

# Think Again

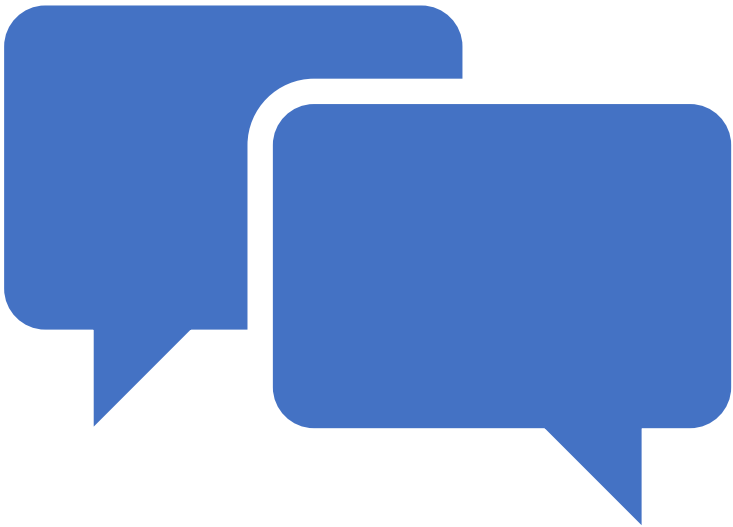
Fall Term 2021

Class 2

# Email and Website

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<http://olli-think-again.weebly.com>



# On Tap for Today

- Review
- Brain Parts
- Optical Illusions





# Review

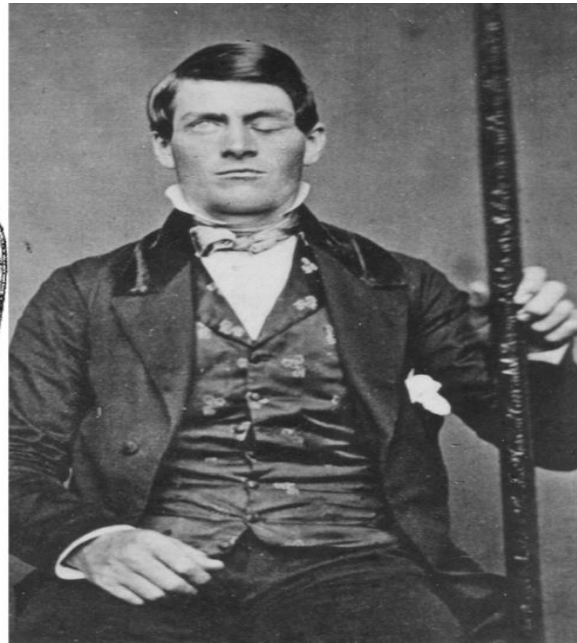
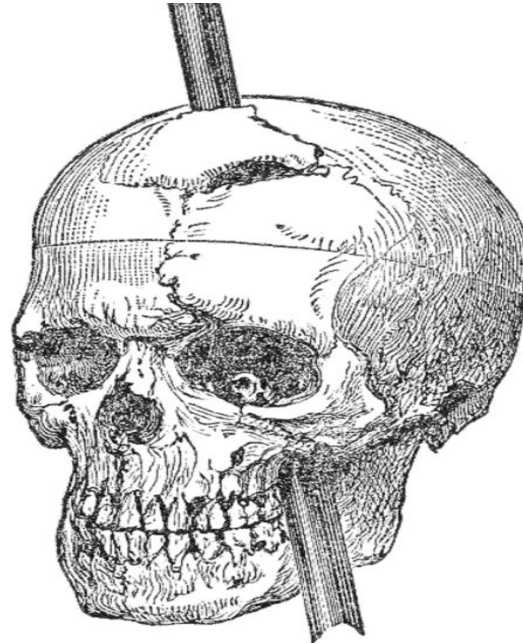
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- The brain's function is not to think.
- It is to recognize patterns and make predictions.
- Sensory input is synthesized, adjusted for identified patterns, and the resulting prediction is brought to conscious awareness.
- While this process can create false impressions, its speed, efficiency, and usefulness make it a strength rather than a weakness.

# Brain Parts



# Phineas Gage



Iron rod went through skull in work accident. It changed his personality and led to understanding of how different parts of brain control different functions and emotions. The rest of the story, rarely mentioned, is that over time his normal personality returned.

# Brain Research



- As the result of Phineas Gage, people realized that different parts of the brain control different functions and determine personalities.
- Until recently, that was the bulk of the research.
- We now realize it is much more complicated with almost every part involved in multiple functions, multiple parts involved in virtually every function, and constant changes.
- For simplicity we will often talk about parts as having specific functions but please understand that is overly simplistic.

# Forget Reptile, Limbic, and Neocortex

Historic classifications that have proven to be wildly inaccurate.

Divisions are inaccurate as applied to both humans and animals, including reptiles.

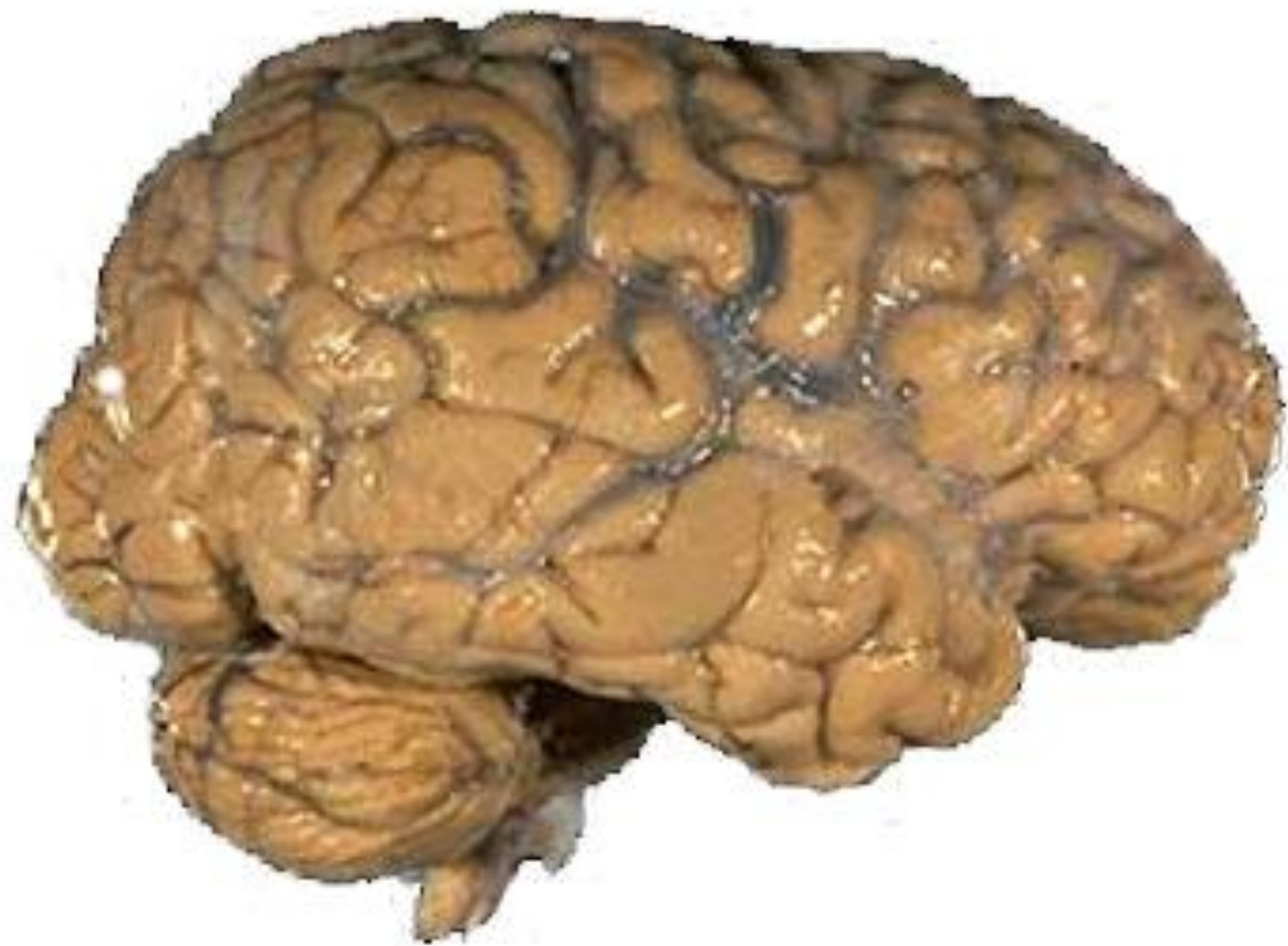




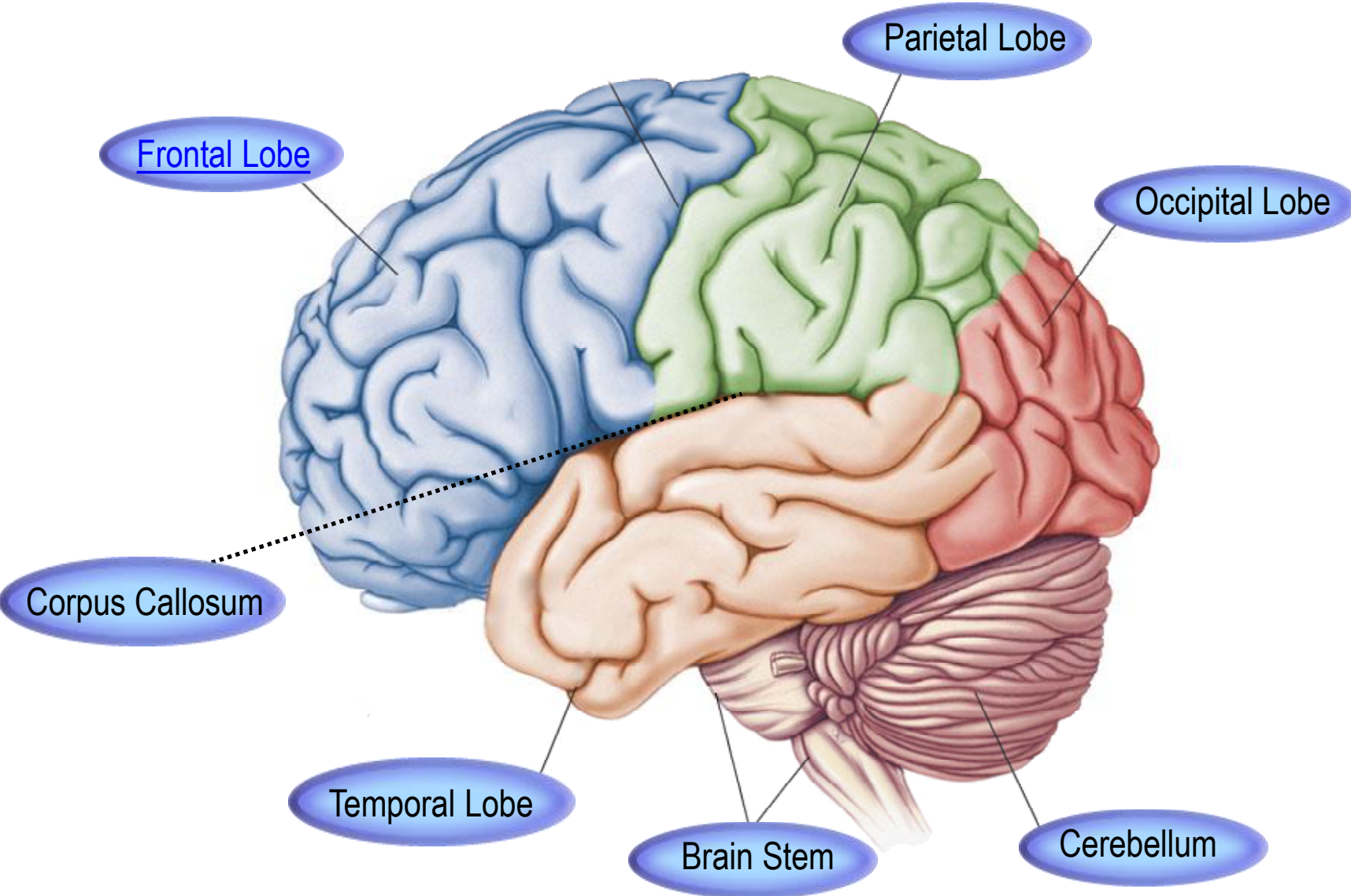
# Human Brain is Only One Model



- We often assume intelligence is determined by how closely brains resemble human's, particularly the size of the neocortex.
- There is some basis for that when comparing mammals but none with non-mammals.
- Species do what it takes to survive and develop the necessary components.
- Octopuses, Corvids, Slime Molds, and even Bacteria show enormous intelligence with nothing close to a human brain structure.
- The greatest advance in biotechnology, CRISPR, bacteria learned to do a billion years ago.
- Maybe bacteria should have been awarded the 2020 Nobel Prize in Chemistry.



