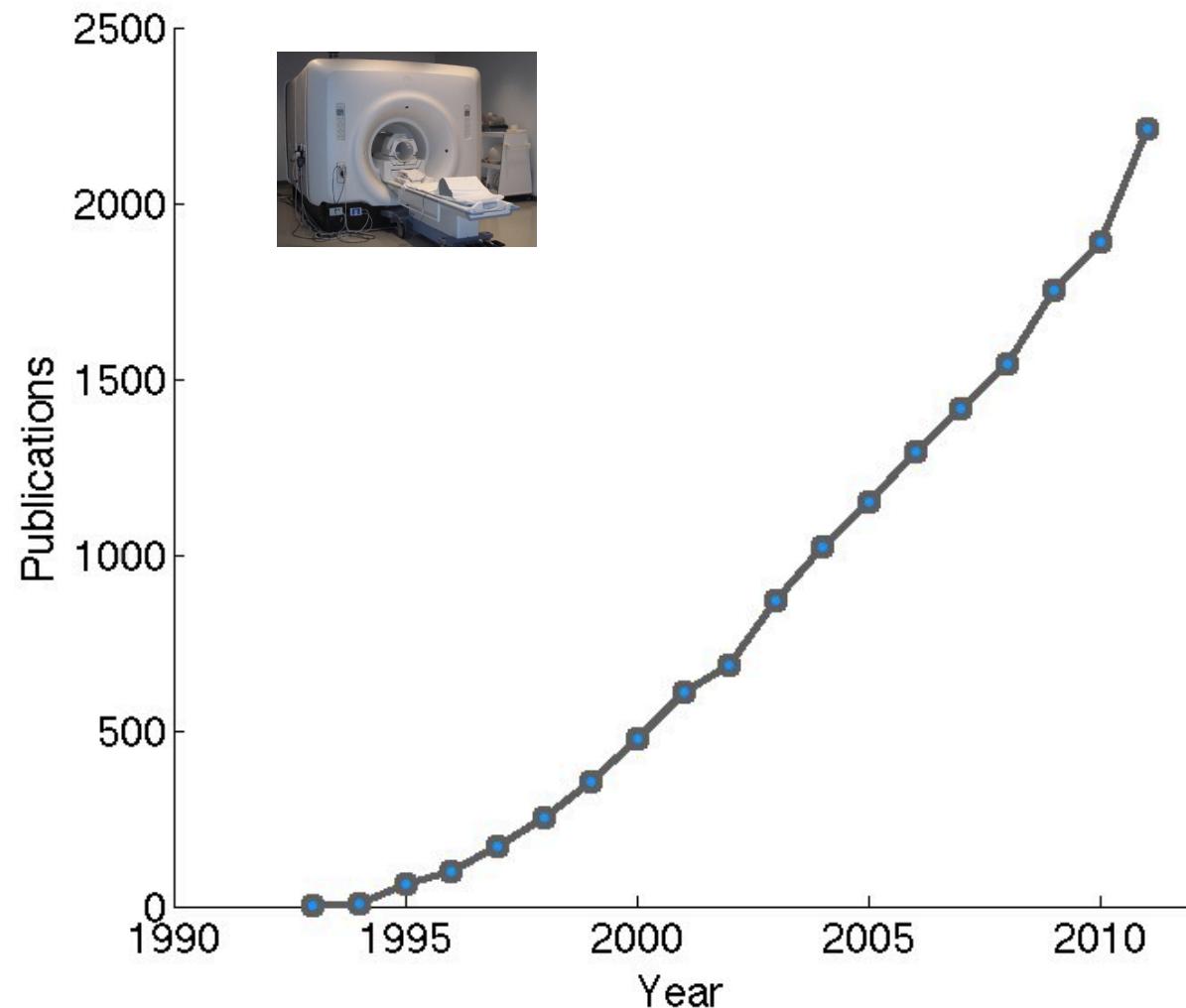
Positron Emission Tomography



Functional Magnetic Resonance



A growing new field

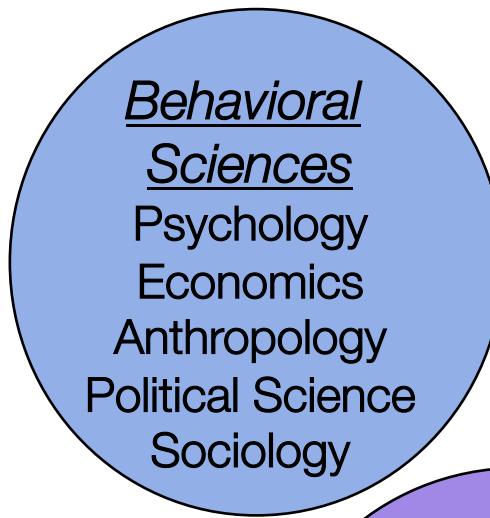


