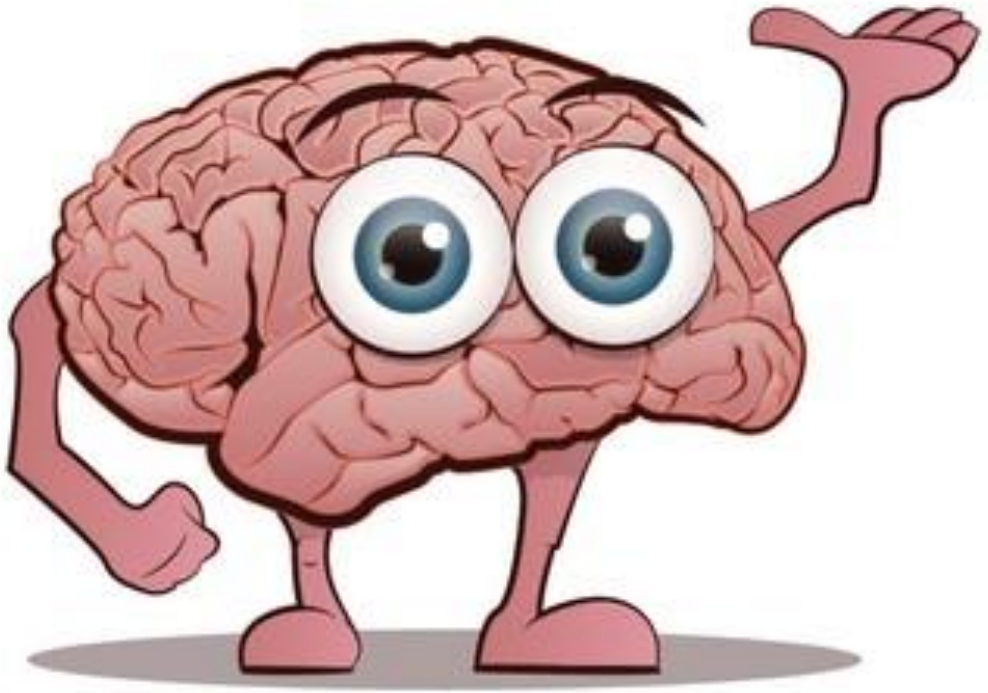

Brain tales

Anna Drabik

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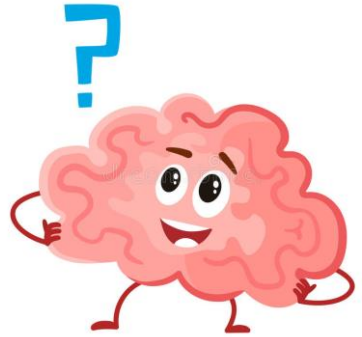
Evaluation conditions



- Time schedule

Lectures:

12.10

19.10

9.11

16.11

23.11

Seminar classes

30.11

7.12

TEST

14.12

October

Su	M	Tu	W	Th	F	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

November

Su	M	Tu	W	Th	F	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

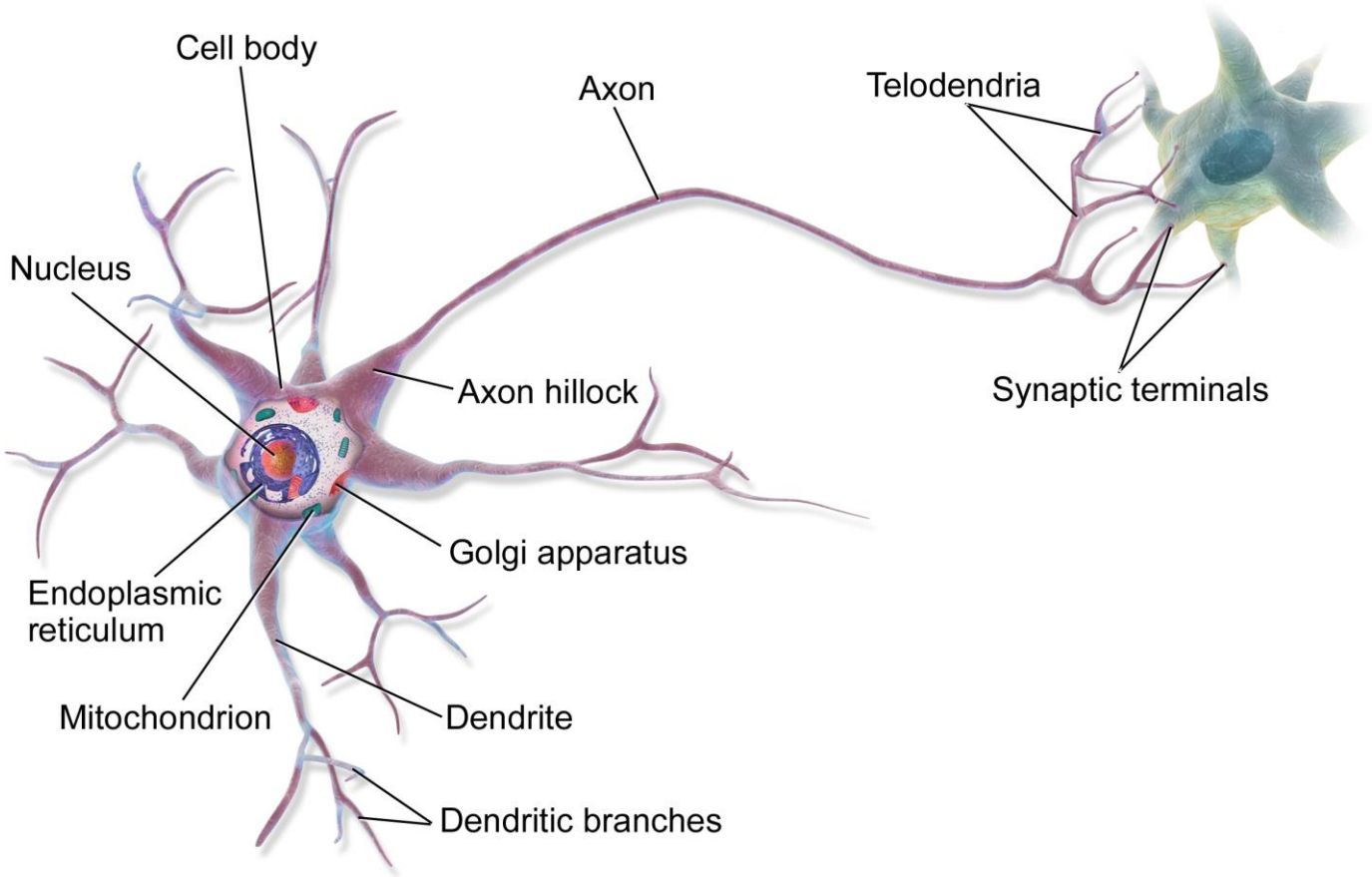
December

Su	M	Tu	W	Th	F	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

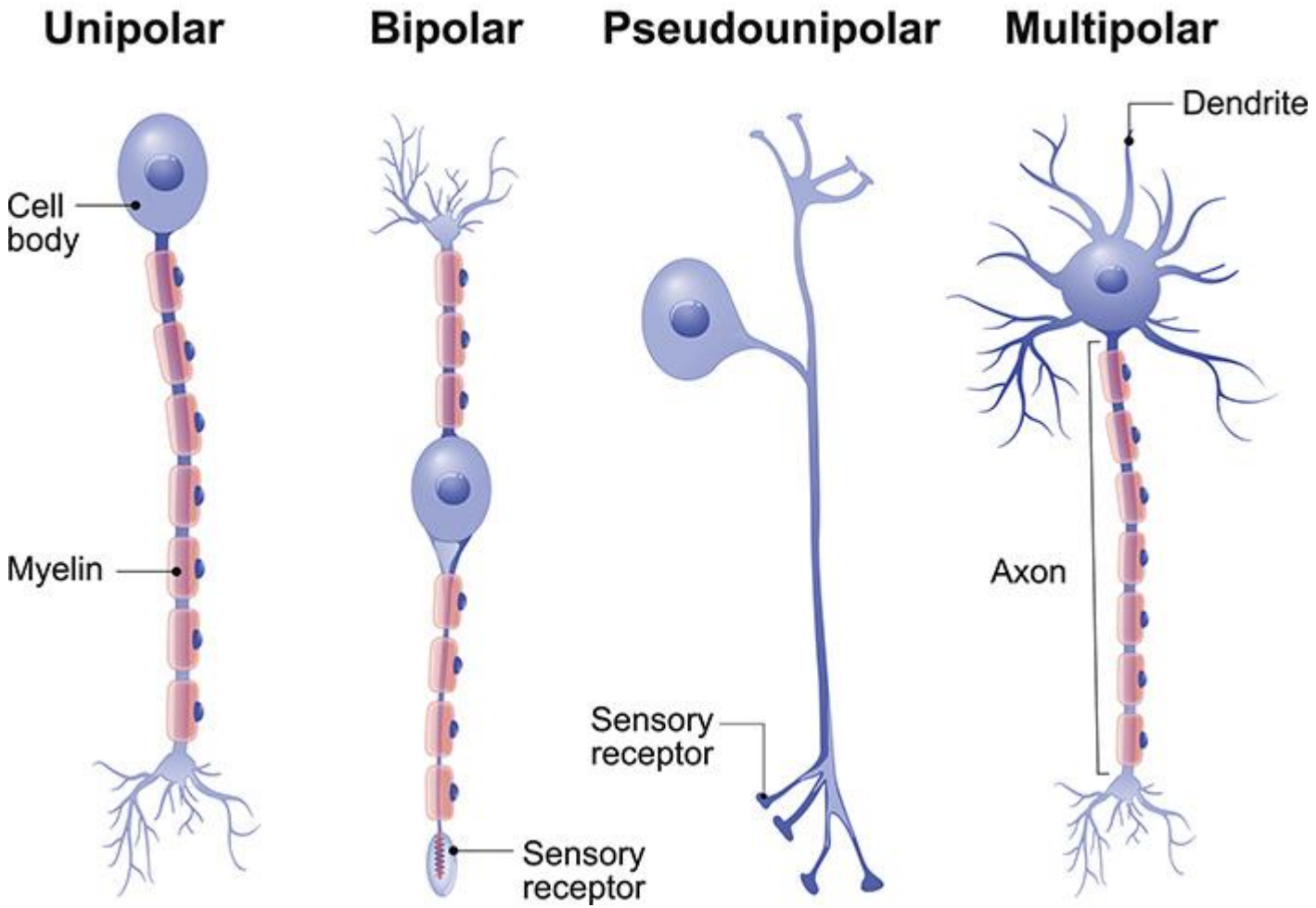
- Presence at seminars
- Evaluation test

- What makes you YOU?
- How do we perceive the world ?
- What is addiction?
- Where are emotions coming from?
- What is consciousness ?
- What goes wrong in neurodegenerative disorders?
- How can we account for all of those mysterious faculties that are so quintessentially human, such as art, language, metaphor, creativity, self-awareness, and even religious sensibilities?