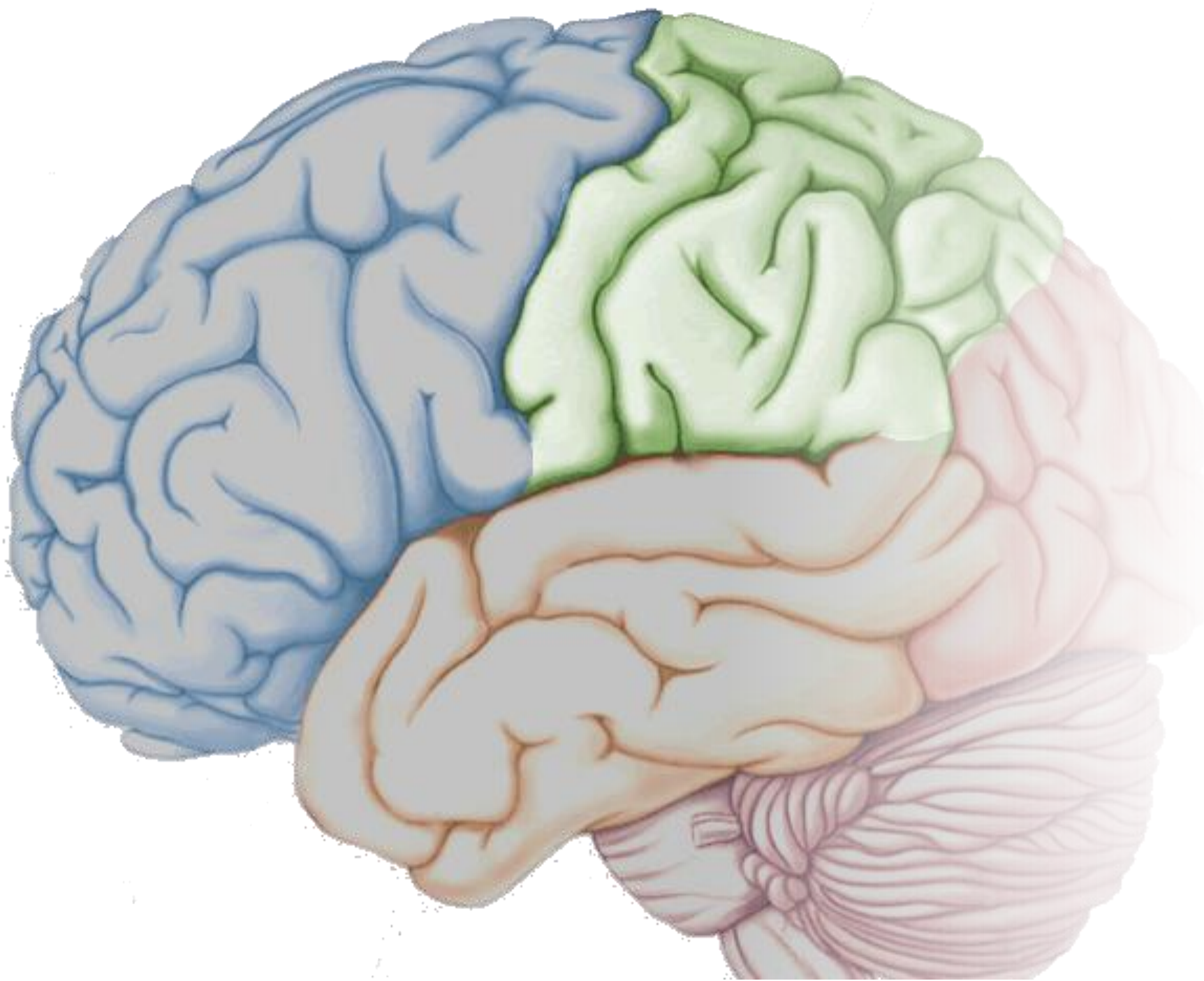
# Parts & Functions of the Human Brain





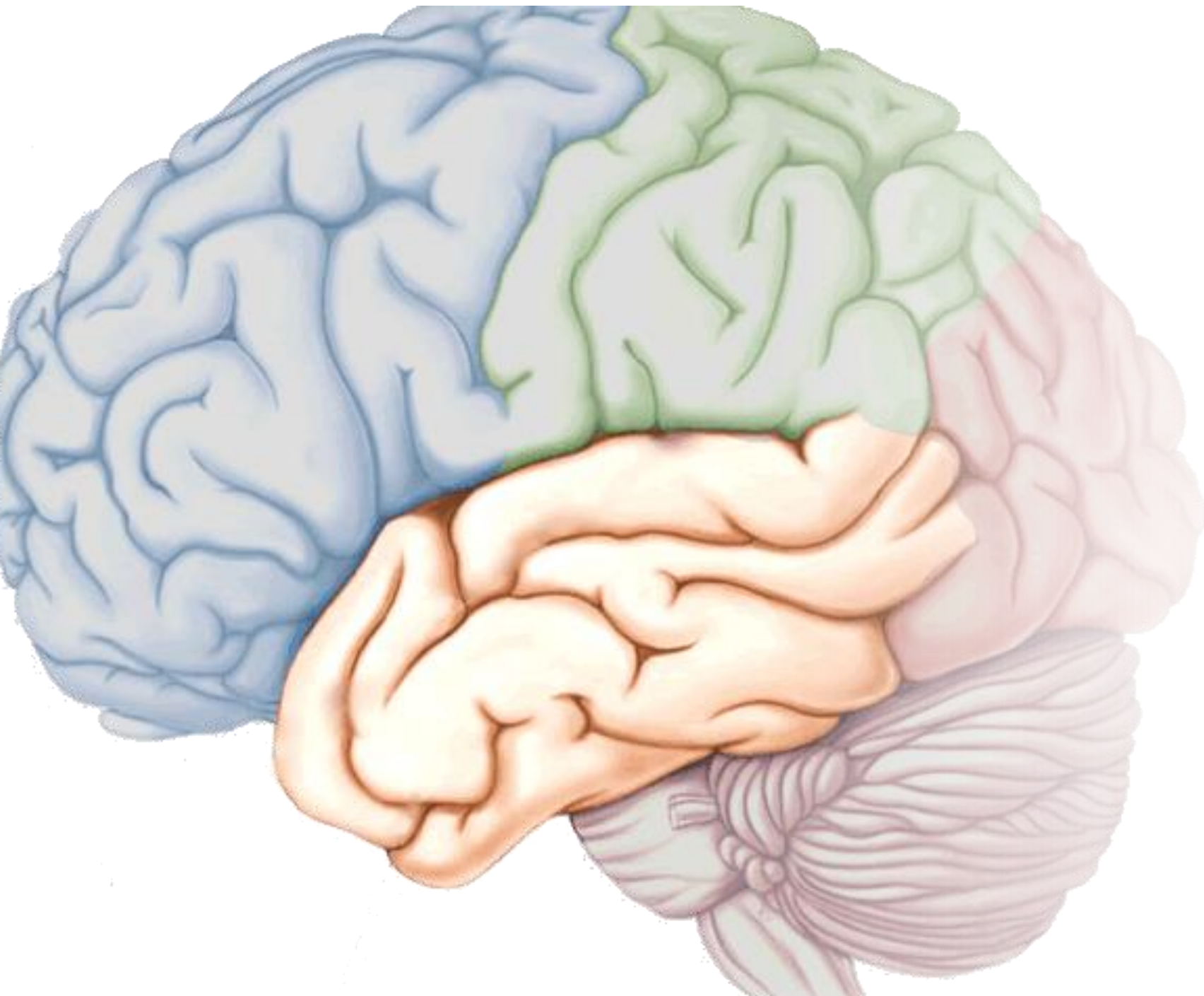
## Frontal Lobe

- Found under your forehead.
- Center of reasoning, planning, some parts of speech, movement (motor cortex), emotions, and problem solving.



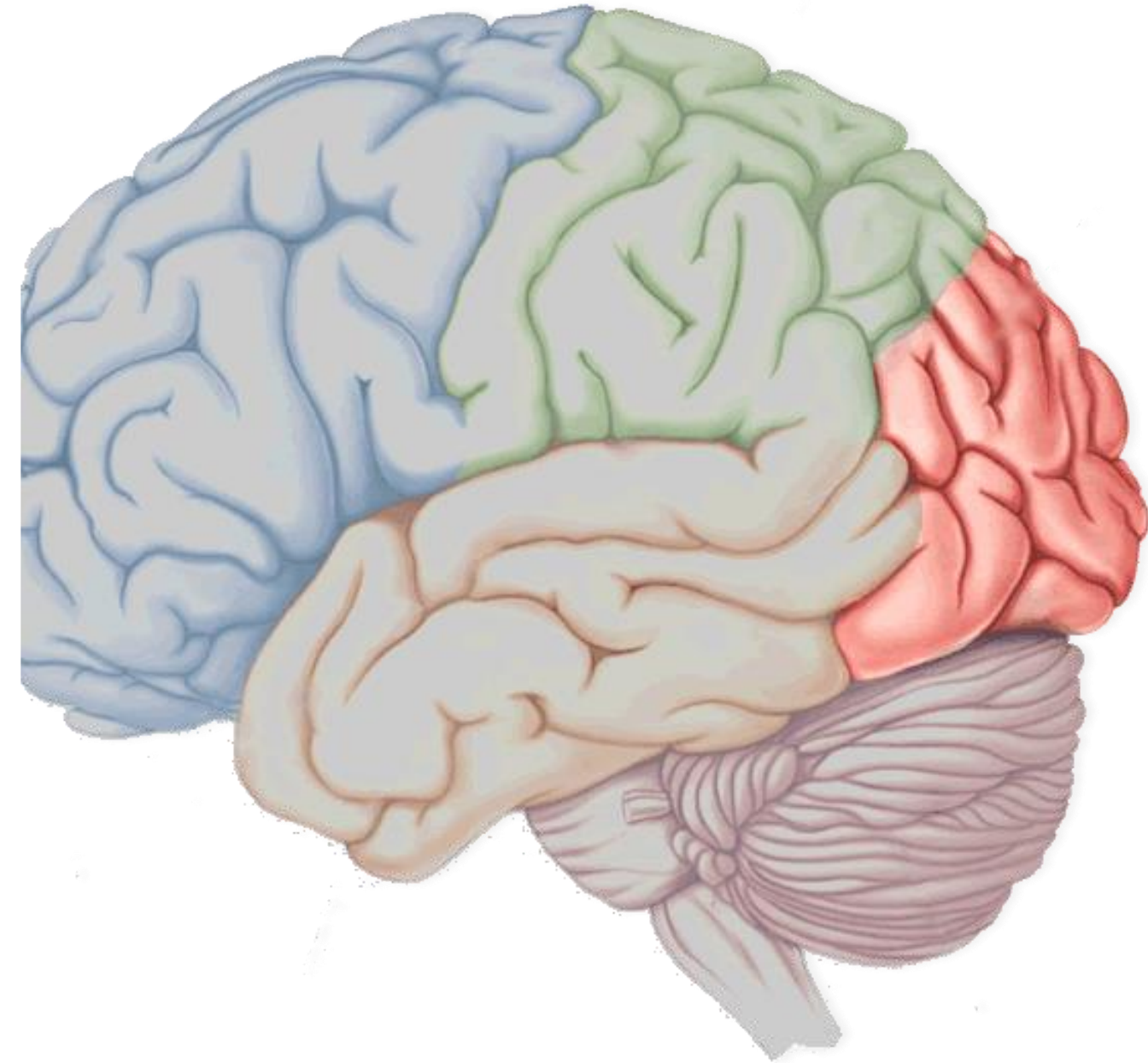
## Parietal Lobe

- Found on the top of your head.
- Receives sensory input from the skin. (touch, pressure, temperature, & pain)



## Temporal Lobe

- Found on the sides of your head above your ears.
- Functions include speech perception, hearing, some types of memory



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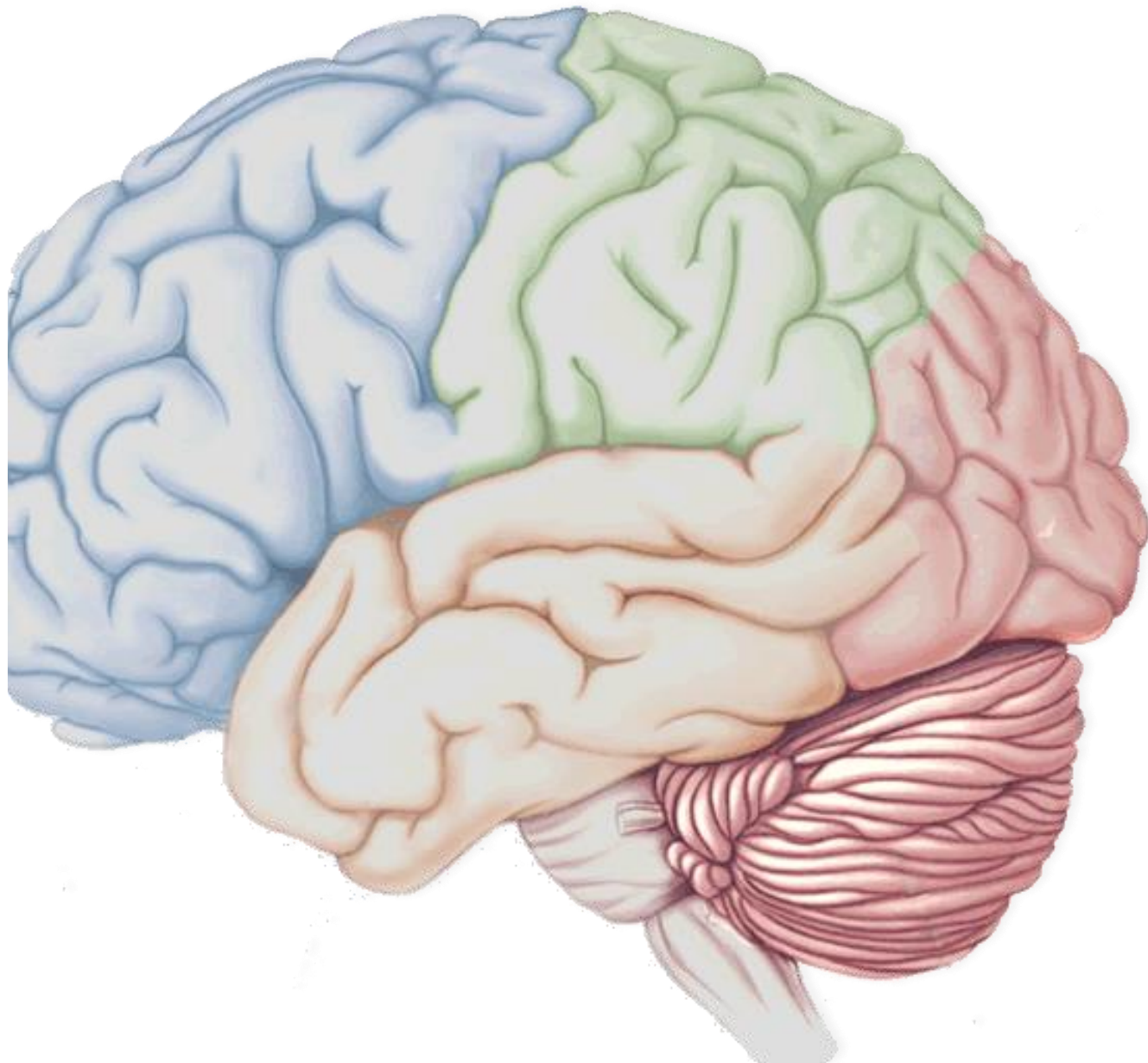
## Occipital Lobe

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Found at the back of your head

Receives input from the eyes

Often referred to as the visual cortex



## Cerebellum

Found at the back of your head under the cerebrum.

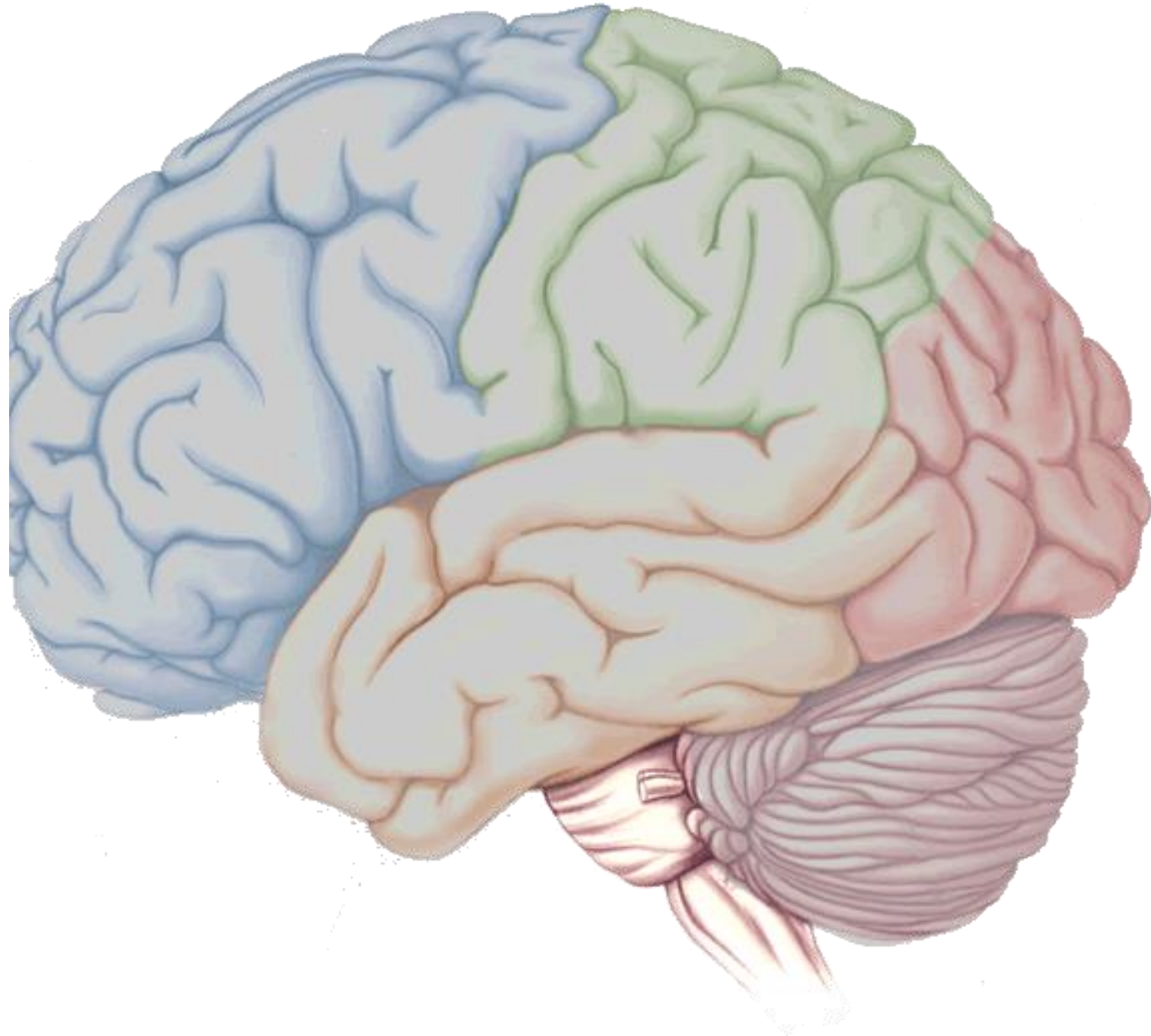
Means “little brain”

Responsible for movement, balance, posture.

