

The brain

A 2-hour crash course

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Overview

- Objective
 - By the end of this session, you should understand basic facts about the brain which will help you understand the methods used in the literature (next week's lecture).
- To do that, you need to be able to
 - Marvel at its complexity
 - Understand how we've come to the knowledge we have
 - Understand its basic anatomy and properties
 - Develop a healthy dose of neuroscepticism

Before we start

- Any exciting findings this week?

Time to marvel

- Can I pick up this pen by the power of my mind?
- The mind-body issue:
 - The soul / mind is immaterial
 - The body is material
 - How do they interact??



Time to marvel

- Vision
 - Picking out variations in light
 - Assemble into patterns
 - Know what patterns signal danger

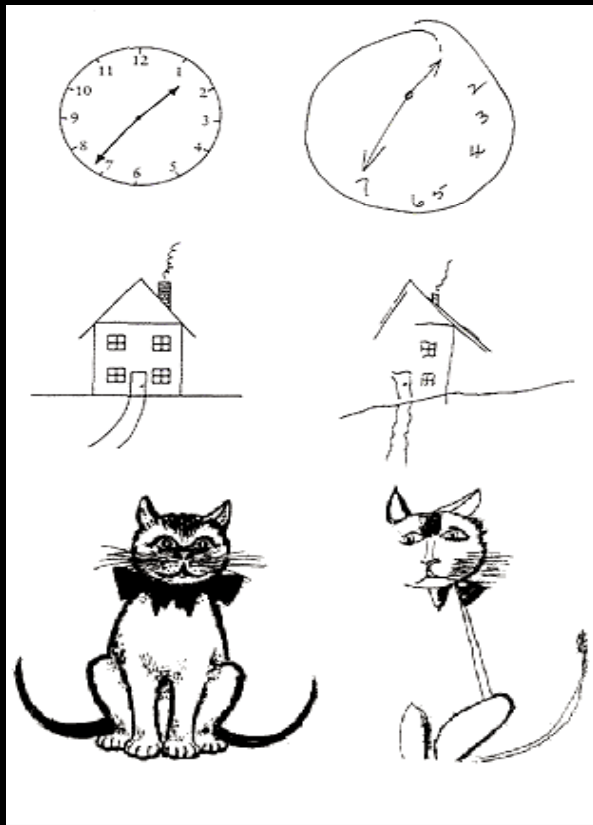


Time to marvel

- Human conversation
 - Thoughts in my head
 - Structured into words and sentences
 - Motor control to produce variations in air pressure
 - Variations hit ear-drum
 - Brain encodes variations as noise
 - Encodes noise into words
 - Words into sentences
- Message transferred

Time to marvel

- Consciousness – awareness without awareness?
 - Hemi neglect



Time to marvel

- Just think about it...

<http://www.youtube.com/watch?v=7foGE-T6d34>

We've come a long way

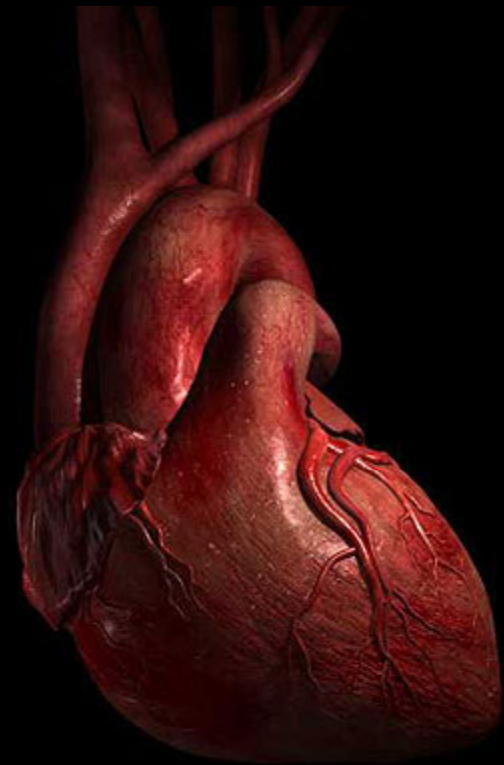
- The aim of Neuropsychology
 - To understand the operation of psychological processes in relation to brain structures
(Stirling and Elliott, 2008, p.3)
- A fascination since 3000 BC
 - Surgical papyrus found in Egypt in 1862
 - First evidence of brain considered as behaviour control centre
- Ups and downs in the “brain hypothesis” since then!

We've come a long way

- Brain or heart?



