



# The Aging Brain

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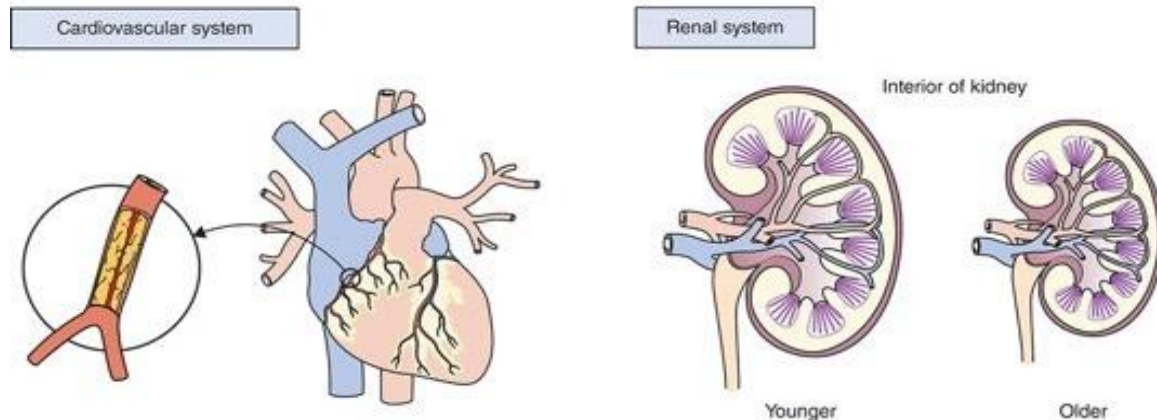
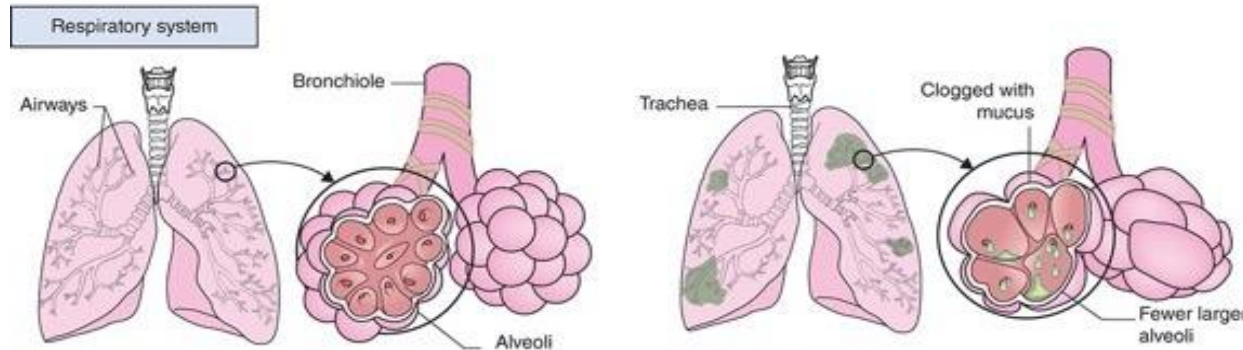
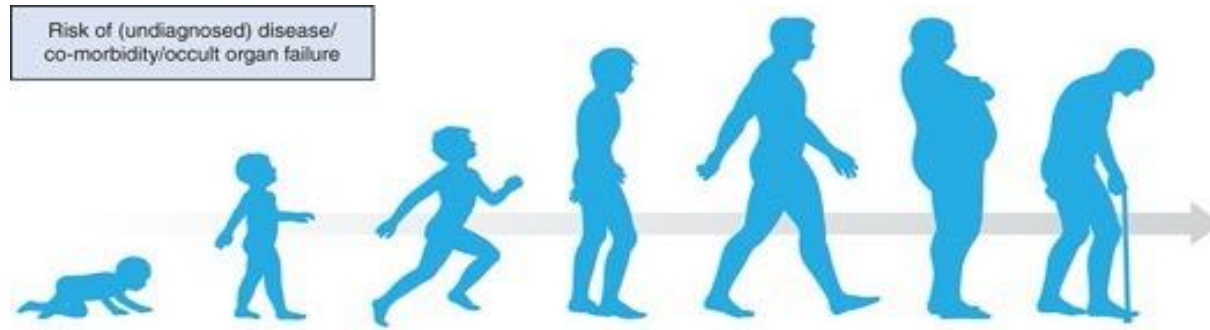


## Aging: life's inevitability

- **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

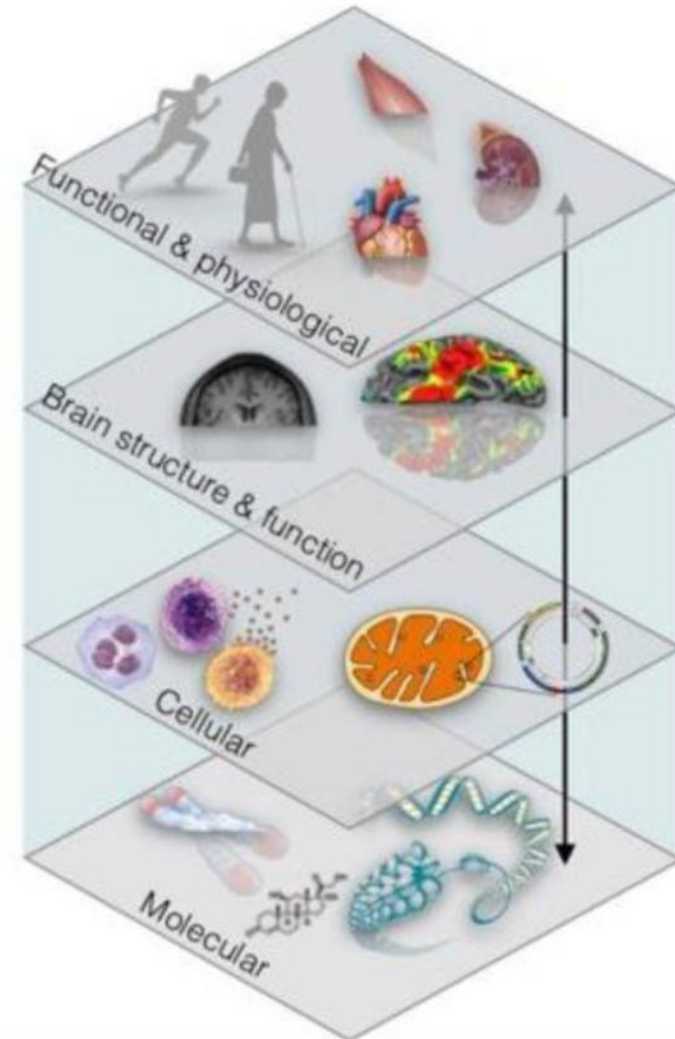


- Initially, aging gives us our independence
- Eventually, aging threatens to take independence away
- Every organ system is impacted by age- heart, lungs, kidneys, muscles

