



# The Aging Brain

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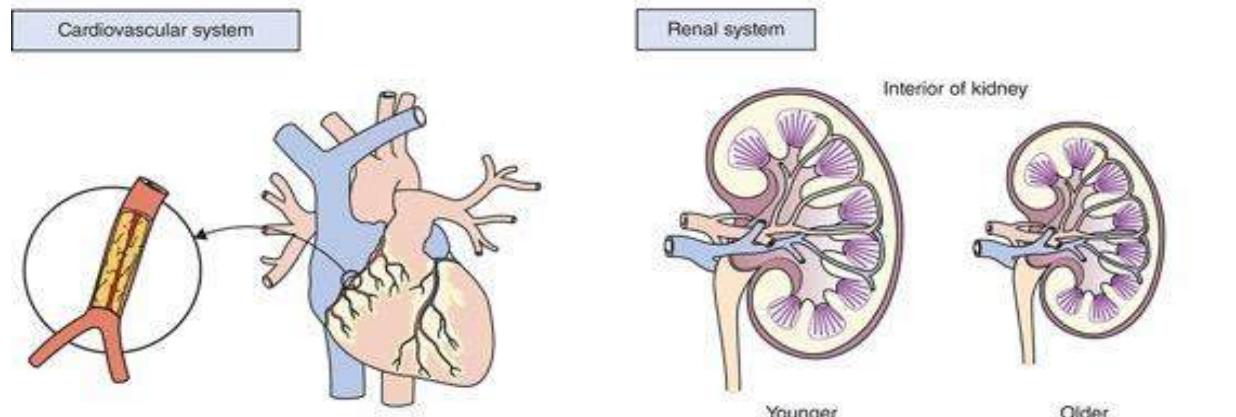
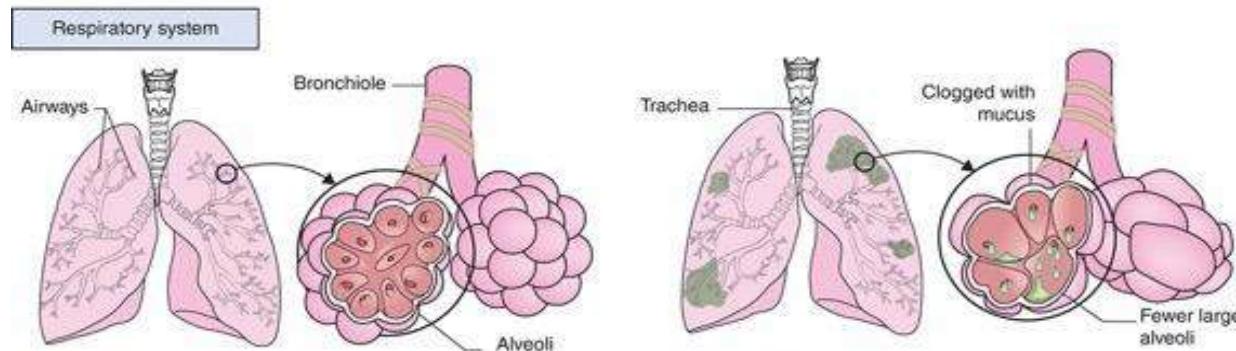
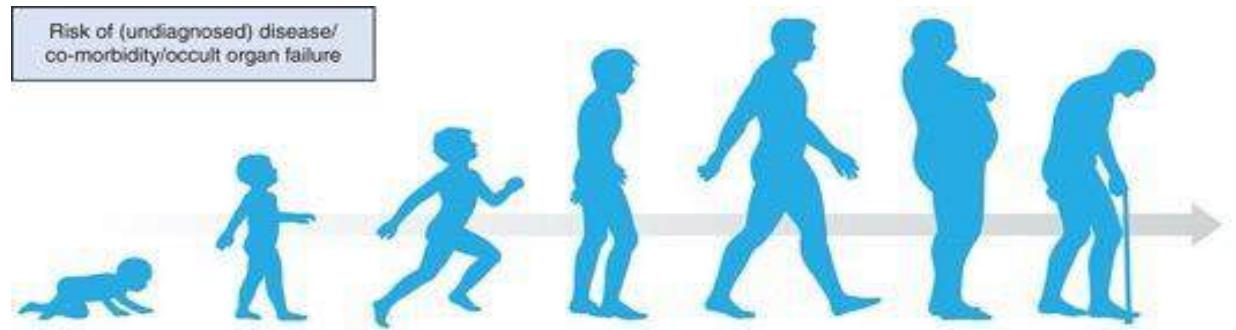
# Aging: life's inevitability



- Aging is guaranteed
- Aging is associated with changes to our body that affect function and performance
- Aging is a major risk factor for stroke and other neurological disorders
- Both genetics and lifestyle choices impact how we age



# With age comes wisdom and physiological changes to our bodies

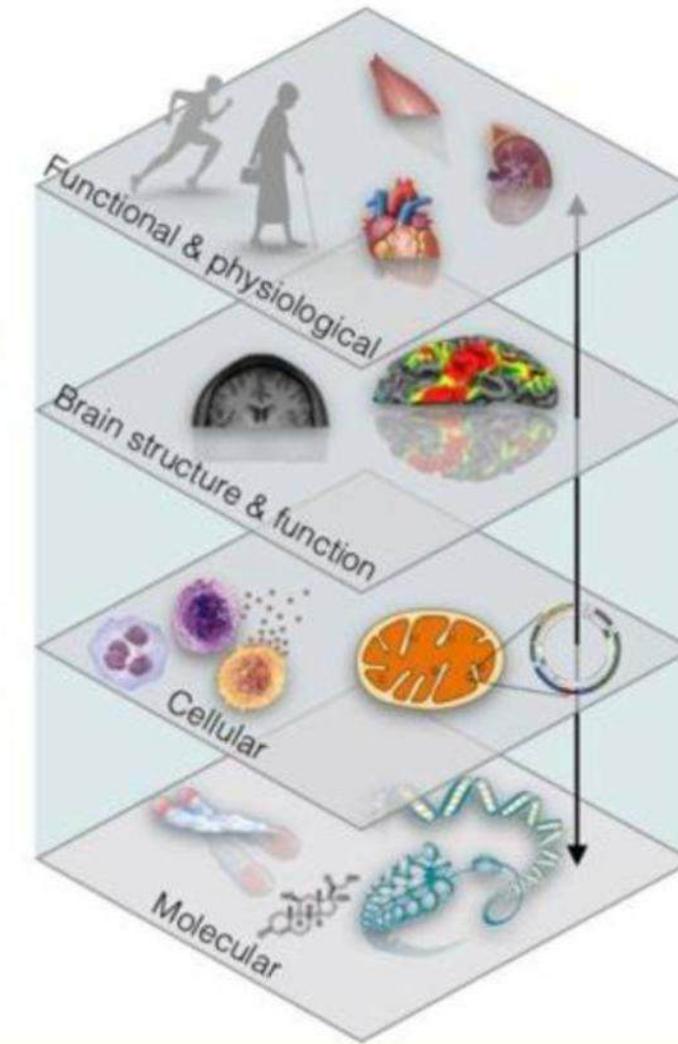


- Initially, aging gives us our independence
- Eventually, aging threatens to take independence away
- Every organ system is impacted by age- heart, lungs, kidneys, muscles

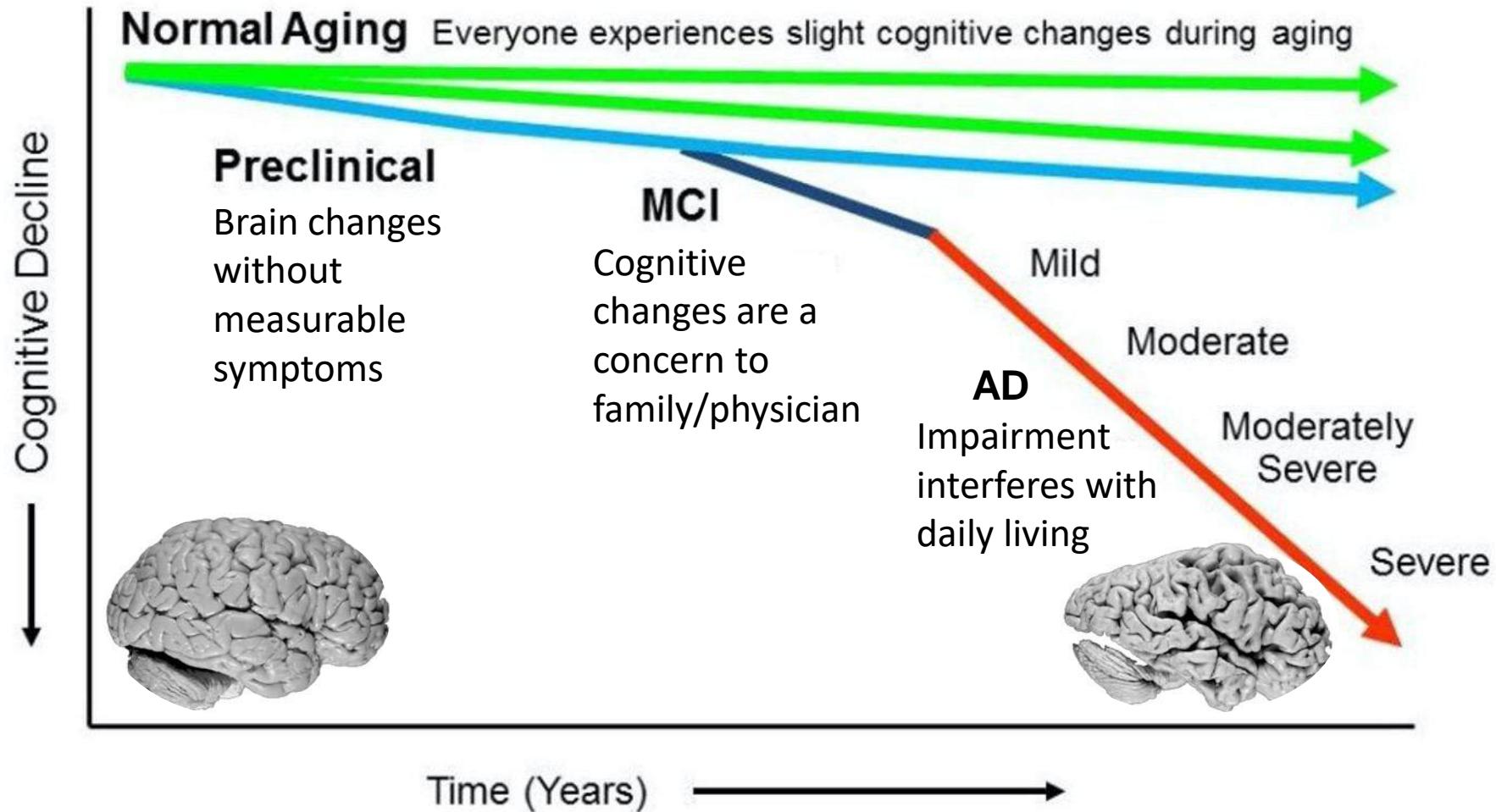
# Aging impacts function at all biological levels



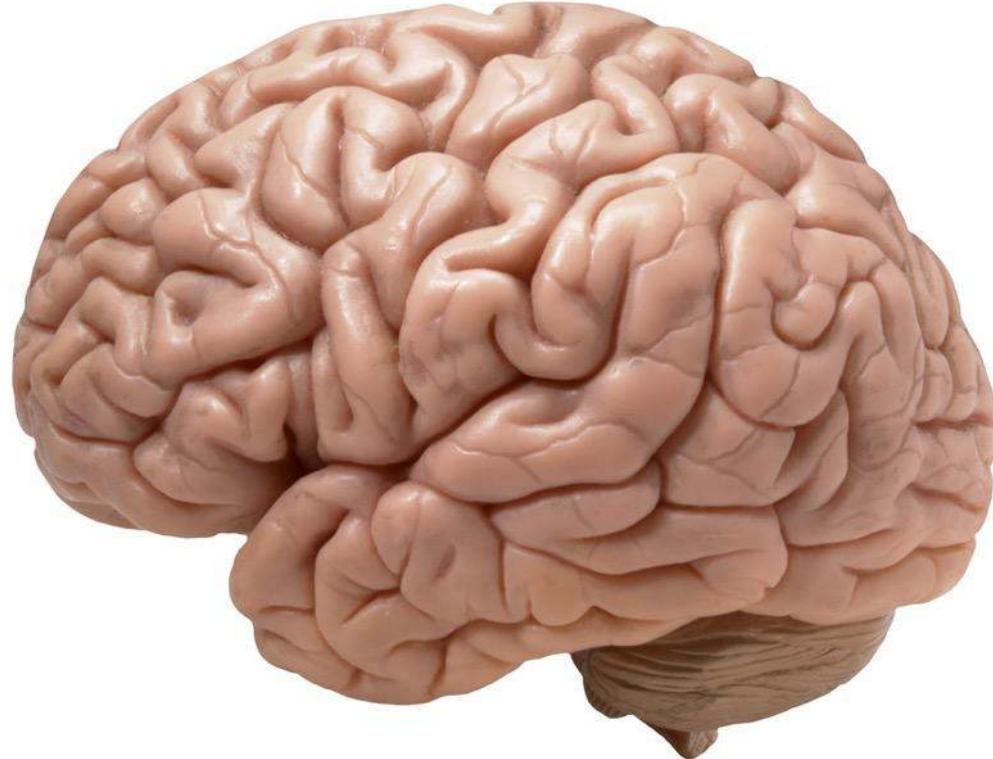
## Biological age indicators MULTI-LEVEL