- Egyptian surgeon (3000BC)
- Hippocrates & Plato (400 BC)
- Galen (1st c. AD) observation of brain injured gladiators



- Aristotle (350 BC)
- Galen dismissed “heart hypothesis”

We've come a long way

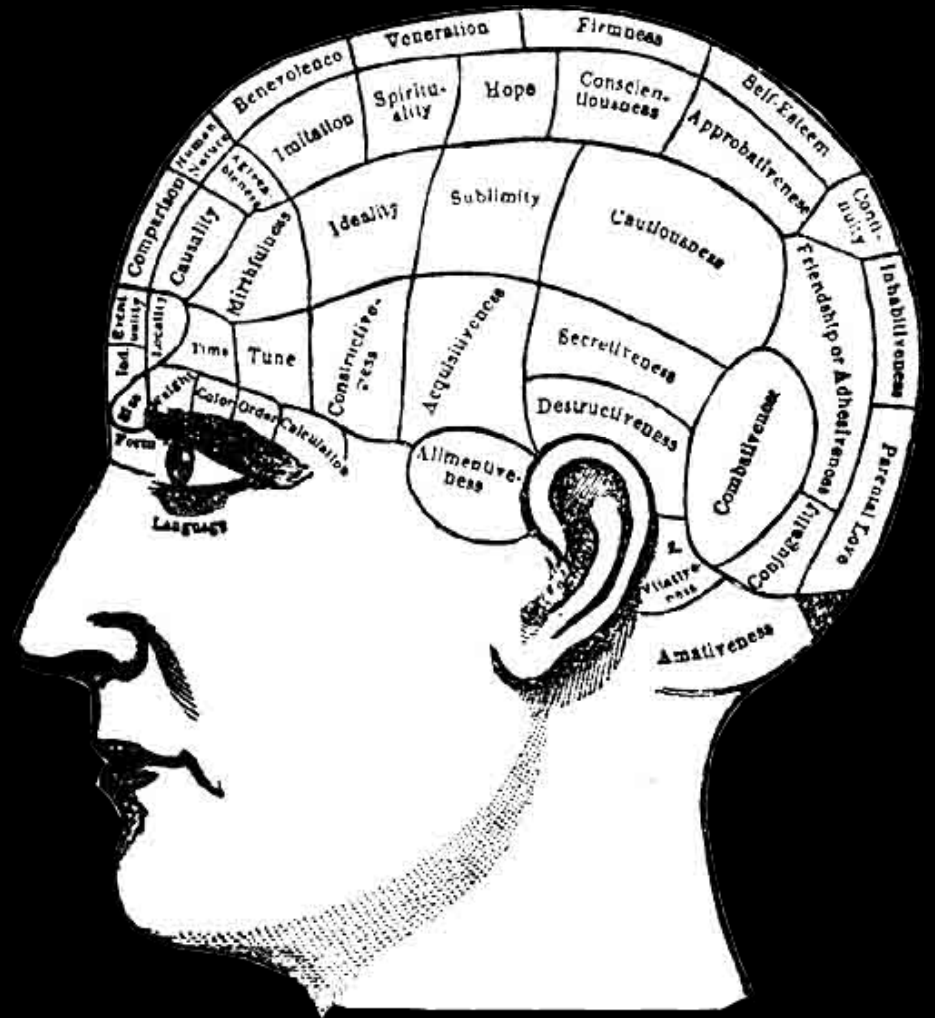
- The next 1500 years: soul searching
 - Pineal gland and corpus callosum?
 - Obvious structures
 - Role: bodily rhythms, hormones and connection between hemispheres of the brain
- A return to the study of the brain in 15th and 16th c.
 - Descartes: mind-body problem solved by pineal gland?

We've come a long way

- Gull and Spurzheim (early 19th c.)
 - Interested in localisation of function within the cortex
 - Documented gyri and sulci
 - Brain connected to spinal chord
 - Brain's ability to control muscles
 - Grey matter / White matter (cell bodies / axons)
 - Described first case of aphasia (language impairment)
- One bad idea: Phrenology

We've come a long way

- Phrenology
 - Bumps show which areas are more developed
 - Murderers, cautious people, parental love, self-esteem...
 - Shape of skull?!



We've come a long way

- Aggregate field theory
 - Flourens (1824): Lesion studies on birds
 - Extent of impairment due to size not location of lesion
 - *Mass action*: Whole brain works together
 - *Equipotentiality*: each cortical region can assume control for any given behaviour
 - Undamaged areas make up for lesions in damaged ones
- “We only use a small proportion of our brains” – **Myth!**
- But what about this...?