Goals of neuroimaging:

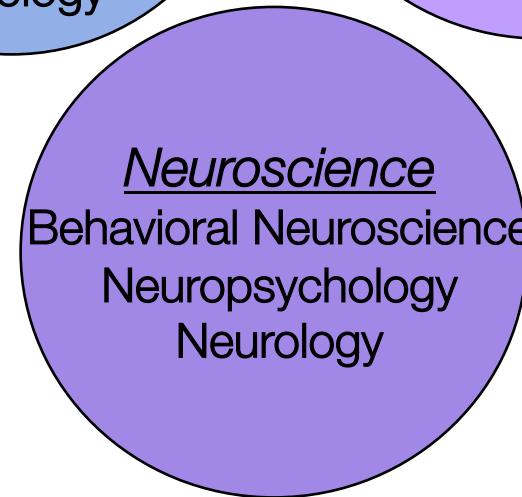
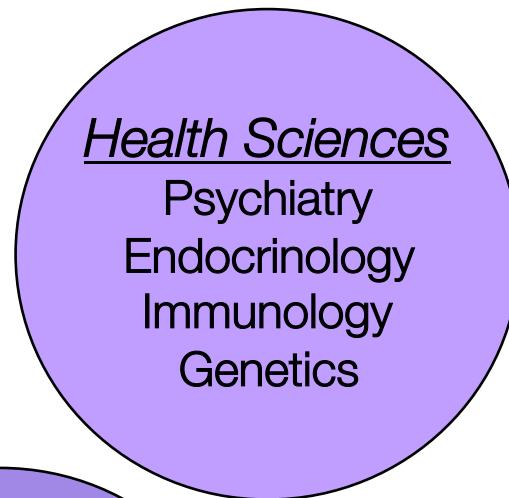
TOWARD MULTIDISCIPLINARY SCIENCE