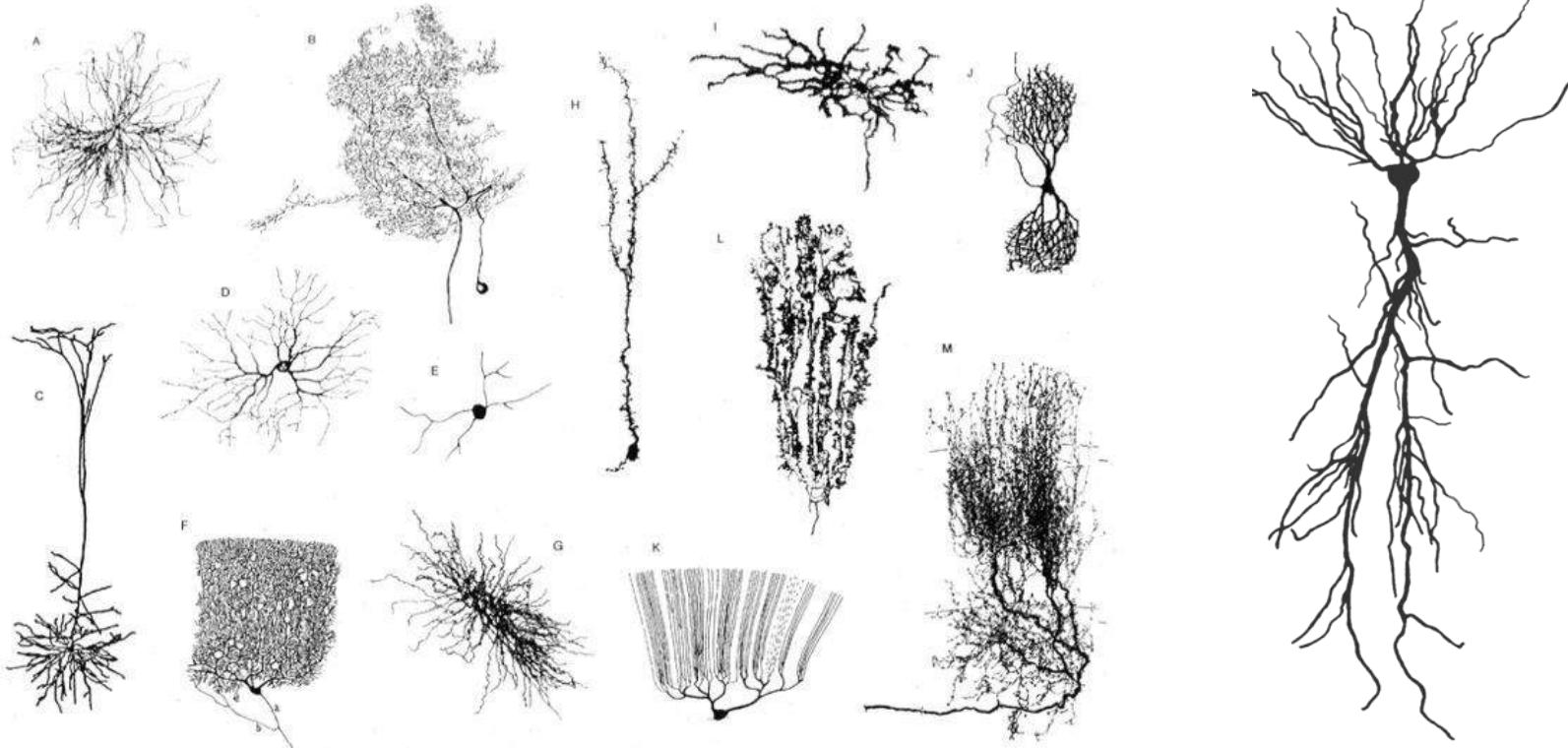
# Our brain ages with the rest of our bodies



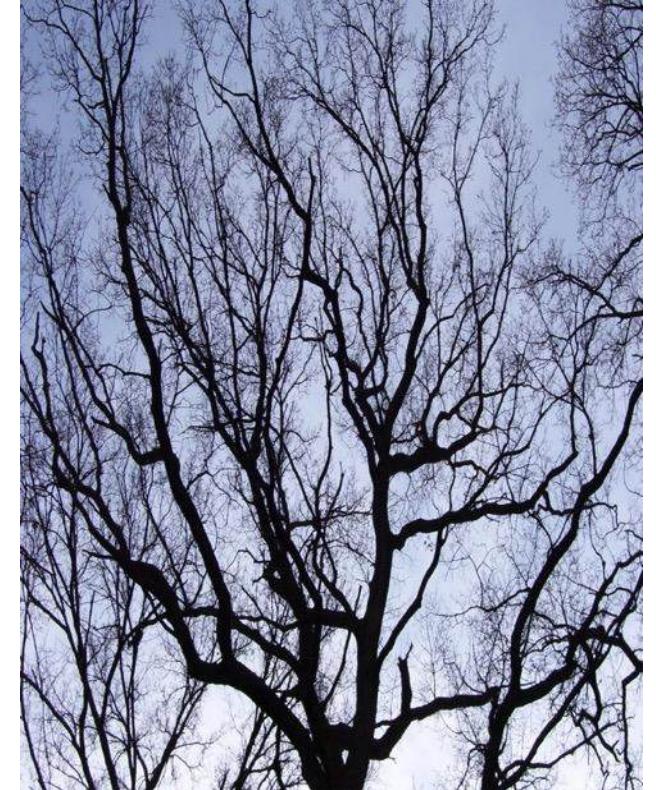
# Healthy human brain



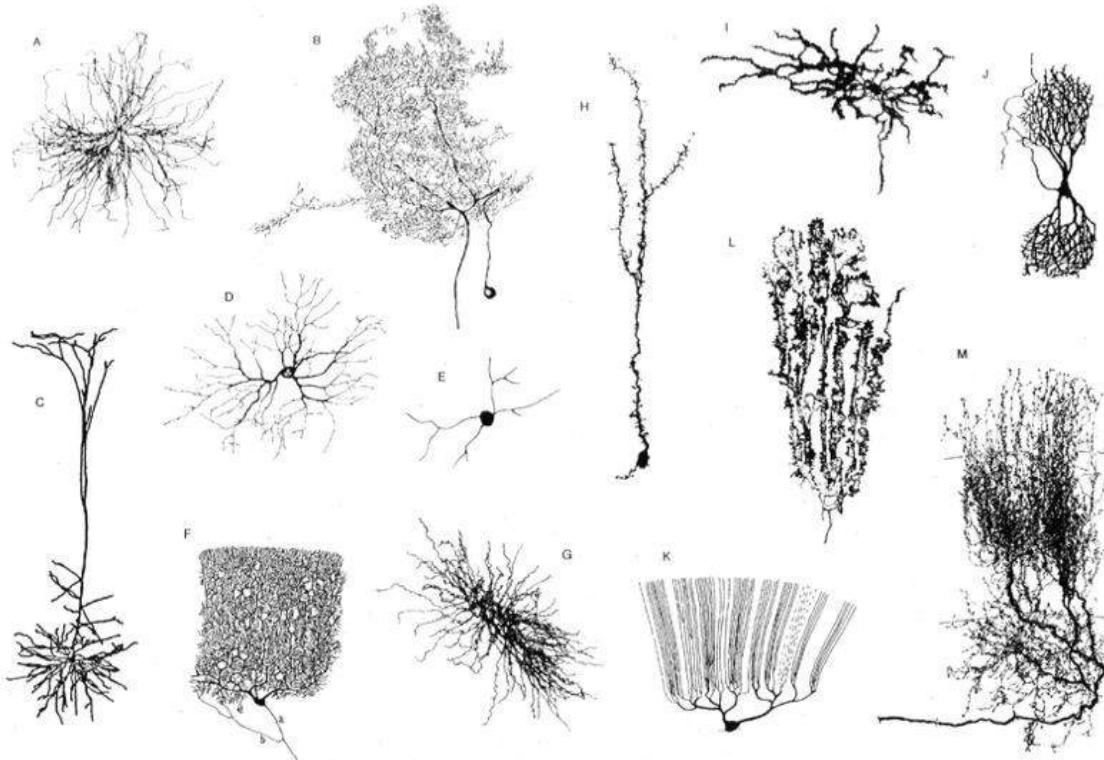
# Brain cells are complex branched structures



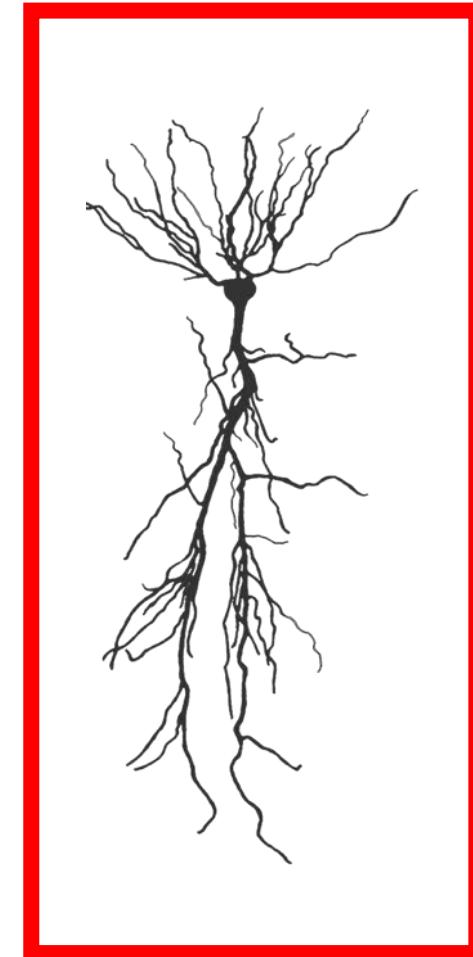
Dendrites, Oxford University Press, 2015; Modified from Mel, B.W. Neural Computation, 1994.



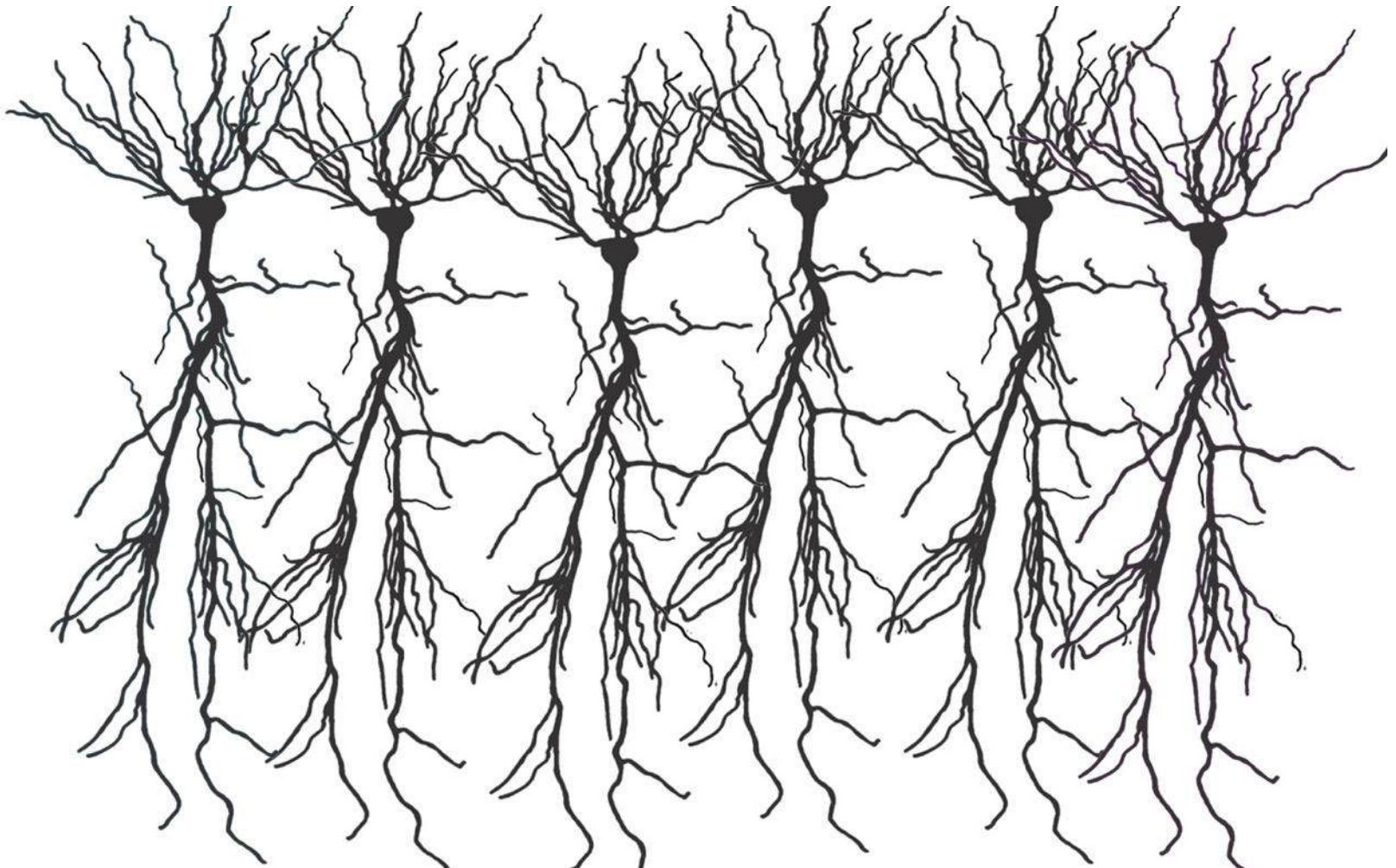
# Brain cells are complex branched structures



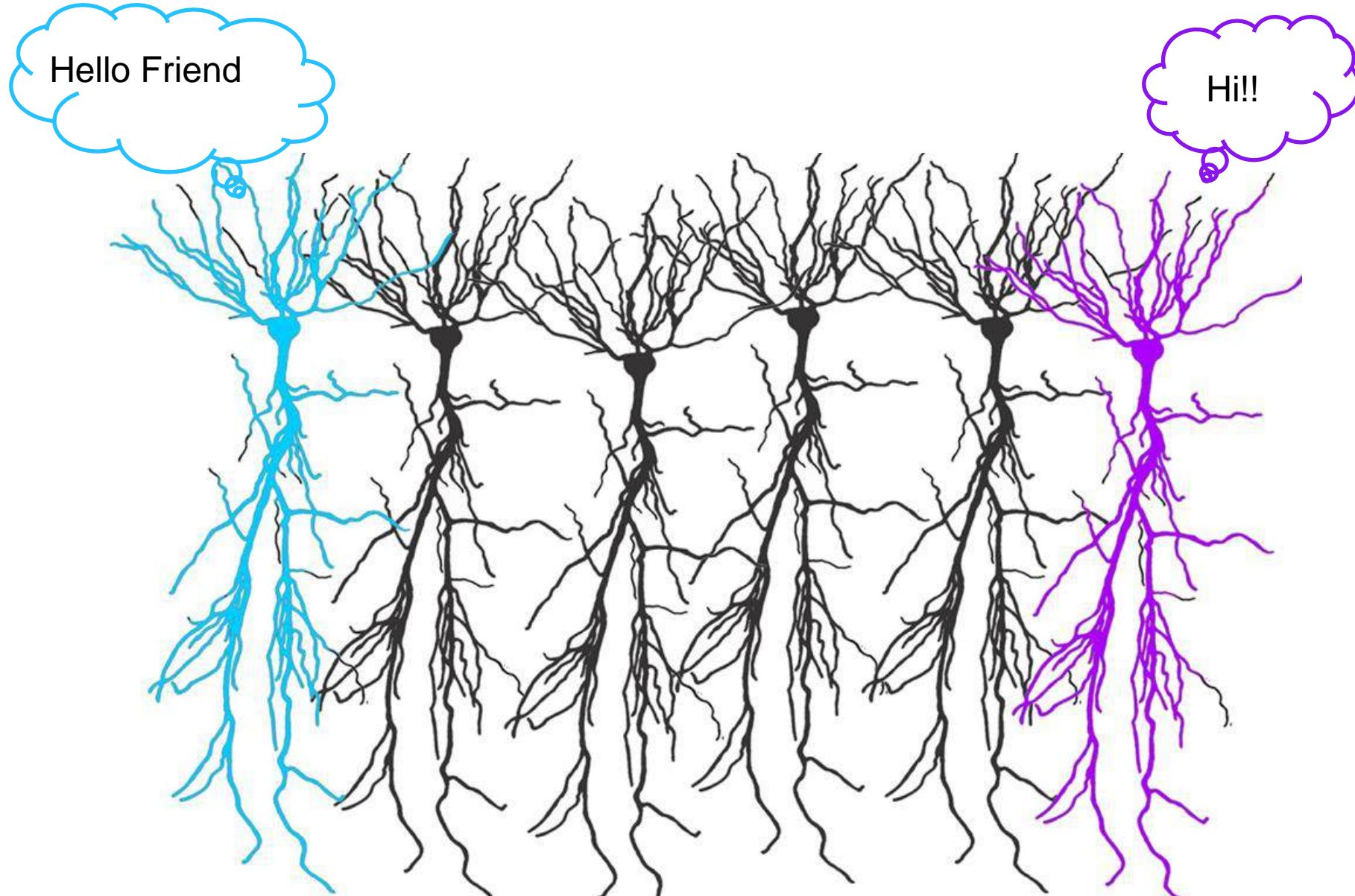
Dendrites, Oxford University Press, 2015; Modified from Mel, B.W. Neural Computation, 1994.