http://www.youtube.com/watch?v=FMR_TomM7Pc

We've come a long way

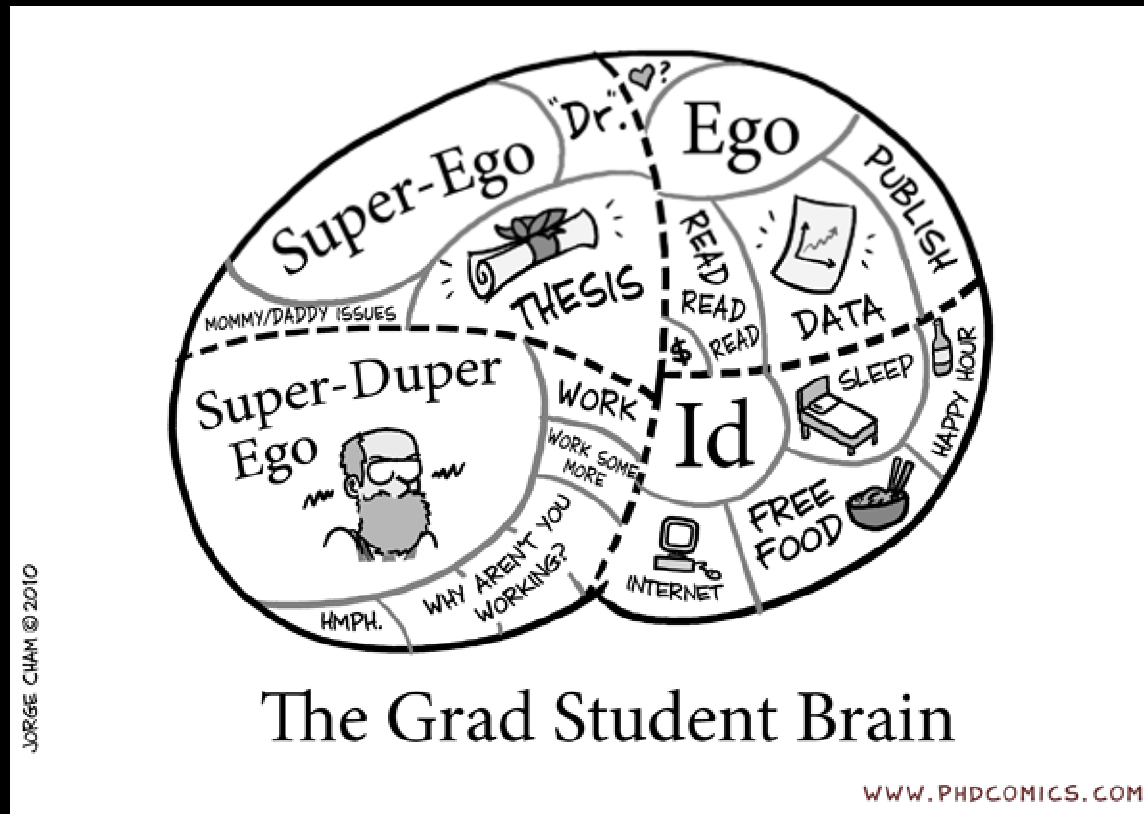
- TMS (more on this next week) stops a part of the brain from working → affects specific functions in specific areas
- New interest in localisation in 19th and early 20th c.:
Aphasia (language impaired, other functions fine)
 - Famous patient: “Tan” → Broca’s area
 - Other patients, fluent but nonsense → Wernicke’s area
 - Others couldn’t connect what they heard with any meaning.... → Lots of areas underpin language!

We've come a long way

- Current view
 - “The brain coordinates mental processes through the collaboration of (and interconnections between) multiple brain regions” (S & E, 2008, p.13)
- Deficits?
 - Damage of specialised cortical function
 - Damage to connecting pathways
 - Both

We've come a long way

- Break time!



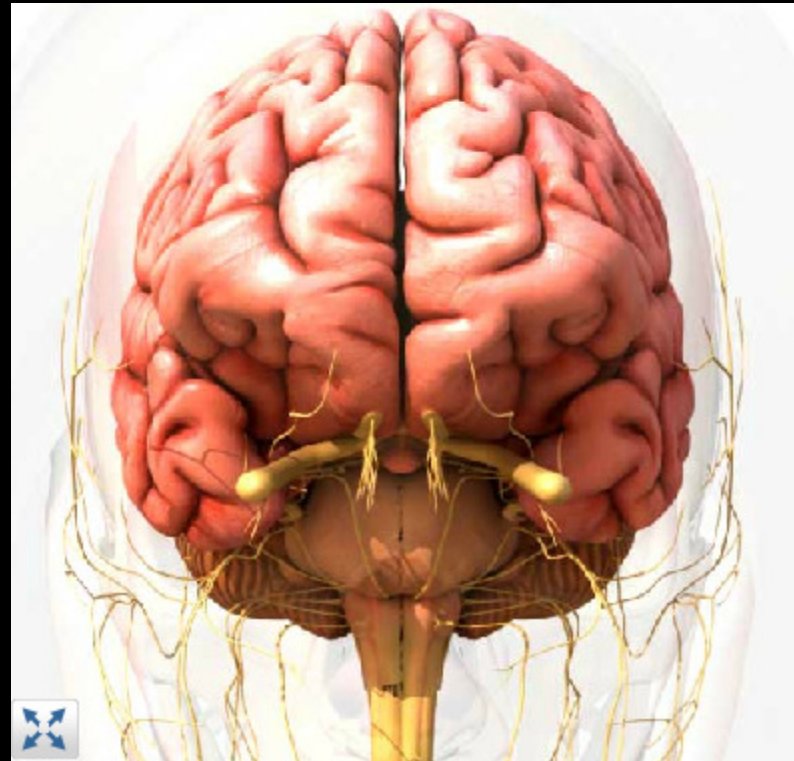
What is it made of?