Multidisciplinary Science

Mind



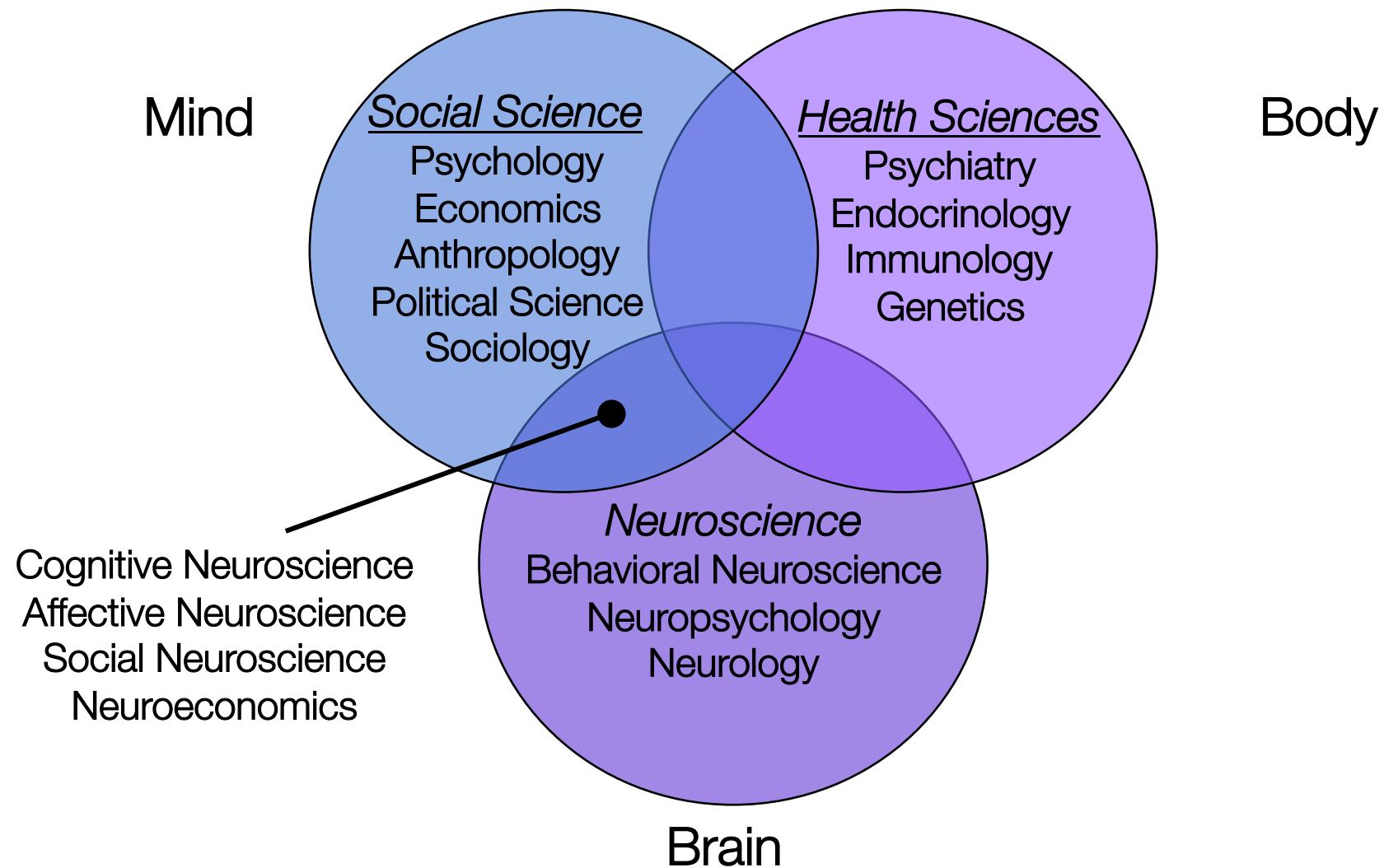
Body



Brain

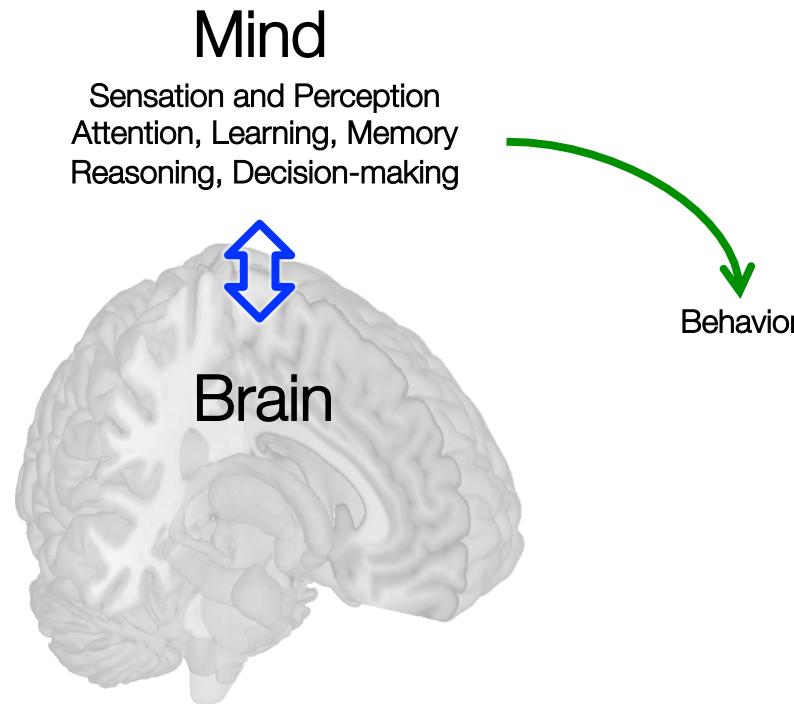


Multidisciplinary Science



MRI and Cognitive Science:

Biological bases of mental representation



Brain representation:
Physical basis for a
mental experience or
information structure

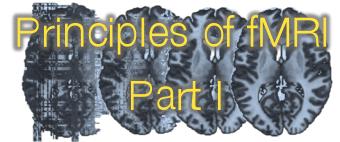
Cognitive science: The interdisciplinary scientific study