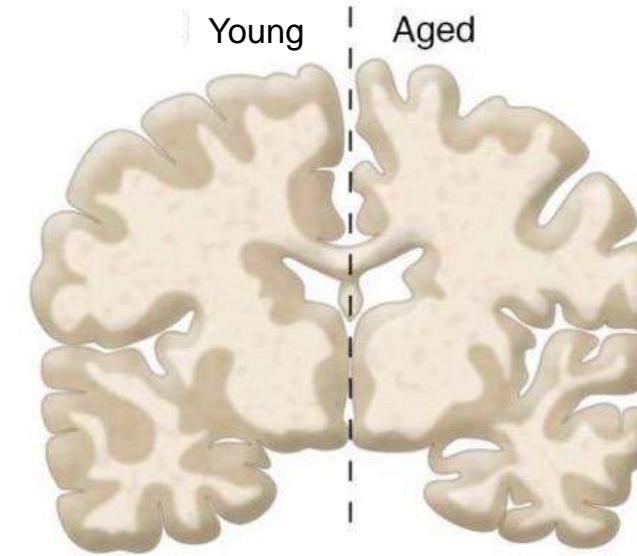
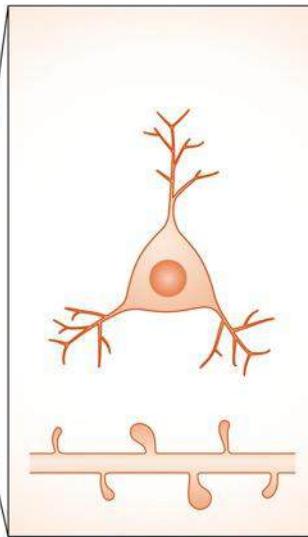
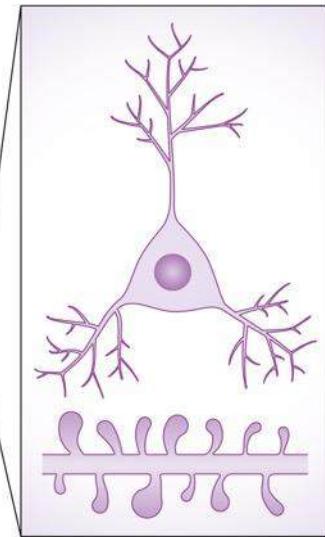
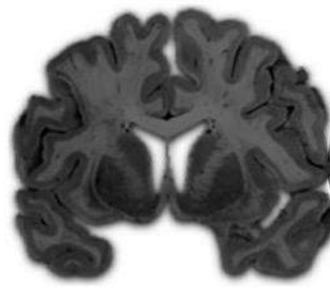
**Billions of brain cells are in a human brain**



# Millions of brain cells are in a human brain

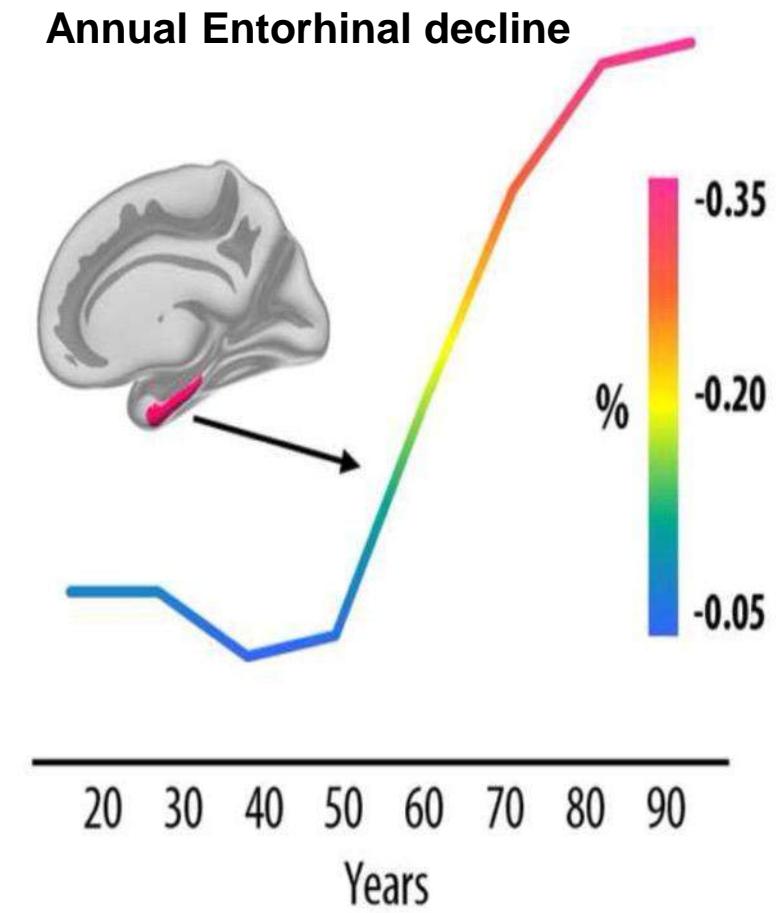
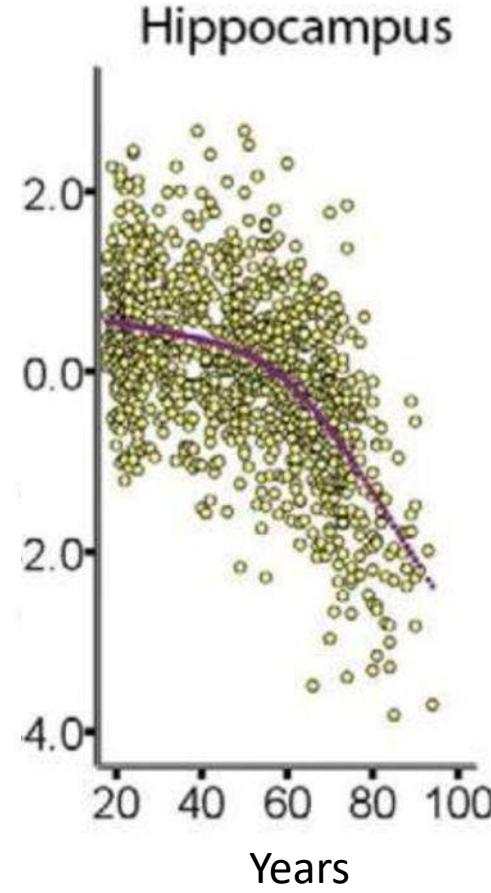
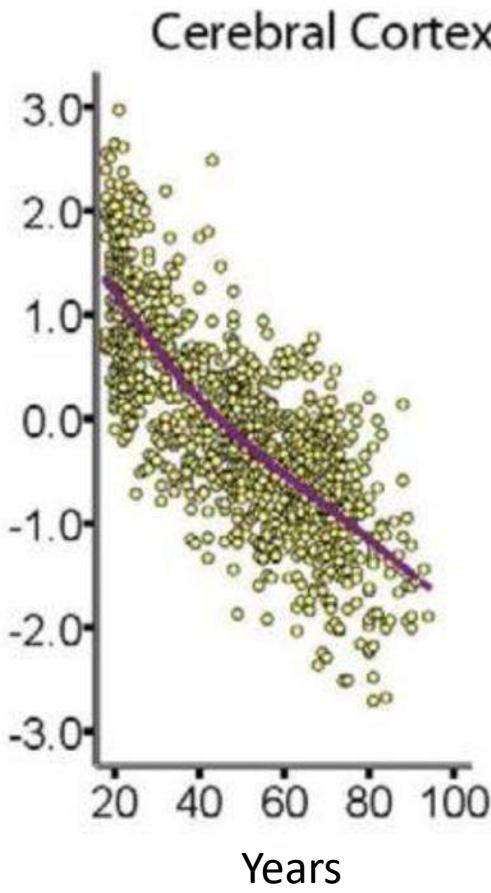
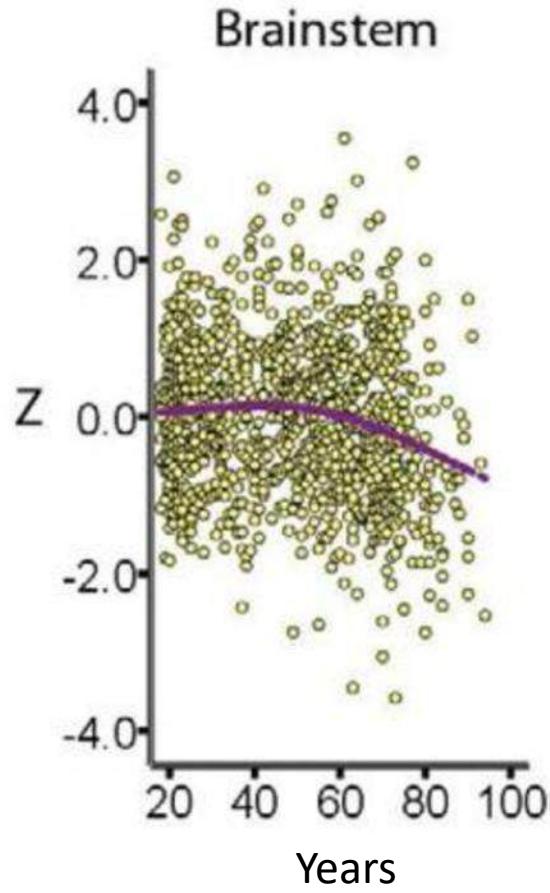


# Aging induces changes to cells in the brain and their function

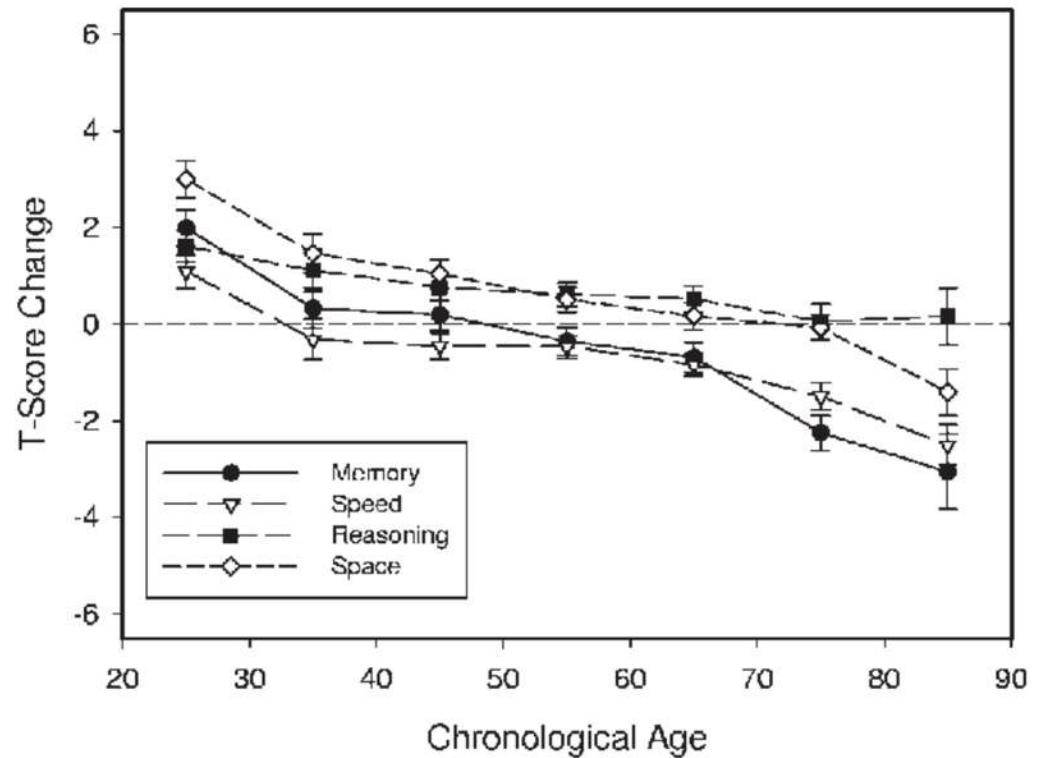
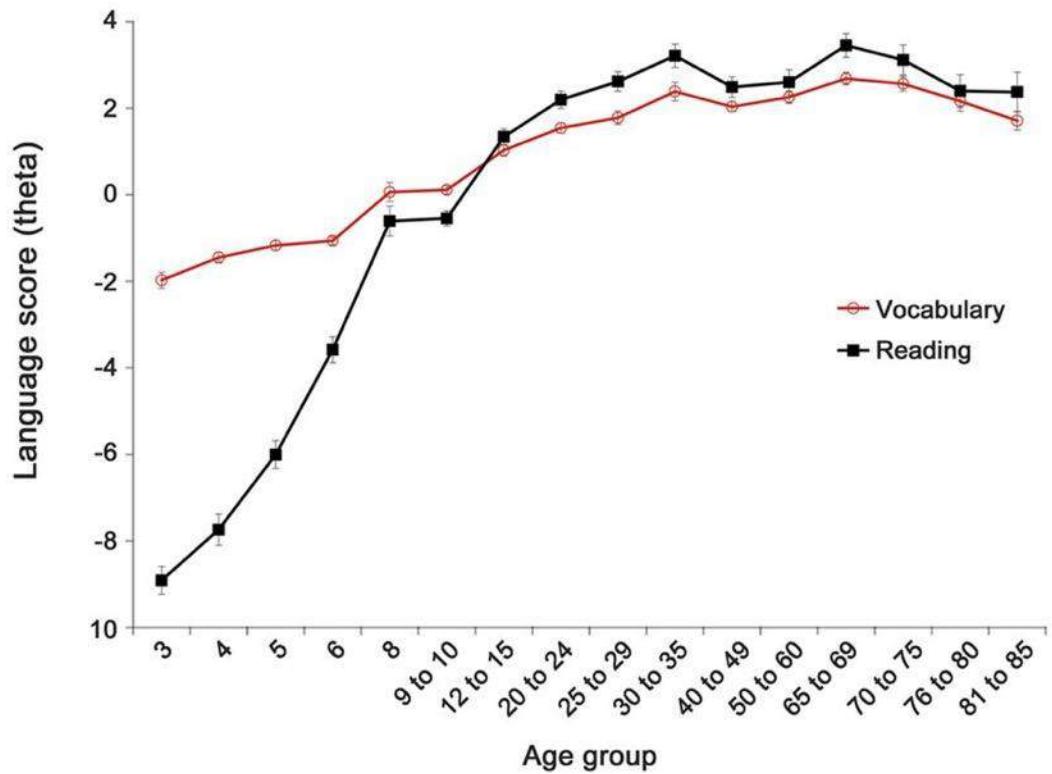