- <http://www.healthline.com/human-body-maps/brain>

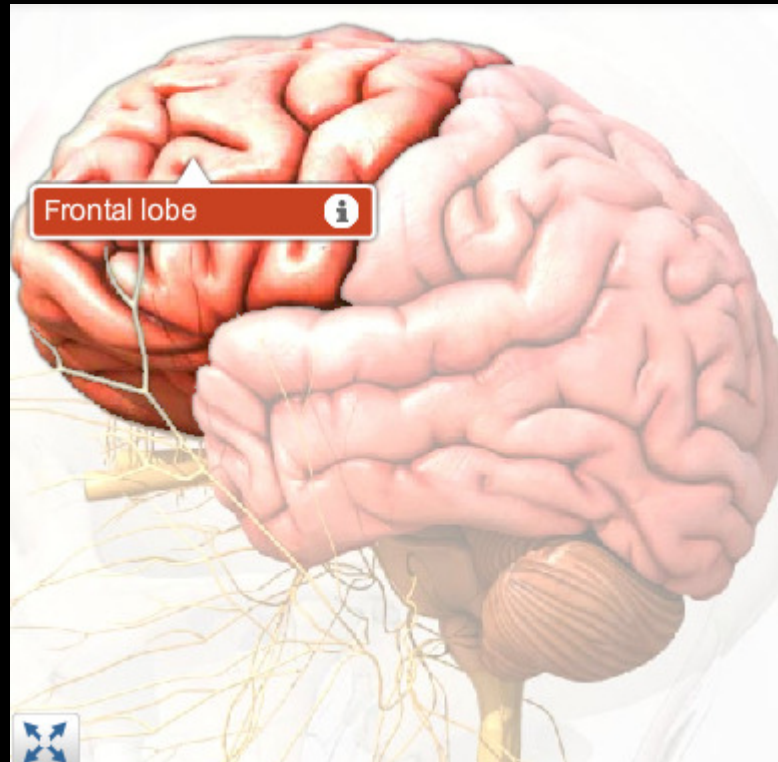
What's it made of?

- **The Cortex:** two hemispheres linked by the Corpus Callosum
- Anterior / Posterior = front / back
- Right / Left from point of view of person whose brain it is