of the human mind

Cognitive neuroscience Affective neuroscience Decision neuroscience Social neuroscience



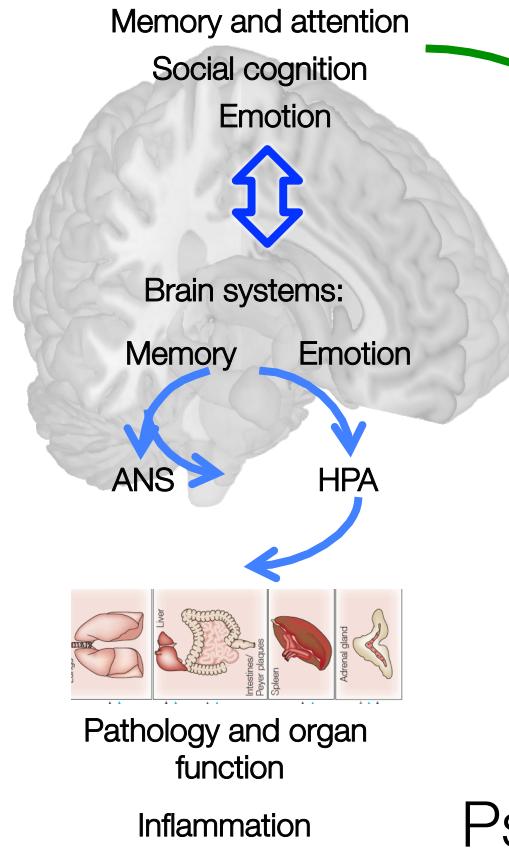
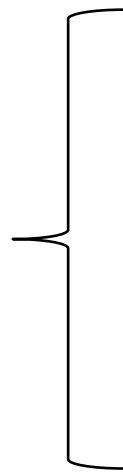
MRI and Health Neuroscience:

Mind, brain, body, and health



Mental health
Psychology
Psychiatry

Brain health
Neurology
Biol. psychiatry



Cognitive neuroscience (and related)