Often takes over learned activities- Like riding a bike!



# Brainstem



Most basic part of your brain.

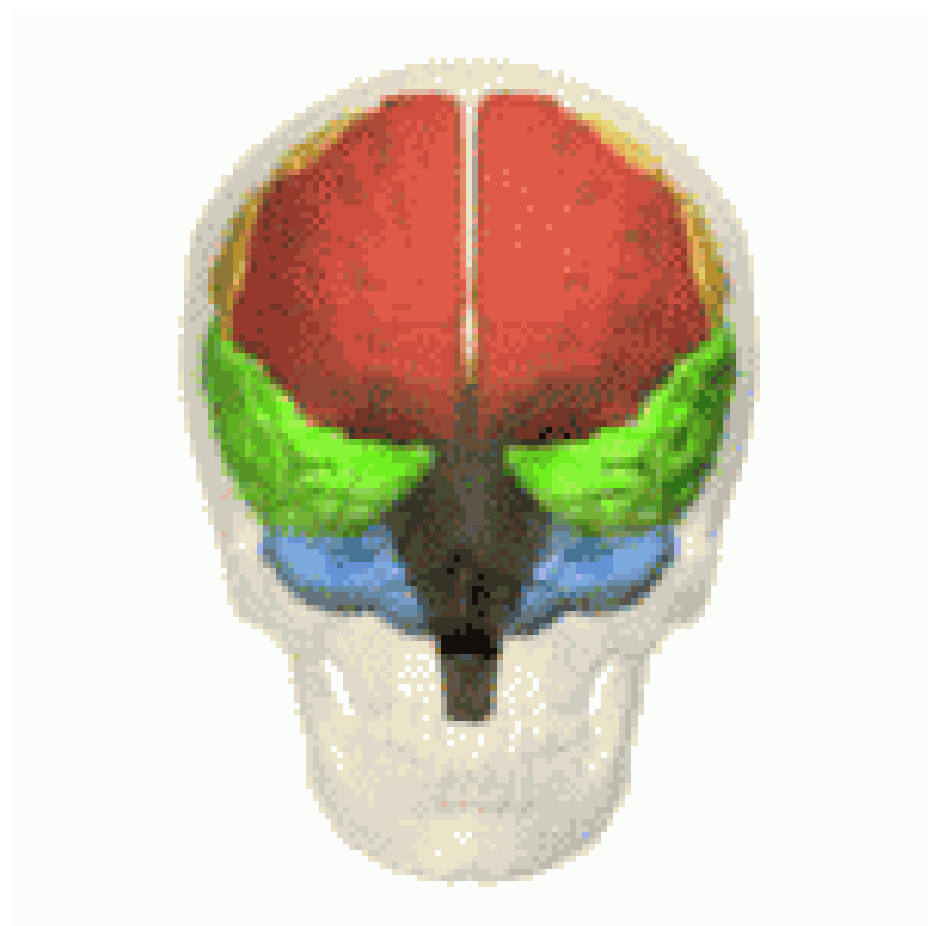
Controls functions essential to life (breathing, digesting, eliminating waste, sleeping, maintaining body temperature...)

Maintains life without “thinking” (or so we used to think)



The brain has two nearly identical hemispheres connected by the corpus callosum

Most of the components we discuss exist on both sides

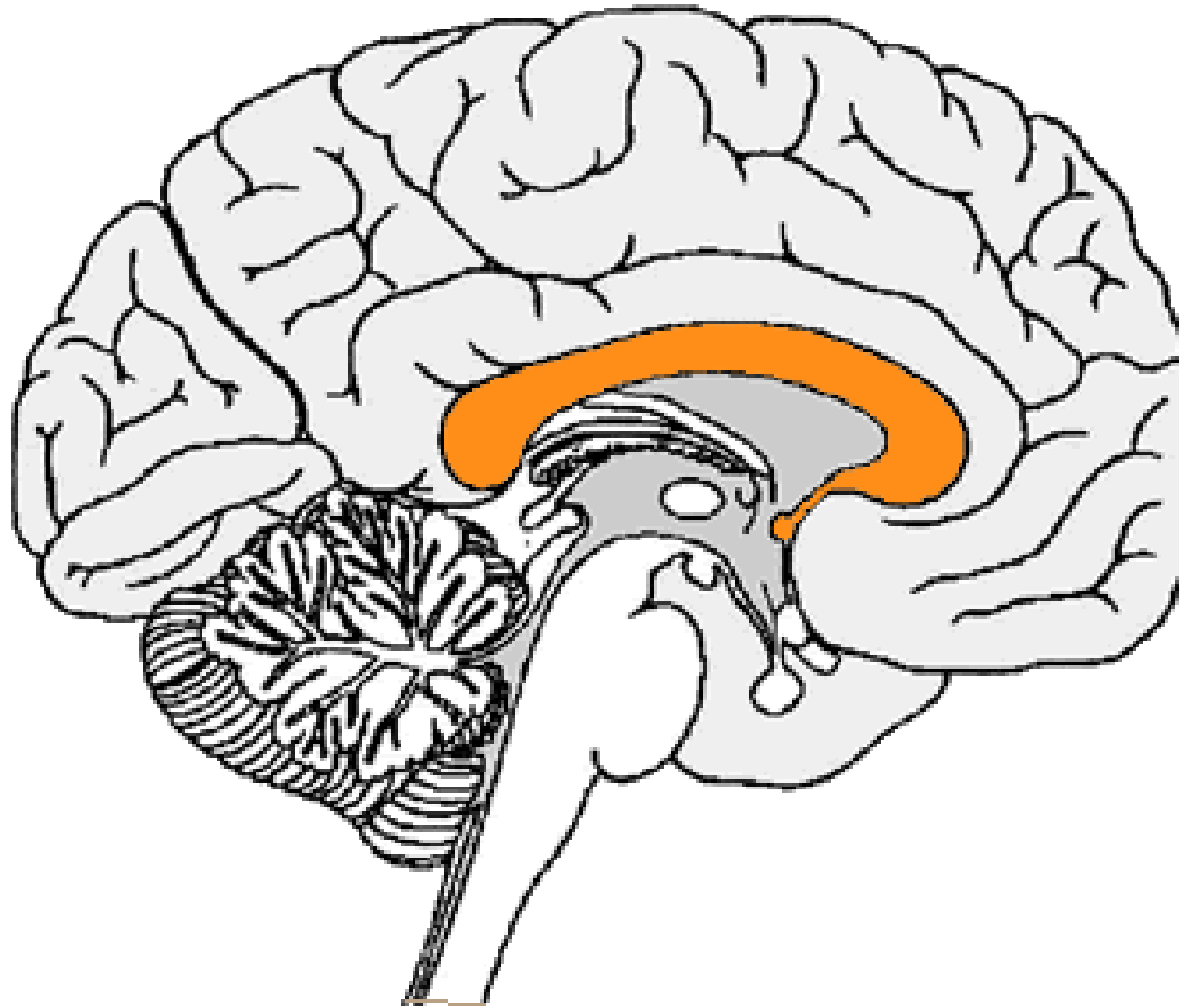


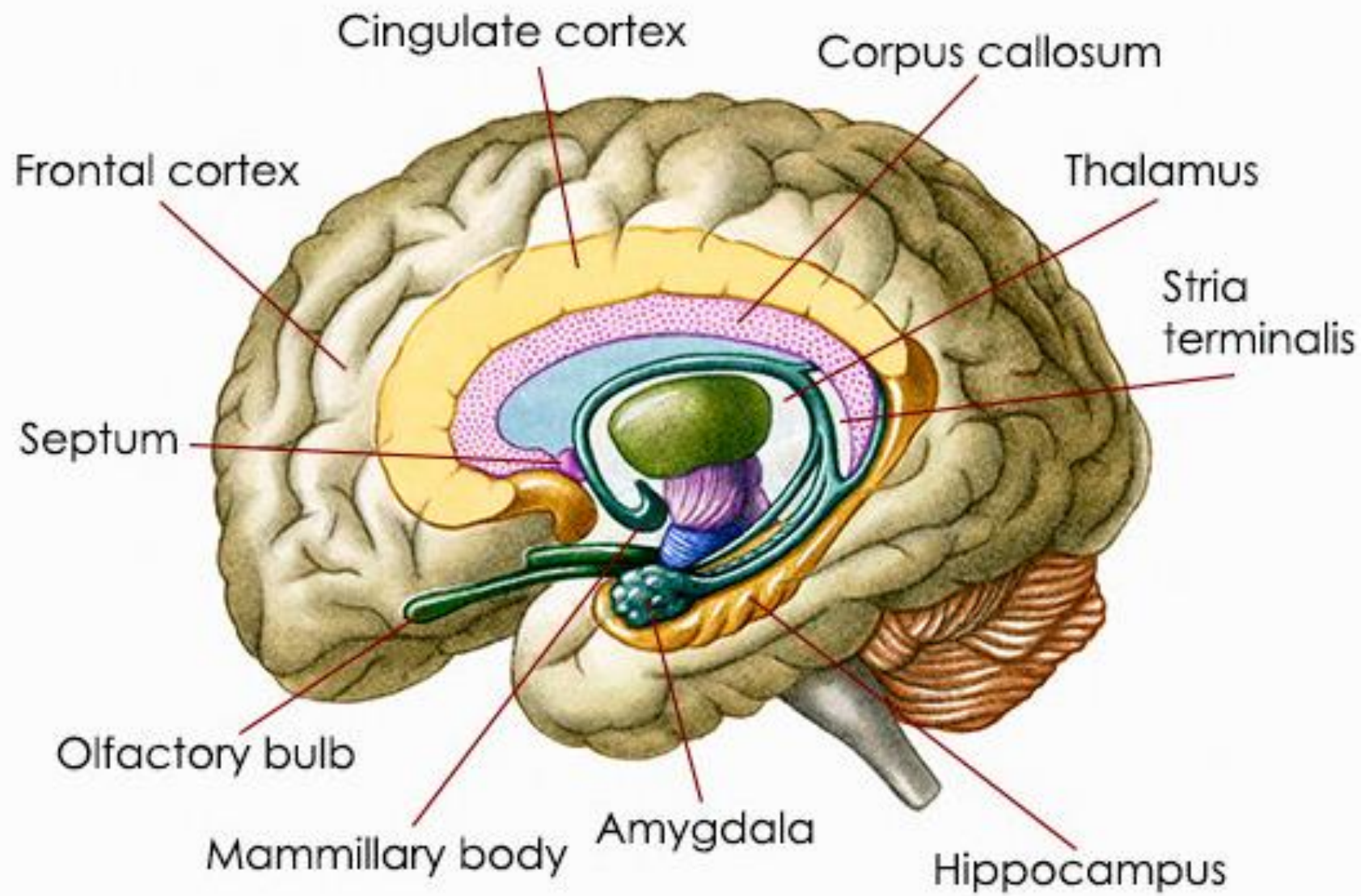
# Corpus Callosum

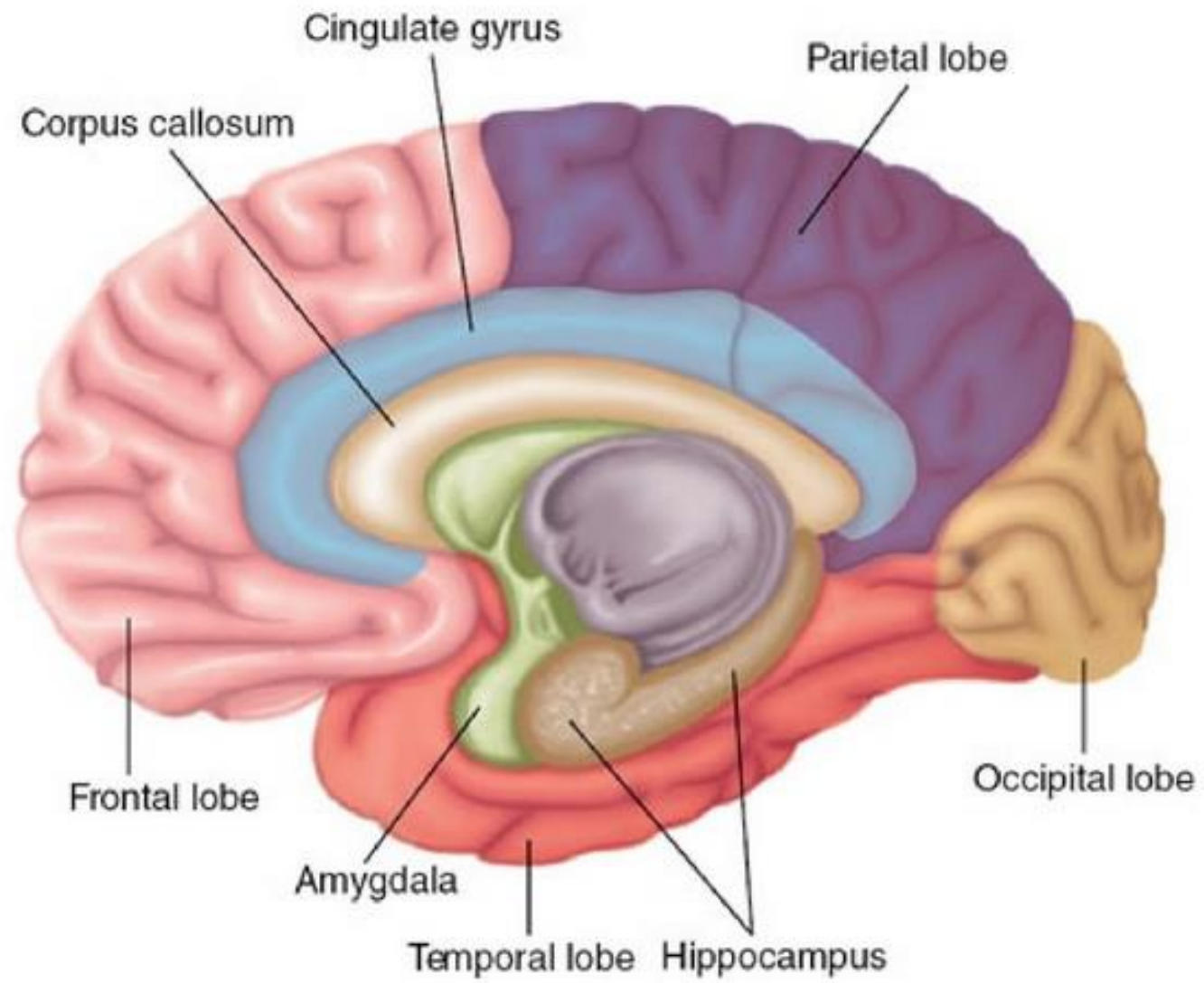
This is located centrally between the left and right hemispheres of your brain.

It is a bundle of fibers that connects the left and right hemispheres.