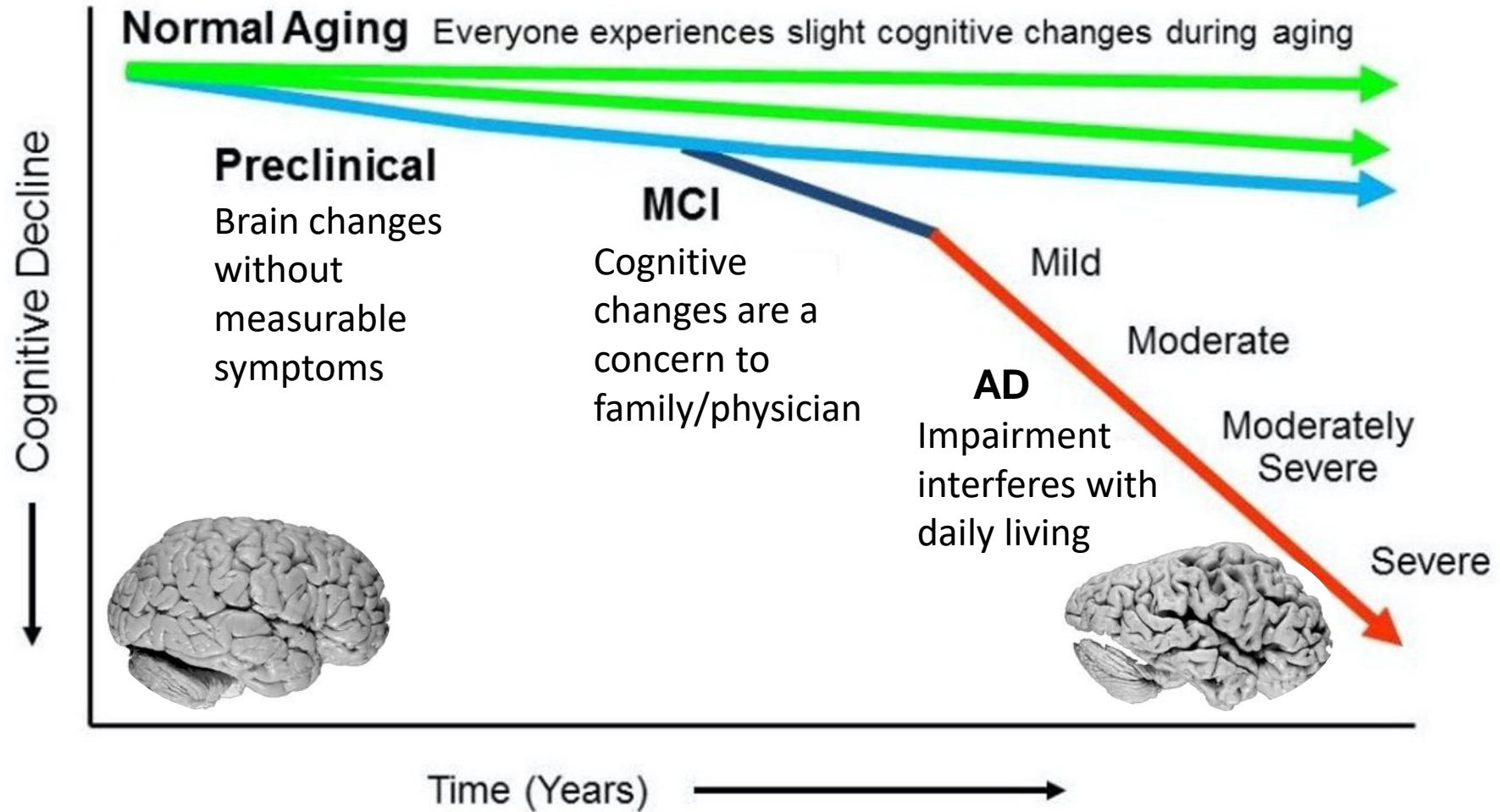
# Aging impacts function at all biological levels