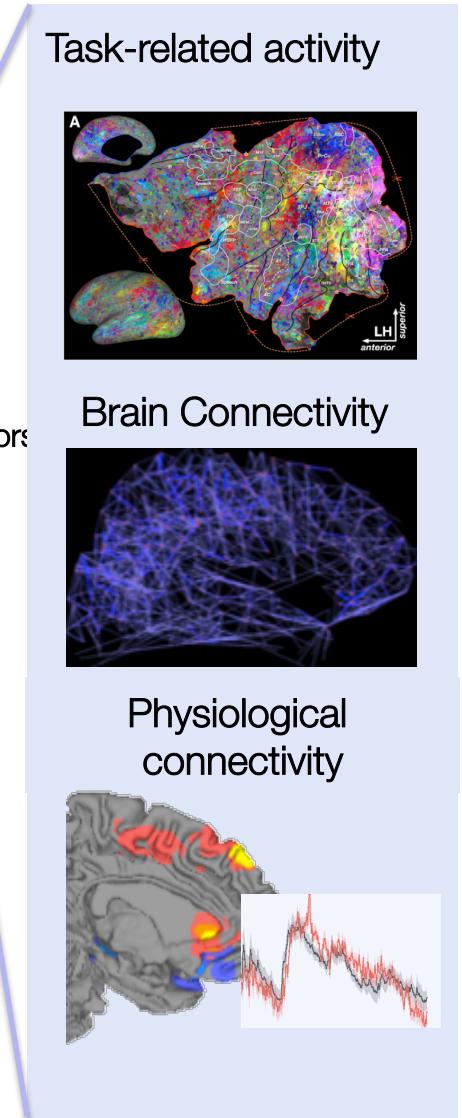
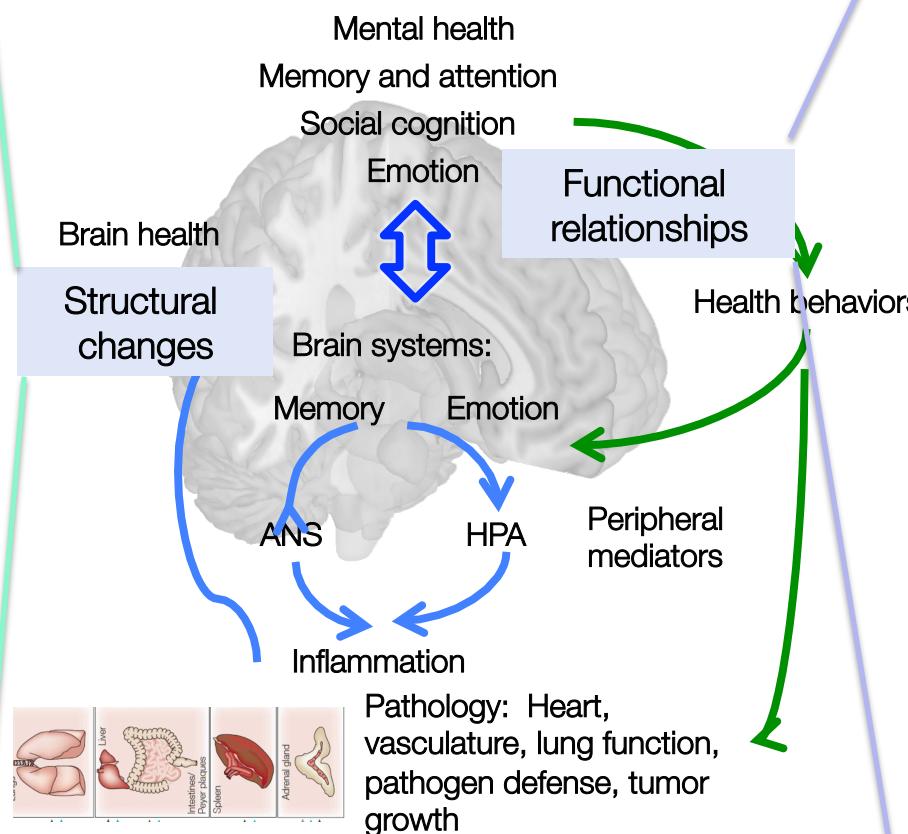
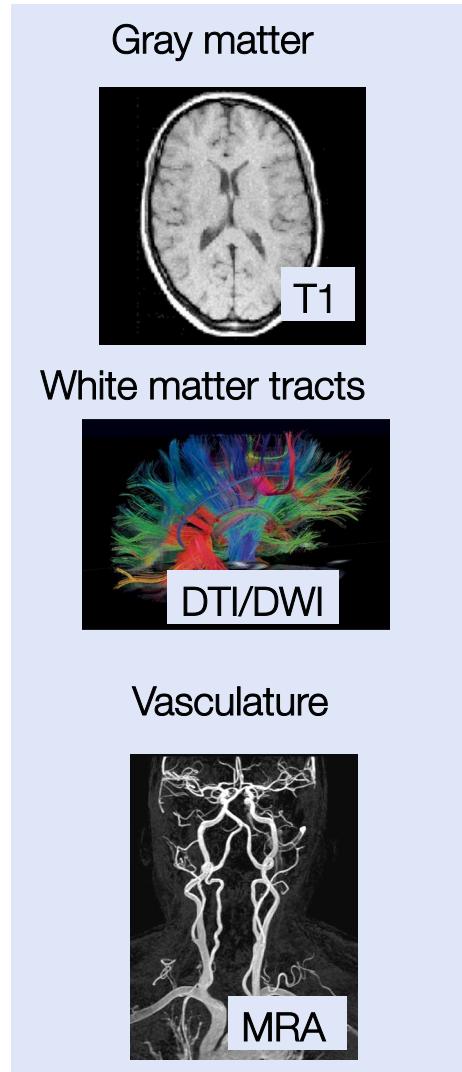
Psychophysiology
Stress science

