Lecture 1

What is cognitive neuroscience?

A new(ish) area of science that aims to understand how thought (cognition) emerges from the brain (neuroscience).

This is a hard problem.

What questions do we ask in CN?

- How does brain activity lead to behavior?
- How should the brain be divided **anatomically**?
- How should the brain be divided **functionally**?
- How does the brain compute?
- How does the brain represent information?
- How does your brain function as a **dynamical system**?
- How does your brain change during attention and learning?
- How does your brain function change during injury or disease?
- How can we decode the brain, or insert new information?

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The brain is difficult to access
It is hard to measure brain activity
Principles of brain function are mysterious
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Historial questions about brain function

- Is the brain somehow special or different from all other organs in the body?
- Is intellect, memory and sensation located in the heart, the ventricles of the brain? or in the brain matter itself?
- What are the functional differences between the gross anatomical divisions of the brain?
- Is cortex divided into separate component parts or is it just one huge bowl of murky soup?

Origins of CN

- Babylonian and Egyptian physicians made detailed observations of various neurological and psychiatric conditions.
- Babylonians distinguished between various types of epilepsy
- However, they thought epilepsy was caused by demonic possession
- Egyptians understood that brain injury could cause loss of function far from site of injury or on the opposite site of the body
- They understood contre-coup injuries

- However, they thought that the heart was the seat of intellect

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Check: Geoff Hinton: Back propagation learning rule
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Current controversies in CN

- Which cognitive functions are localized versus distributed?
- Does each brain area carry out only a single function, or can one area perform multiple functions?
- Can cognitive functions be decomposed into constituent subunits, or do the subunits interact?
- What do large-scale brain correlations tell us about function?
- How does attention and learning change brain organization and function
- How misleading are current