Declining cognition  
Deficits in memory and processing speed  
Circadian rhythm/sleep disruption

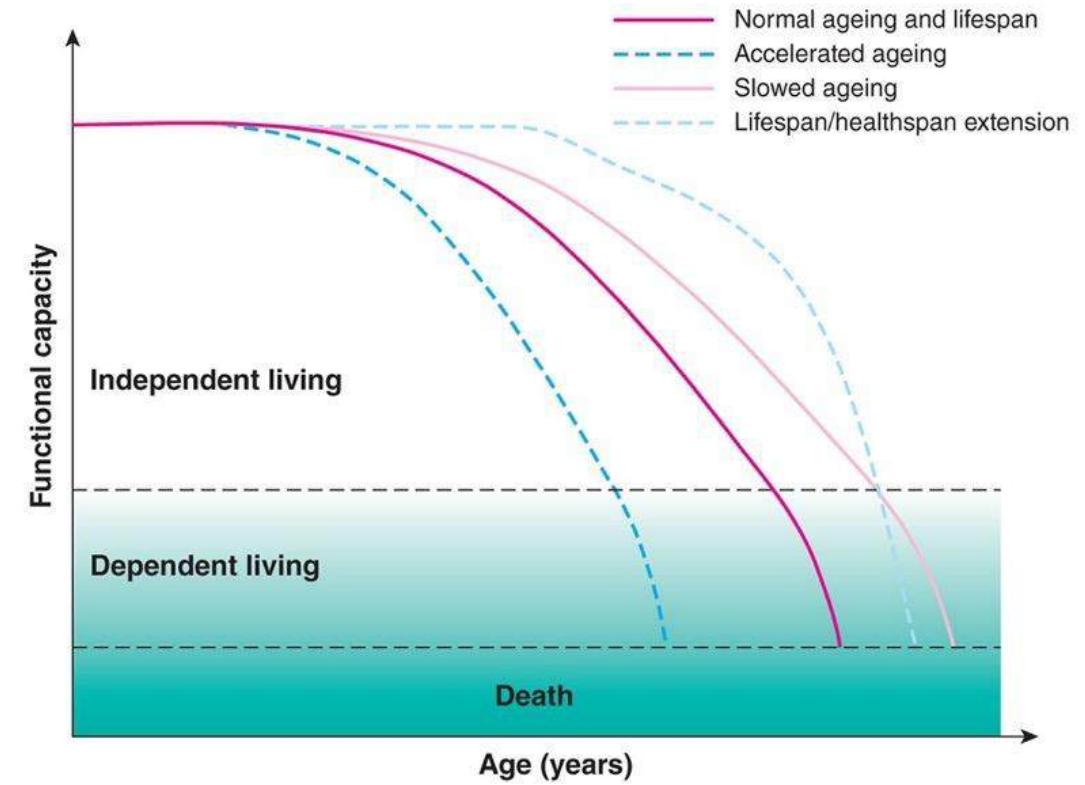
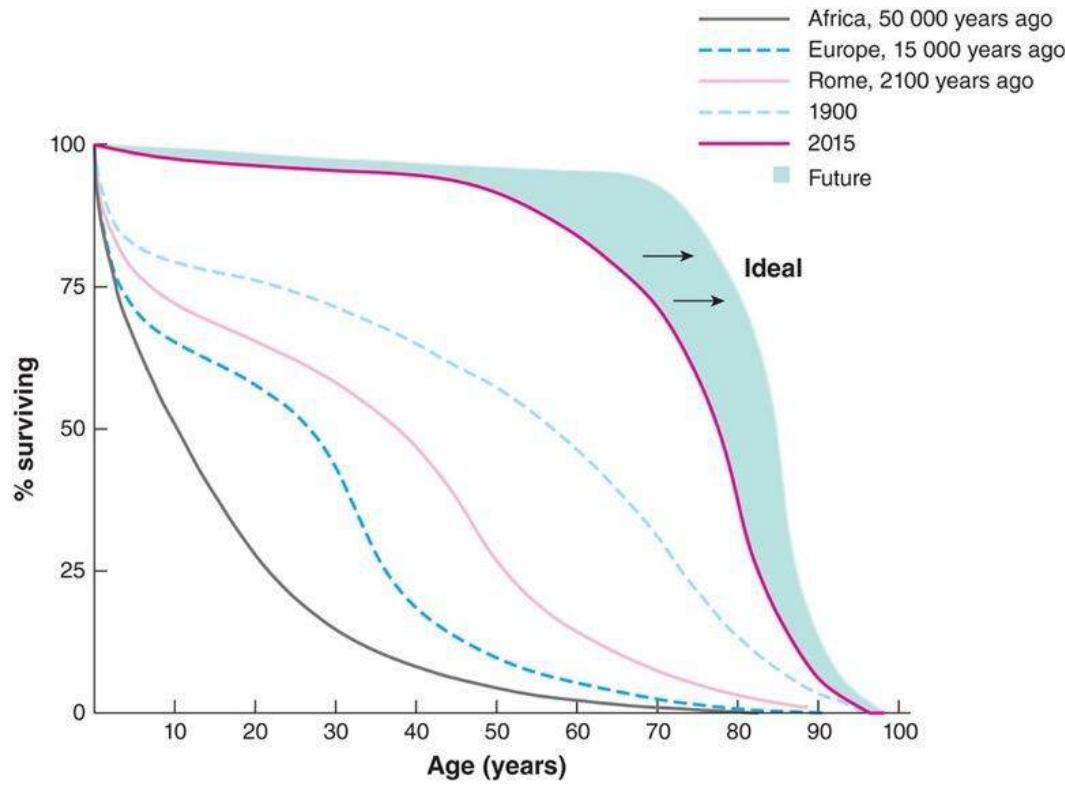
# Brain volume is reduced with age



# Changes to cognitive function are a normal part of aging



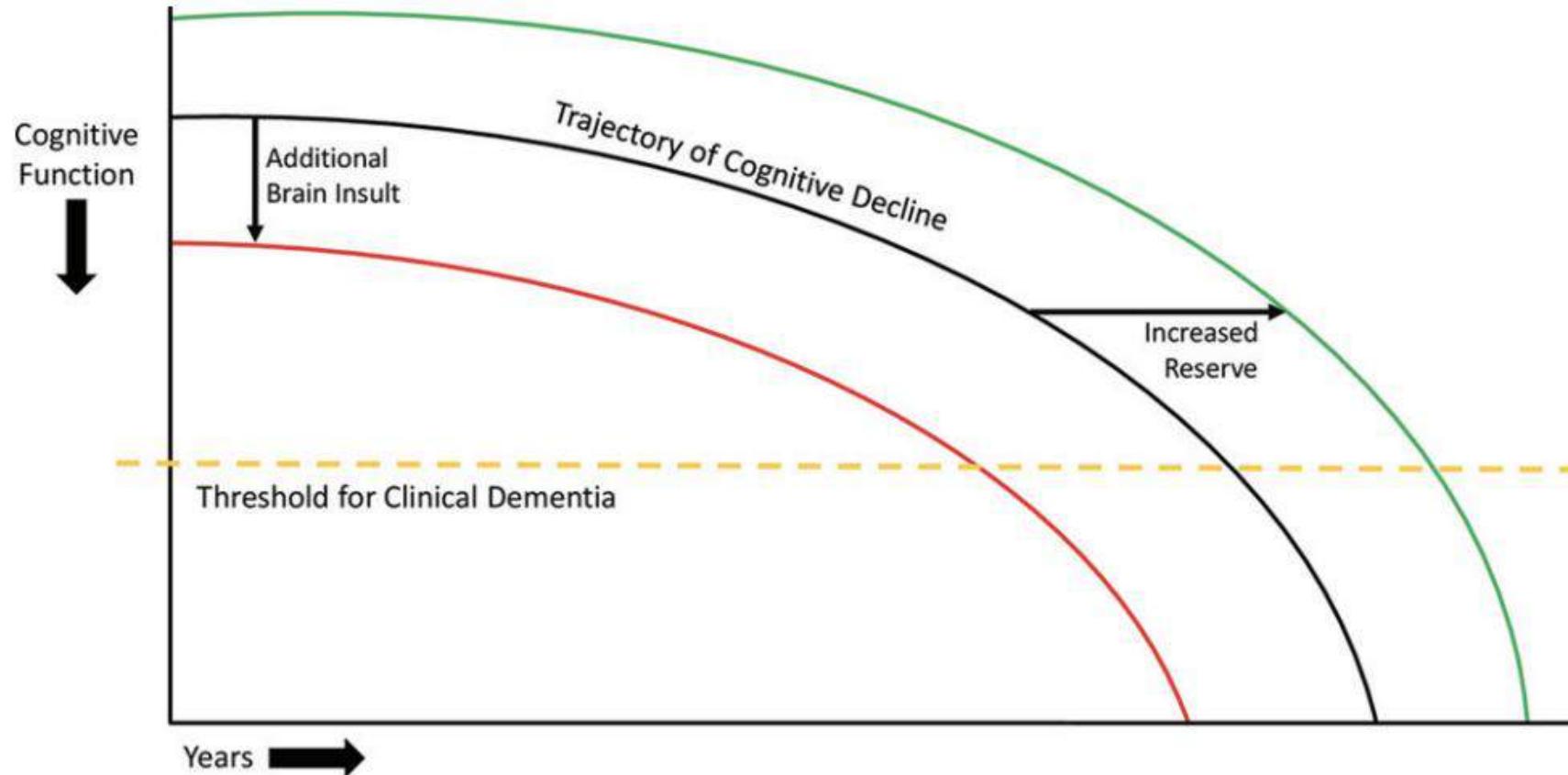
# Advances in nutrition and medical care is increasing our life expectancy