## Biological age indicators *MULTI-LEVEL*



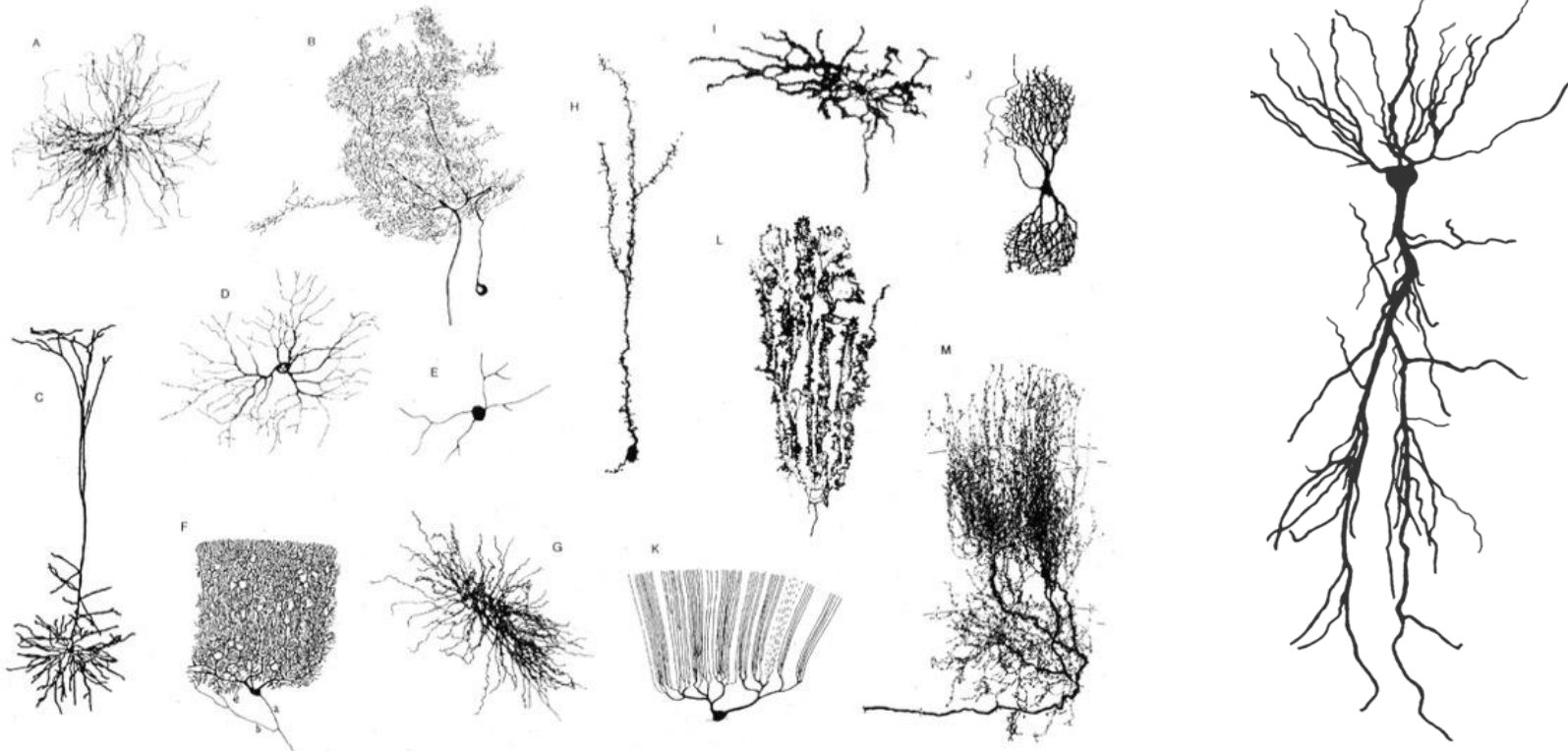
# Our brain ages with the rest of our bodies



# Healthy human brain



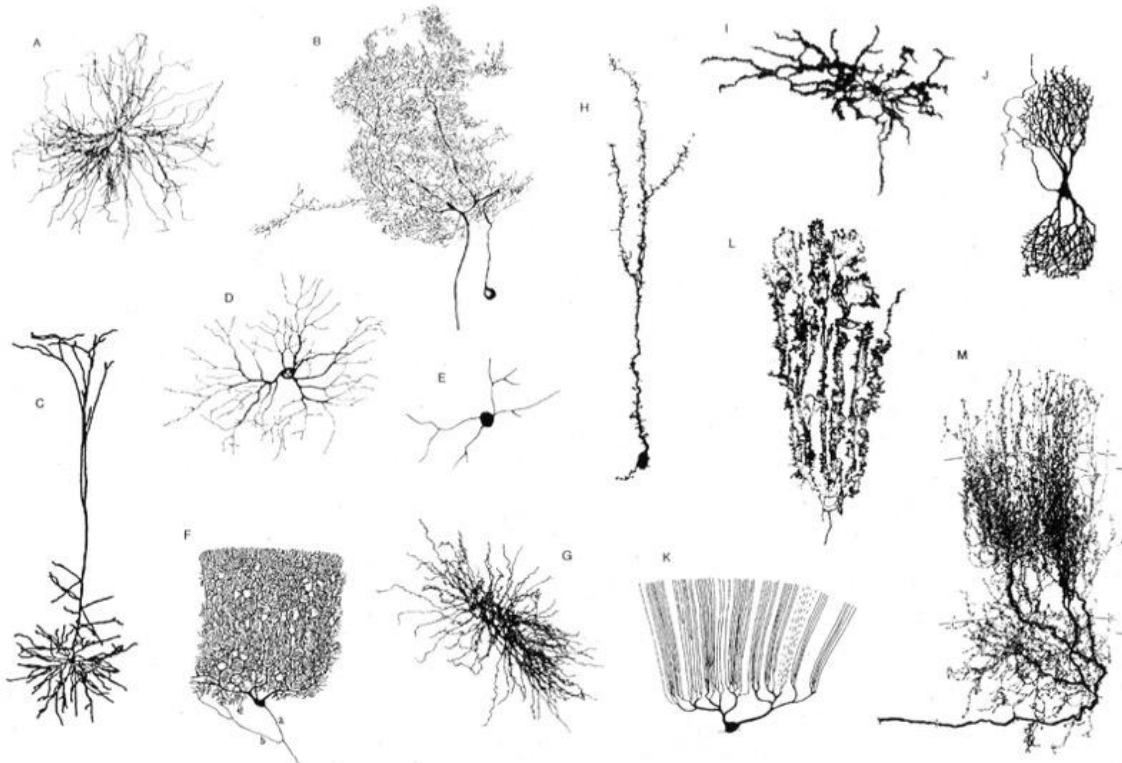
# Brain cells are complex branched structures



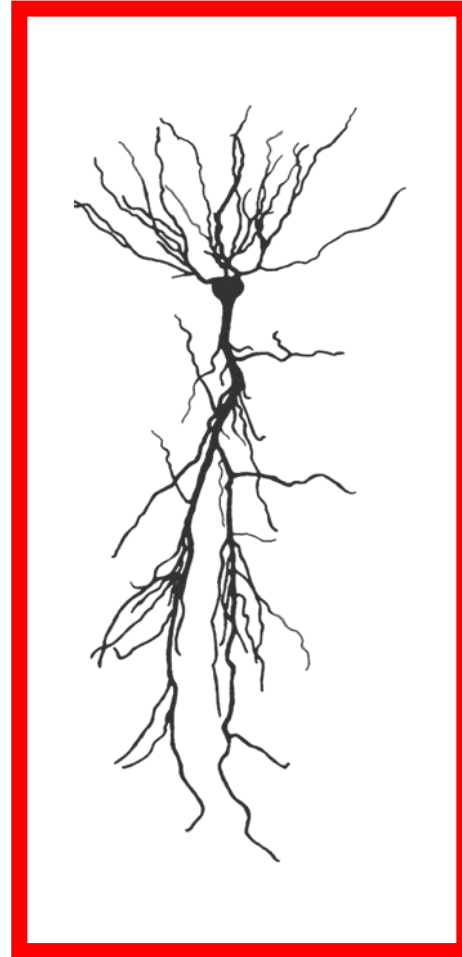
Dendrites, Oxford University Press, 2015; Modified from Mel, B.W. Neural Computation, 1994.