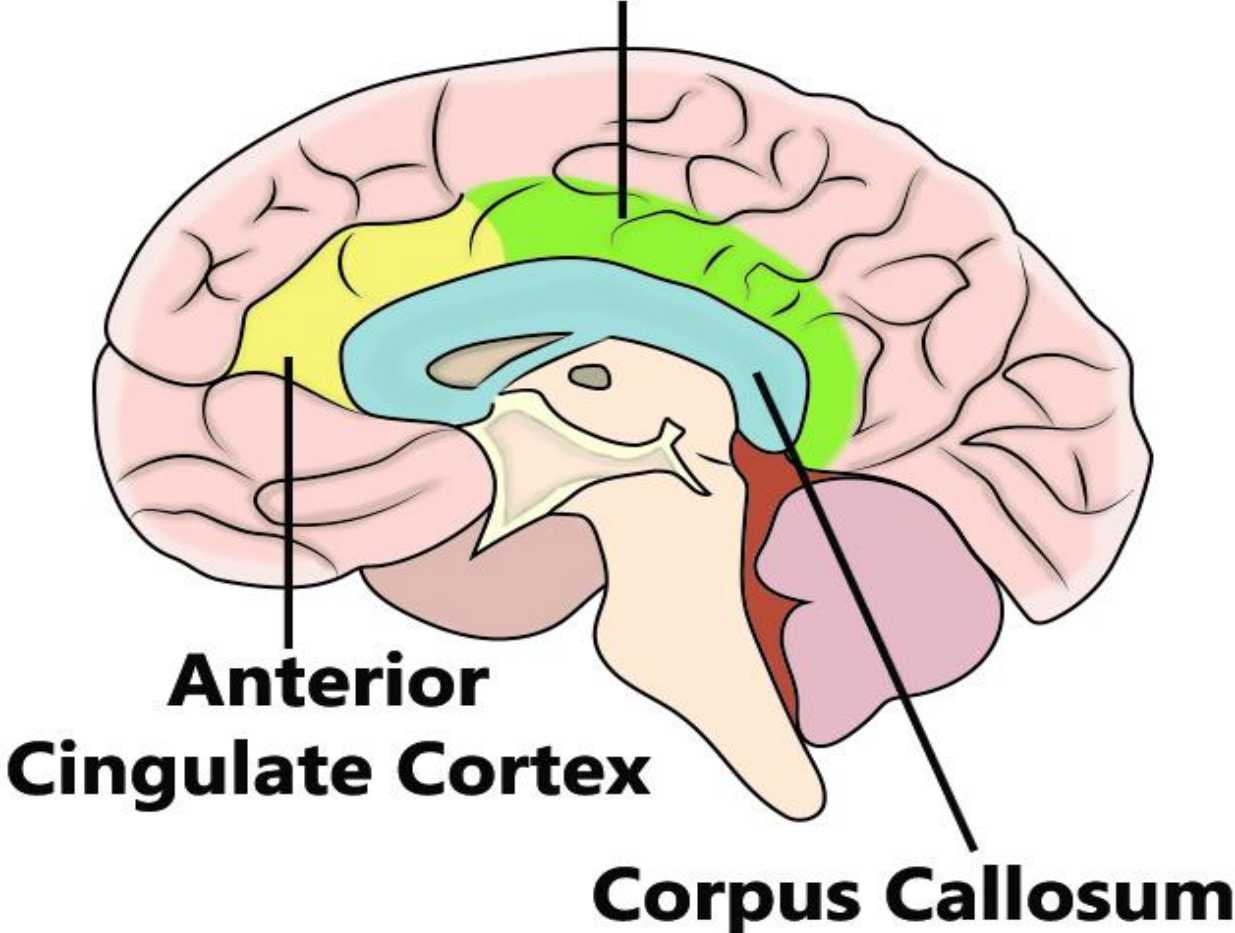
It is believed this area is involved in creativity and problem solving.

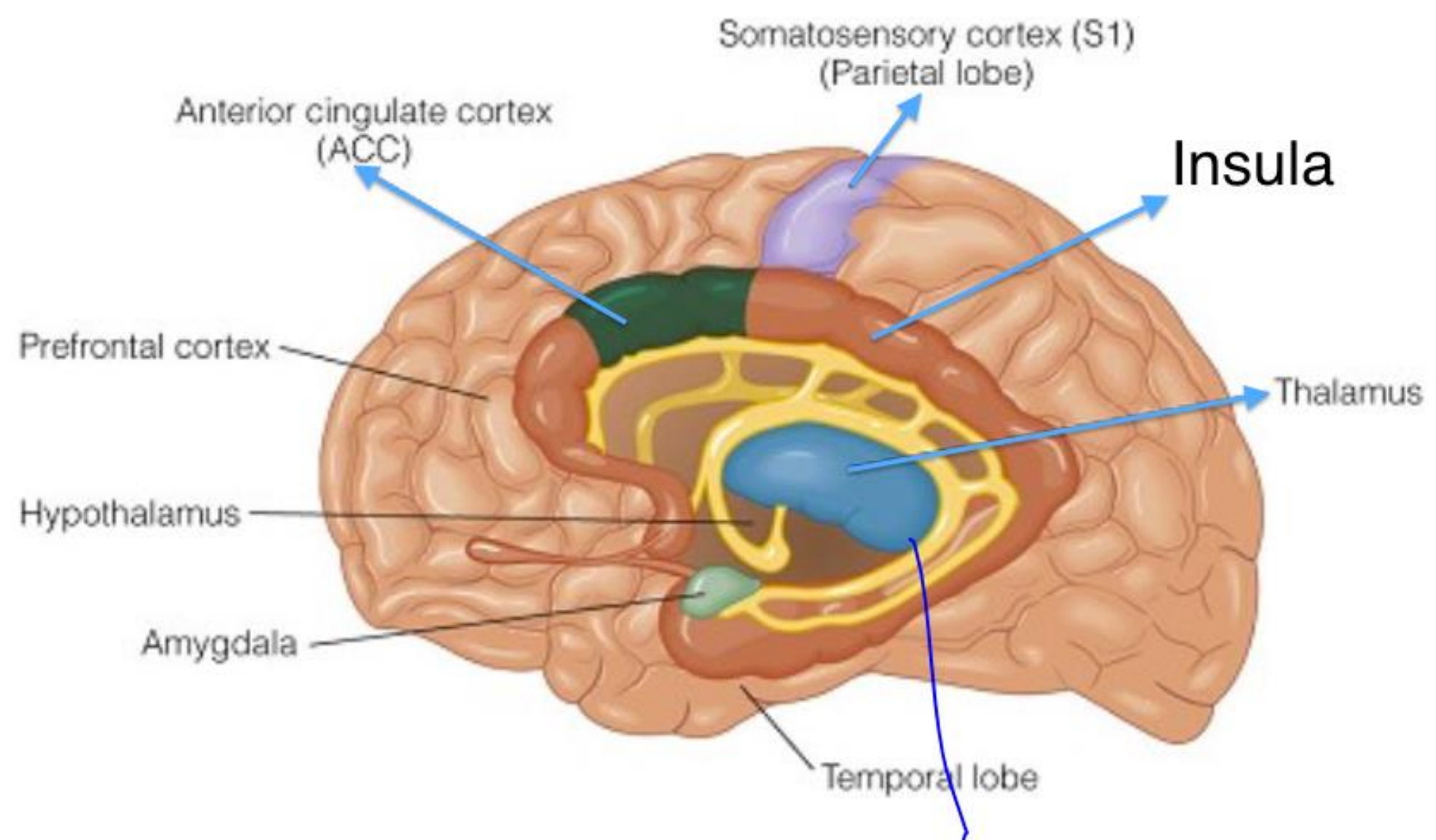






# Posterior Cingulate Cortex

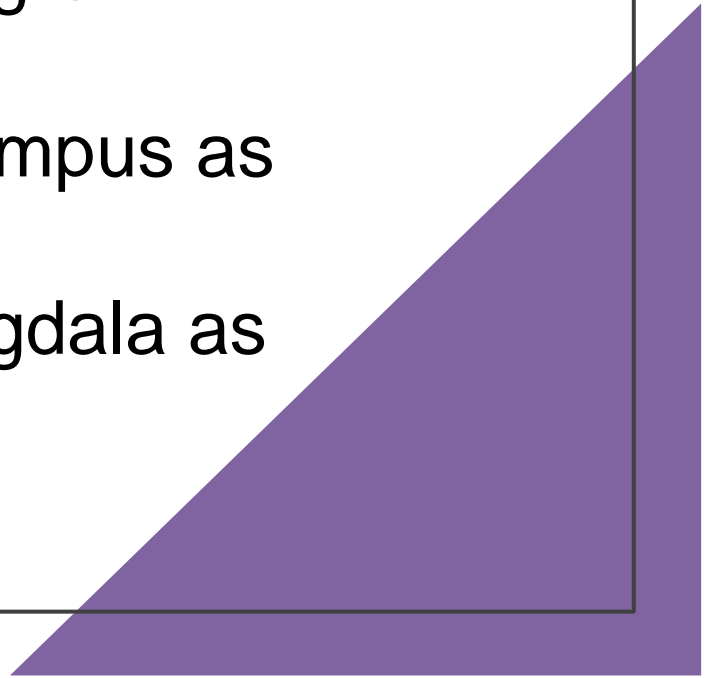






# Amygdala and Hippocampus

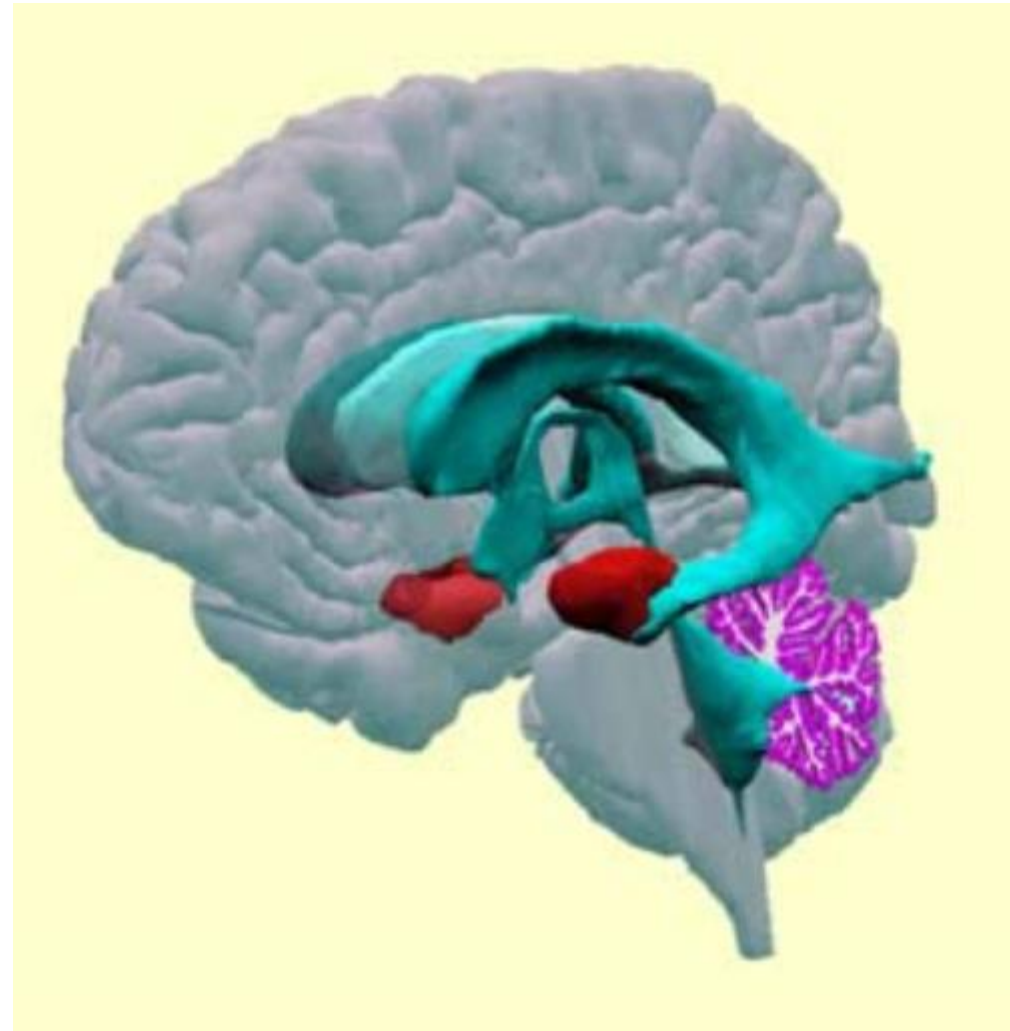
- Much of our focus will be on these two brain components
- Possibly the only parts of the brain that can grow throughout our lives, but can also shrink
- It is overly simplistic but think of the hippocampus as the seat of memory
- Similarly over simplistic but think of the amygdala as the seat of emotions, particularly fear