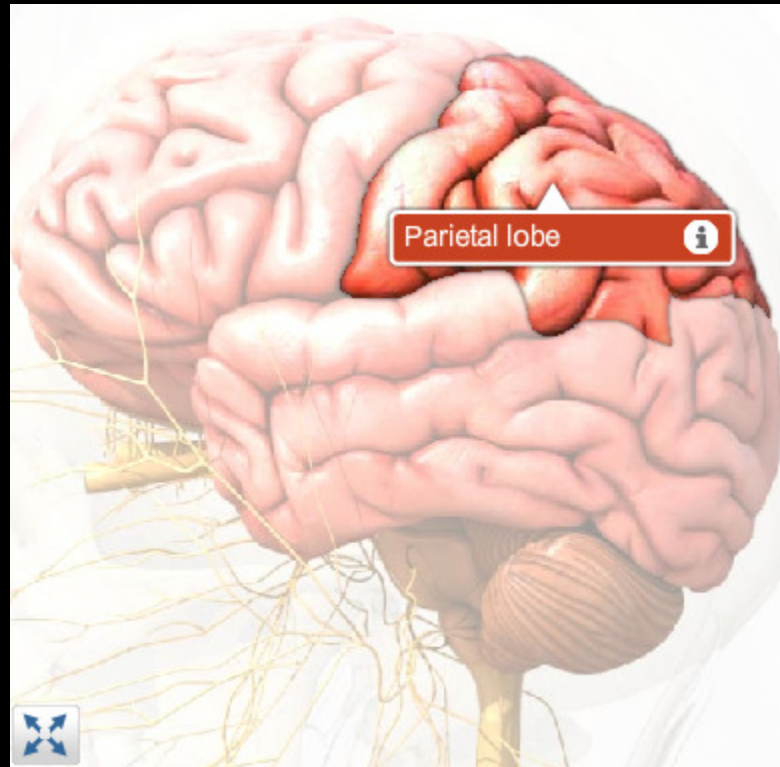
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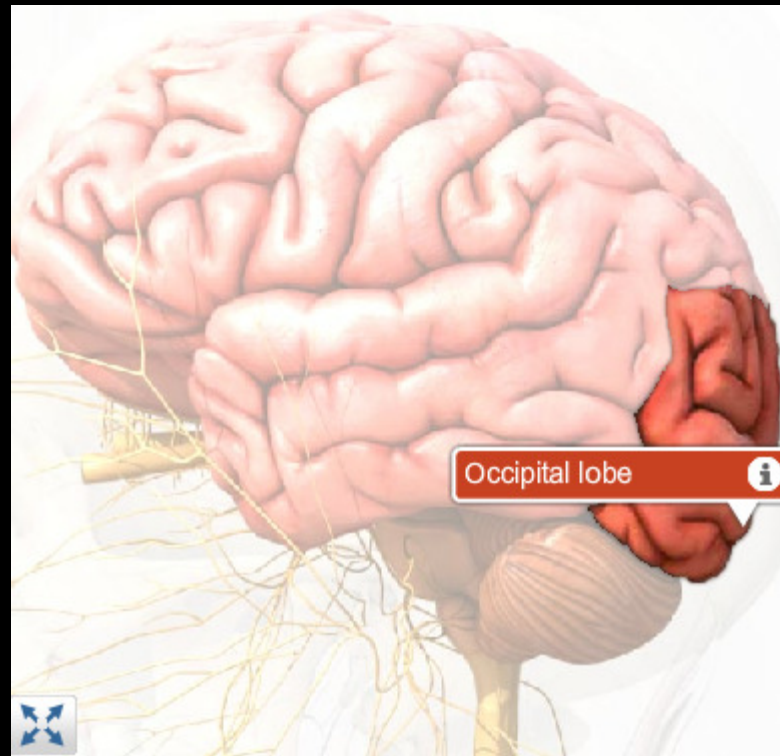
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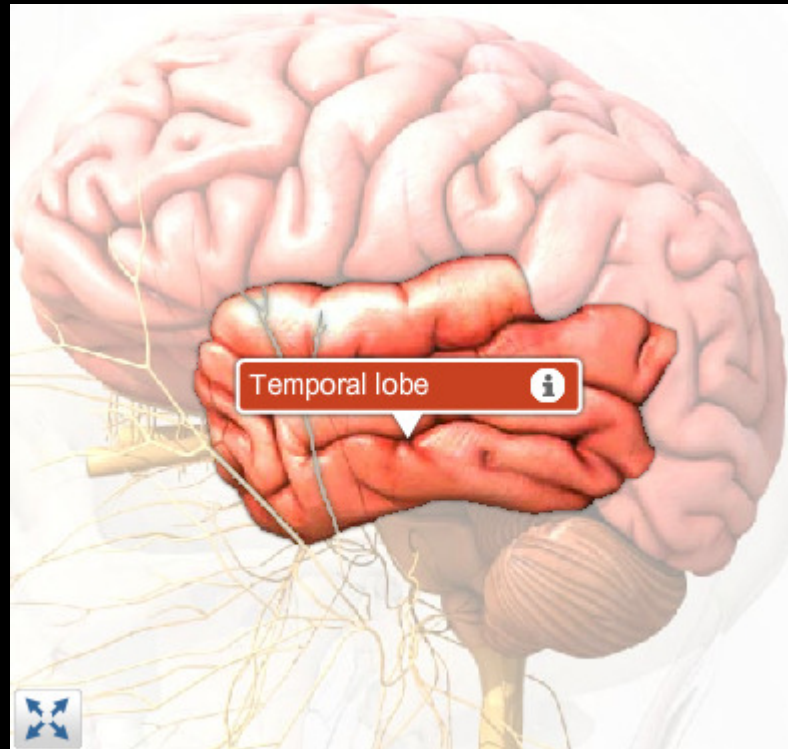
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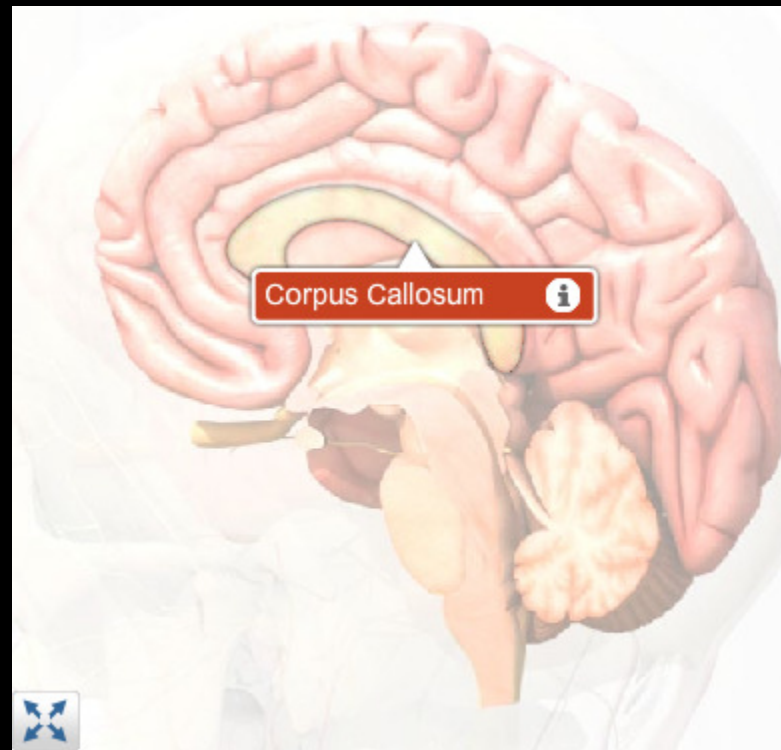
What's it made of?