# Brain cells are complex branched structures

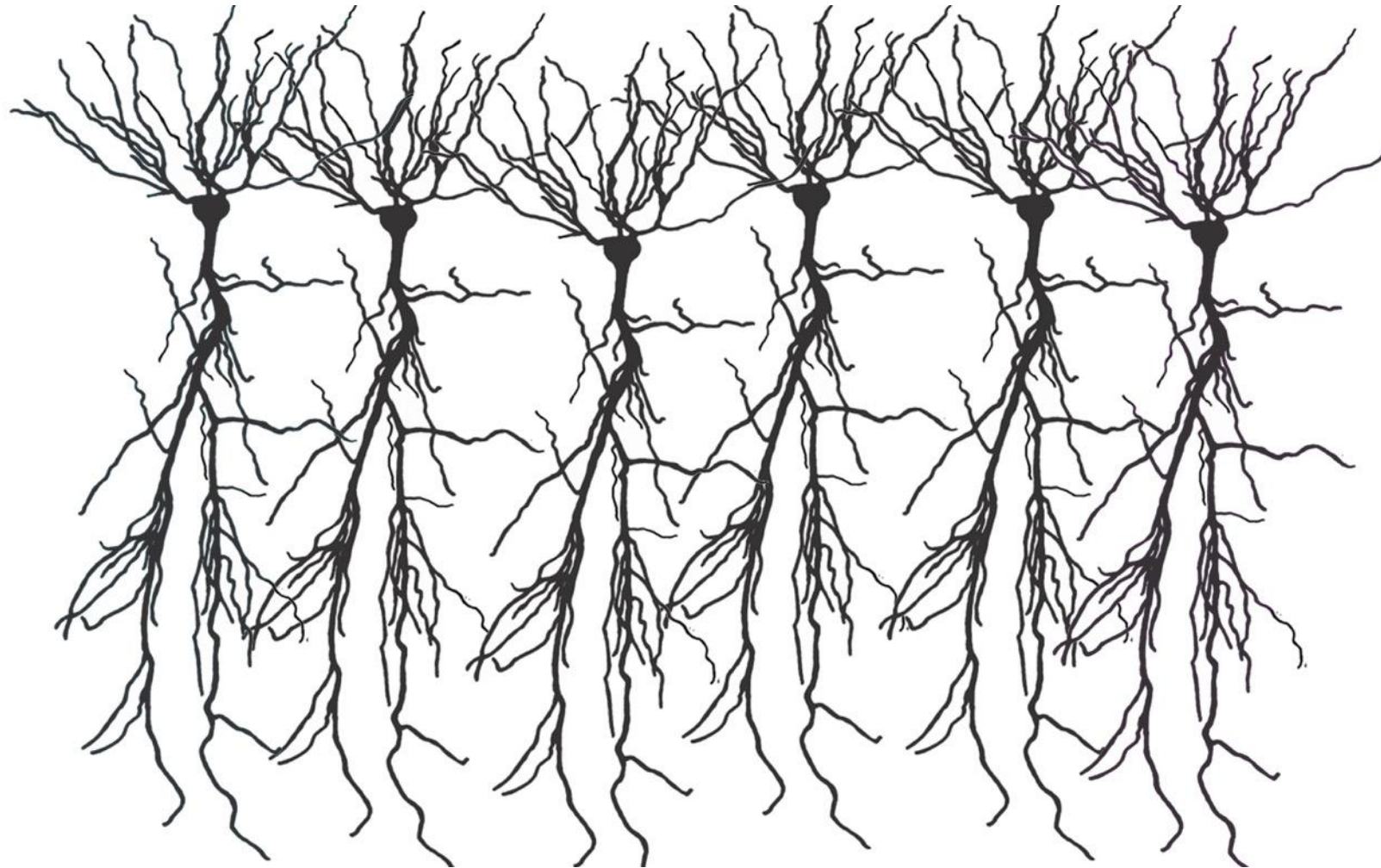


Dendrites, Oxford University Press, 2015; Modified from Mel, B.W. Neural Computation, 1994.