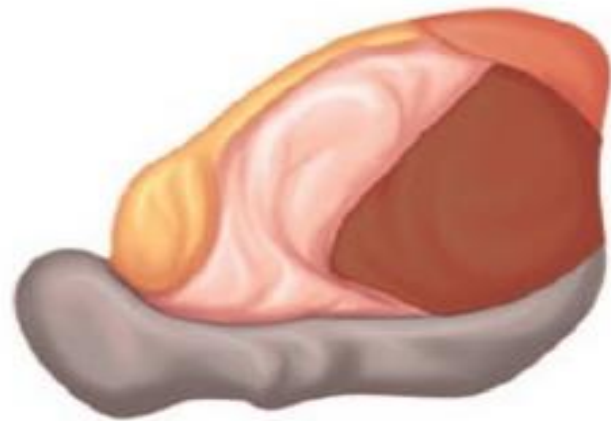


# Hippocampus – Greek for Seahorse

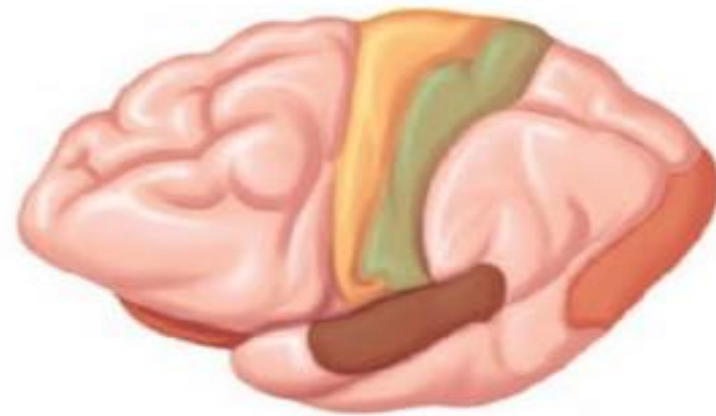


# Amygdala – Greek for Almond





Rat



Chimpanzee



Human



# Homo Sapien vs. Neandertal Skulls

Larger forehead to accommodate more developed prefrontal cortex

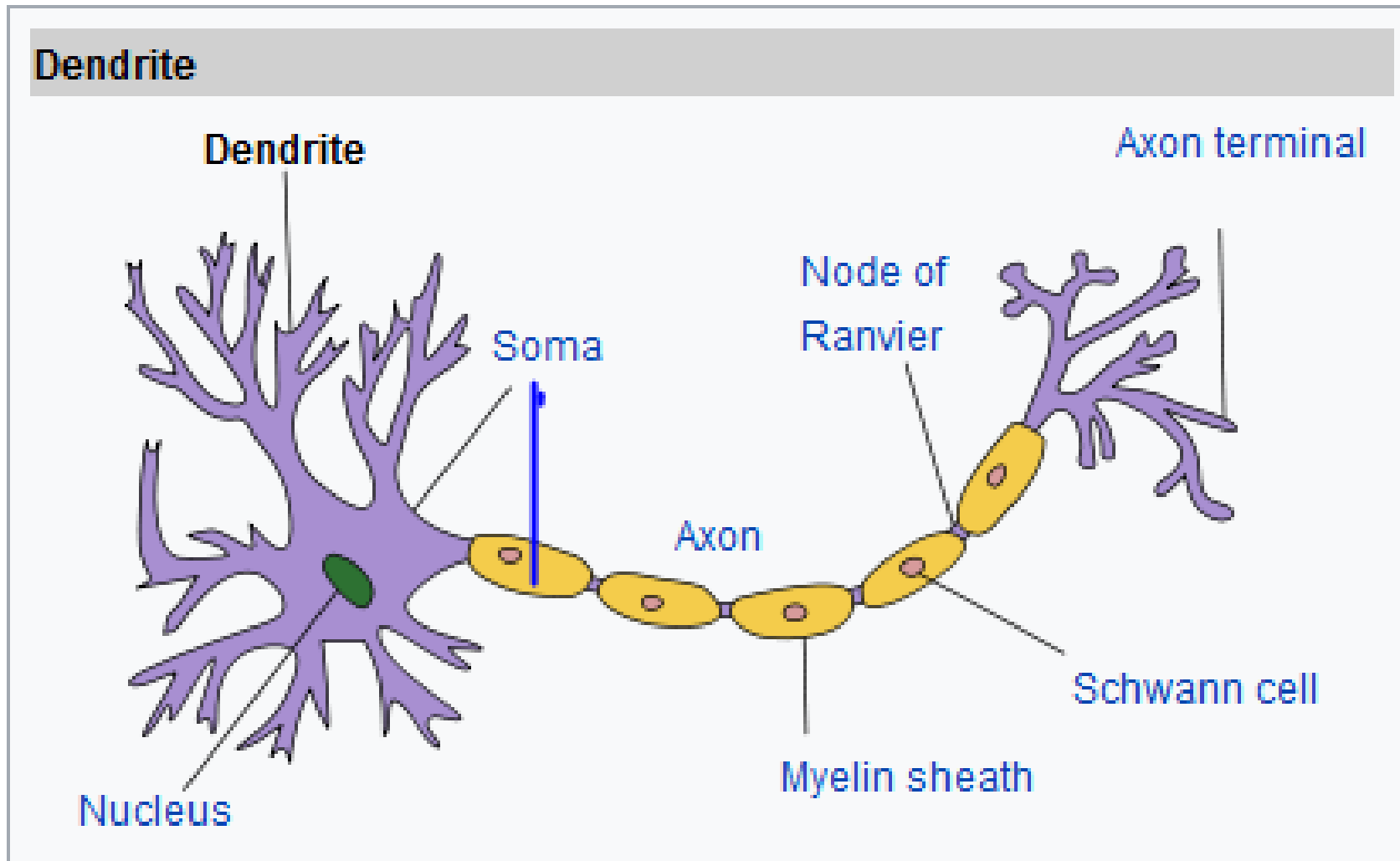


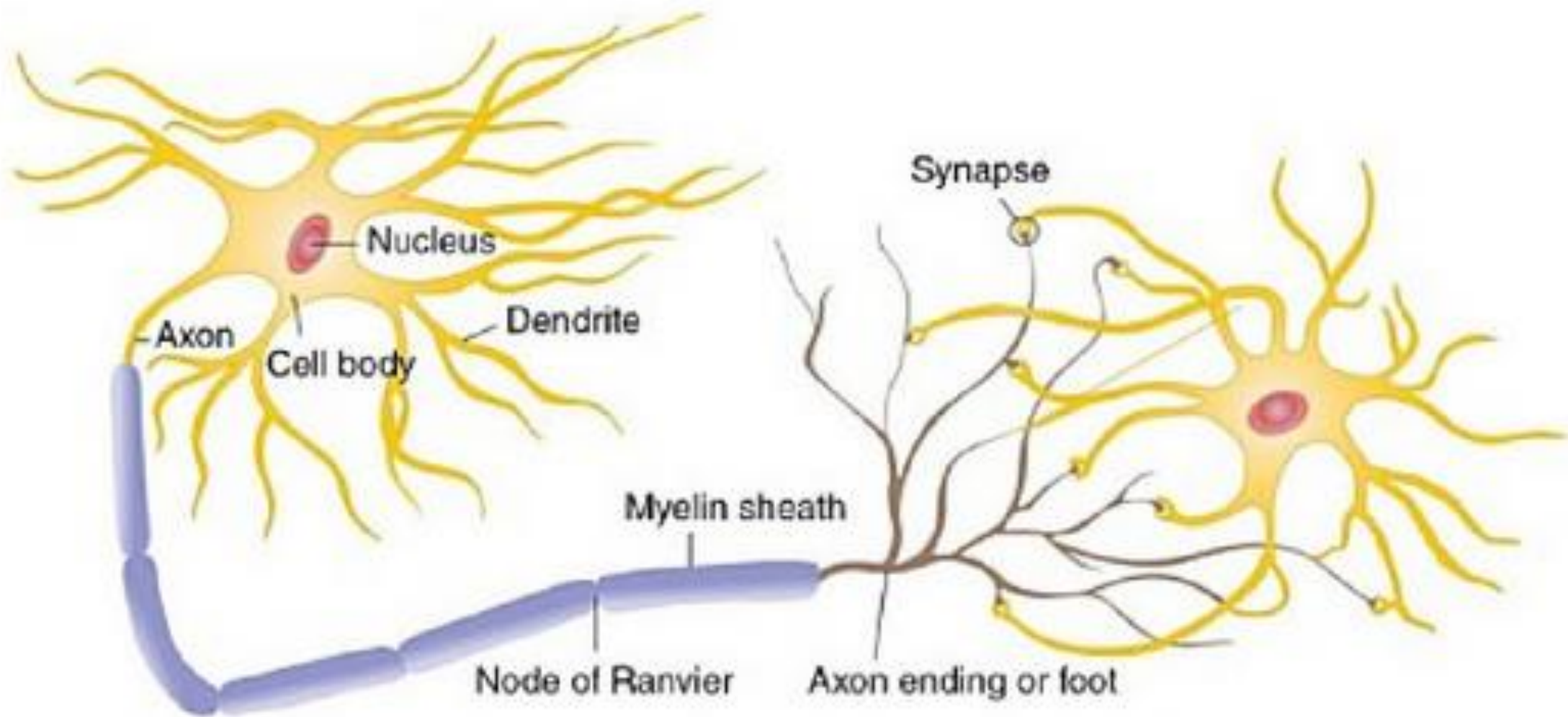
Larger occipital lobe to accommodate larger visual cortex

# Neurogenesis

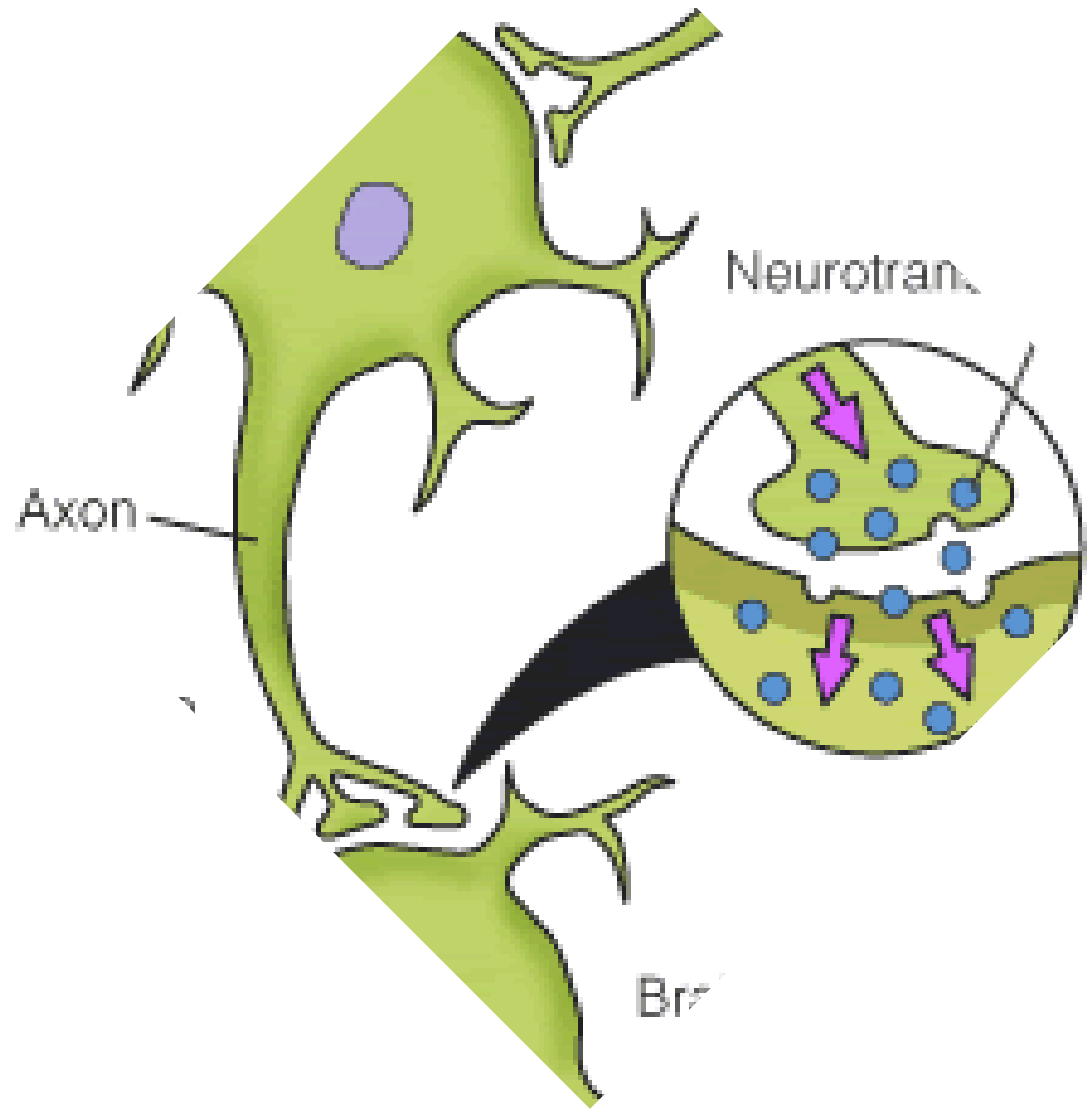
- Neurogenesis refers to the growth of new neurons.
- Unlike virtually all other human cells, neurons stay with us for our whole lives.
- Major exceptions are early year changes of new growths followed by pruning away and neurons in the amygdala and hippocampus.
- Psychedelics appear to promote neurogenesis.
- On the other hand, connections through dendrites and synapses undergo massive change.

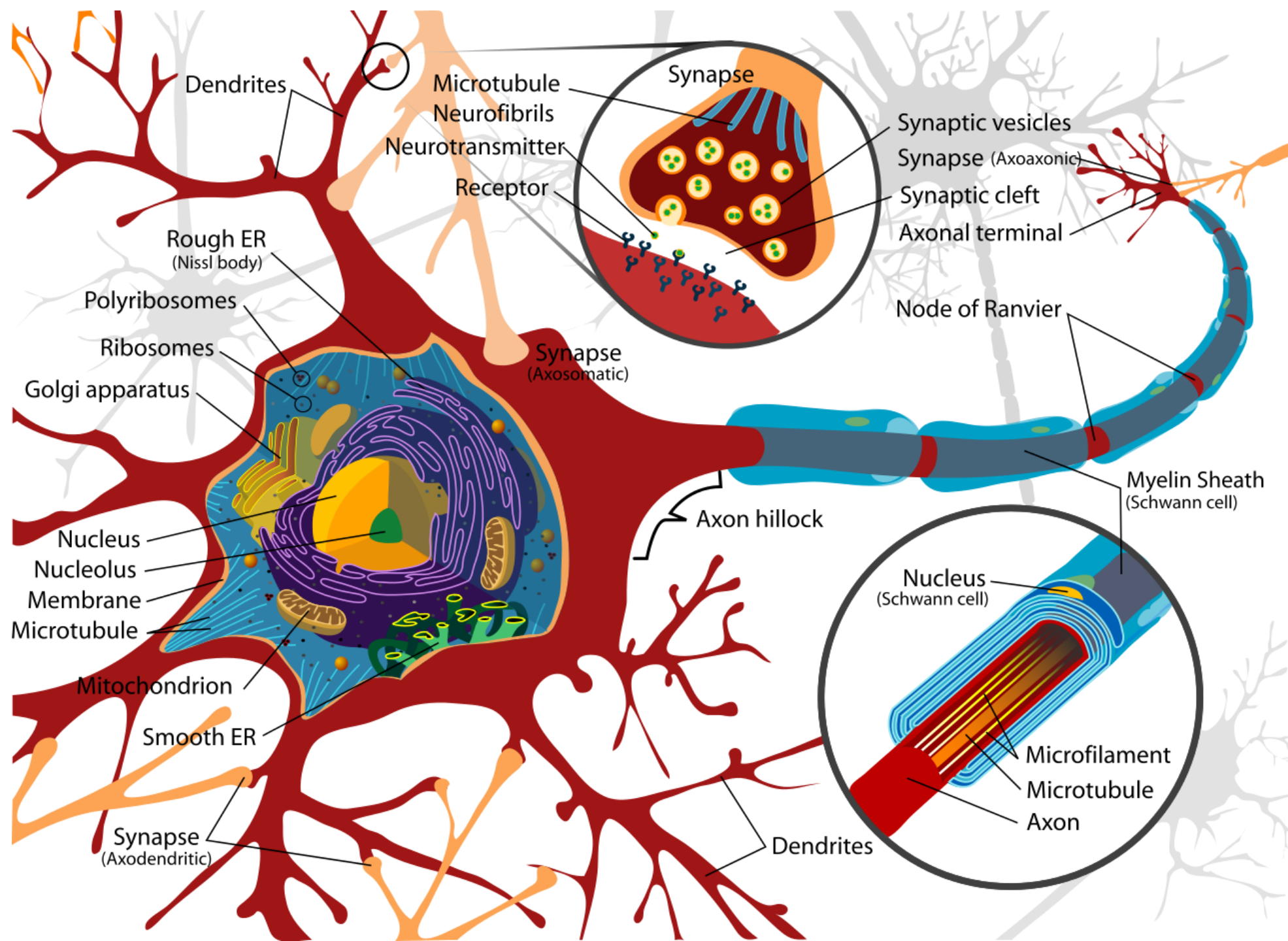
## Structure of a typical neuron









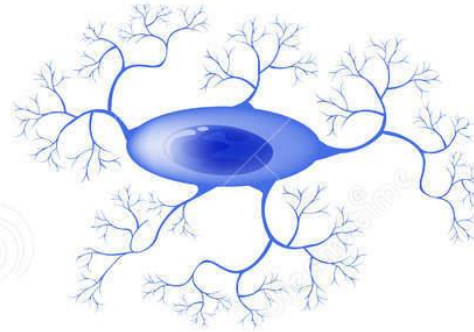


# GLIAL CELLS

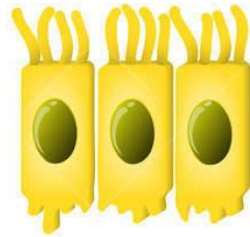
*Oligodendrocytes*



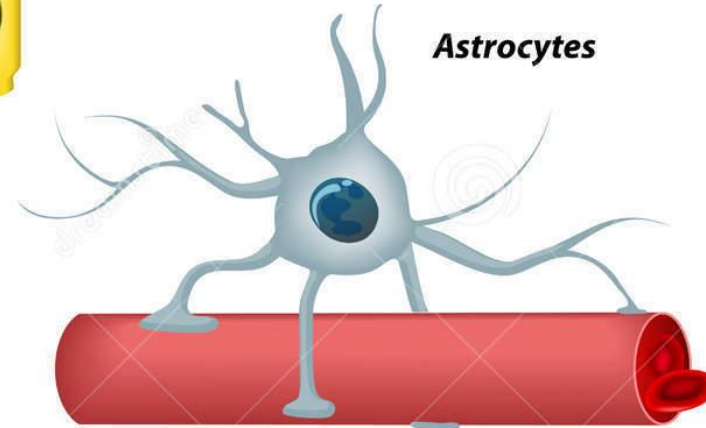
*Microglia*



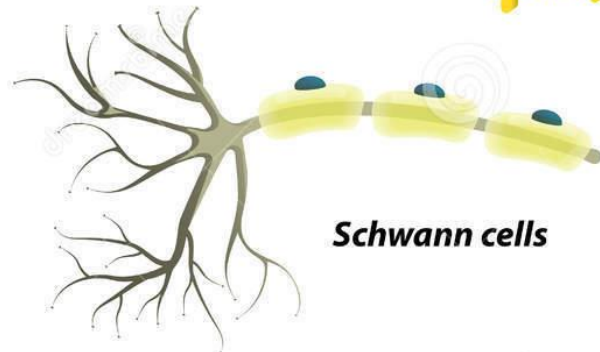
*Ependymal cells*



*Astrocytes*



*Schwann cells*



# Astrocytes

- Most common glial cells
- Called astrocytes because they are star shaped
- Einstein's brain differed from most due to high concentration of astrocytes in his frontal lobe.
- Glial cells produce proteins.
- Numbers of glial cells that produce glial fibrillary acidic protein (GFAP) and Vimentin are significantly reduced in those suffering from depression (cause and effect unknown).
- Unlike neurons, where the number is generally fixed, we grow new astrocytes regularly.