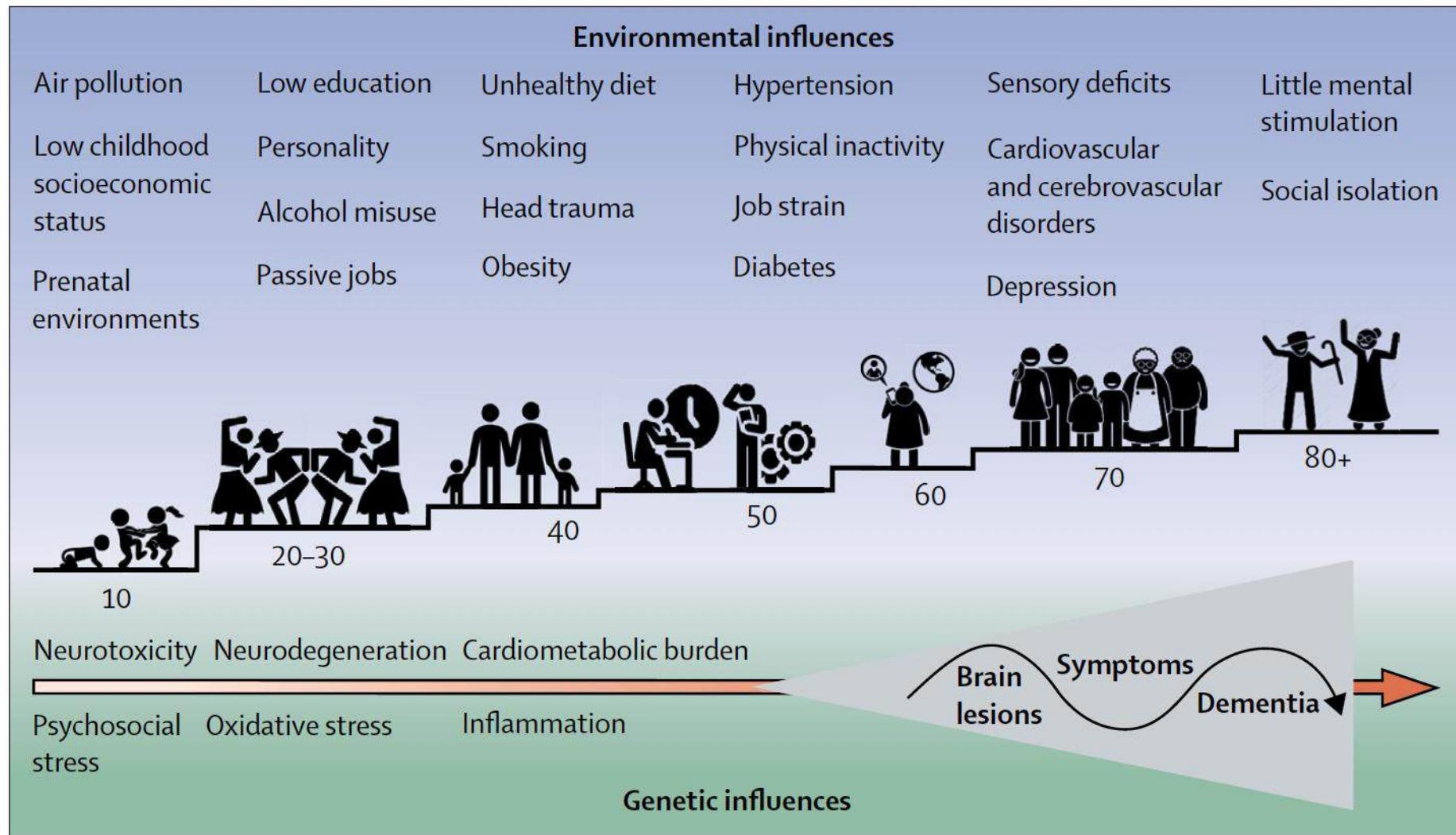
<https://doi.org/10.1002/bjs.10053>

**It is imperative that we protect our body and brain health**

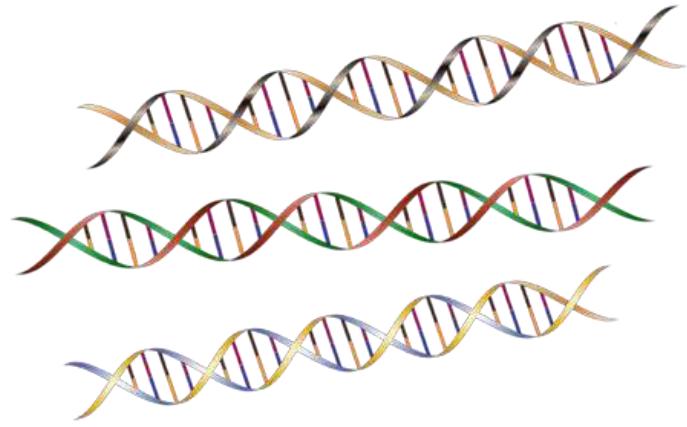
# We can change our aging trajectory



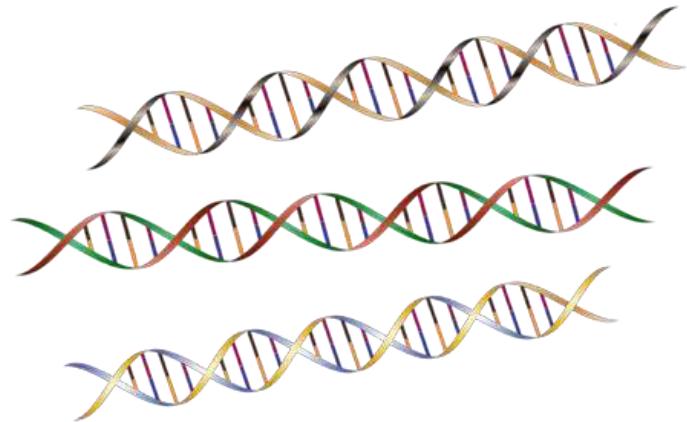
# Factors throughout life impact aging



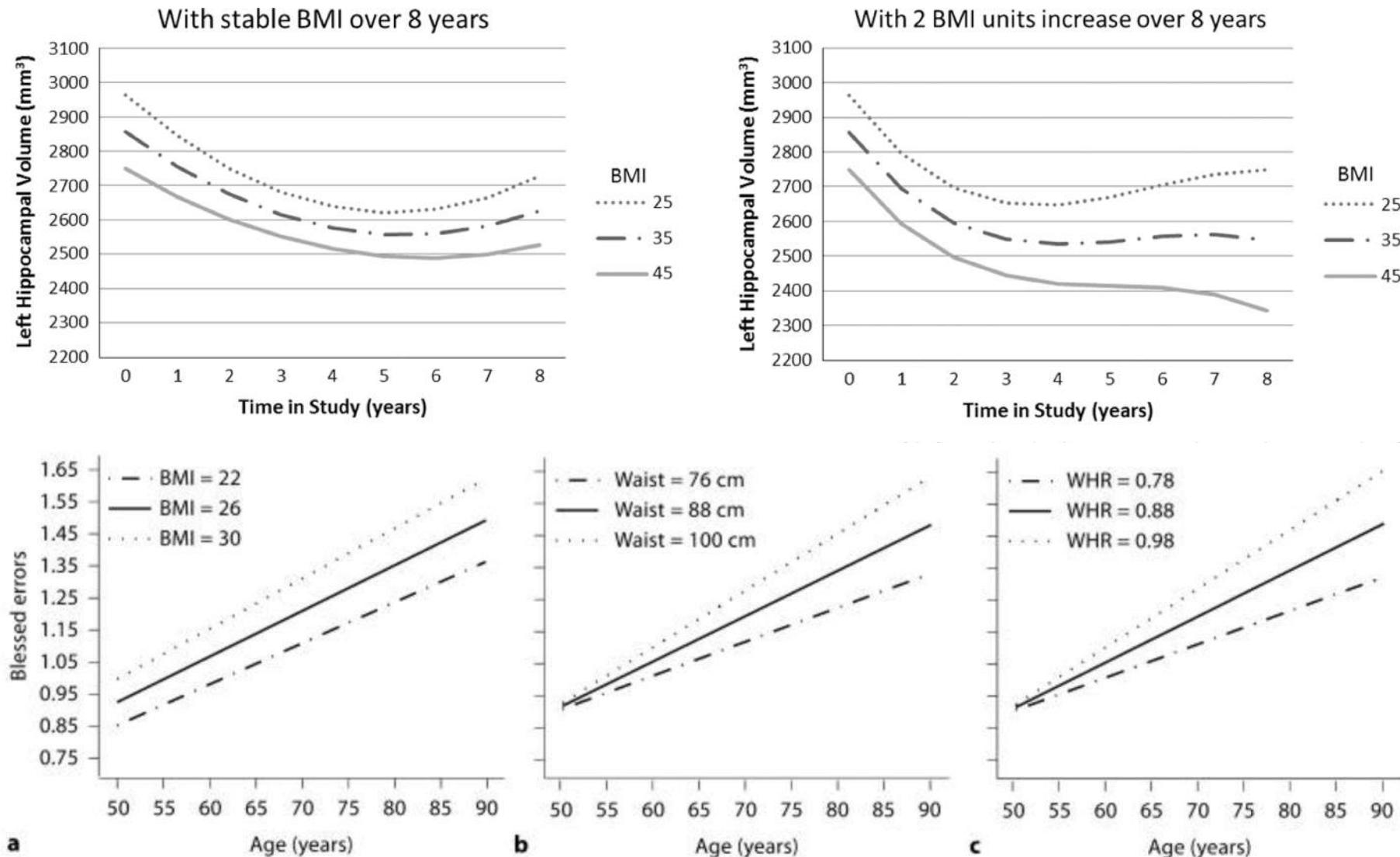
# There are positive and negative influences on aging



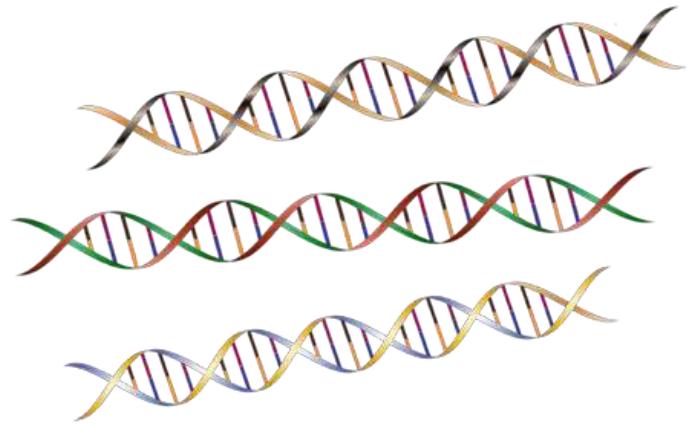
# There are positive and negative influences on aging



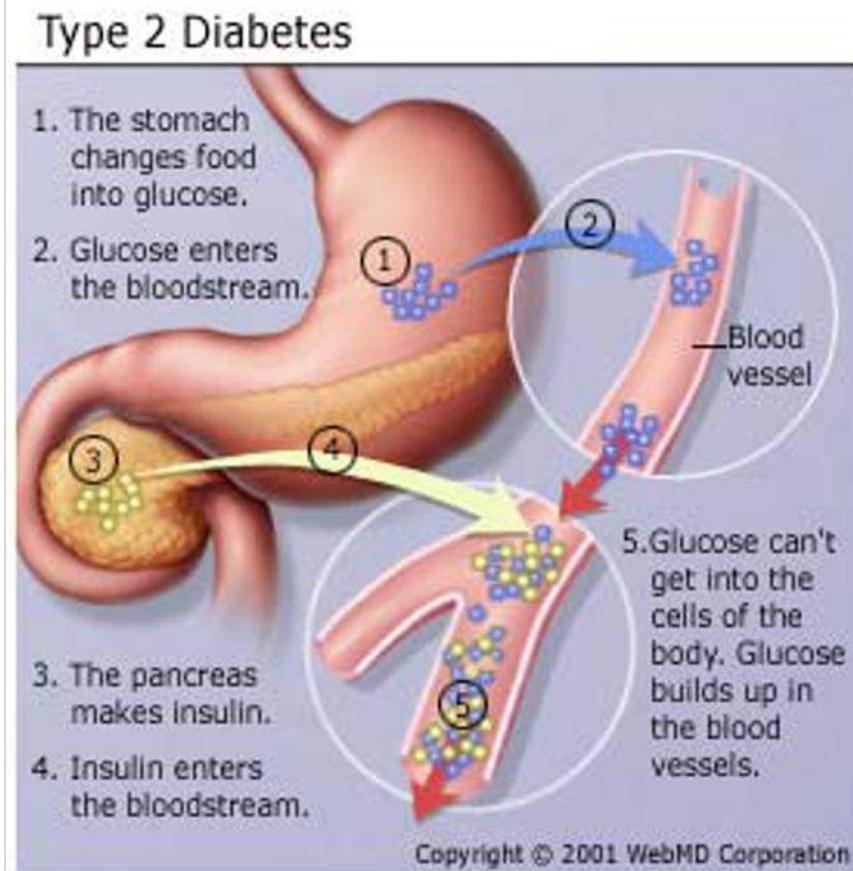
# Higher BMI is associated with reduced hippocampal volume and poorer memory performance



# There are positive and negative influences on aging

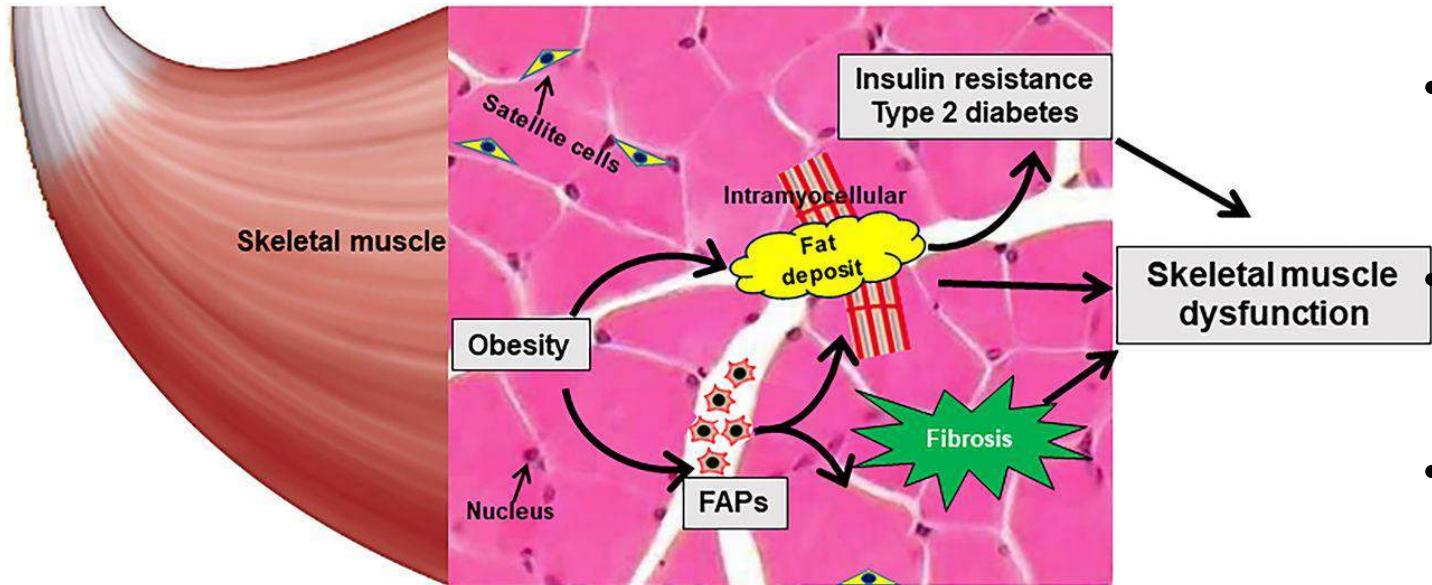


# Type 2 diabetes (T2D) affects the way your body metabolizes sugar



- The cells in your body use glucose (sugar) for energy
- Insulin helps glucose enter into cells
- In T2D your body can not use insulin properly and sugar builds up in your blood

# Type 2 diabetes impacts skeletal muscle function



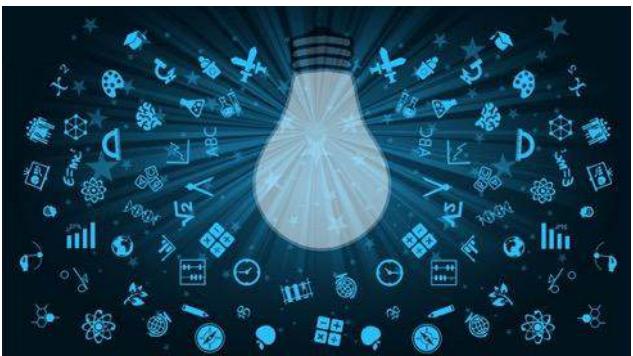
- Changes within muscle can contribute to type 2 diabetes
- Type 2 diabetes reduces muscle quality and function
- Some studies suggest that type 2 diabetes can reduce muscle mass