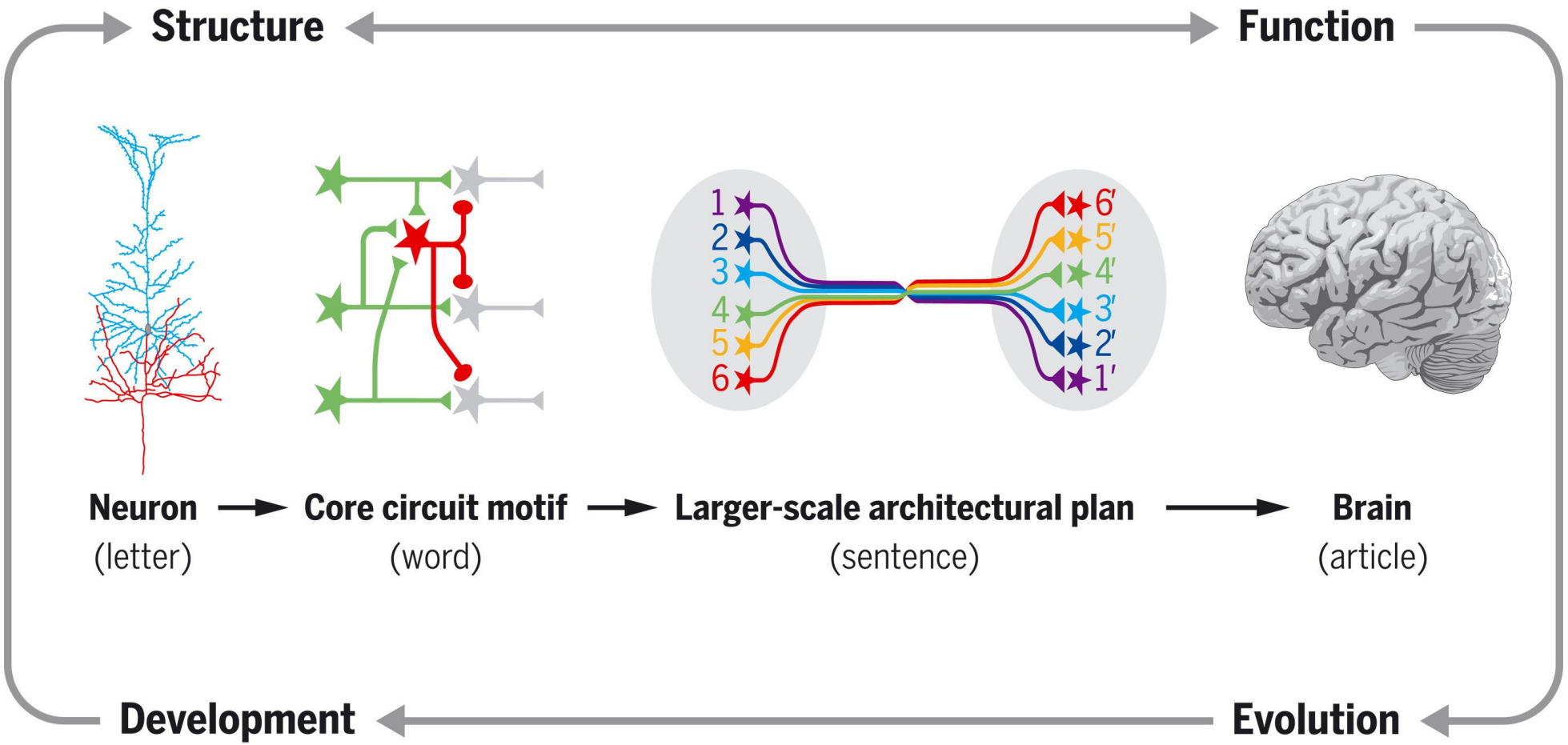
Brain is made of neurons



What makes humans different from worms and other animals?