Health neuroscience
Neuroimmunology
Psychoneuroimmunology
Microbiome: Brain-gut

ANS: Autonomic nervous system
HPA: Hypothalamic-pituitary axis



MRI: Multiple Measures



A Multidisciplinary Community

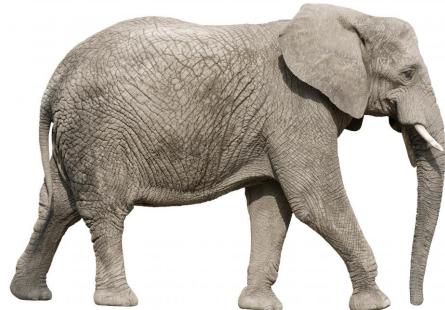
Psychologists

Statisticians

Physicists

Computer scientists

Neuroscientists



Engineers

Behavioral scientists

Clinicians

Philosophers

Public health

Biologists

- Need experts in each discipline working together
- Need individuals with multiple types of expertise



Introduction to MRI:

IMAGE BASICS

Brain Imaging

- Brain imaging can be separated into two major categories:
 - Structural brain imaging
 - Functional brain imaging
- There exist a number of different modalities for performing each category.

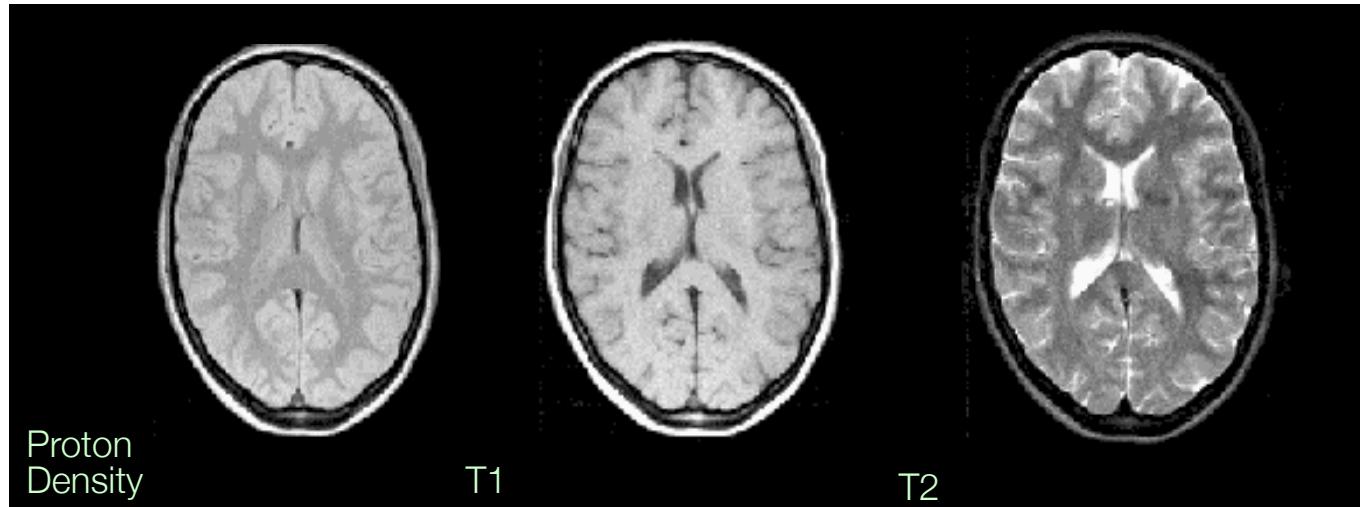


Structural Brain Imaging

- Structural brain imaging deals with the study of brain structure and the diagnosis of disease and injury.
- Modalities include:
 - computed axial tomography (CAT),
 - magnetic resonance imaging (MRI), and
 - positron emission tomography (PET).



MRI

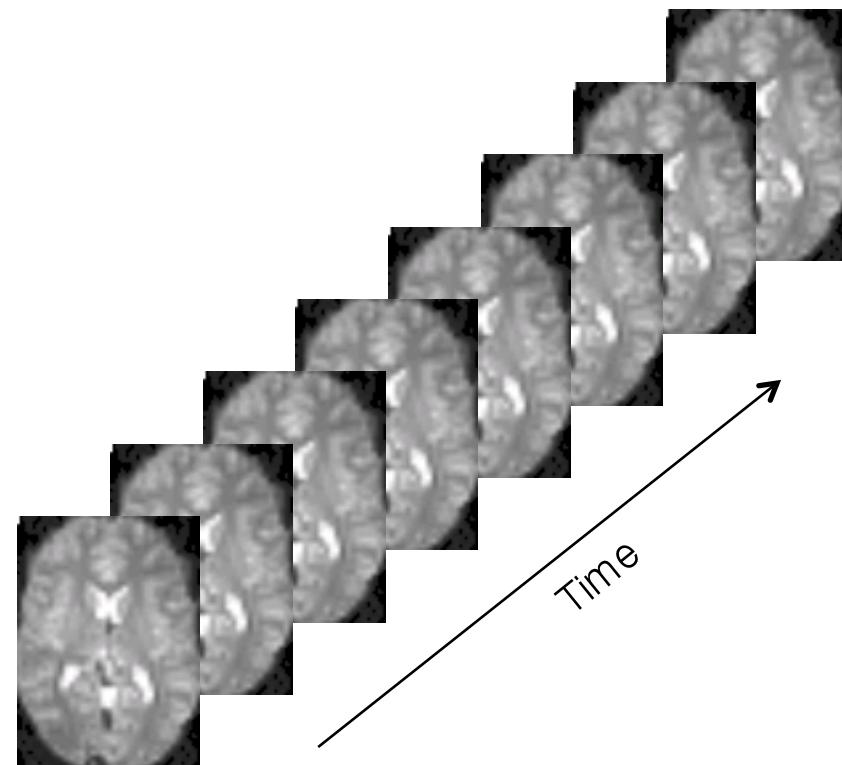


Functional Brain Imaging

- Functional brain imaging can be used to study both cognitive and affective processes.
- Modalities include:
 - positron emission tomography (PET),
 - functional magnetic resonance imaging (fMRI),
 - electroencephalography (EEG), and
 - magnetoencephalography (MEG).