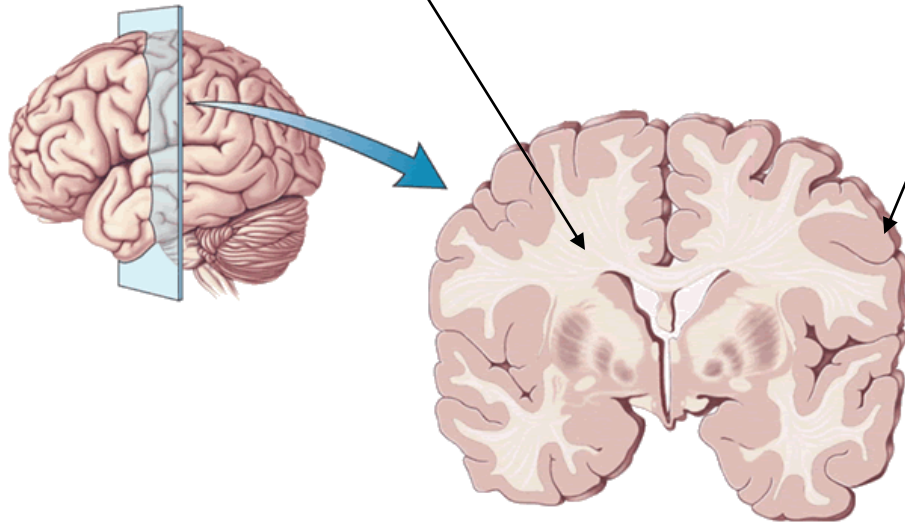


Stained Astrocytes Connecting to Blood Cells

# White Matter

White in color due to [myelin](#) sheath.

Generally responsible for carrying information

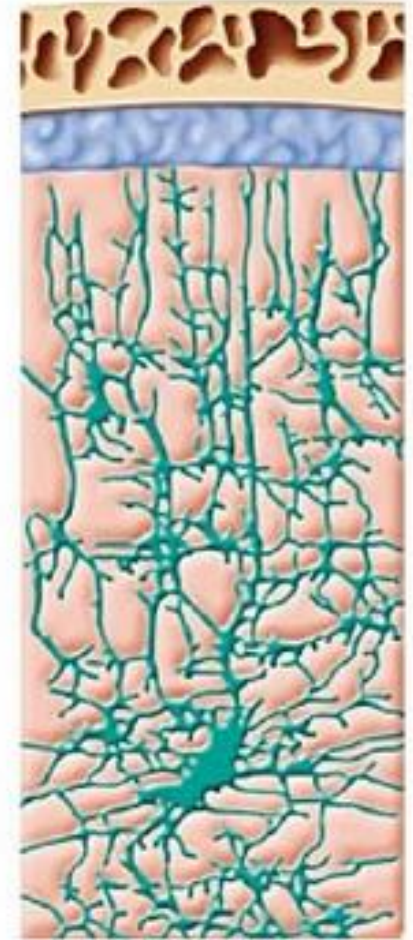
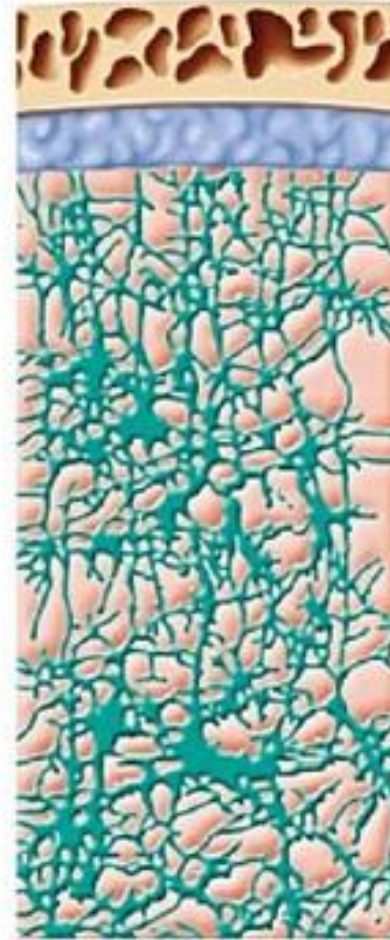


# Gray Matter

Gray/red in color due to the lack of [myelin](#) sheath.

Generally responsible for processing information. Most nerve impulses are generated here.

# Changes in Neurons in Early Years



**36 weeks  
gestation**



**Newborn**



**3 months**



**6 months**



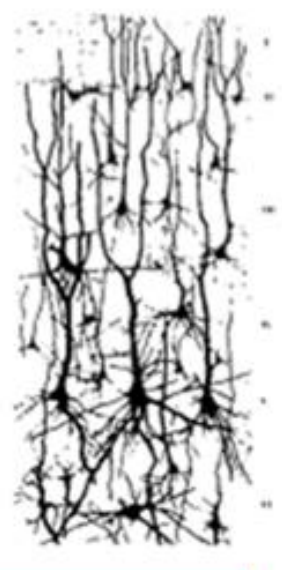
**2 years**



**4 years**



**6 years**

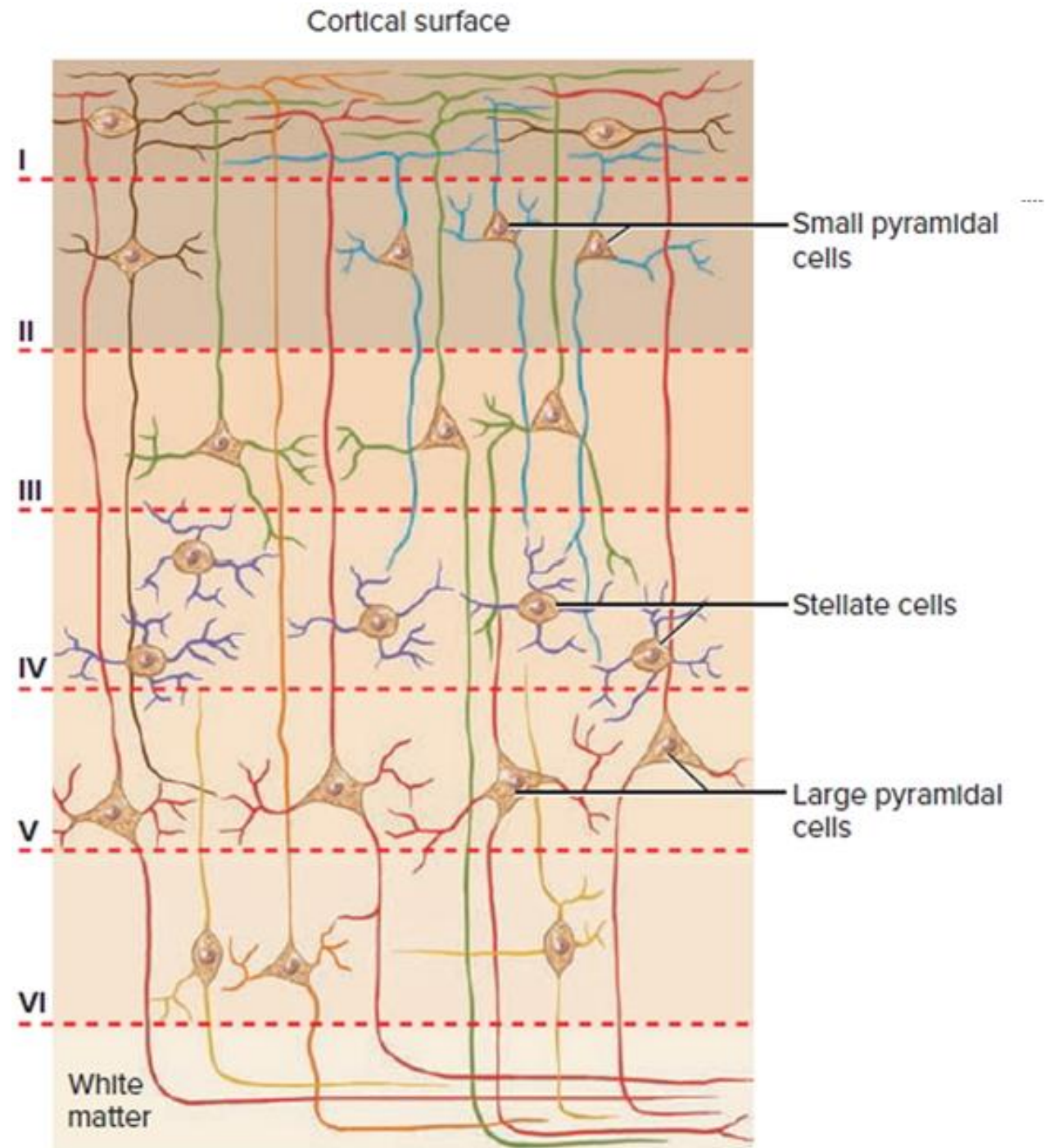


**Synapse formation**

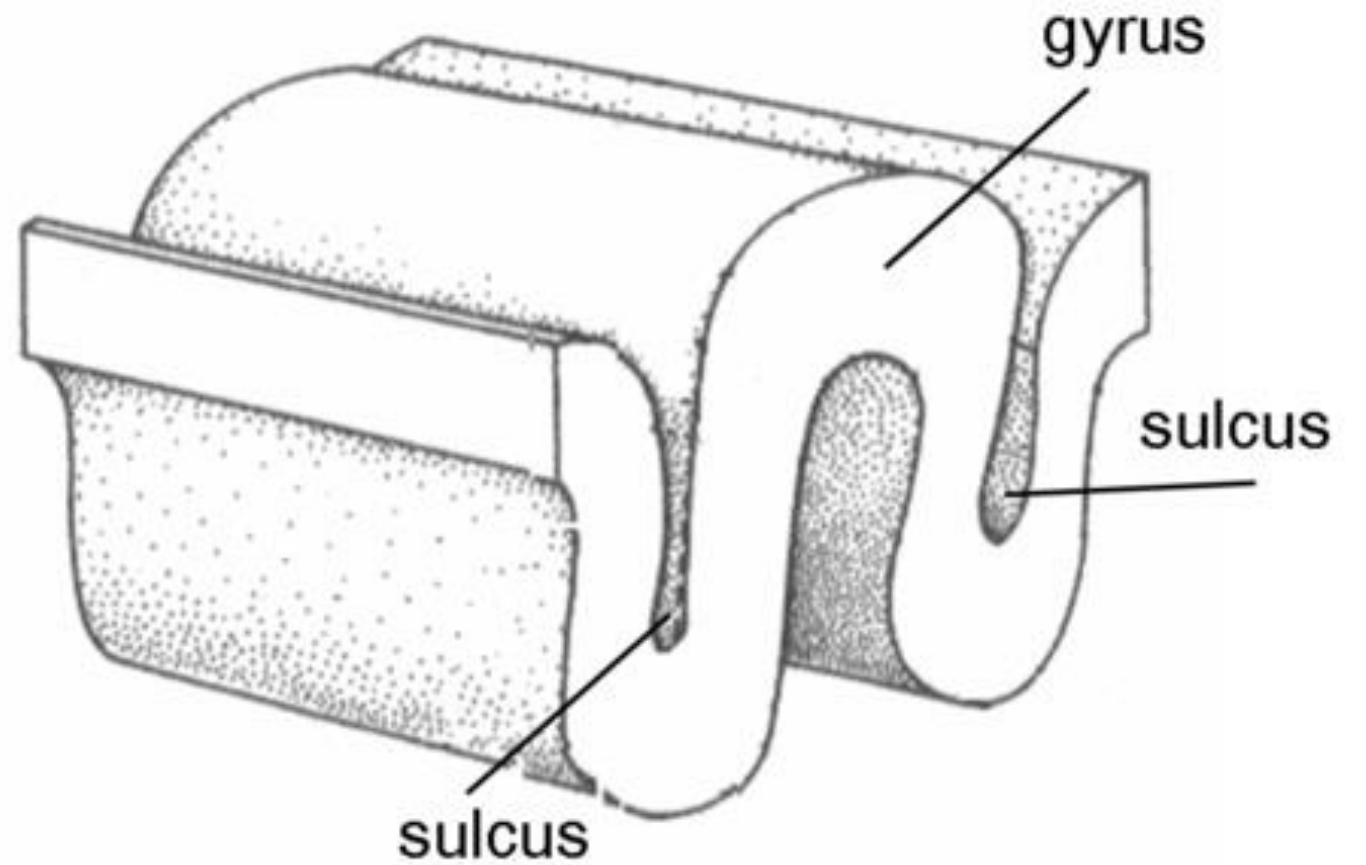
**Synapse pruning**




Neocortex is made up of 6 layers. The folds and the layers allow maximum surface area within a limited skull volume.

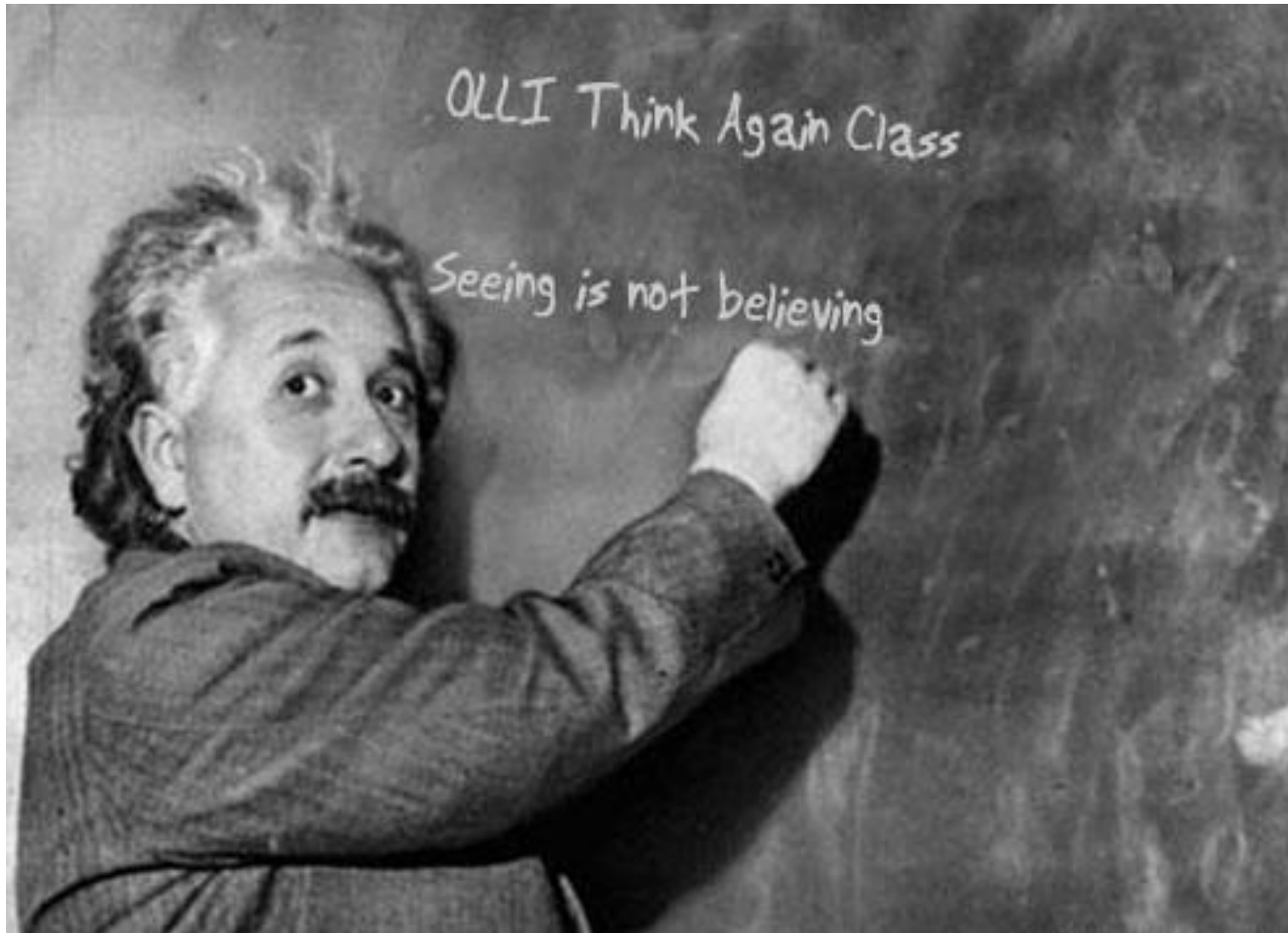


# Gyrus and Sulcus





There is no such thing as an  
Immaculate Perception



OLLI Think Again Class

Seeing is not believing

# What do Benjamin Franklin





# Marvin Gaye and Gladys Knight have in common?

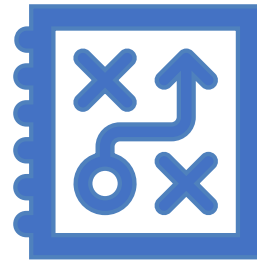
[Video](#)