Special neural circuits

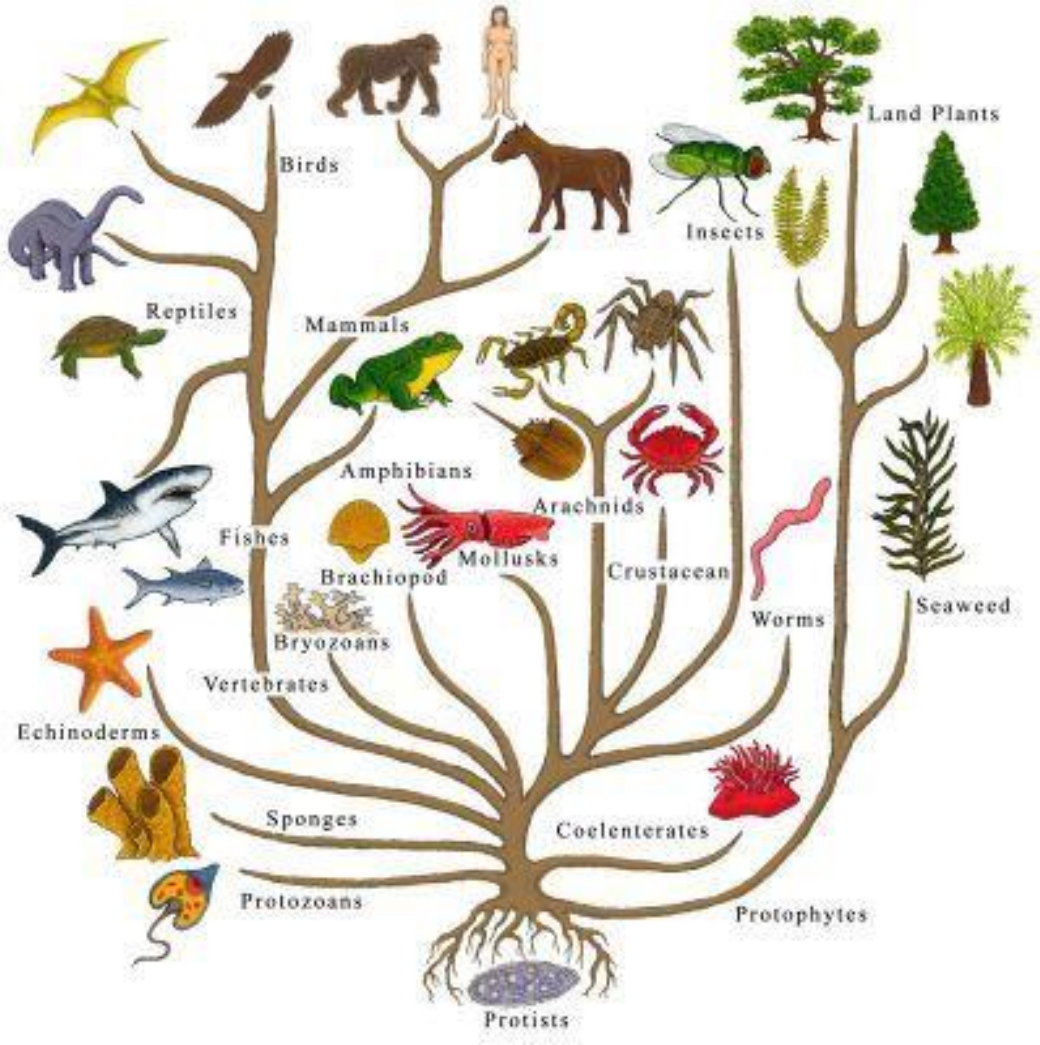


Inteligence

Darwin published his worldshattering treatise on the theory of evolution

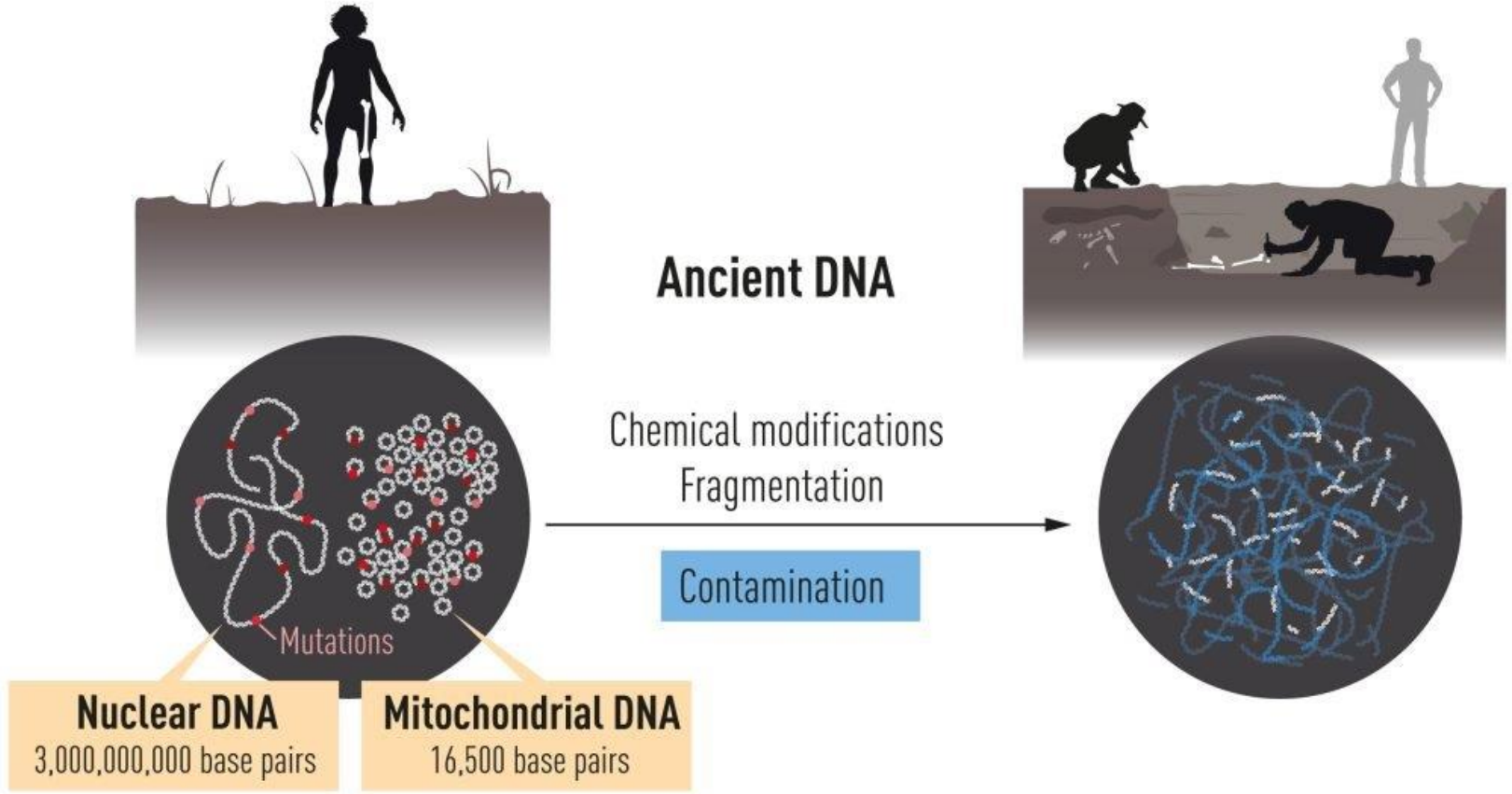
We are anatomically, neurologically, genetically, physiologically apes

We are pulpy, throbbing colonies of tens of trillions of cells?



We are all of these things, but we are not "merely" these things…
something unique, something unprecedented, something transcendent.
We are something truly new under the sun

Nobel Prize

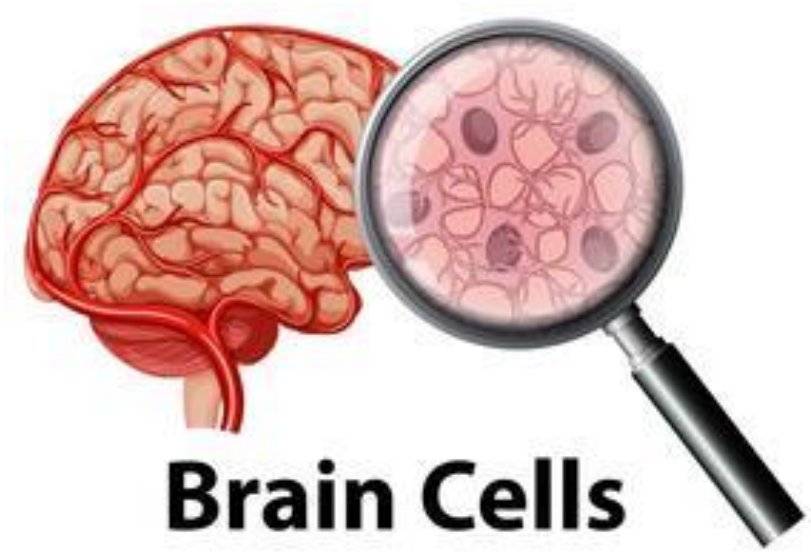


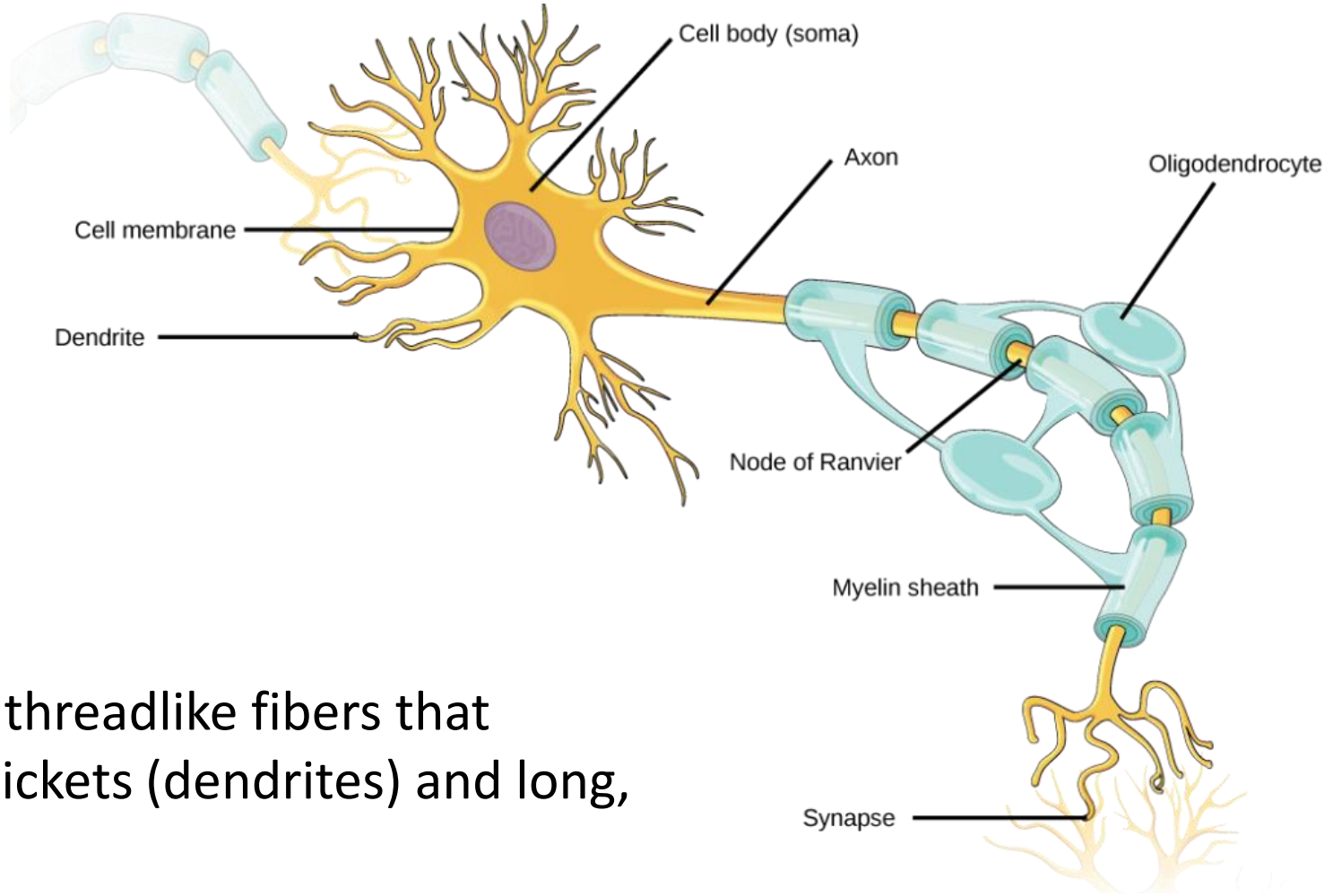
Svante Pääbo [Max Planck Institute in Leipzig, Germany]

for his discoveries concerning the genomes of extinct hominins and human evolution.

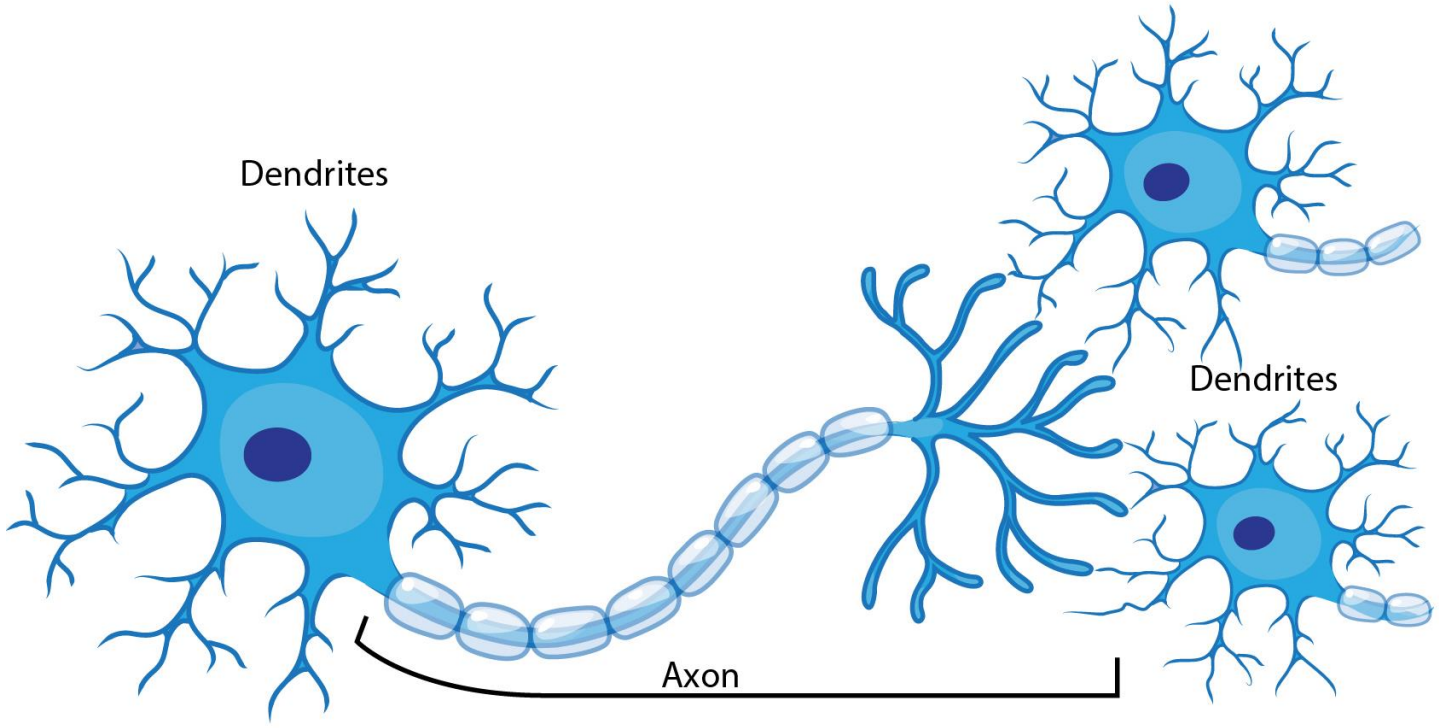
Homo sapiens and Neanderthals thus coexisted in large parts of Eurasia for tens of thousands of years

The human brain is made up of about 100 billion nerve cells, or neurons





Neurons "talk" to each other through threadlike fibers that alternately resemble dense, twiggy thickets (dendrites) and long, sinuous transmission cables (axons).