- **The Cortex:** two hemispheres linked by the Corpus Callosum



What's it made of?

- Corpus Callosum (links the two hemispheres of the Cortex)



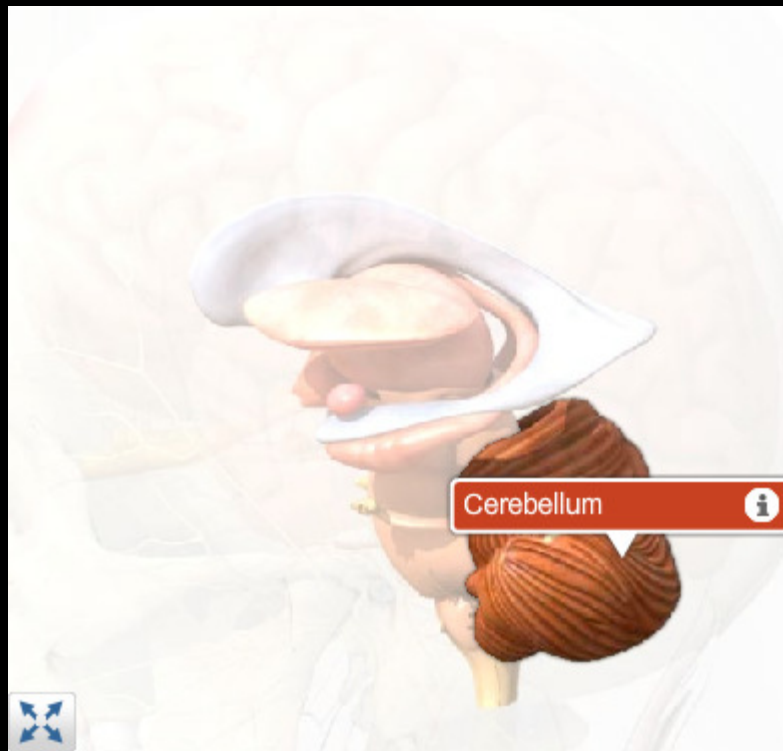
What's it made of?

- Under the Cortex... The “Lymbic system”
 - Hormones, autonomic nervous system, bodily rhythms, arousal, long term memory, emotions...



What's it made of?

- Cerebellum
 - Motor control and motor learning



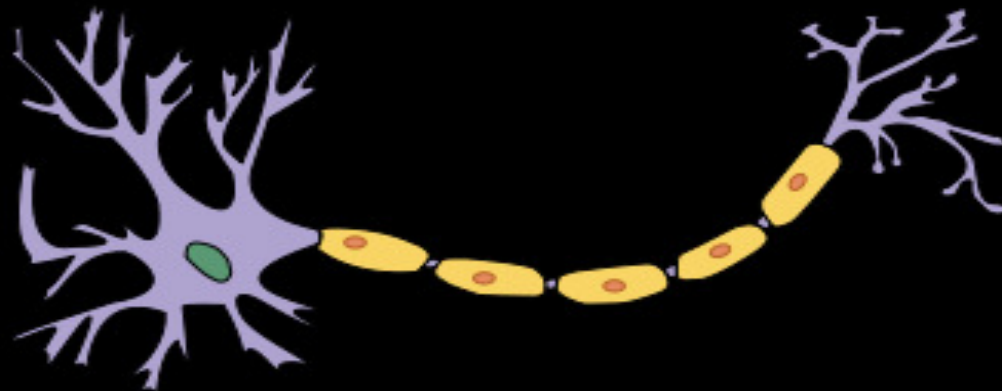
What's it made of?