<https://diabetes.diabetesjournals.org/content/68/1/18>

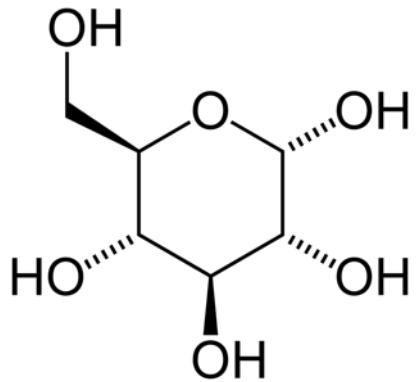
# Insulin impacts brain function



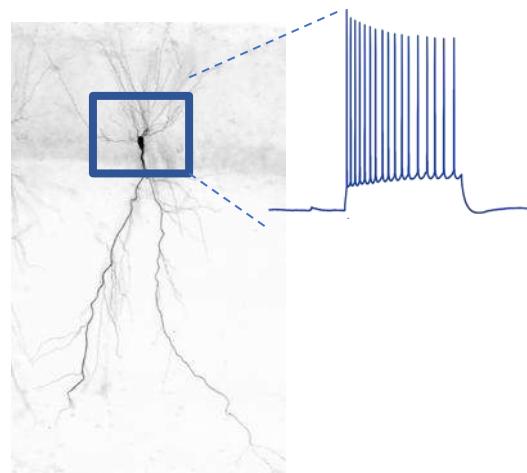
Food intake and body weight



Learning and Memory

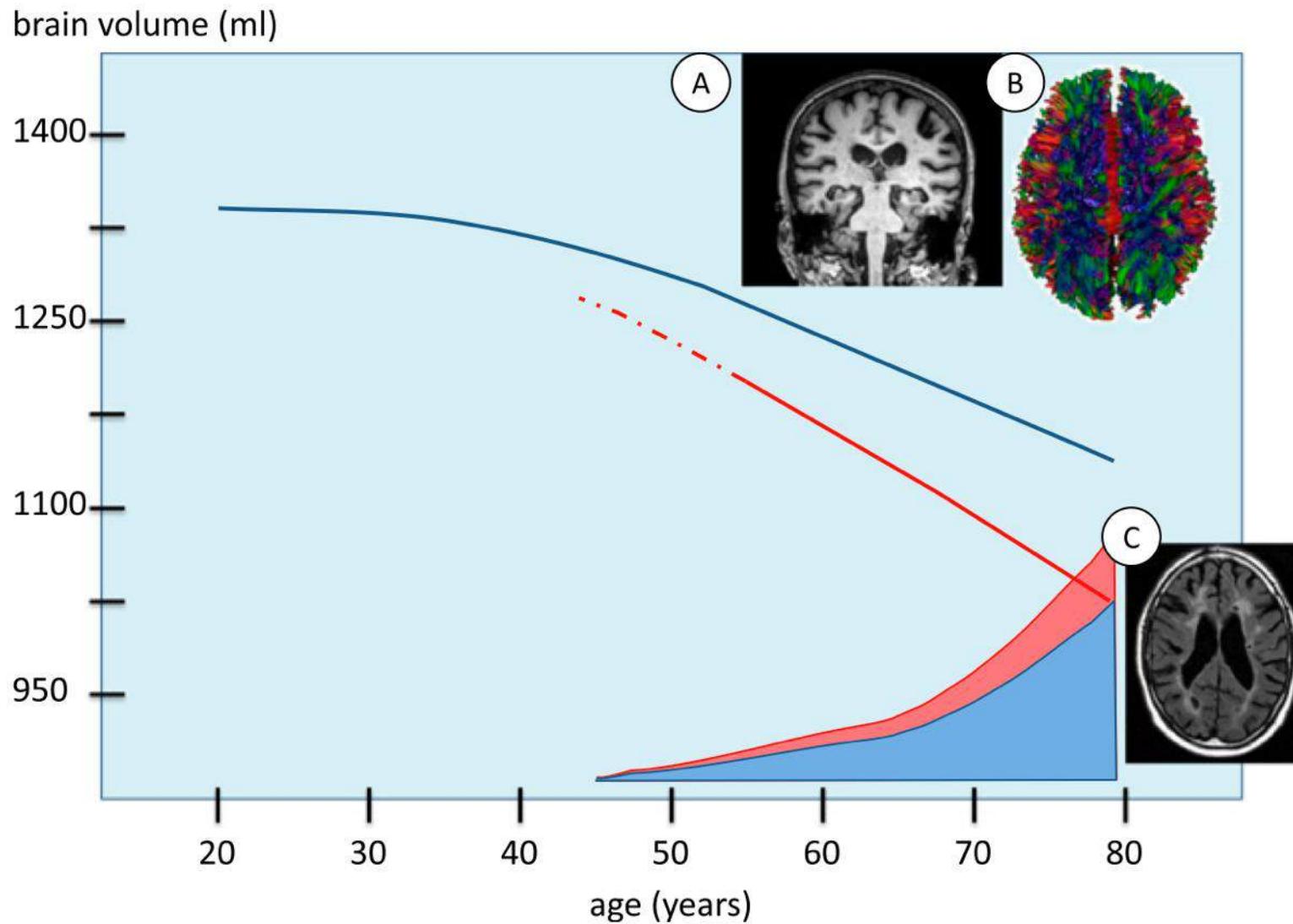


Glucose metabolism

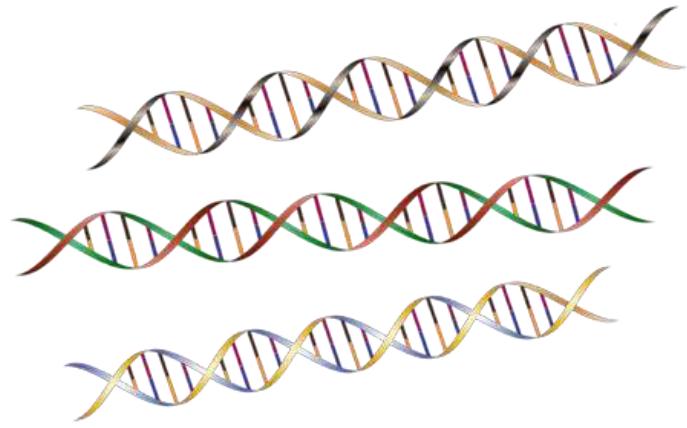


Cellular function

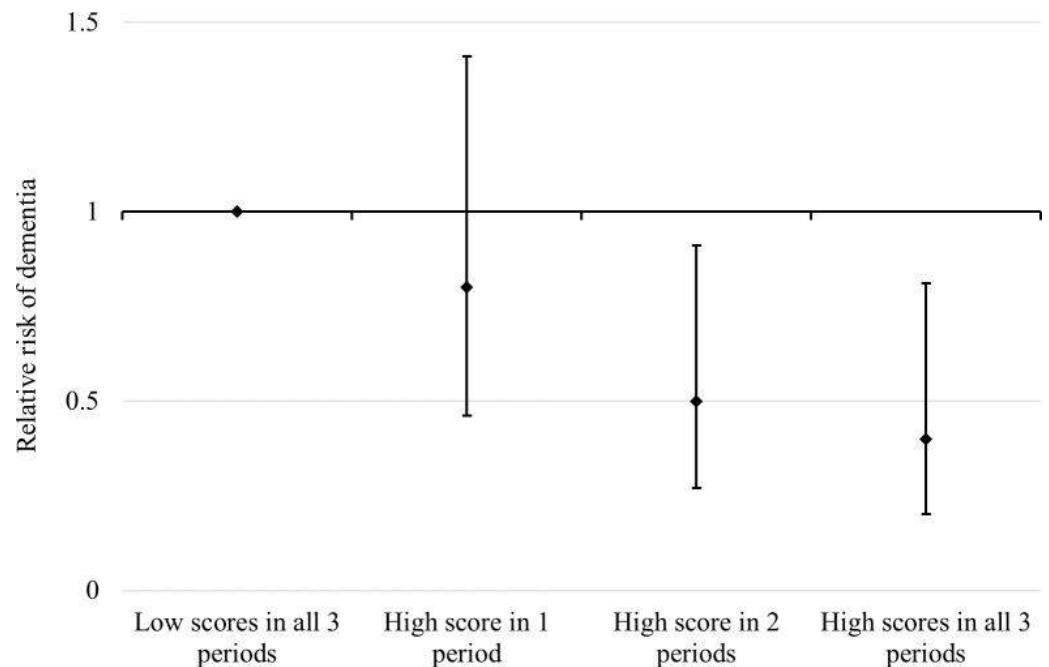
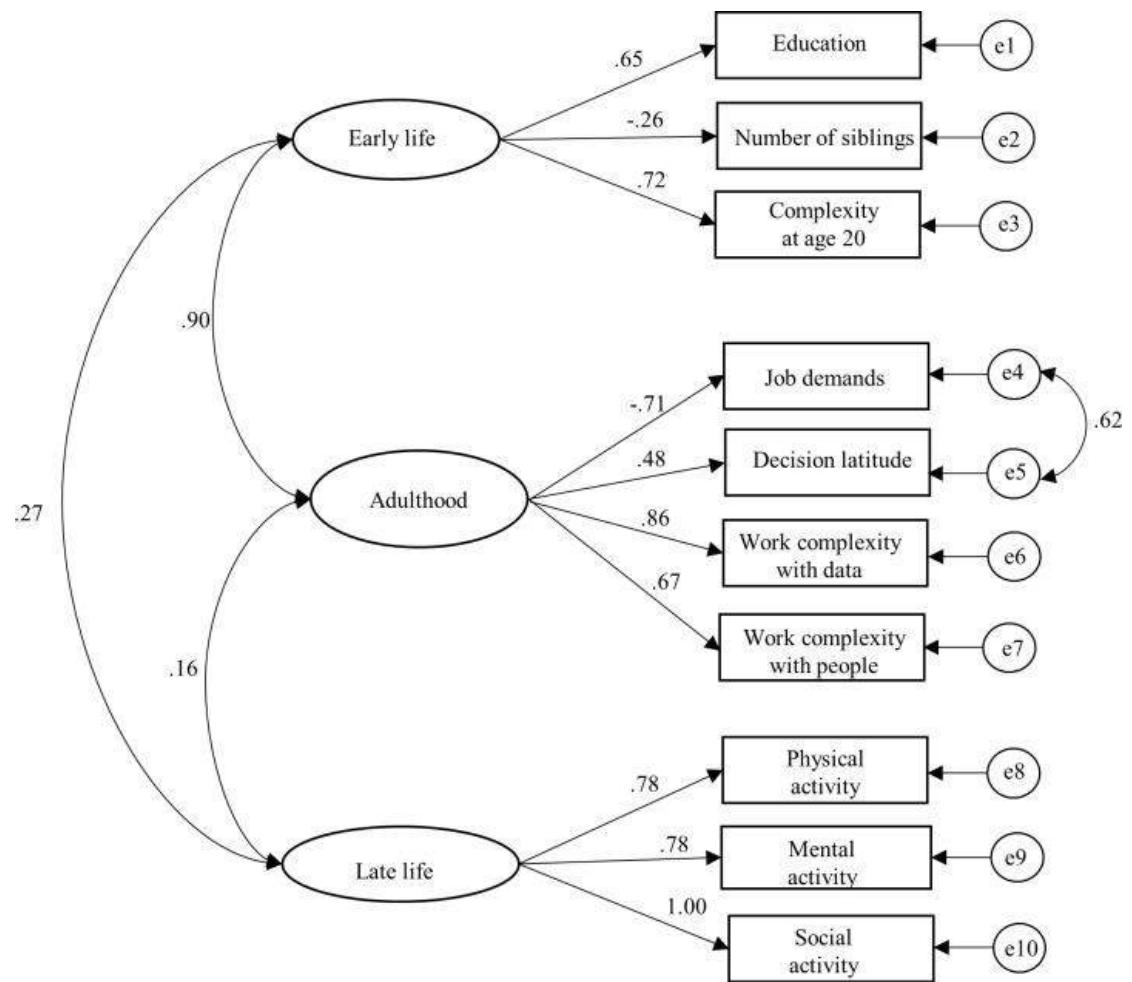
# Type 2 Diabetes decreases brain volume and connectivity over time



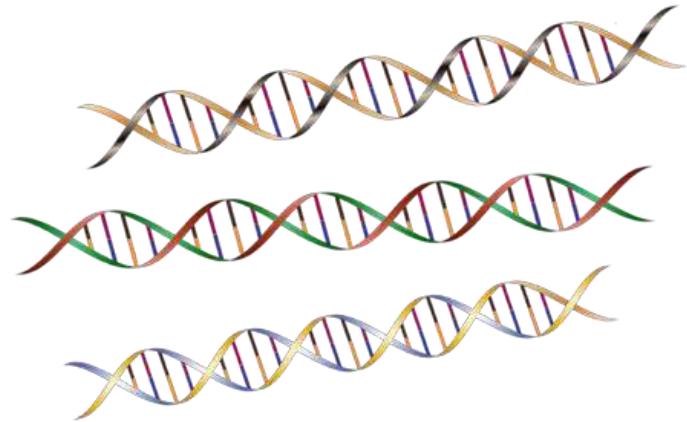
## There are positive and negative influences on aging



# Cognitive reserve reduces dementia risk



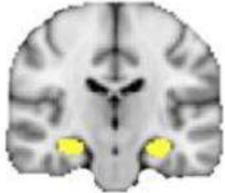
# There are positive and negative influences on aging