Each neuron makes from one thousand to ten thousand contacts with other neurons.

These points of contact, called synapses, are where information gets shared between neurons.

Each synapse can be excitatory or inhibitory, and at any given moment can be on or off.

https://www.youtube.com/watch?v=VNNsN9IJkws

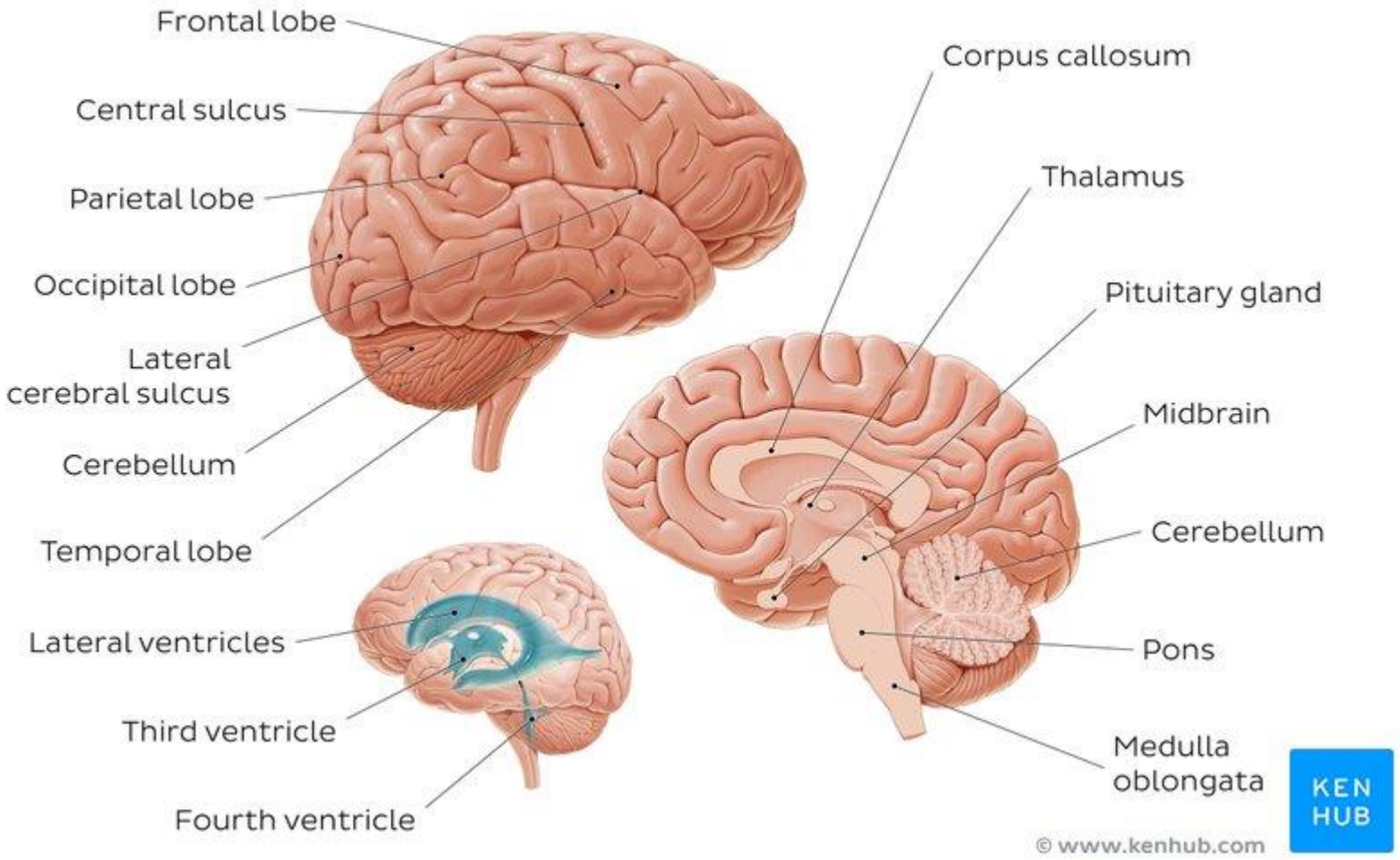
The human brain looks like a walnut made of two mirror-image halves

In humans the cortex has grown so large that it has been forced to become convoluted (folded), giving it its famous cauliflowerlike appearance.

In contrast, the cortex of most other mammals is smooth and flat for the most part.

The brain's many dozens of structures are ultimately all purpose-built networks of neurons, and often have elegant internal organization.

Each of these structures performs some set of discrete (though not always easy to decipher) cognitive or physiological functions



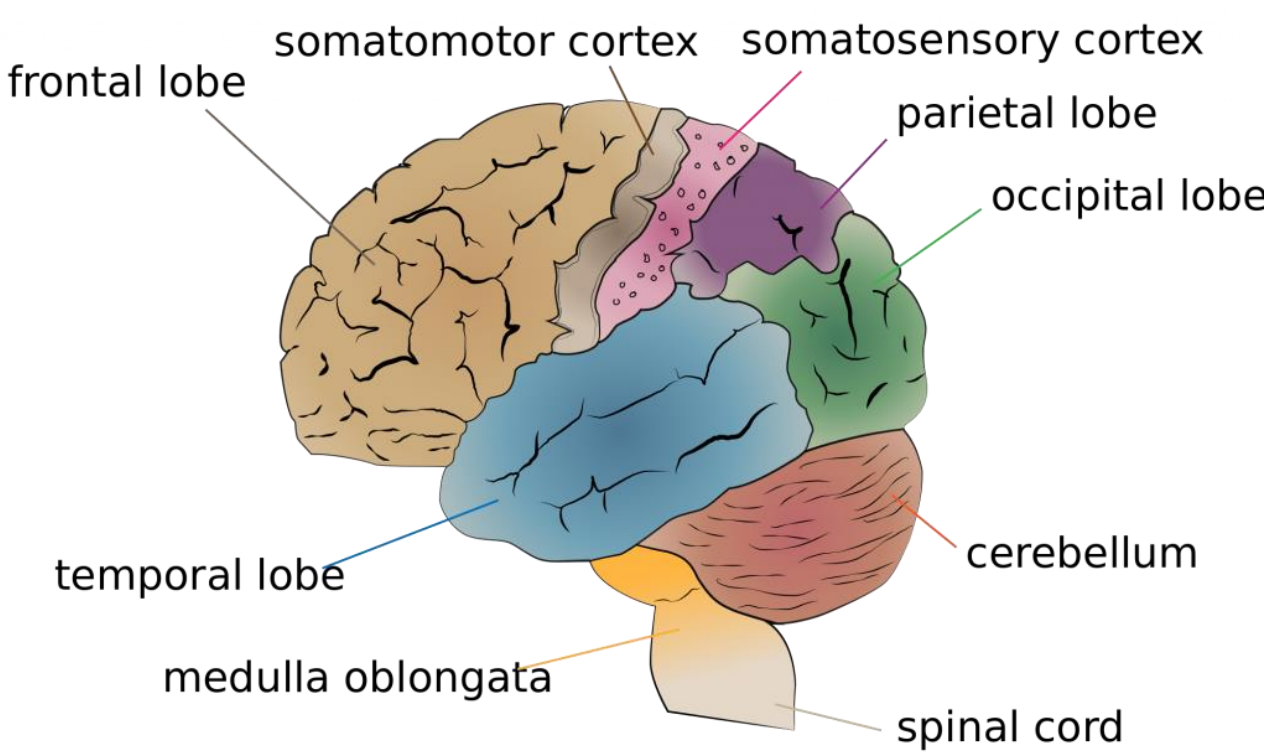
Each cerebral hemisphere is subdivided into four lobes:

occipital,

temporal,

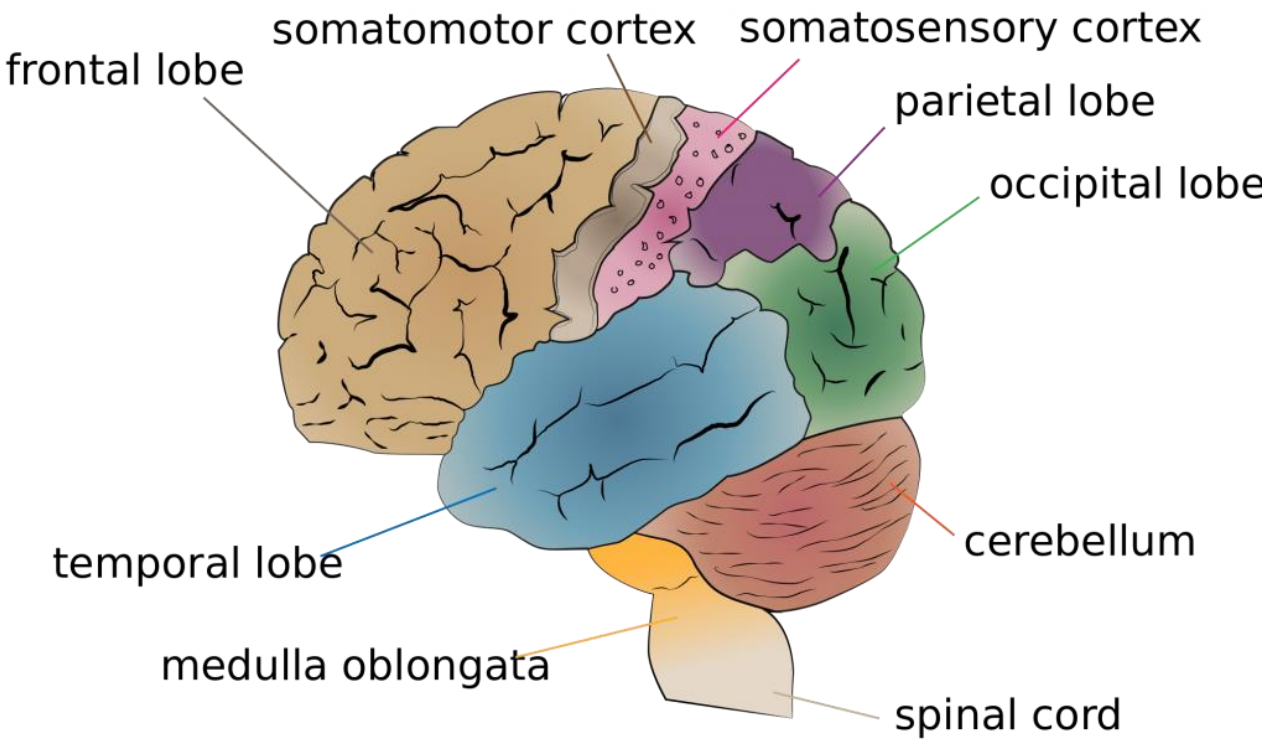
parietal,

and frontal.

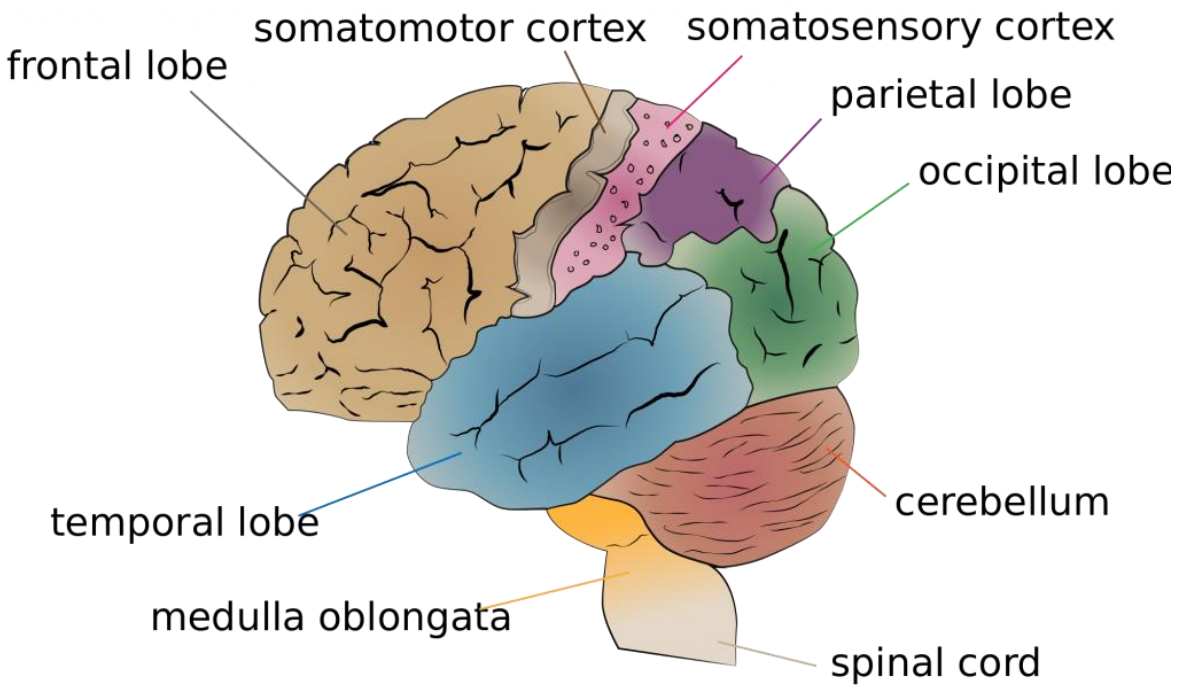


A hemorrhage from even a tiny artery supplying the region of medulla can spell instant death.

Paradoxically, the higher areas of the brain can sustain comparatively massive damage and leave the patient alive and even fit. For example, a large tumor in the frontal lobe might produce barely detectable neurological symptoms.



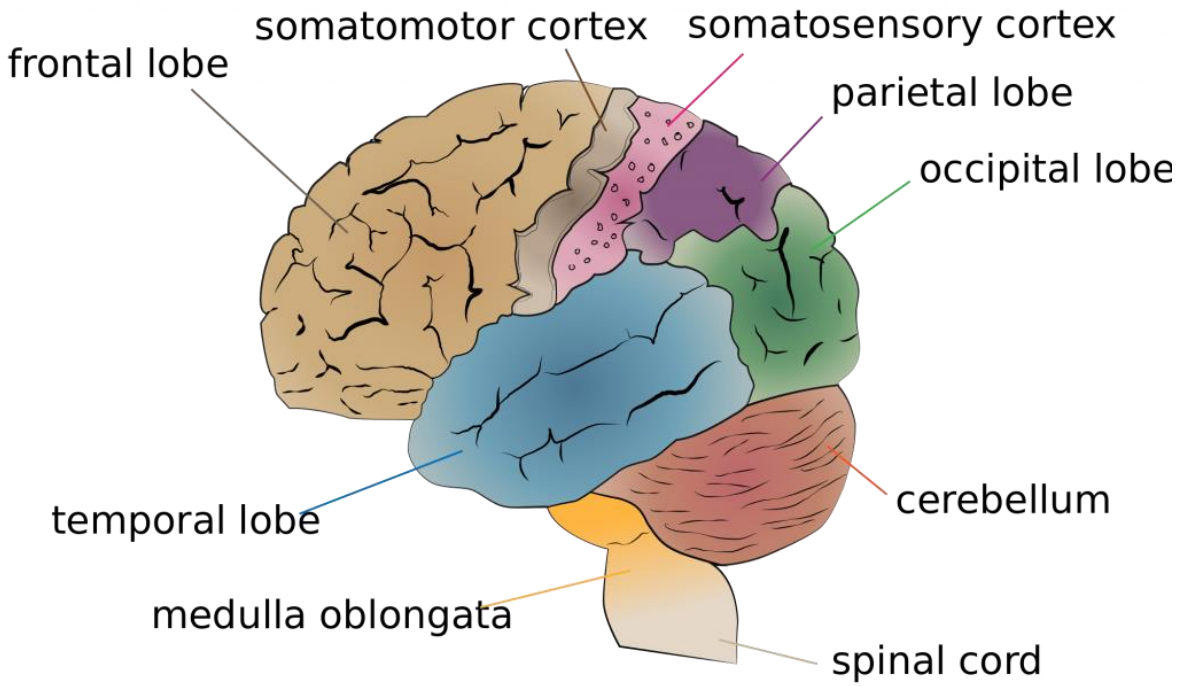
Sitting on the roof of the pons is the cerebellum (Latin for "little brain"), which controls the fine coordination of movements and is also involved in balance, gait, and posture.



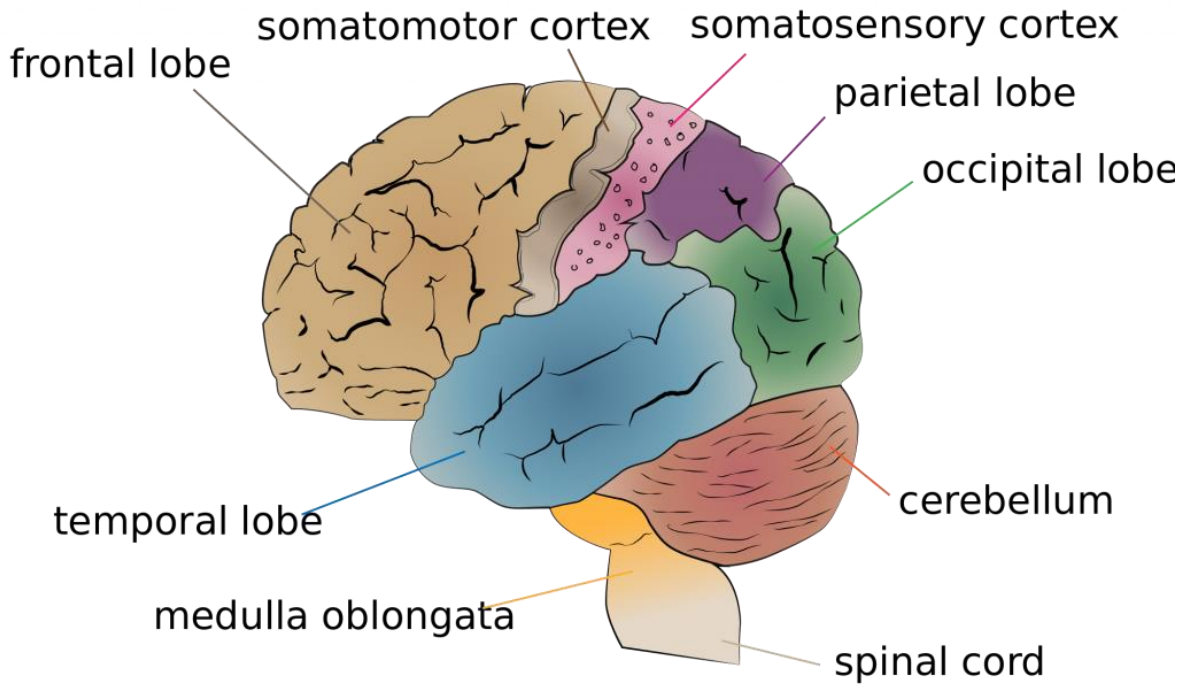
Damage to the cerebellum causes the loop/signal to go into oscillation.
For example, a patient may attempt to touch her nose, feel her hand overshooting, and attempt to compensate with an opposing motion, which causes her hand to overshoot even more wildly in the opposite direction.