# Billions of brain cells are in a human brain

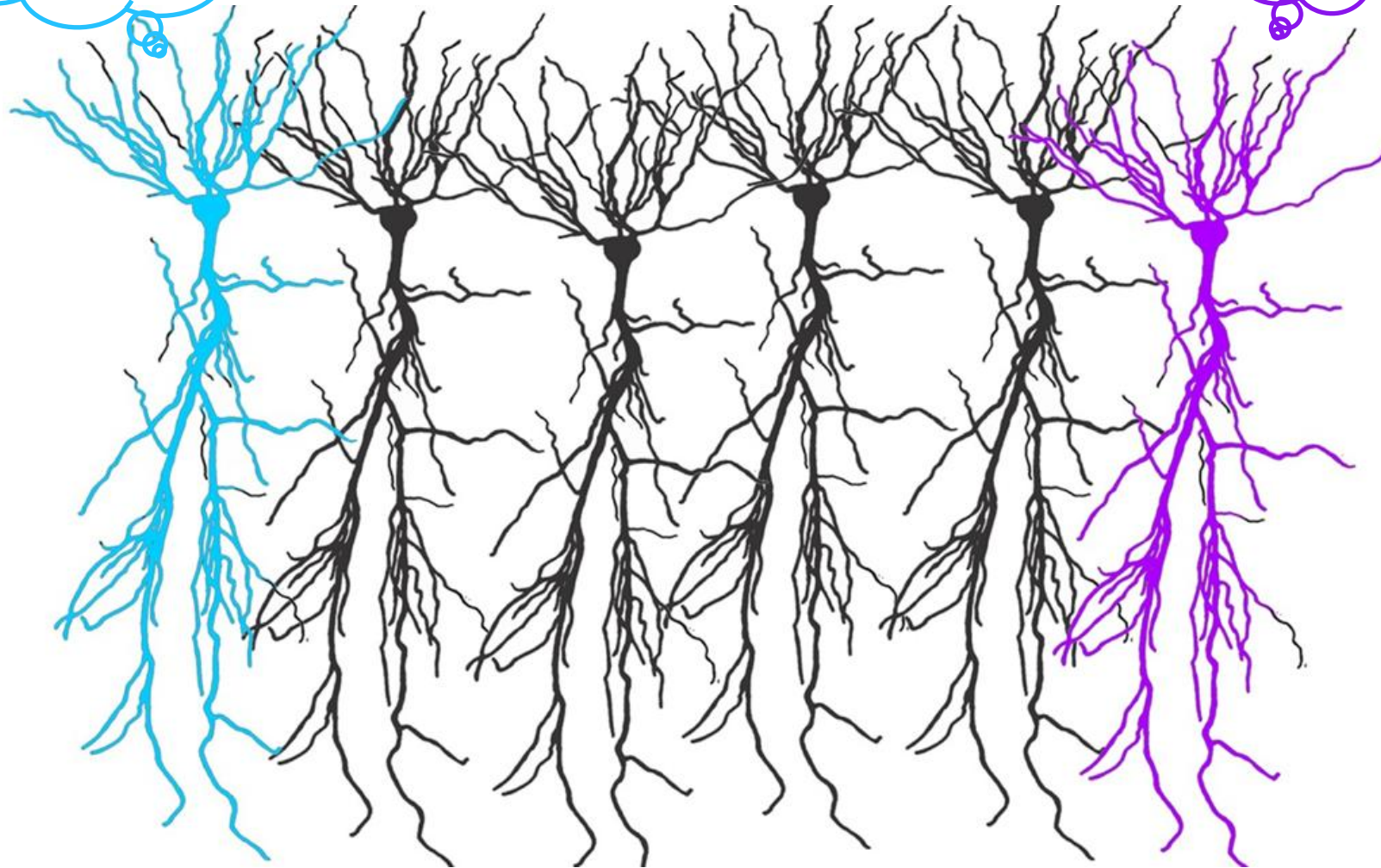


# Millions of brain cells are in a human brain

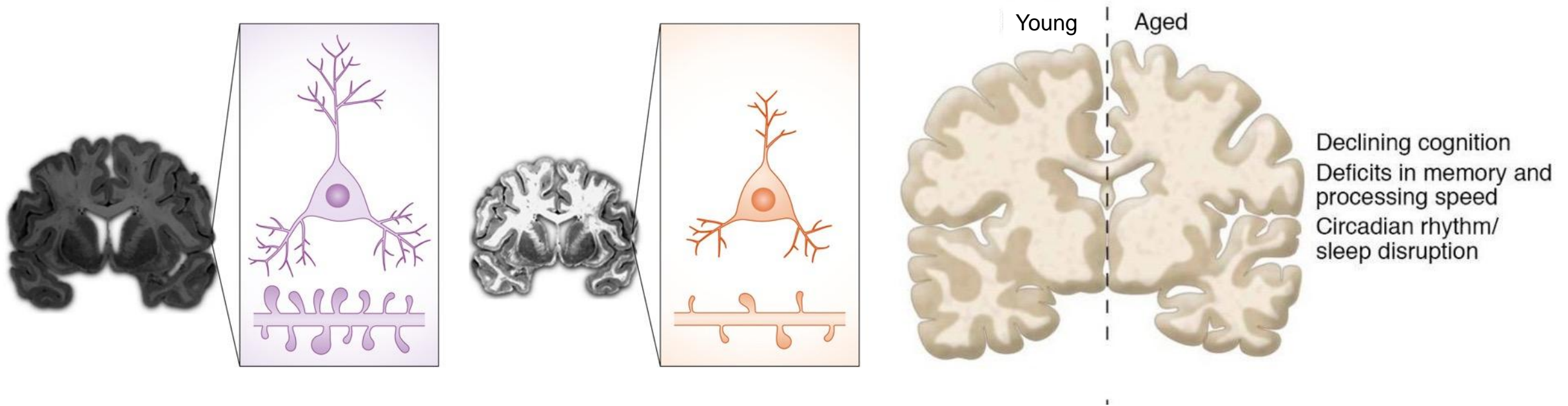