# Exercise increases brain volume and correlates with improved memory

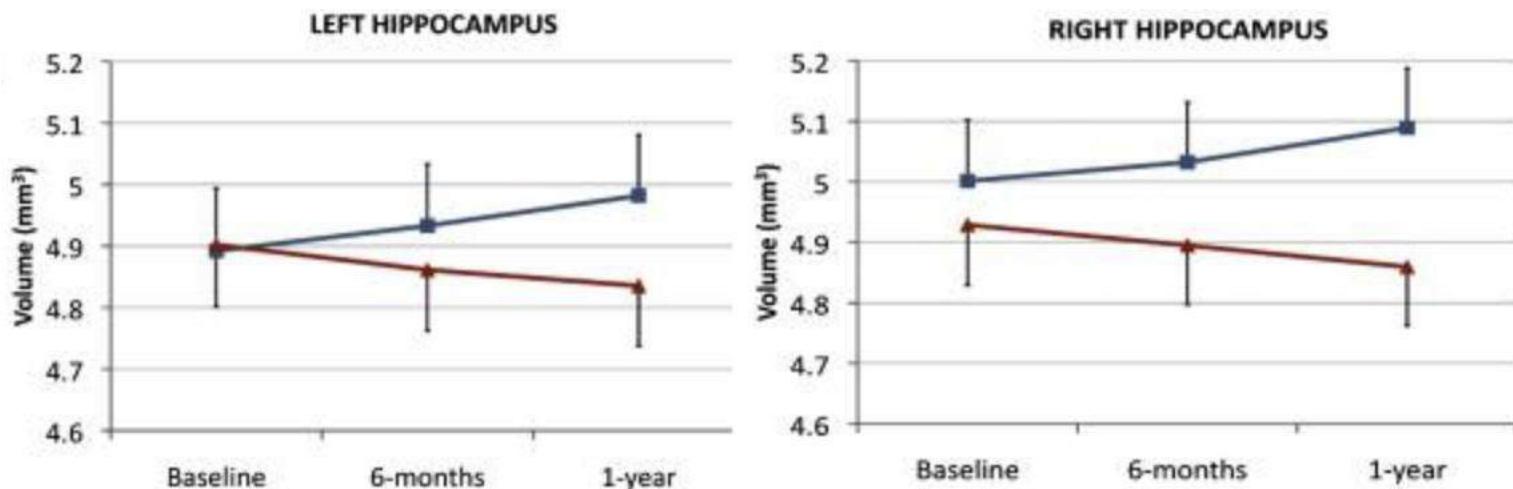


## A Hippocampus

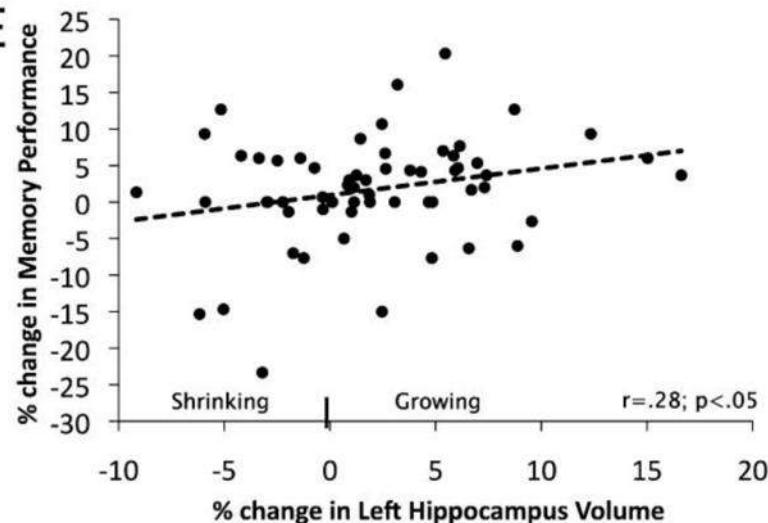


- Exercise
- Stretching

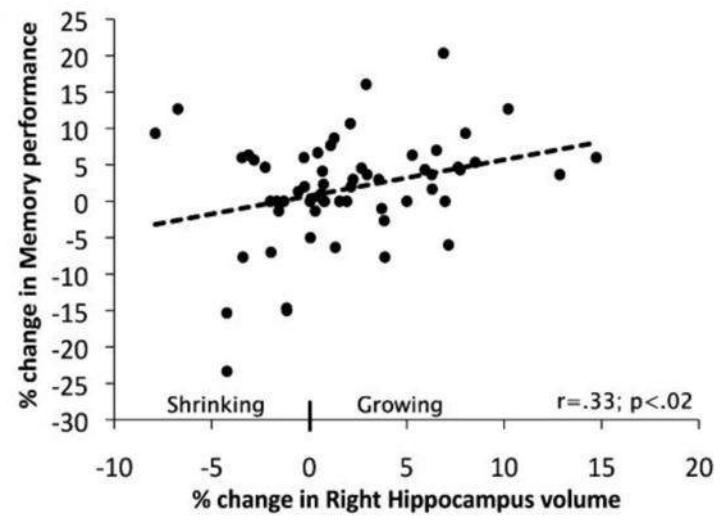
Show Panorama View



E



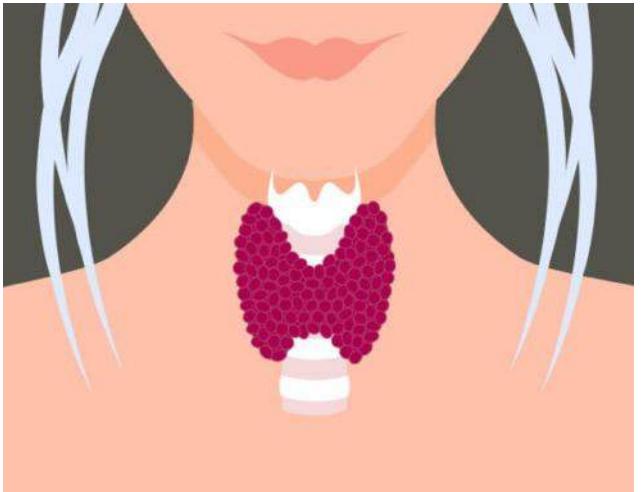
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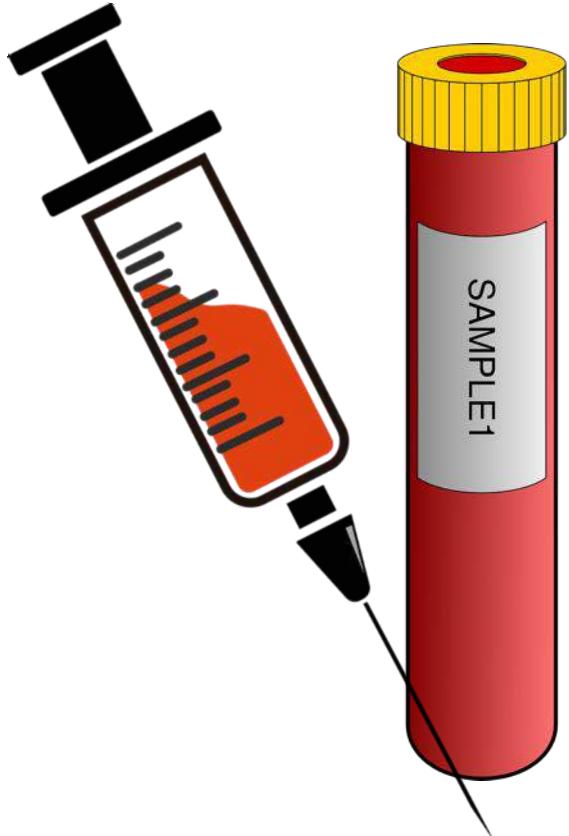
## Normal aging or something more?



## Not all issues with memory and thinking are dementia



# Testing can help determine if there is a concern



MONTREAL COGNITIVE ASSESSMENT (MOCA)  
Version 7.1 Original Version

NAME: \_\_\_\_\_  
Education: \_\_\_\_\_  
Sex: \_\_\_\_\_  
Date of birth: \_\_\_\_\_  
DATE: \_\_\_\_\_

**VISUOSPATIAL/EXECUTIVE**

Copy cube: \_\_\_\_\_  
Draw CLOCK (Ten past eleven) (3 points): \_\_\_\_\_  
[ ] Contour    [ ] Numbers    [ ] Hands    /5

Diagram: A 5x5 grid with nodes labeled A through E. Node A is at the top, B is below it, C is to the left of B, D is to the left of C, and E is to the left of D. Arrows point from E to A, A to B, B to C, and C to D. The word 'Begin' is at the bottom left, and 'End' is at the top left.

**NAMING**

Drawings: Lion, Rhinoceros, Camel  
[ ]    [ ]    [ ]    /3

**MEMORY**

Read list of words, subject must repeat them. Do 2 trials, even if 1st trial is successful. Do a recall after 5 minutes.

	FACE	VELVET	CHURCH	DAISY	RED
1st trial					
2nd trial					

No points \_\_\_\_\_

**ATTENTION**

Read list of digits (1 digit/sec.). Subject has to repeat them in the forward order. Subject has to repeat them in the backward order.

[ ] 2 1 8 5 4    [ ] 7 4 2    /2

**LANGUAGE**

Repeat: I only know that John is the one to help today. The cat always hid under the couch when dogs were in the room.

[ ] /2

**ABSTRACTION**

Similarity between e.g. banana - orange = fruit    [ ] train - bicycle    [ ] watch - ruler    /2

**DELAYED RECALL**

Has to recall words WITH NO CUE    [ ] FACE    [ ] VELVET    [ ] CHURCH    [ ] DAISY    [ ] RED    Points for UNCUED recall only /5

**Optional**

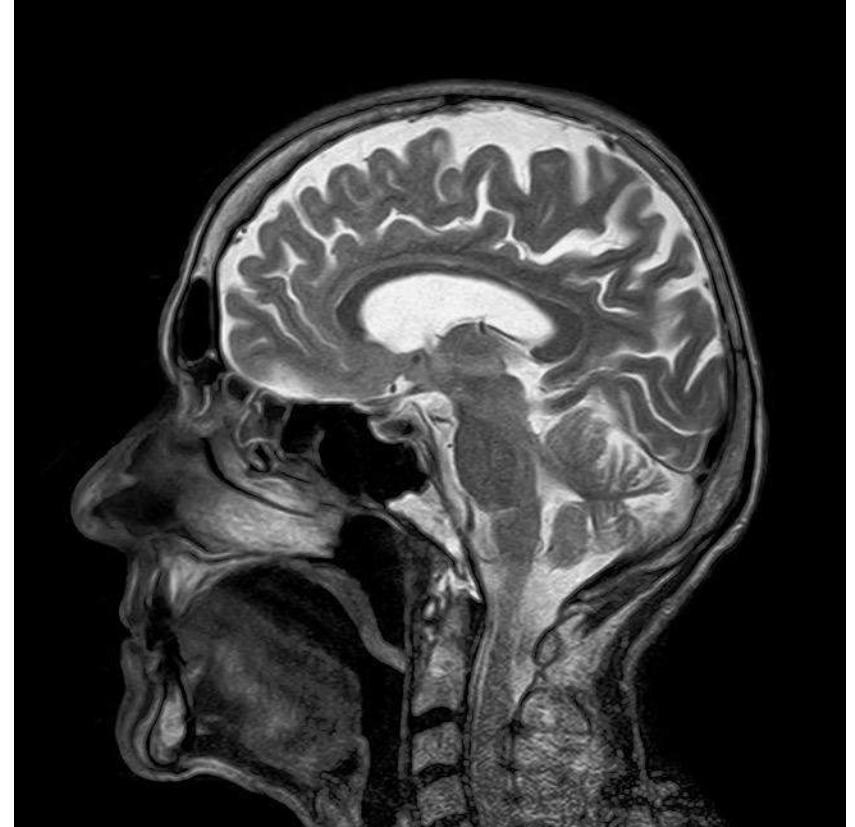
Category cue    [ ]  
Multiple choice cue    [ ]

**ORIENTATION**

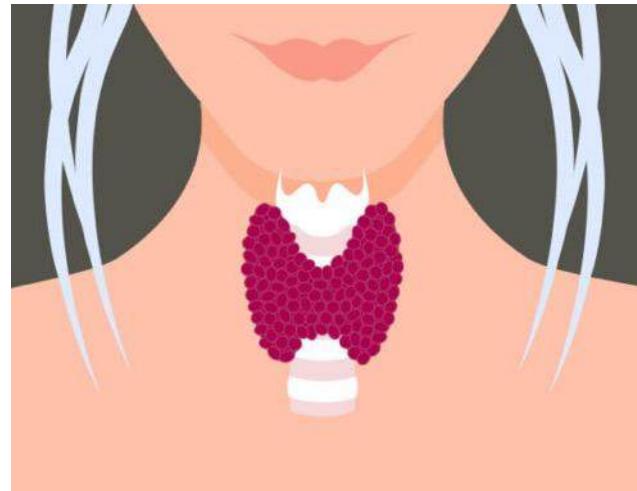
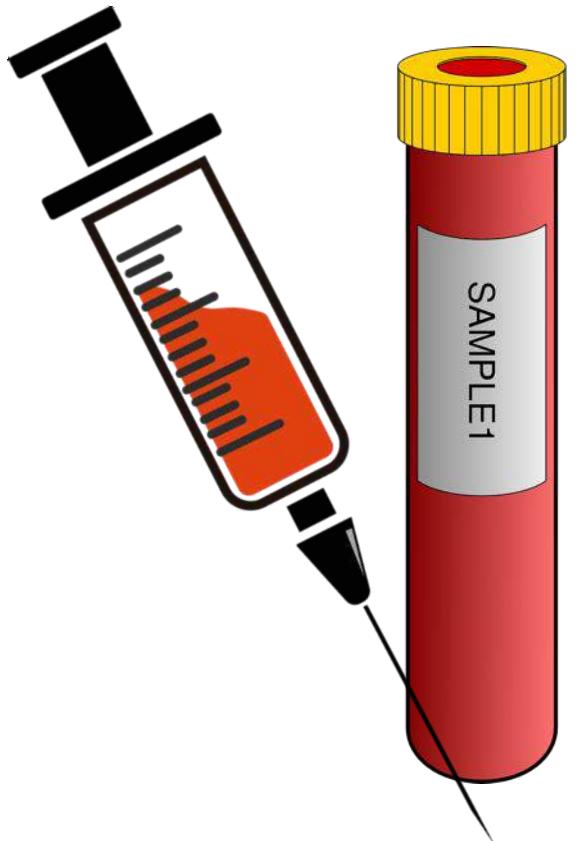
[ ] Date    [ ] Month    [ ] Year    [ ] Day    [ ] Place    [ ] City    /6

Normal  $\geq 26 / 30$     TOTAL  $\geq 26 / 30$   
Add 1 point if  $\leq 12$  yr olds

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Testing can help determine if there is a concern

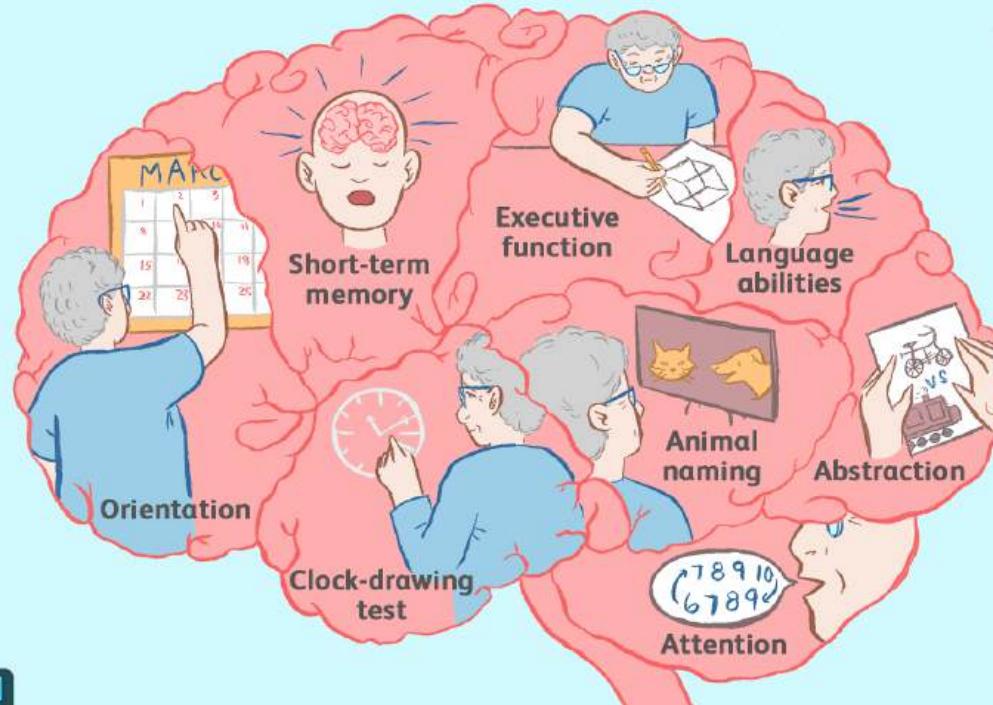


## **Cognitive tests provide objective measurement of function**



## What Does the Montreal Cognitive Assessment Evaluate?

The MoCA assesses cognitive abilities, including:



**This is a memory test**

# **This is a memory test**

**Book**

**Goat**

**Church**

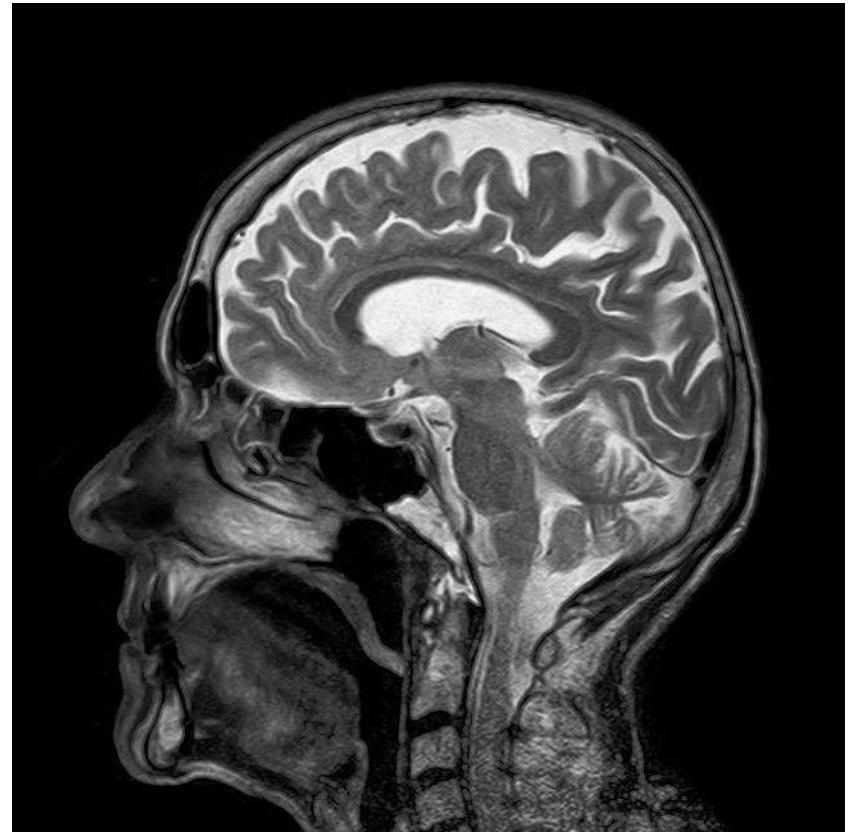
**Happy**

**Square**

**This is a memory test**

**Try to remember those 5 words.**

# Magnetic Resonance Imaging



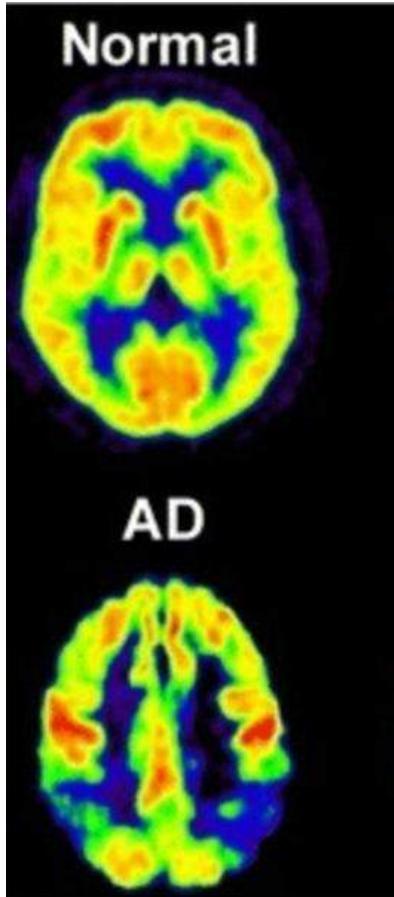
# Positron Emission Tomography



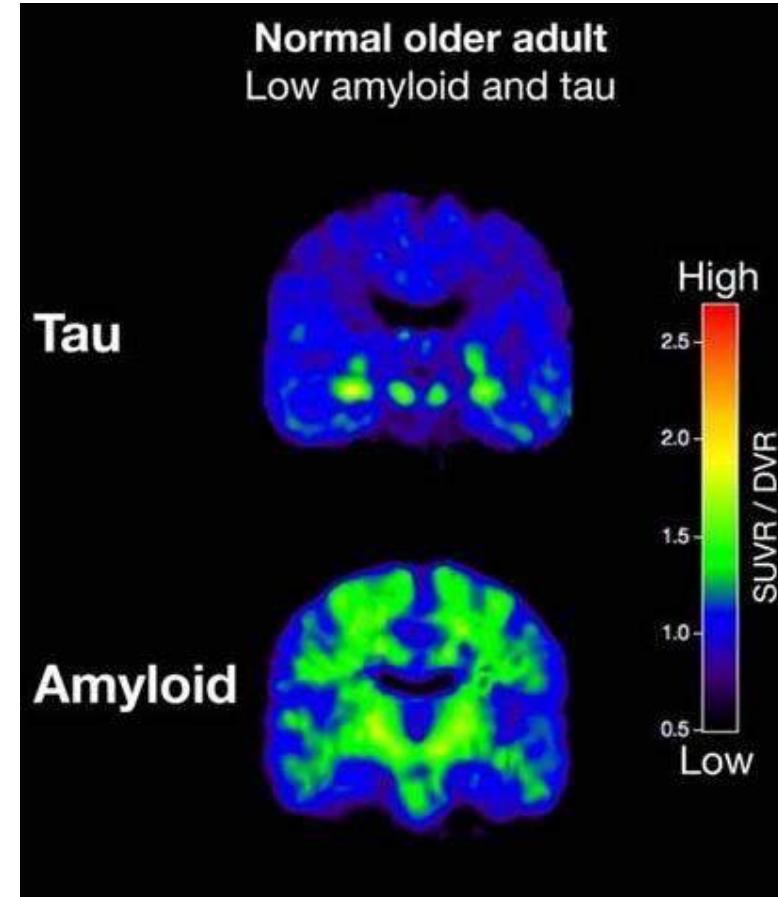
PET scanner



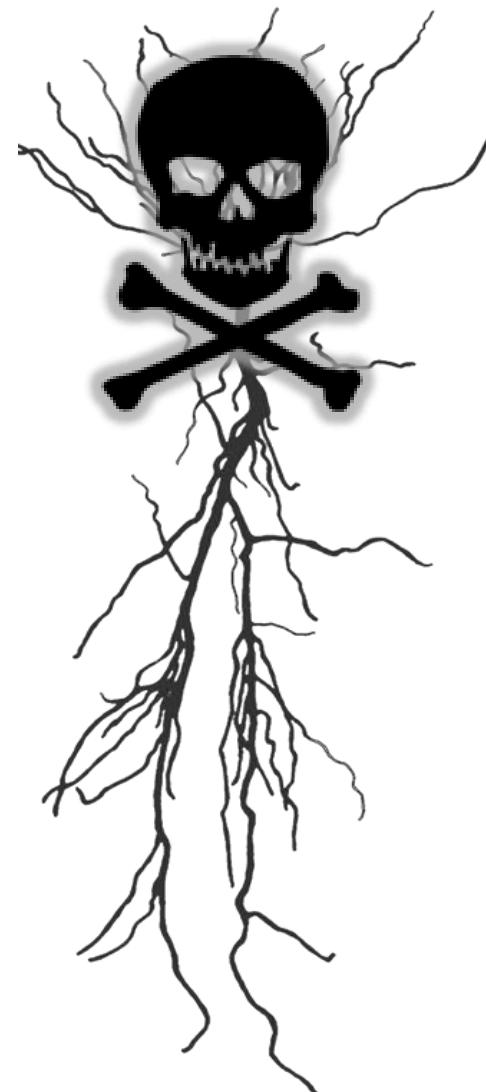
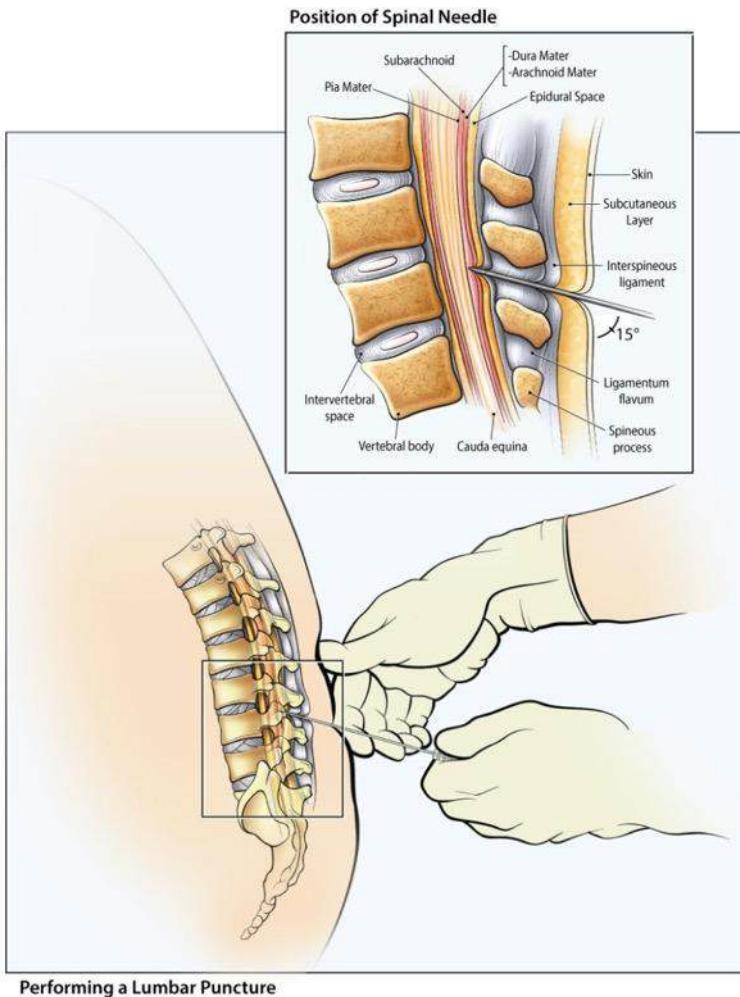
Glucose Metabolism



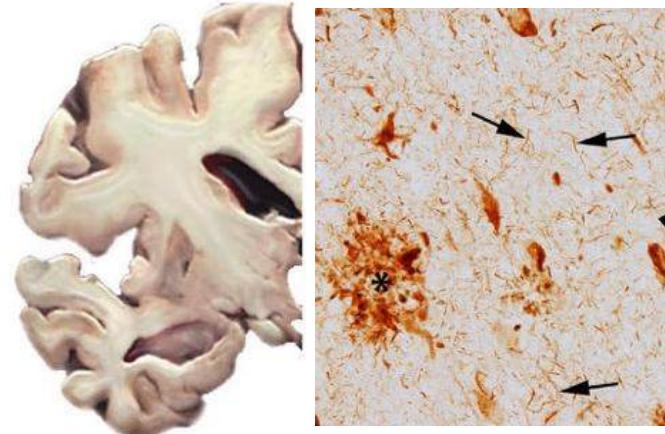
AD pathology



# Cerebral spinal fluid gives information about the brain



## AD pathology



## Neuroinflammation





**What were those five words  
that I asked you to remember??**



**What were those five words  
that I asked you to remember??**

**Book**

**Goat**

**Church**

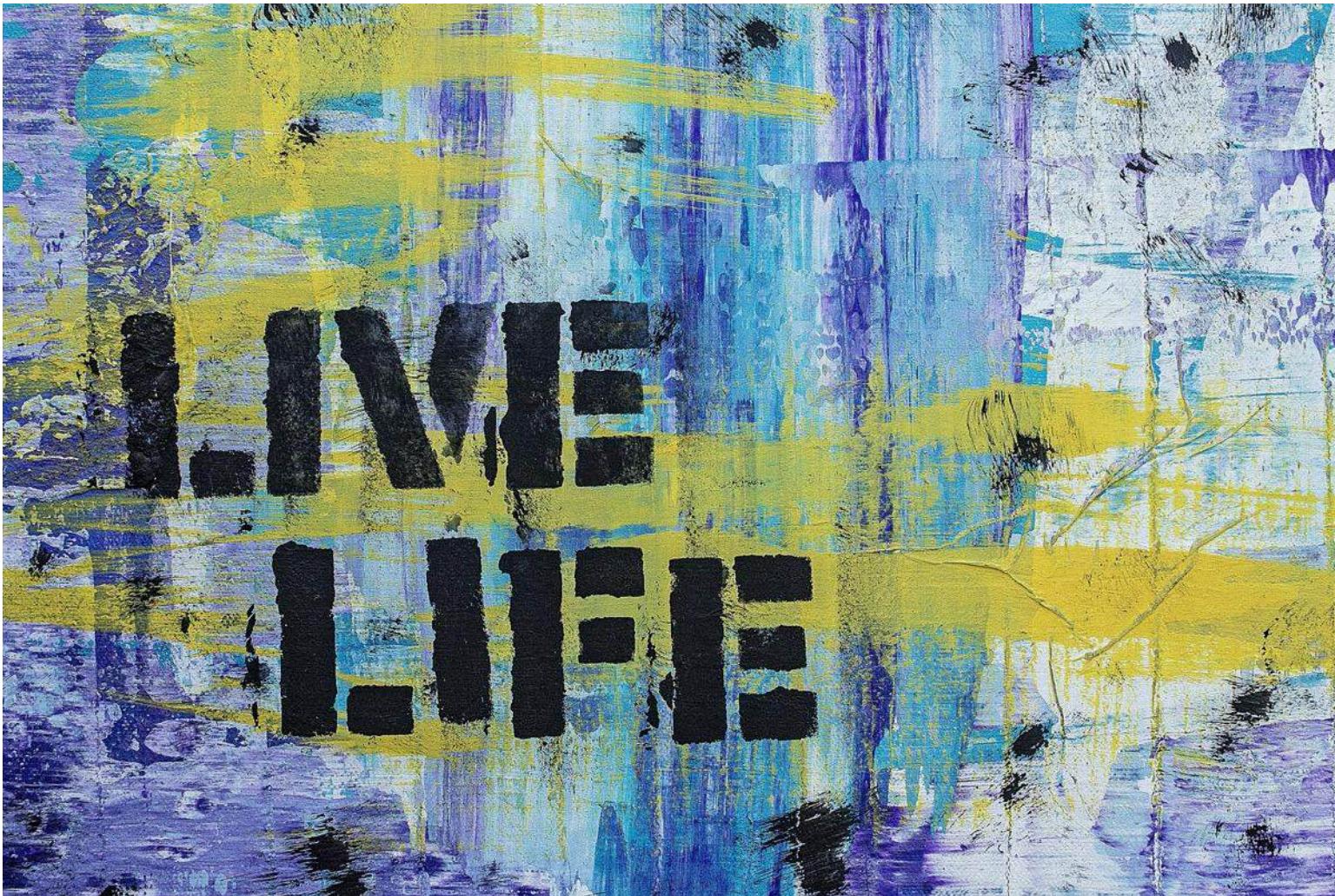
**Happy**

**Square**

## Take control of your aging process



## Focus on the positive





THANK YOU!  
QUESTIONS?