Occipital lobes are mainly concerned with visual processing.

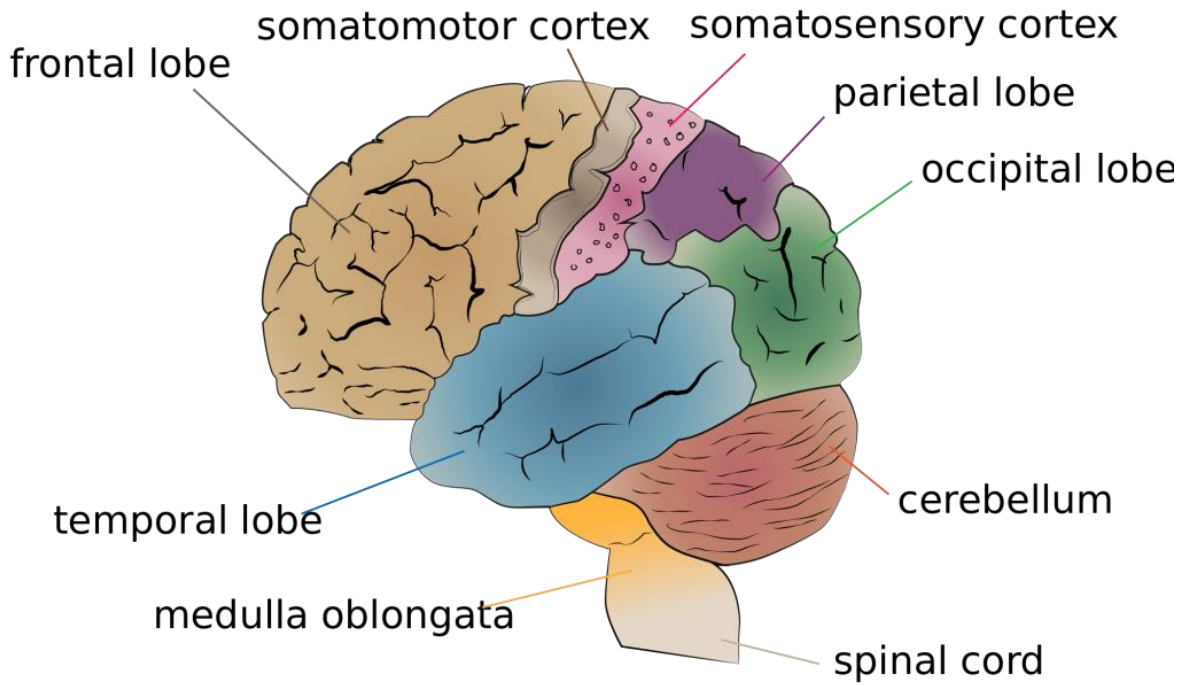
In fact, they are subdivided into as many as thirty distinct processing regions, each partially specialized for a different aspect of vision such as color, motion, and form.



The temporal lobes are specialized for higher perceptual functions, such as recognizing faces and other objects and linking them to appropriate emotions.



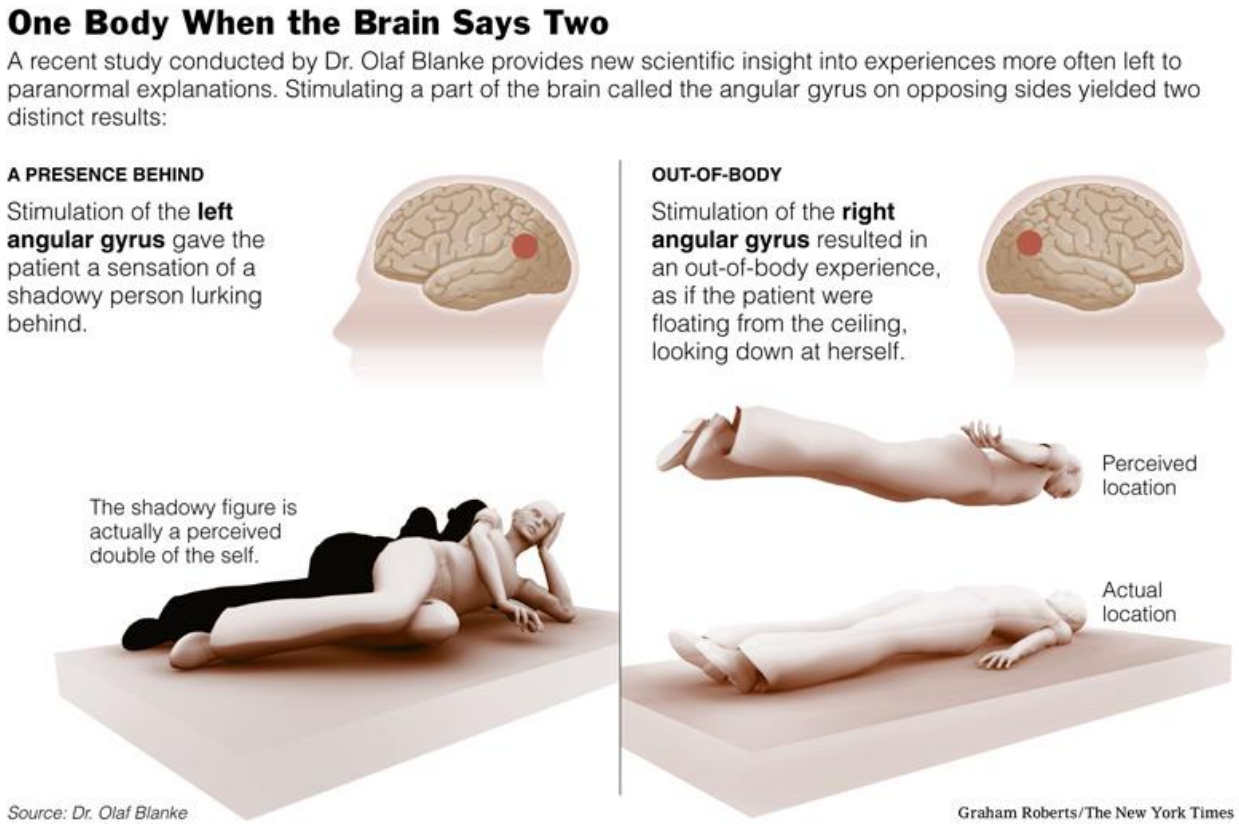
The parietal lobes are primarily involved in processing touch, muscle, and joint information from the body and combining it with vision, hearing, and balance to give you a rich "multimedia" understanding of your corporeal self and the world around it.



Damage to the right parietal lobe commonly results in a phenomenon called hemispatial neglect: The patient loses awareness of the left half of visual space. Even more remarkable is somatoparaphrenia, the patient's vehement denial of ownership of her own left arm and insistence that it belongs to someone else. ILLUSIONS

The right parietal lobe is involved in creating a mental model of the spatial layout of the outside world: your immediate environs, plus all the locations (but not identity) of objects, hazards, and people within it, along with your physical relationship to each of these things.

Thus you can grab things, dodge missiles, and avoid obstacles, constructing your body image-the vivid mental awareness you have of your body's configuration and movement in space.

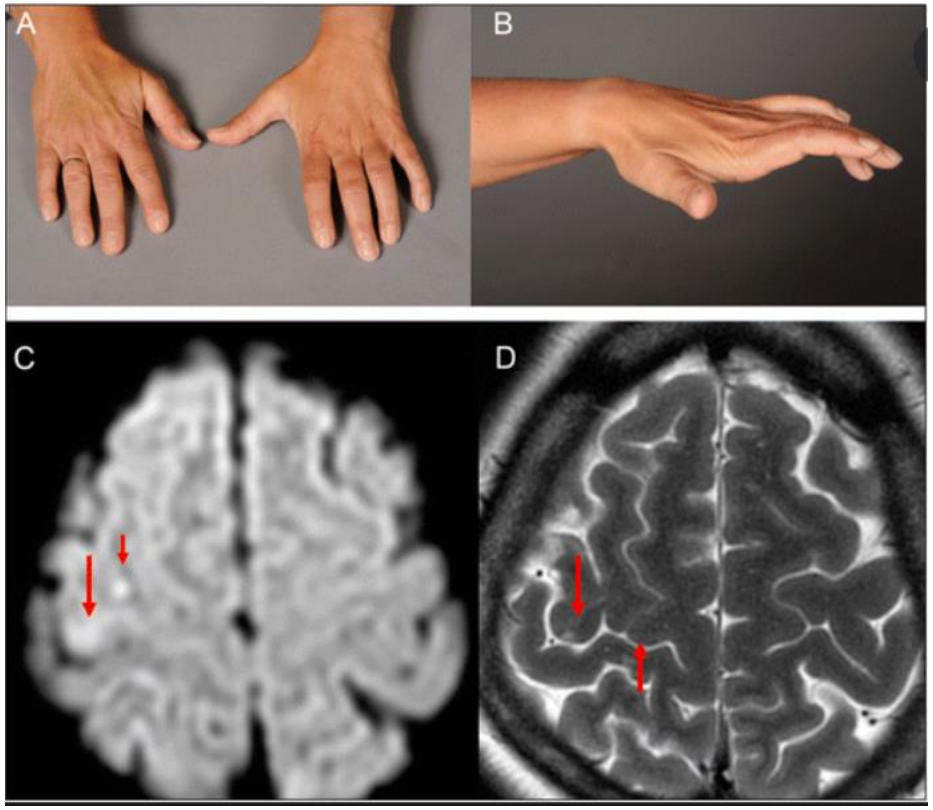


Note that even though it is called an "image," the body image is not a purely visual construct; it is also partly touch and muscle based. After all, a blind person has a body image too, and an extremely good one at that.

In fact, if you zap the right angular gyrus with an electrode, you will have an out-of body experience.

The left angular gyrus is involved in important functions unique to humans such as arithmetic, abstraction, and aspects of language such as word finding and metaphor.