<http://gregadunn.com/comissions.html>

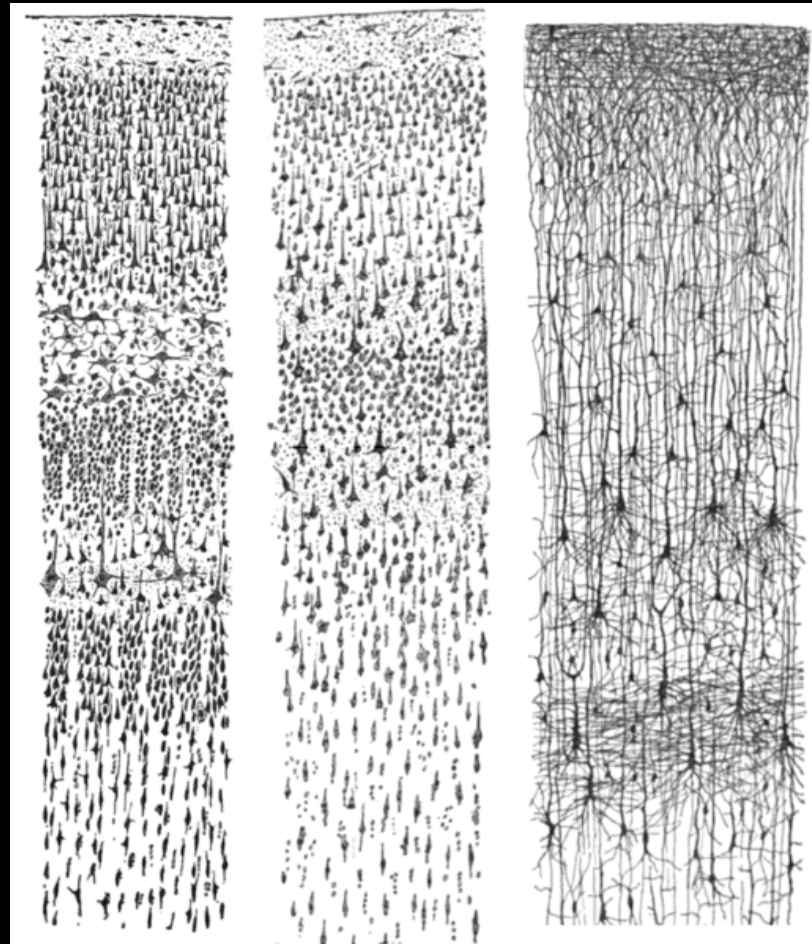
What's it made of?

- Excitable neurons
 - Transmit electricity (change of potential) from one end to the other
 - Transmit this to other neurons via neurotransmitters (chemicals)
 - This happens at the level of the synapse
 - The “white matter” helps the electricity change travel faster



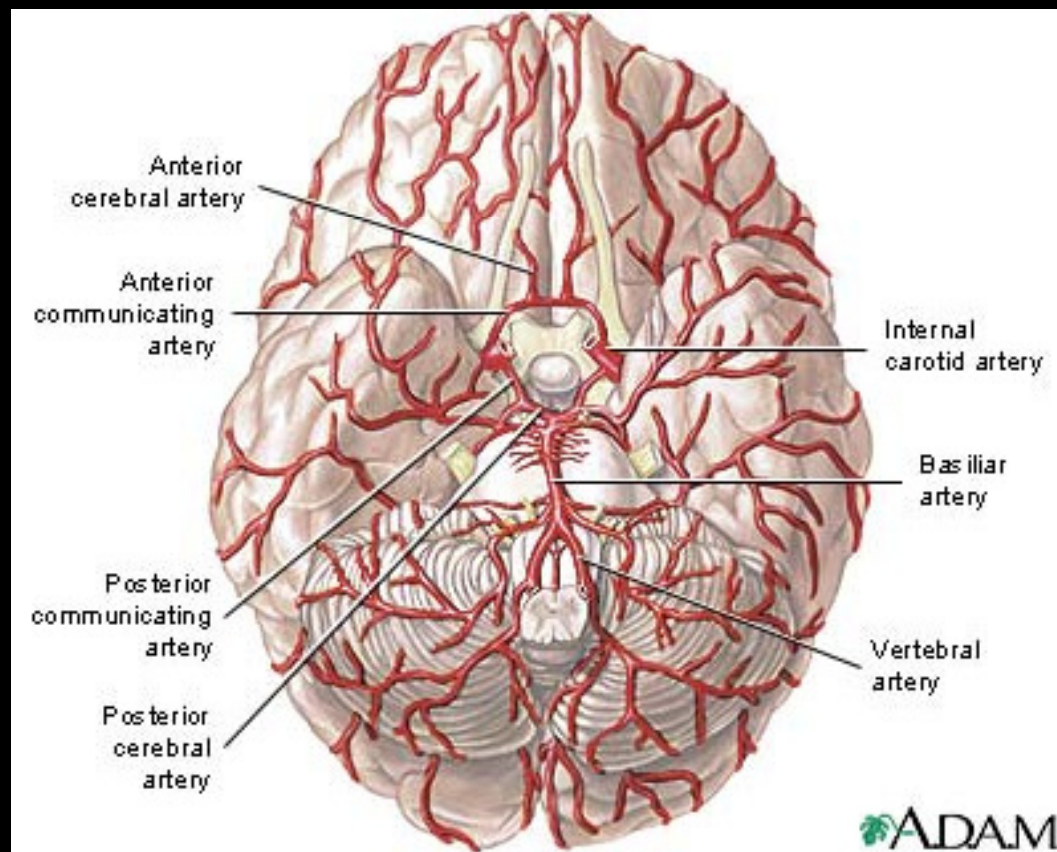
What's it made of?