Hello Friend

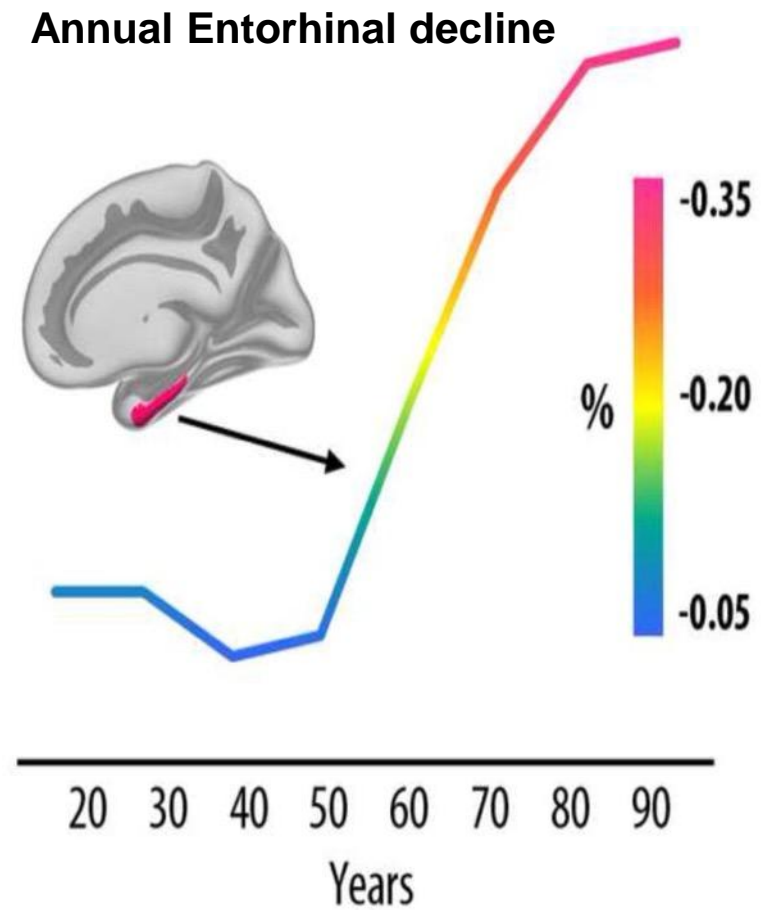
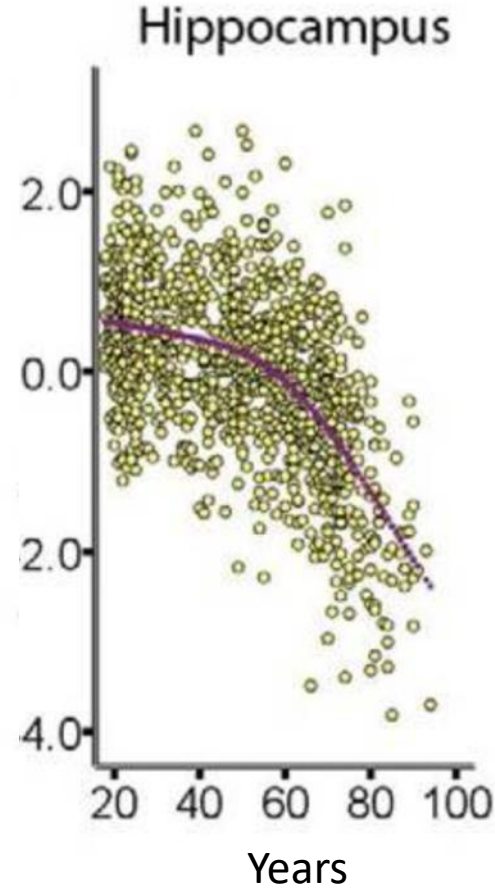
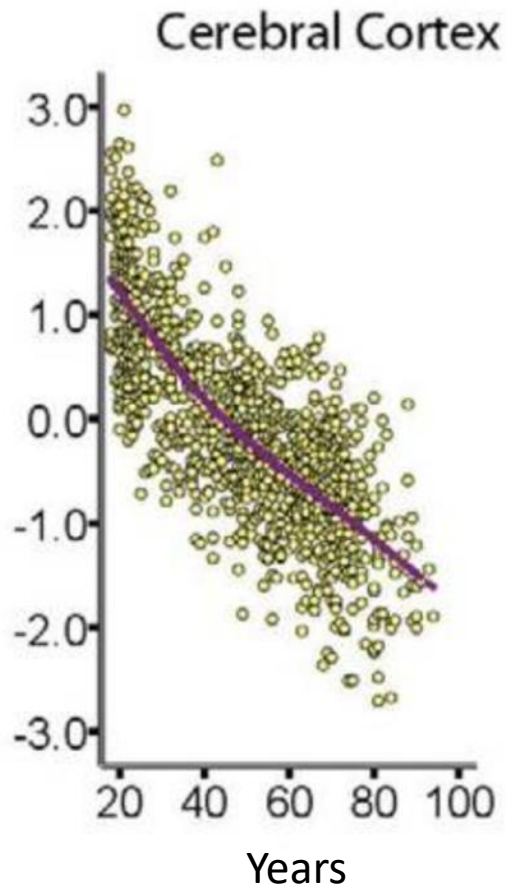
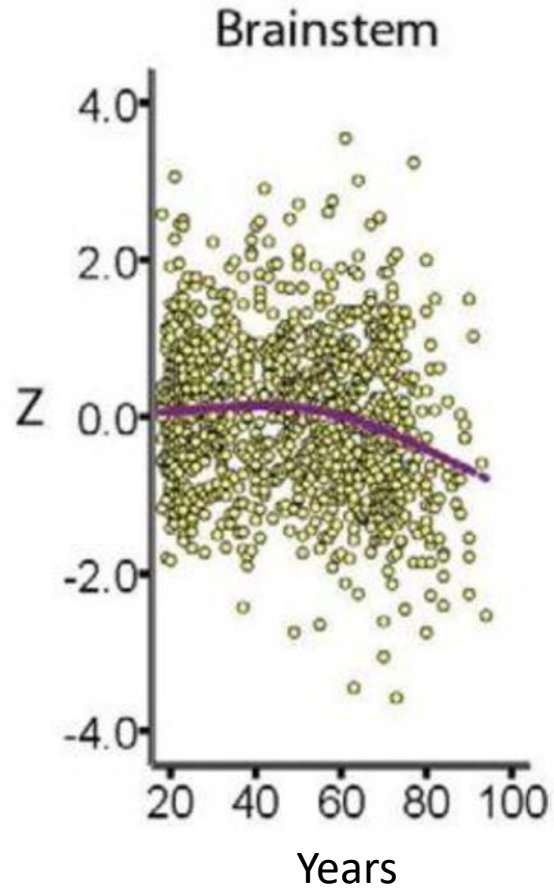
Hi!!