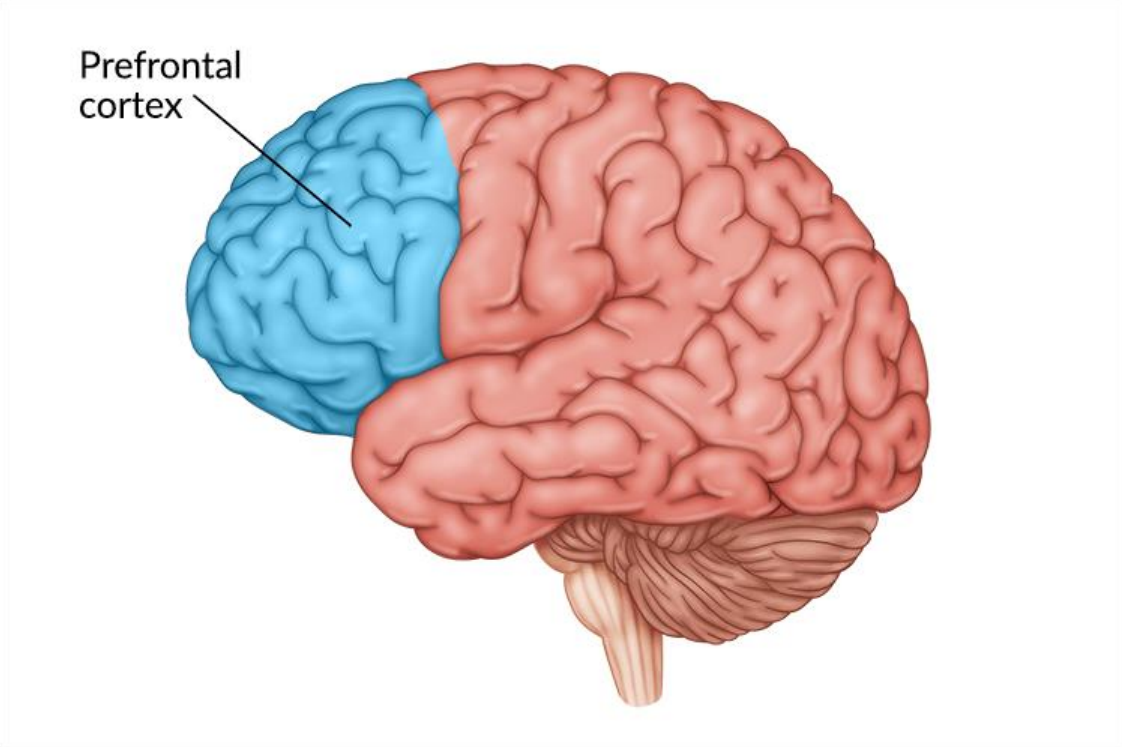
The left supramarginal gyrus, on the other hand, conjures up a vivid image of intended skilled actions-for example, sewing with a needle, hammering a nail, or waving goodbye, and executes them.



Lesions in the left angular gyrus eliminate abstract skills like reading, writing, and arithmetic, while injury to the left supramarginal gyrus hinders you from orchestrating skilled movements.

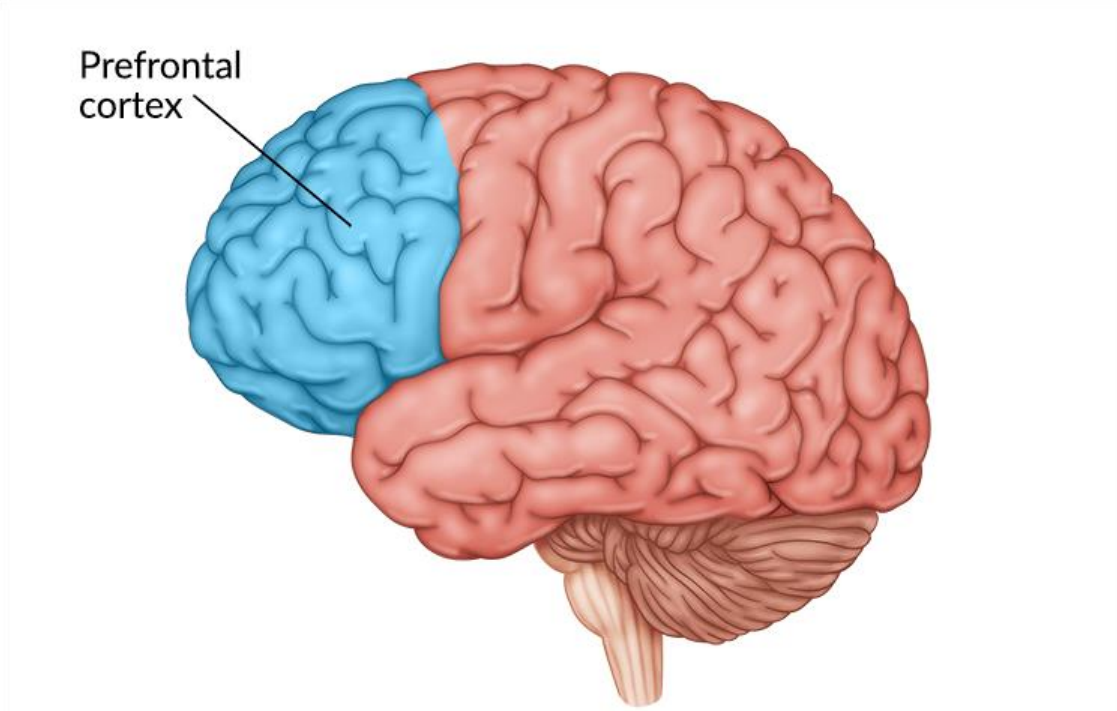
If the left prefrontal lobe is damaged, the patient may withdraw from the social world and show a marked reluctance to do anything at all.

This is euphemistically called pseudodepression.



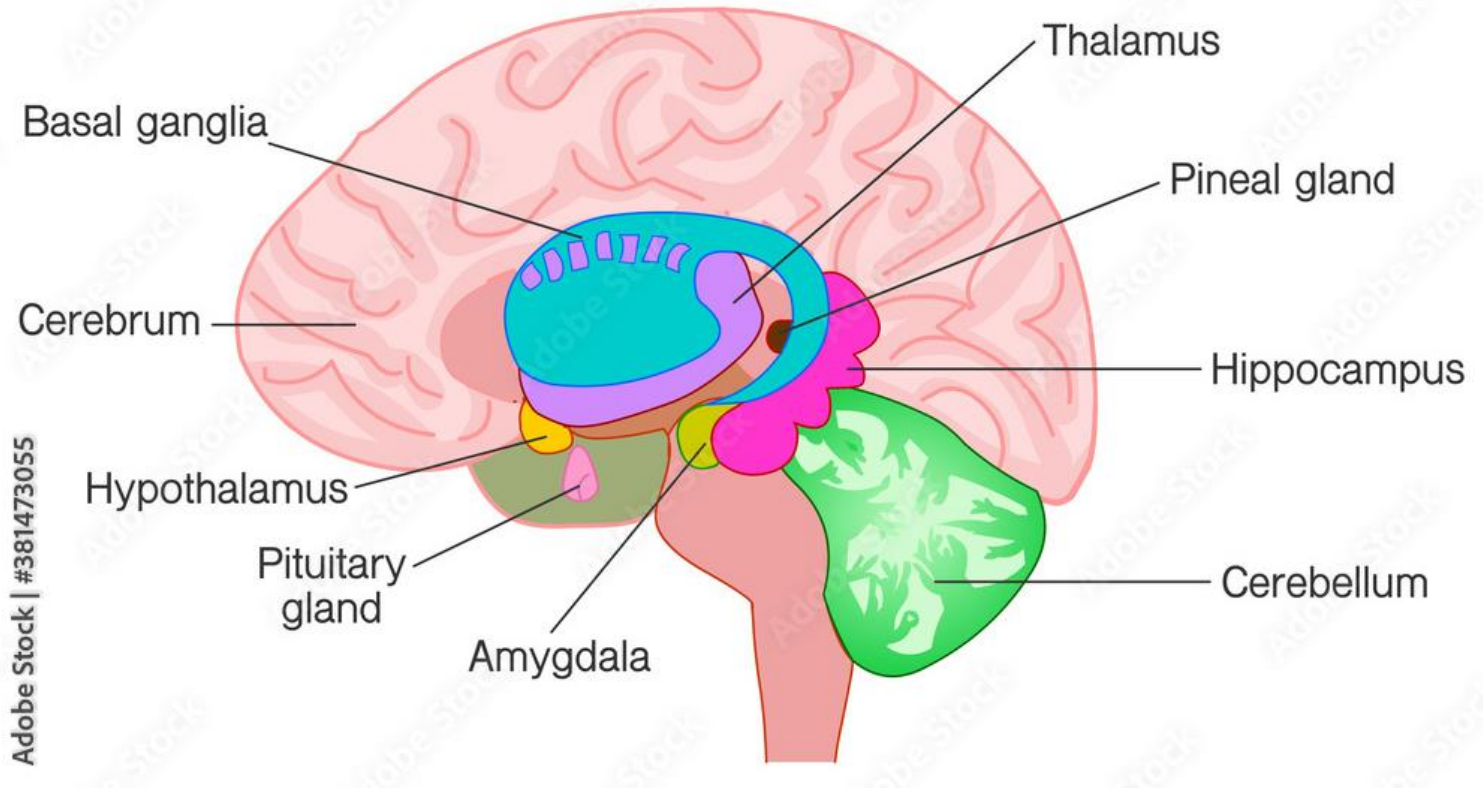
Conversely, if the right prefrontal lobe is damaged, a patient will seem euphoric! Such a patient seems to lose all interest in his own future and he shows no moral compunctions of any kind. He may laugh at a funeral or urinate in public.