fMRI

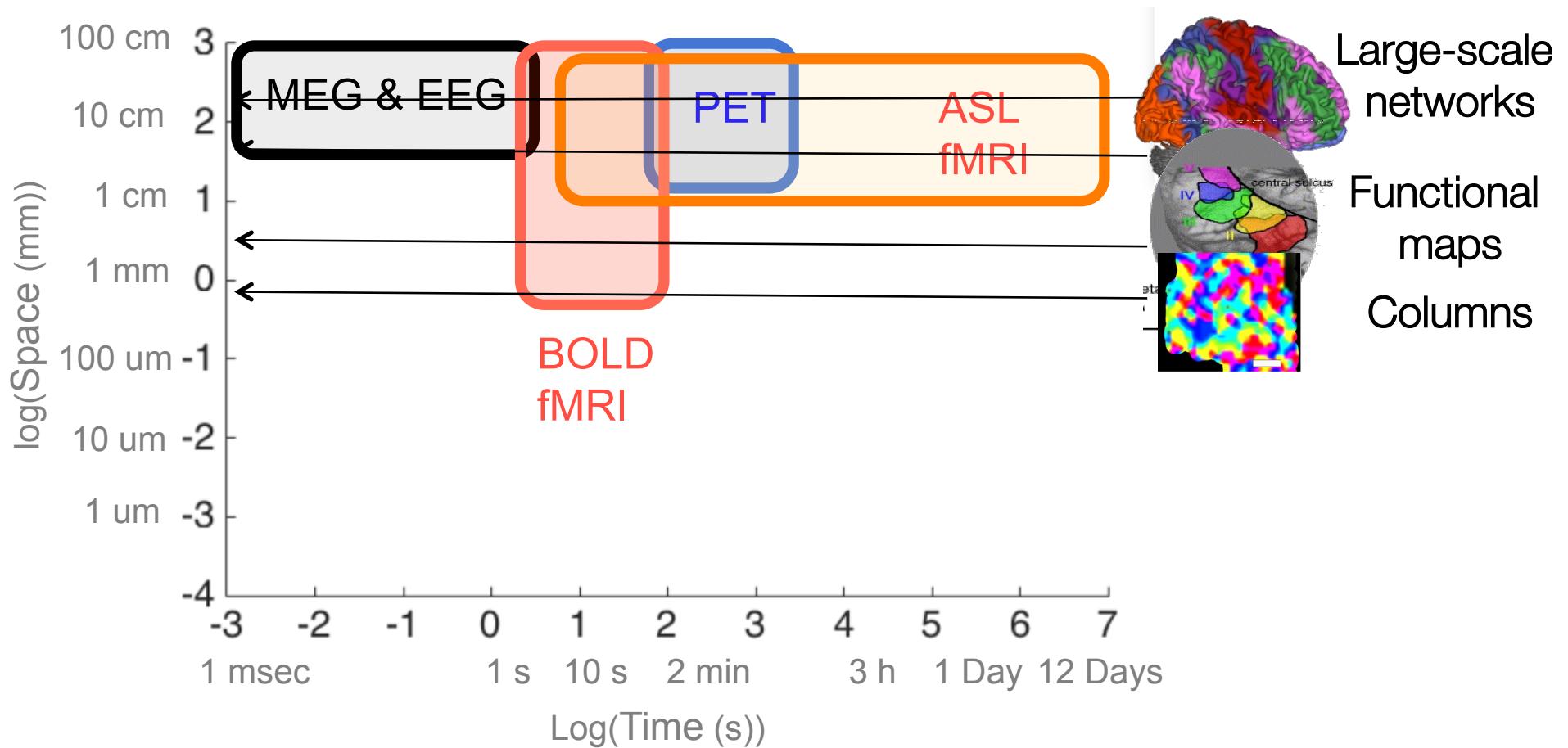


Properties

- Each functional imaging modality provides a different type of measurement of the brain.
- They also have their own pros and cons with regards to spatial resolution, temporal resolution and invasiveness.
- Functional MRI provides a nice balance between these properties and has become the dominant functional imaging modality in the past decade.



Human neuroimaging



End of Module



@fMRIstats

Brain Imaging

- In recent years there has been explosive interest in using imaging techniques to explore the inner workings of the human brain.
- Brain imaging data has found applications in a wide variety of fields, such as psychology, economics, political science, and statistics.
- In addition, it is central to several emerging fields, such as cognitive neuroscience, affective neuroscience, neuroeconomics, and more.