2:02



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# Heuristic



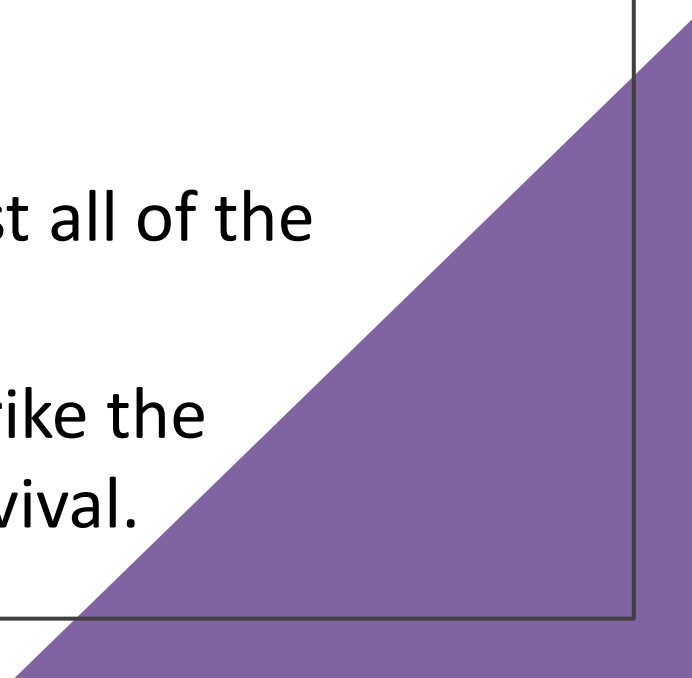
An approach to problem solving, learning, or discovery that employs a practical method not guaranteed to be optimal or perfect, but sufficient for the immediate goals

## Intuitive Heuristic

Concept developed by Kahneman and Tversky applying heuristics to human thinking. It is a heuristic we apply intuitively without conscious thought. It is the tendency to, “when faced with a difficult question, to answer an easier one instead, often without noticing the substitution”.



# Why Does Brain Use Heuristics?

- Would be physically impossible to consider all input.
  - Survival requires brain to preserve limited resources.
  - The trade off is between efficiency and effectiveness.
  - In reality almost all heuristics work almost all of the time.
  - Constantly evaluating and updating to strike the balance that is most likely to support survival.
- 

# Why Are We Sometimes Wrong?

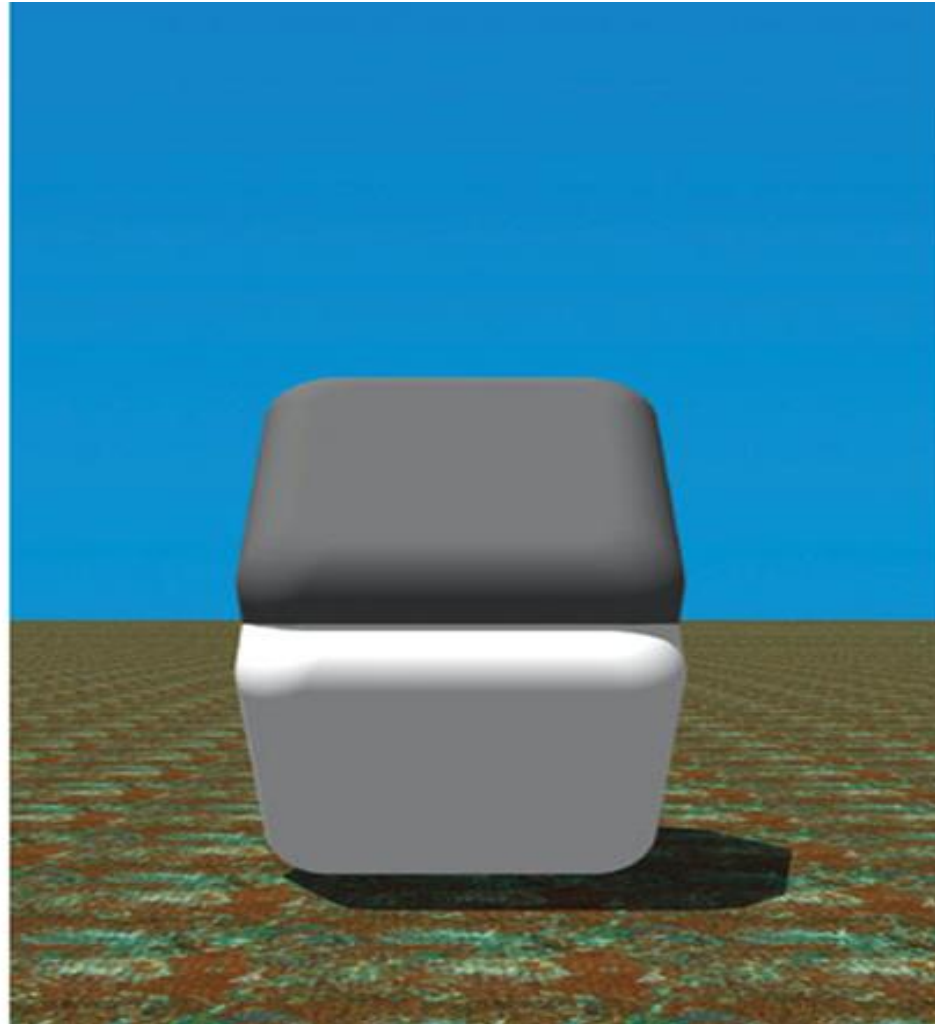
- With illusions, we pick up the cues and process them accurately based on what we have learned.
- The result may be misleading if the cues are manipulated, it is an unusual occurrence, or there are changes that we have not yet integrated.
- We also have built-in biases designed to promote survival, particularly avoidance of loss.

# Things to Think About

- Our brains evolved to process critical cues quickly and create the pictures most likely promote survival.
- Optical illusions insert those cues, realizing they will create the desired illusions.
- Think of how hard it would be to survive if we failed to follow that process.
- It sometimes leads us astray and realizing that can help us avail ourselves of the benefits and avoid pitfalls.
- Those who gain from manipulating our decision-making process, such as advertisers and politicians, specialize in using these cues.
- Think about a poker player who deliberately uses a ‘tell’ signifying bluffing when she wants you to think she is.



# Cornsweet Illusion



[Video](#)





[Video](#)

# Why Shading Illusions Work

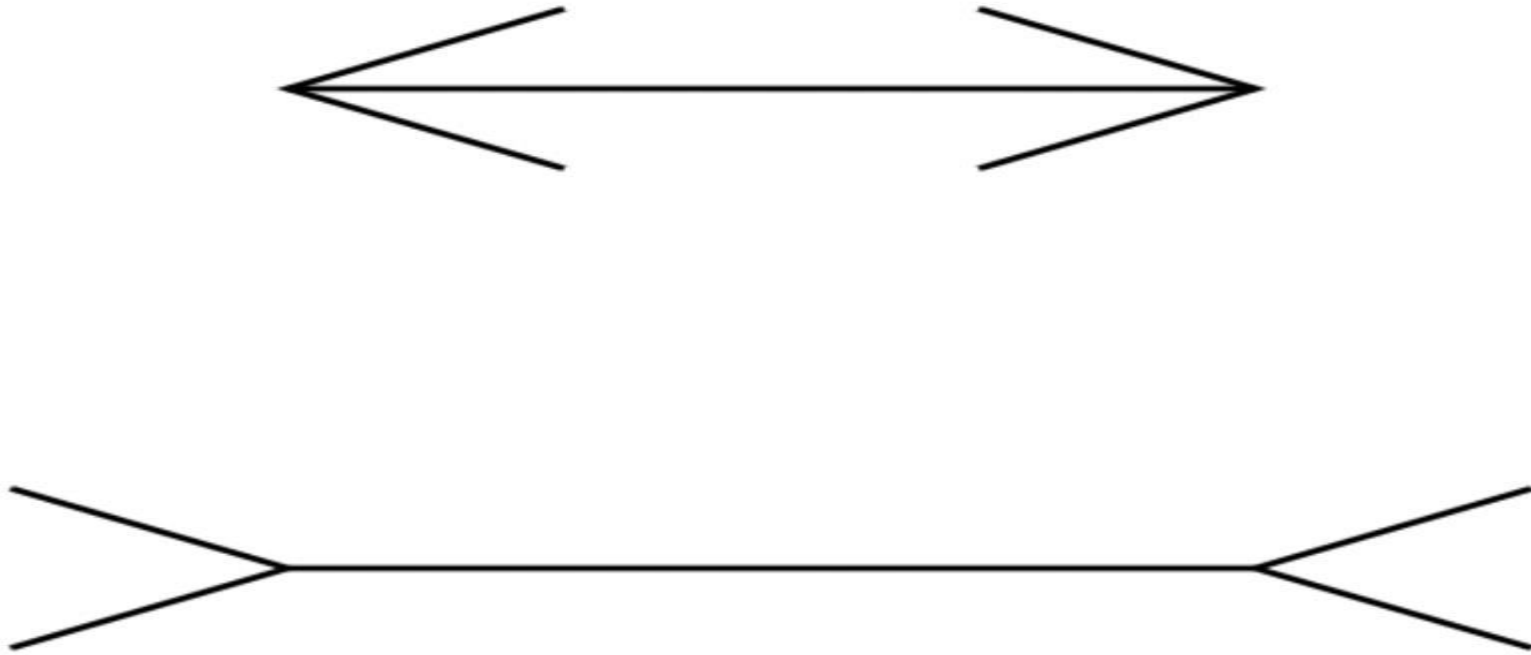
- Sun shines from various angles depending on time of year and time of day.
- Sun is often blocked by buildings, trees, hills.
- Cloud covers vary and constantly change.
- If we could not adjust for shading, we would be wrong most of the time.
- It would take enormous time and energy to calculate shading consciously if it were even possible.
- Illusion works to make us efficient and usually correct.

Which Man  
is Bigger?