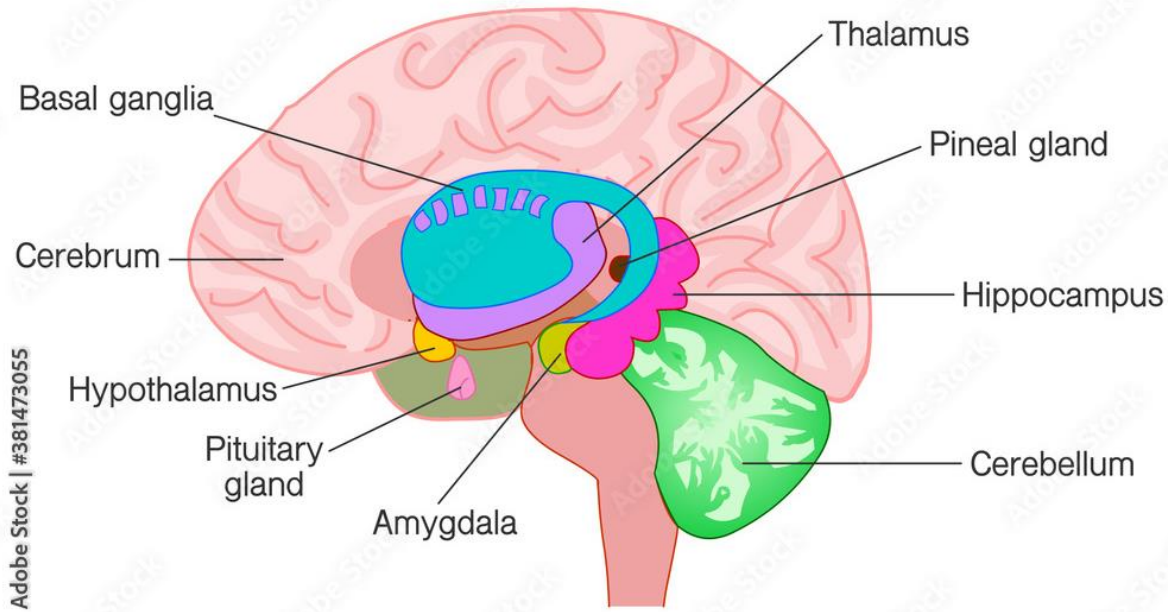
The great paradox is that he seems normal in most respects: his language, his memory, and even his IQ are unaffected.



Yet he has lost many of the most quintessential attributes that define human nature: ambition, empathy, foresight, a complex personality, a sense of morality, and a sense of dignity as a human being

Hippocampus ("seahorse"), which lays down new memory traces.





The basal ganglia are concerned with the control of automatic movements associated with complex volitional actions-for example, adjusting your shoulder when throwing a dart, or coordinating the force and tension in dozens of muscles throughout your body while you walk.

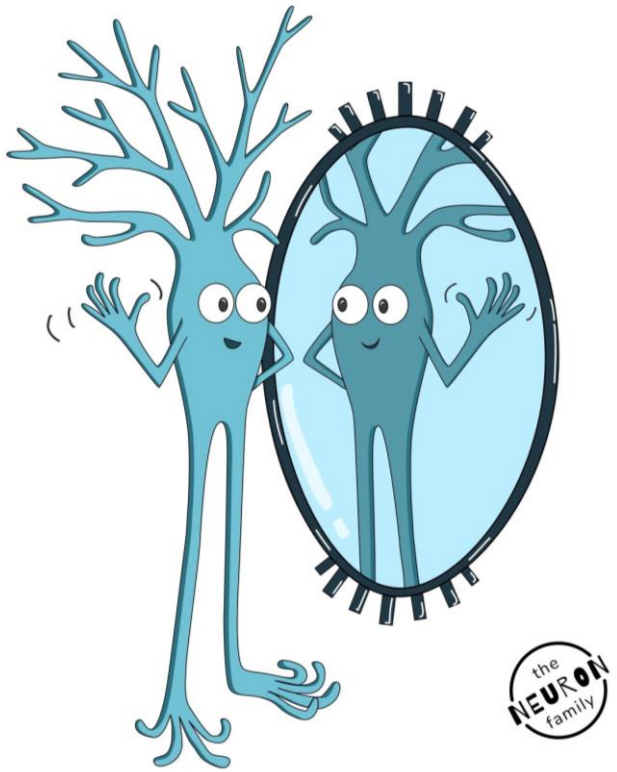
Damage to cells in the basal ganglia results in disorders like Parkinson's disease, in which the patient's torso is stiff, his face is an expressionless mask, and he walks with a characteristic shuffling gait.

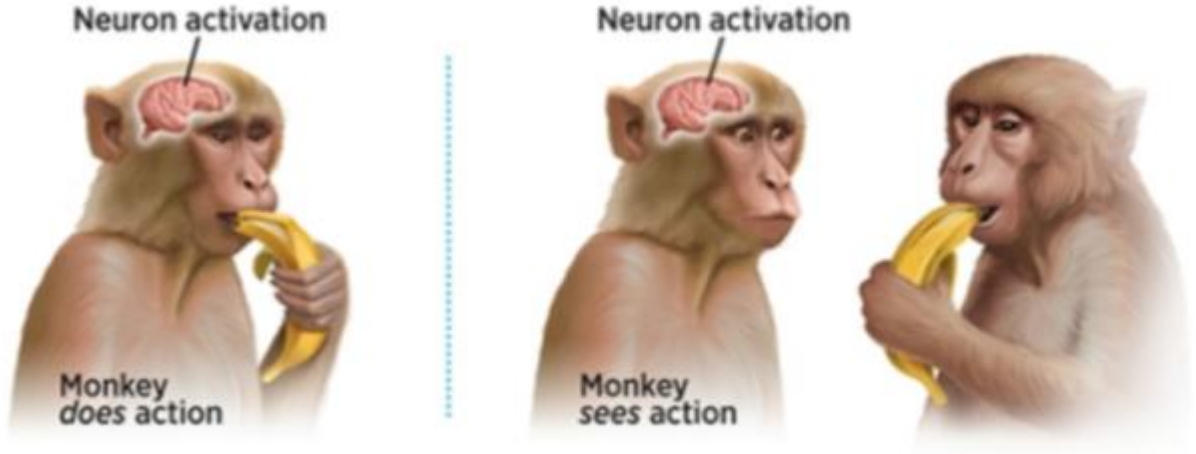
Empathy?

Running a simulation of other actions using your own body image.

When you watch someone else reach for a glass of water, for example, your mirror neurons automatically simulate the same action in your (usually subconscious) imagination.

Your mirror neurons will often go a step further and have you perform the action they anticipate the other person is about to take-say, to lift the water to her lips and take a drink.



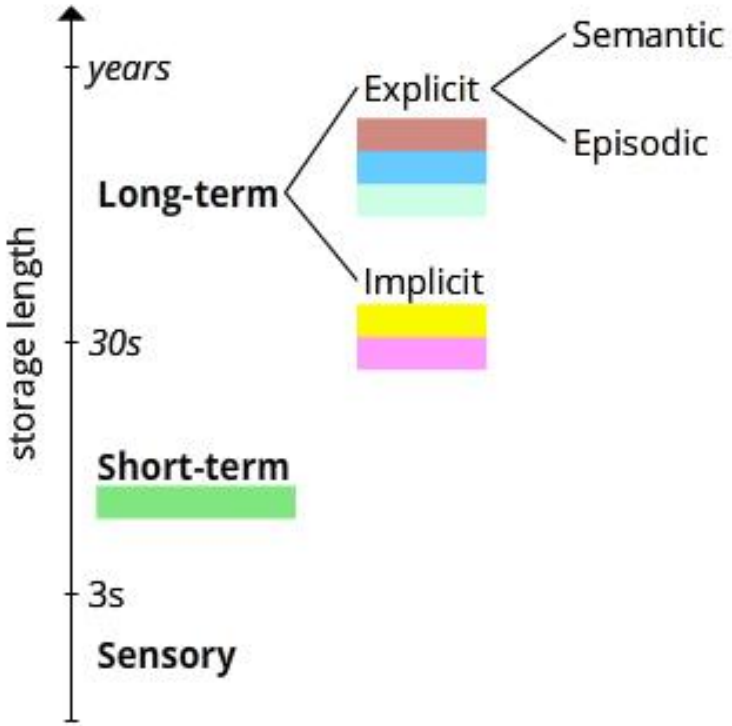


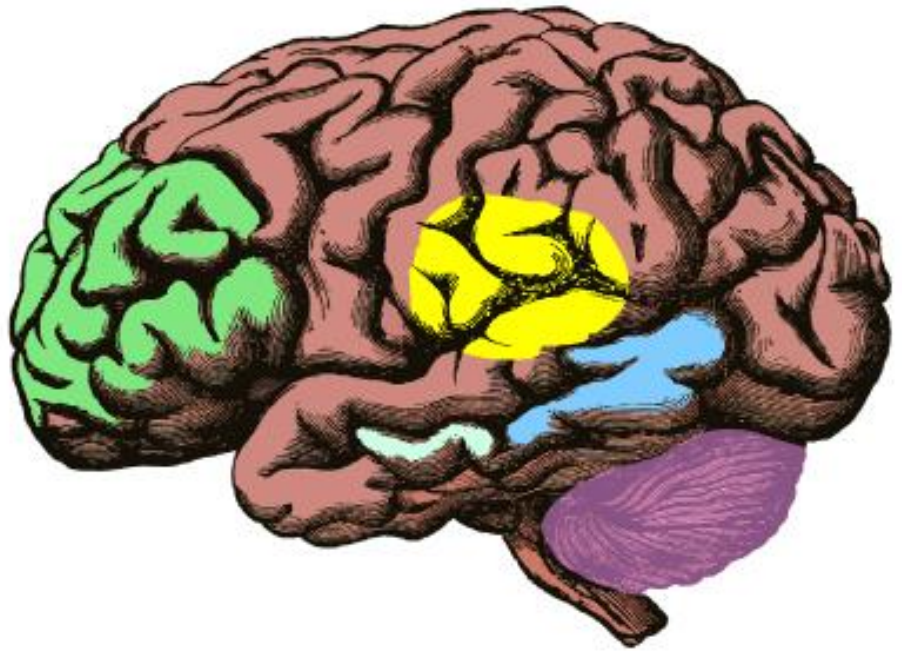
Mirror neurons

They may well be central to social learning, imitation, and the cultural transmission of skills and attitudes.

Thus culture became a significant new source of evolutionary pressure, which helped select for brains that had even better mirror-neuron systems and the imitative learning associated with them.

Learning and memory





Thank you