- Excitable neurons structured in columns



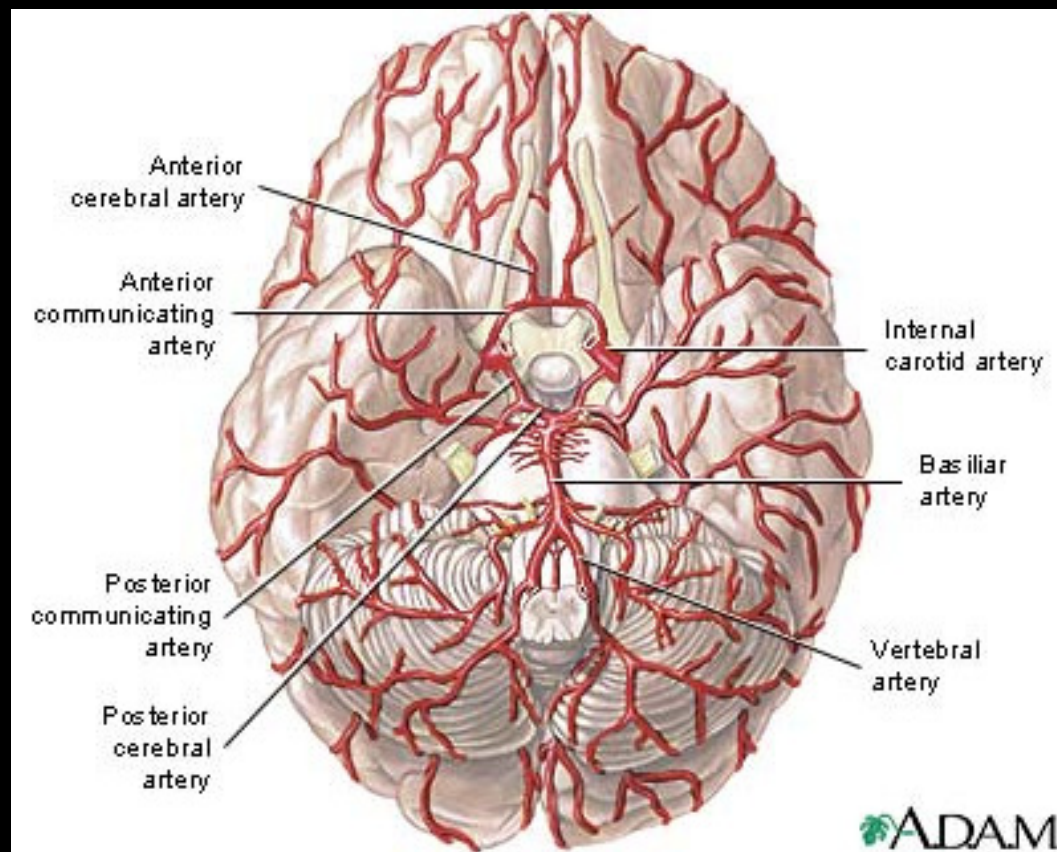
What's it made of?

- Excitable neurons structured in columns, fed by blood glucose



What's it made of?

- Excitable neurons structured in columns, fed by blood glucose, and blood oxygen



What's it made of?

- So many things we could spend years discussing it!
- Best plan: play around with this website:
<http://www.healthline.com/human-body-maps/brain>
- Read peer-reviewed papers about specific functions and their localisation (more on methods next week)
- Don't try to remember it all!

Heading in the right direction?

- What do you make of this?

<http://factlets.info/EyesClosed>

Heading in the right direction?

- Neuromarketing and the new phrenology

The New York Times

The Opinion Pages

WORLD U.S. N.Y. / REGION BUSINESS TECHNOLOGY

OP-ED CONTRIBUTOR

You Love Your iPhone. Literally.

By MARTIN LINDSTROM
Published: September 30, 2011

The two areas in the brain associated with anxiety and disgust — the amygdala and the insula — were especially active when men viewed “Republican.”

A flurry of activation in the insular cortex of the brain, which is associated with feelings of love and compassion.

The New York Times

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OP-ED CONTRIBUTORS

This Is Your Brain on Politics

Published: November 11, 2007

Heading in the right direction?

- You love your iPhone
- “But most striking of all was the flurry of activation in the insular cortex of the brain, which is associated with feelings of love and compassion. The subjects’ brains responded to the sound of their phones as they would respond to the presence or proximity of a girlfriend, boyfriend or family member. In short, the subjects didn’t demonstrate the classic brain-based signs of addiction. *Instead, they loved their iPhones.*”

Heading in the right direction?

- Do brain scans tell us all that much?
- The anterior insula is one of the most highly activated parts of the brain, showing activation in nearly 1/3 of all imaging studies (Yarkoni et al., 2011, Nature Methods)
- Love linked to reward systems more than to insula (Fisher et al., multiple studies!)
- Activations in: speech, language, explicit memory, working memory, reasoning, pain, and listening to emotional music

Heading in the right direction?

- Do brain scans tell us all that much?
- “fMRI study shows music more emotional if listen with eyes closed”
- Best ways to test emotional nature of music: ask participants to provide ratings, look at skin conductance, heart rate... NOT blood flow in specific areas of the brain
- More on this: deevybee.blogspot.com/2011/06/brain-scans-show-that.html

Any questions?

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- Next week: The musical brain...