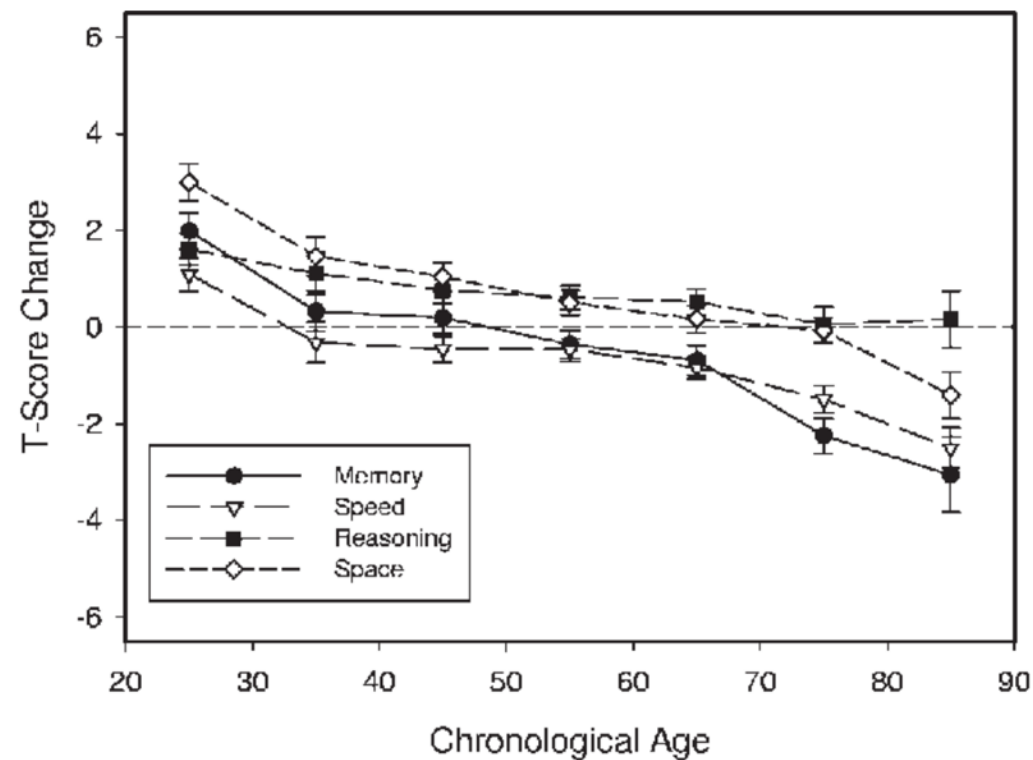
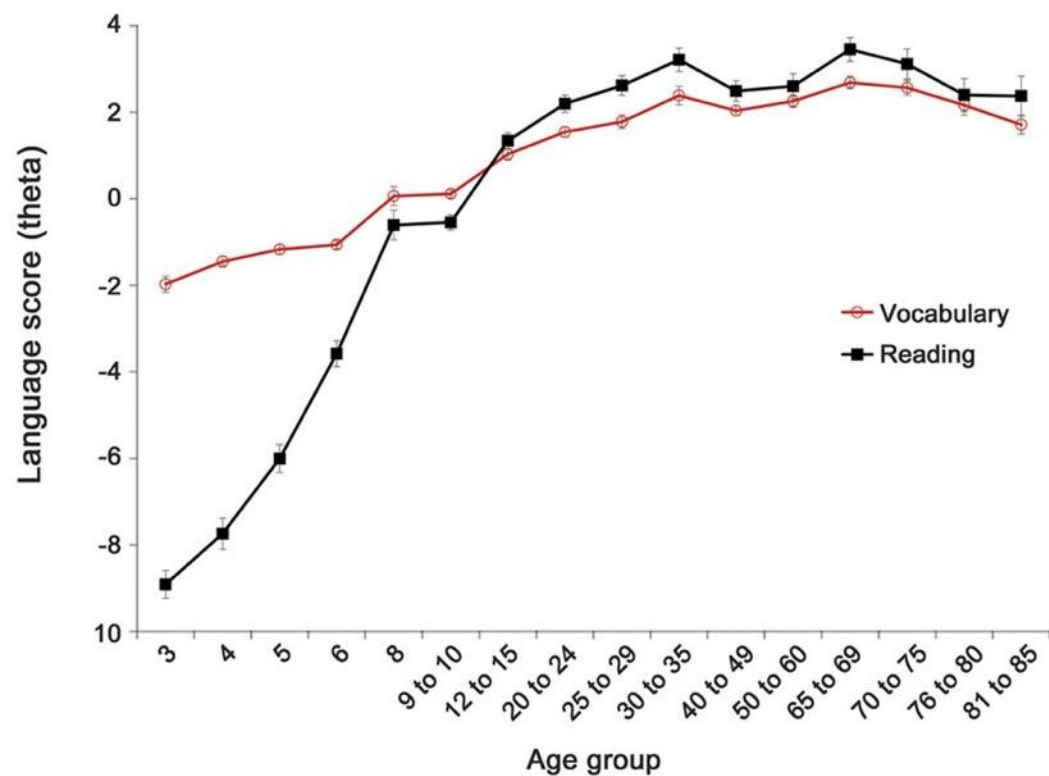
# Aging induces changes to cells in the brain and their function



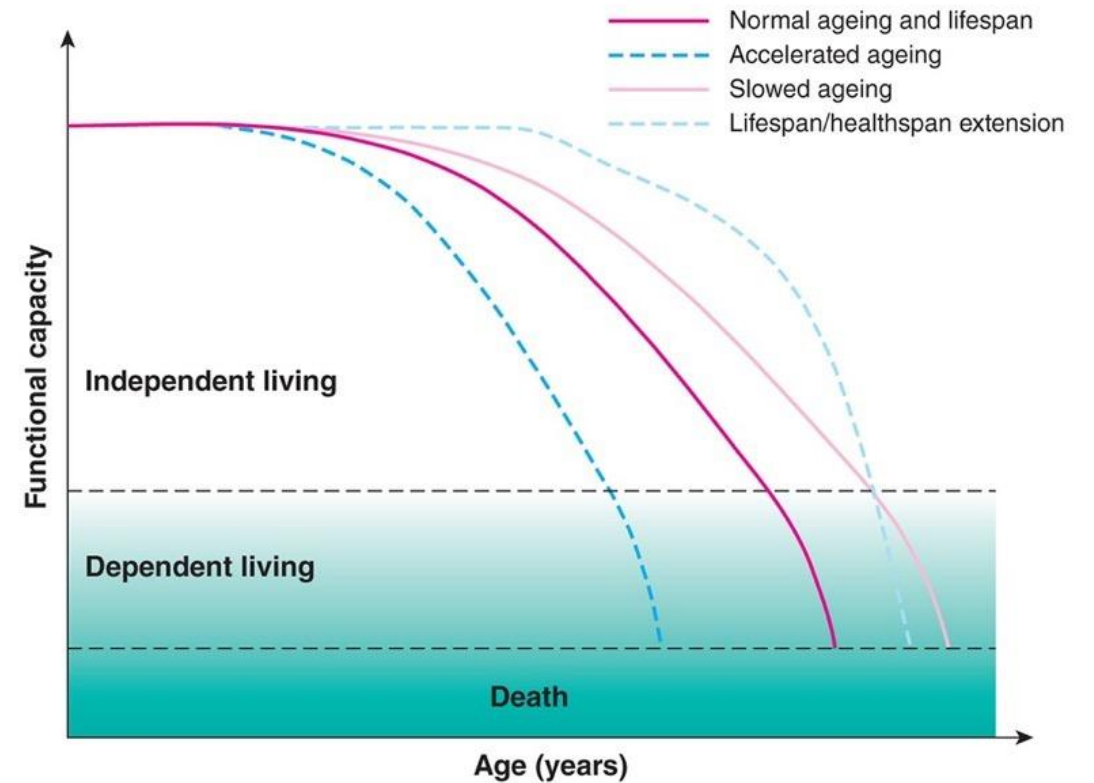
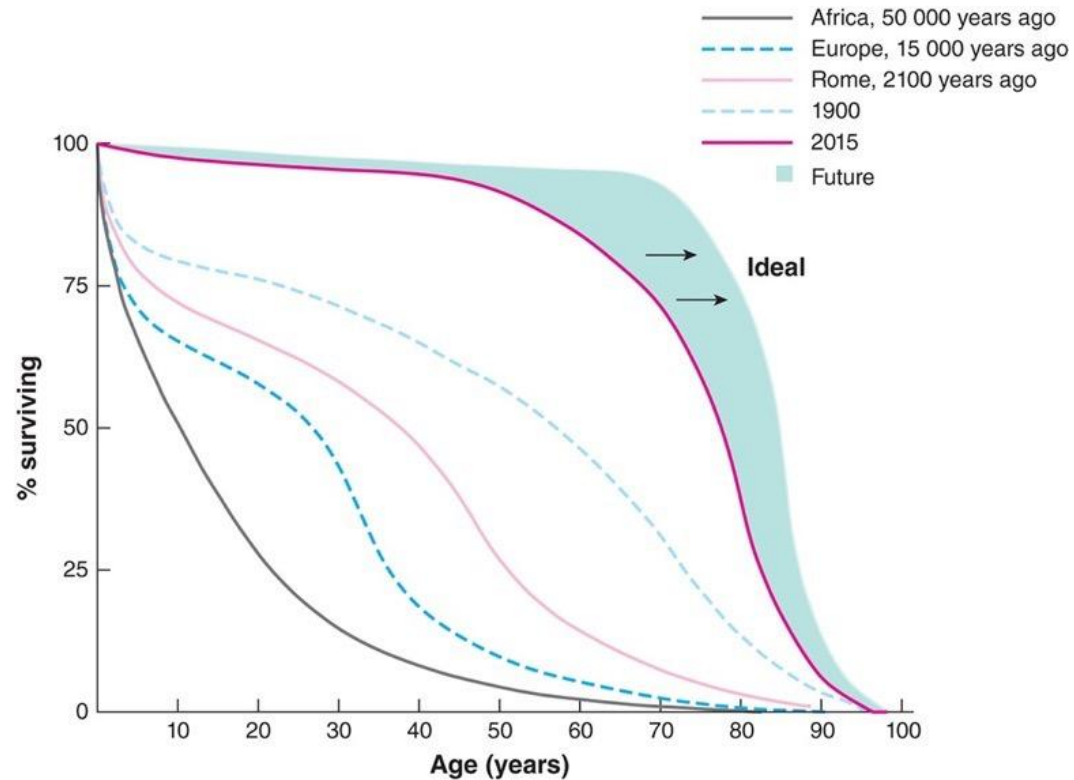
# Brain volume is reduced with age



