Basic Principles of Brain Imaging

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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
The figure illustrates the membrane potential over time, with three distinct phases:

1. **Depolarization phase**
2. **Repolarization phase**
3. **Undershoot**

The graph shows the membrane potential (in mV) on the y-axis and time (in msec) on the x-axis. The threshold is indicated by a dotted line, and the resting potential is shown as a horizontal line below the threshold.
Seeing the invisible in vivo
Ogawa et al: BOLD contrast imaging

EEG widely available
Basic principle of tomographic imaging
Means for contrast in images
[11C] carfentanil
MOR tracer

[11C] MADAM
SERT tracer

[11C] raclopride
D2R tracer
T1-weighting

T2-weighting

T2*-weighting (EPI)

1 mm isotropic voxel

1 mm isotropic voxel

3 mm isotropic voxel
ARE THESE BRAINS STATISTICALLY DIFFERENT?

CONTROLS

PATIENTS
...but that's a different story altogether