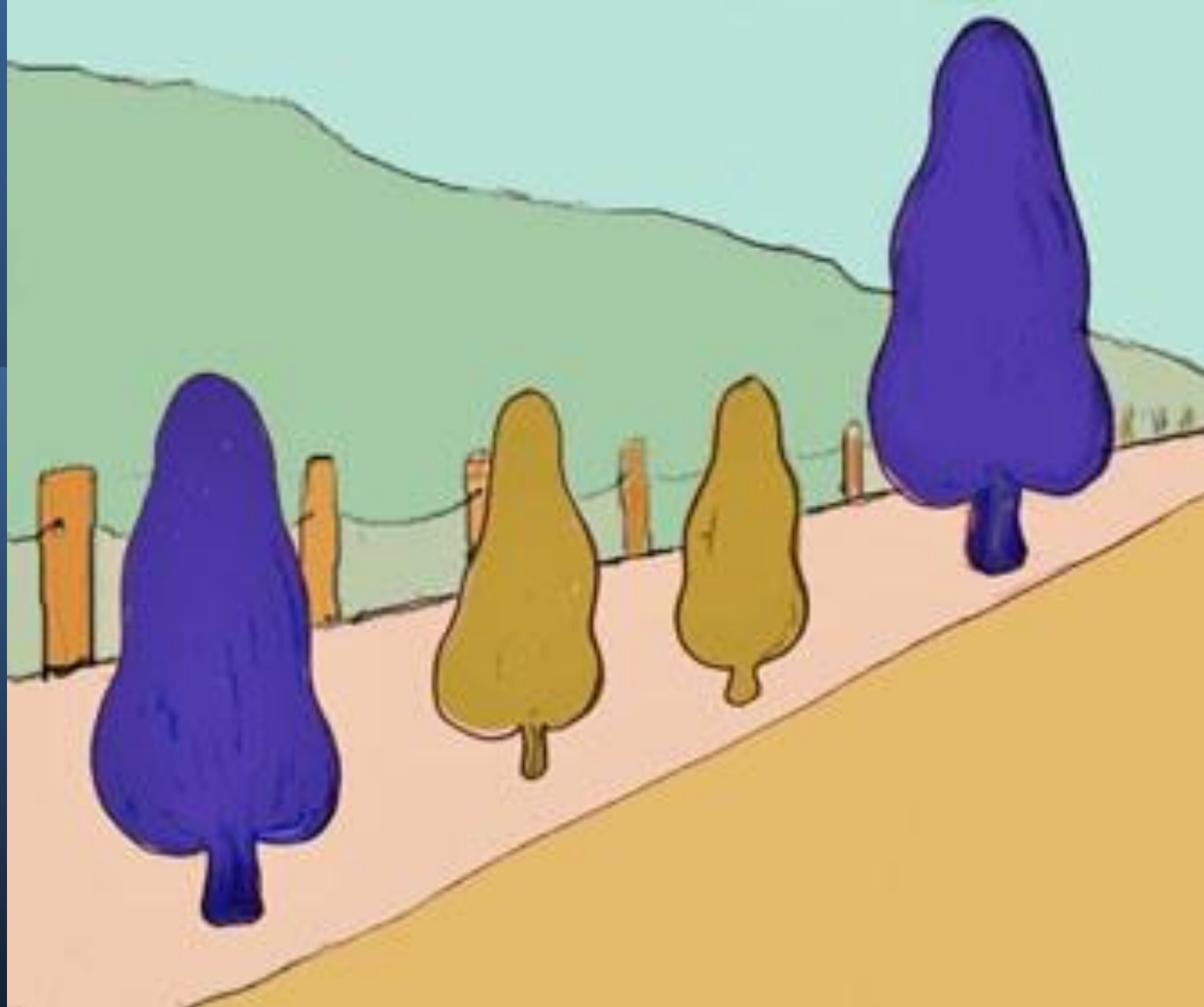




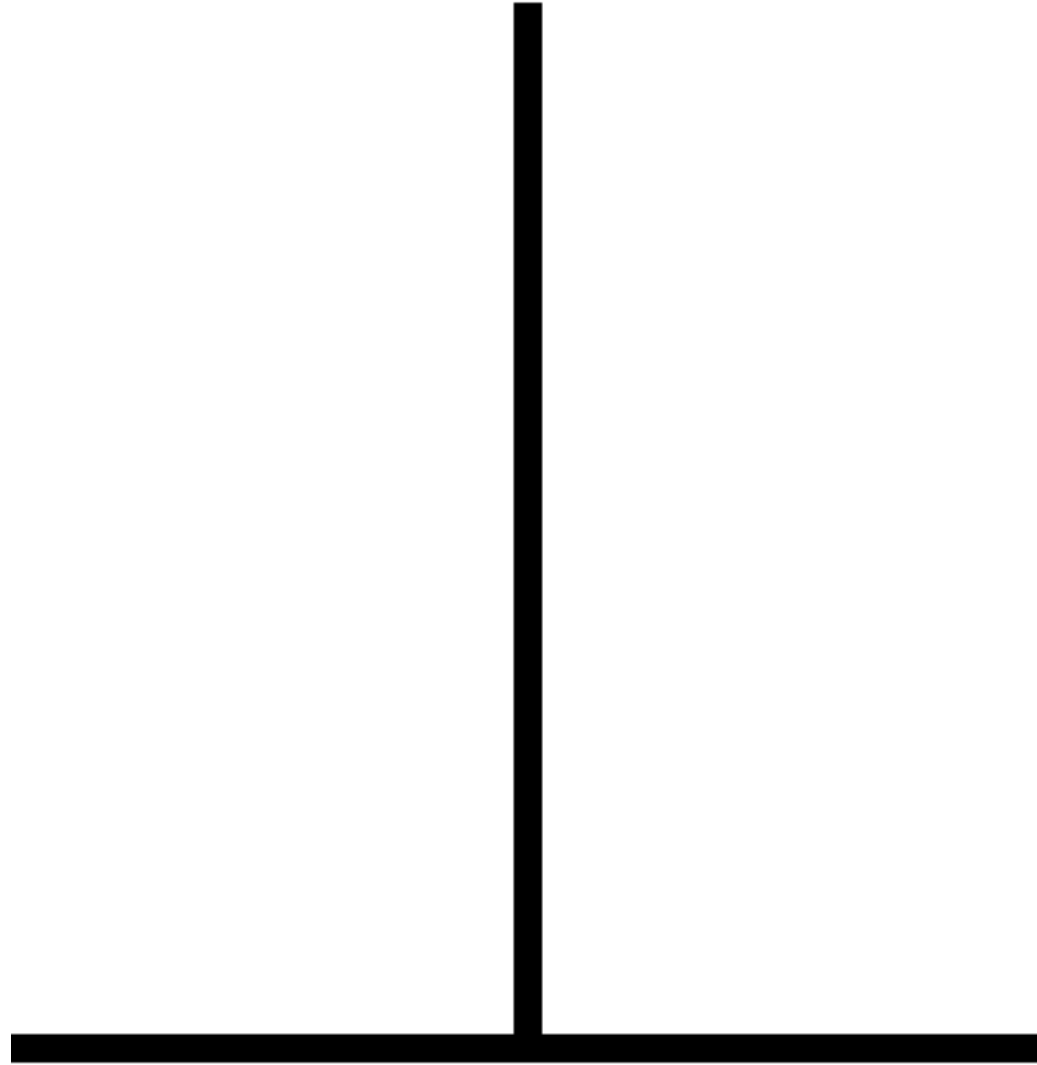
# Muller – Lyer

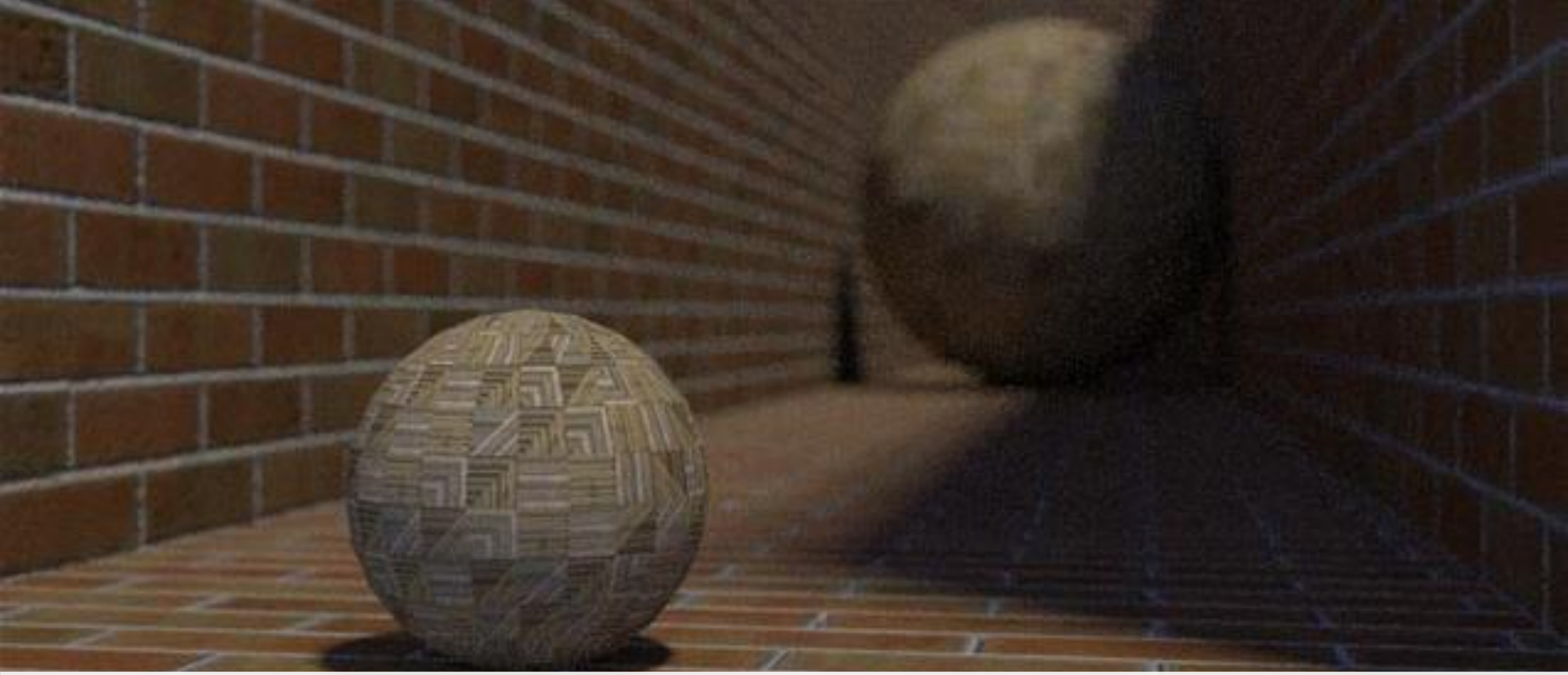


I Never Saw a  
Purple Tree

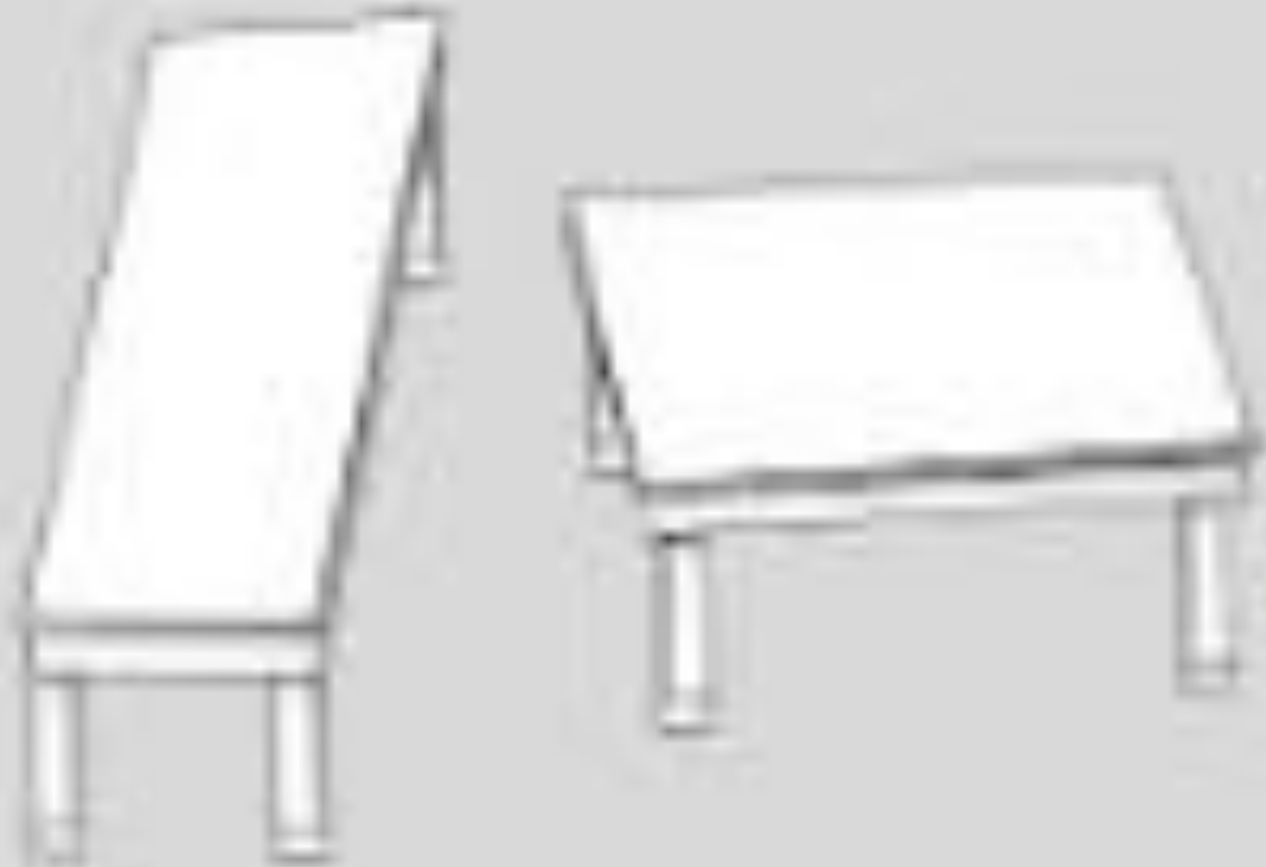


Which is  
Longer?





Which Ball is Larger?



[Video](#)





Video

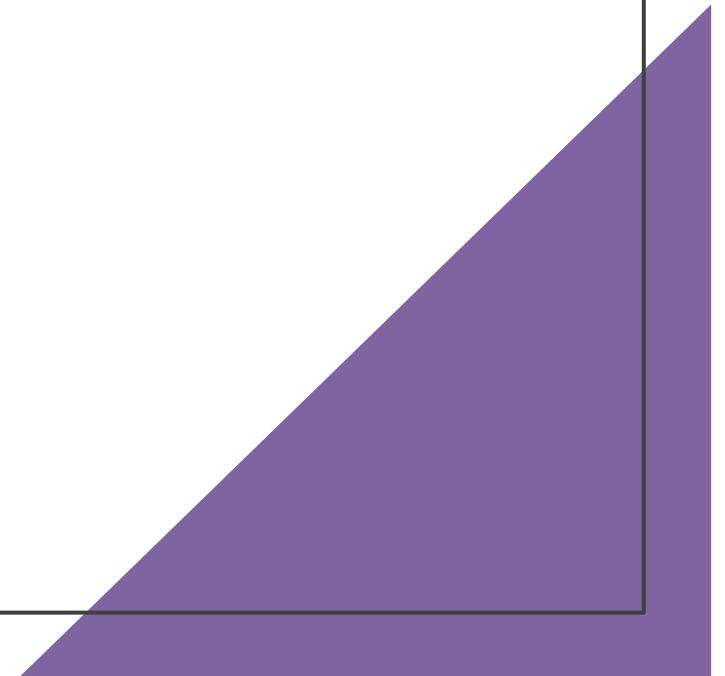
# Why Size Illusions Work

- We only see two dimensional, still images.
- Depth, motion, and distance are beyond our physical capabilities.
- We subconsciously use external cues to appreciate that something is moving, how far away it is, and what size it is.
- Series of still images would take too long, expend extra energy, and put us at risk.



# Size Constancy

- Size constancy refers to the fact that our perceptions of the size of objects are relatively constant despite the fact that the size of objects on the retina vary greatly with distance, light, rotation, and perspective.
- Capacity to maintain size constancy is so important that it appears in an infant only a couple of weeks old.
- Size constancy expansion refers to the illusory expansion of space with apparent distance.





Size  
Constancy  
Expansion  
Constancy  
Expansion



All Walkers  
Are Same  
Size



# Hybrid Images

- Two images are merged, one in low-resolution and the other in high resolution.
- At a distance, we see the fine lines of the higher resolution image. The lower resolution image gets lost with distance.
- As it gets closer, we see the lower resolution image details.
- The video technique can also be used in which detail can added or subtracted creating the appearance of the image moving toward us or away from us.

# My Marilyn Monroe Nightmare



[Video](#)



# Explanation of Monroe Einstein Illusion

- Link to video that explains why it works.
- [Video](#)



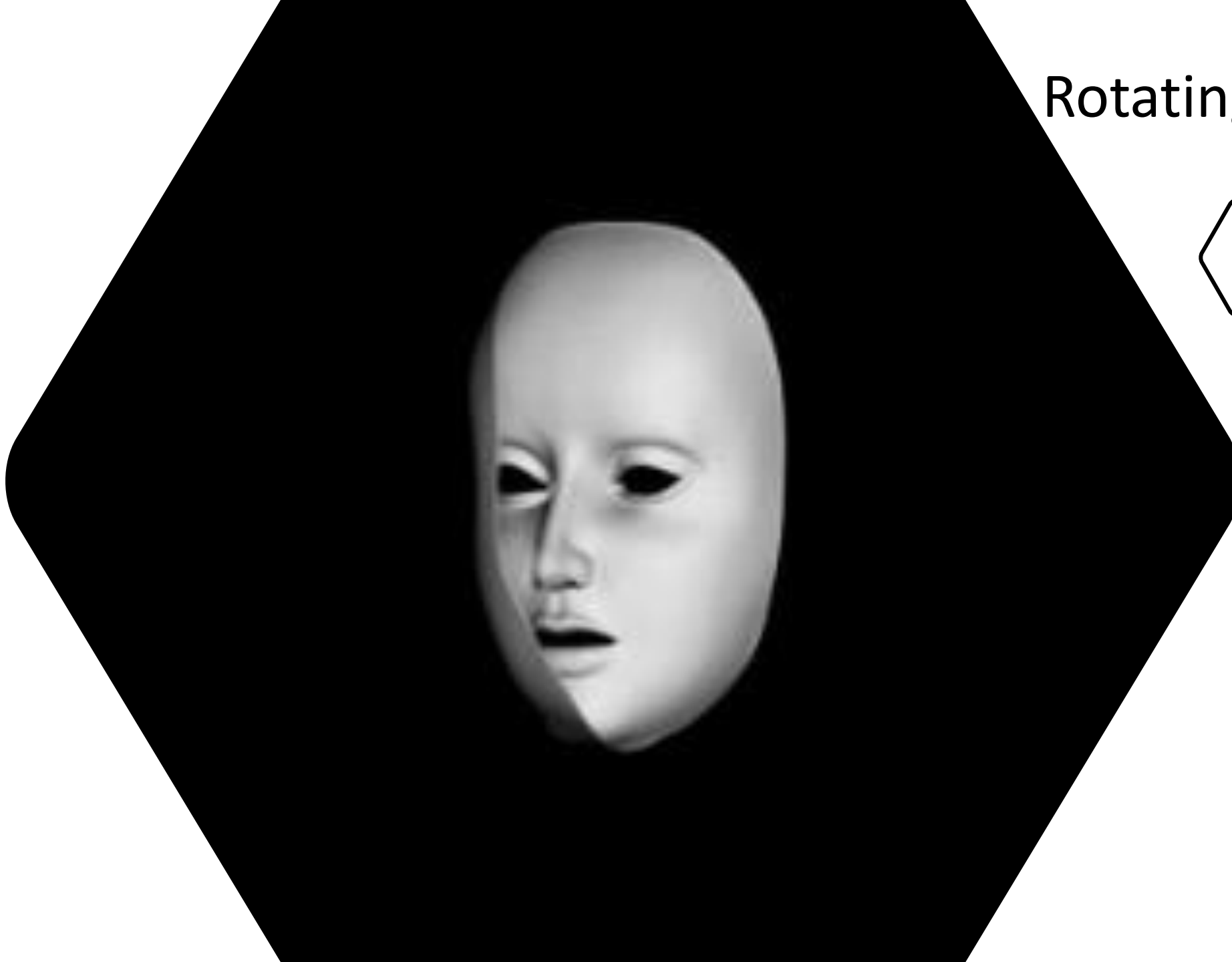
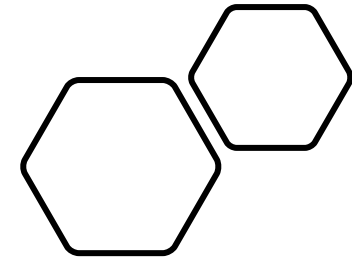
[Video](#)

# Crazy Nuts

[Video](#)



# Rotating Mask Illusion



[Video](#)



# Why We Miss Hollows

- We know from experience that objects are rarely hollow.
- There are no hollow faces so brain automatically corrects.