# Changes to cognitive function are a normal part of aging



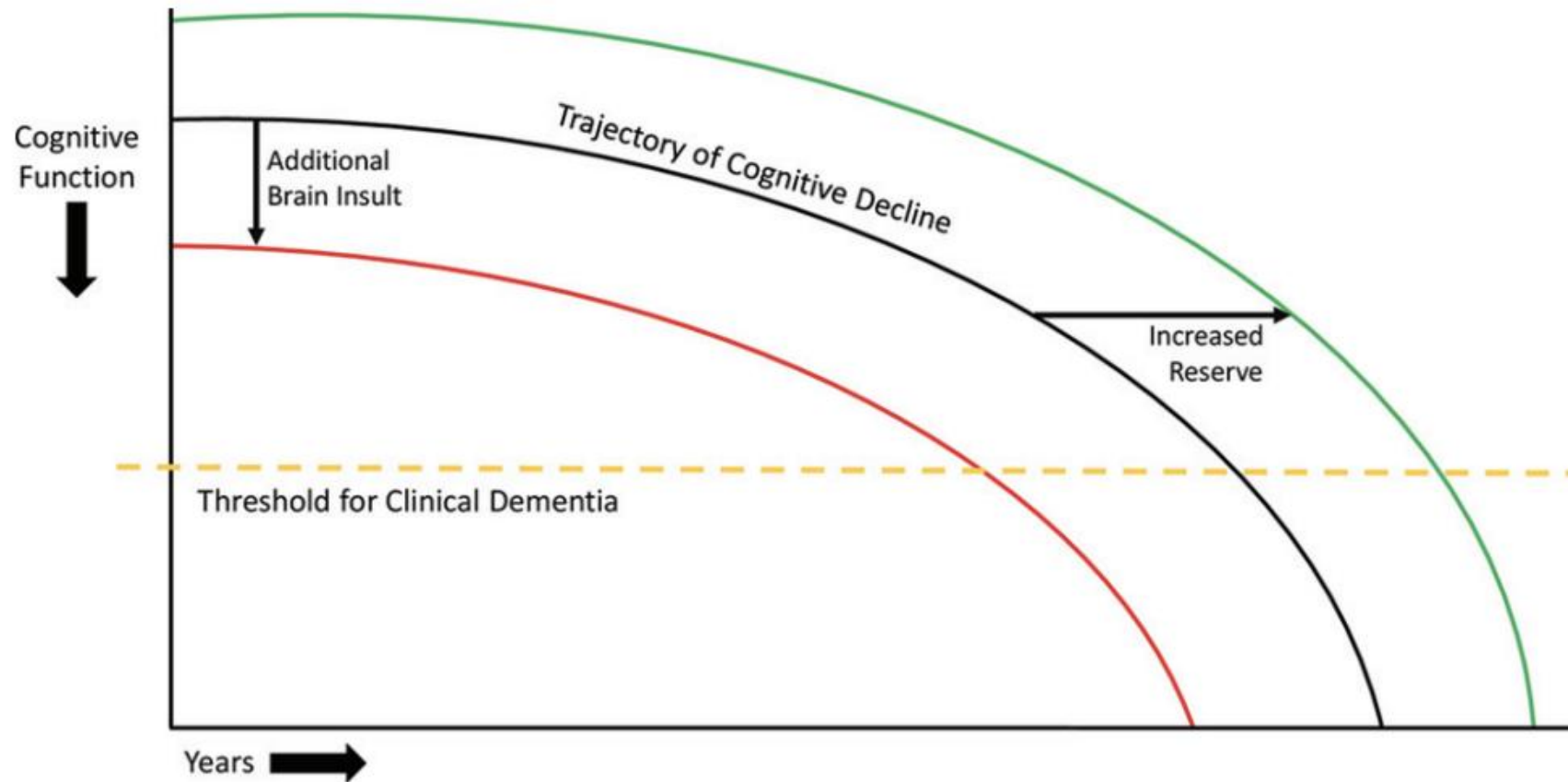
# Advances in nutrition and medical care is increasing our life expectancy



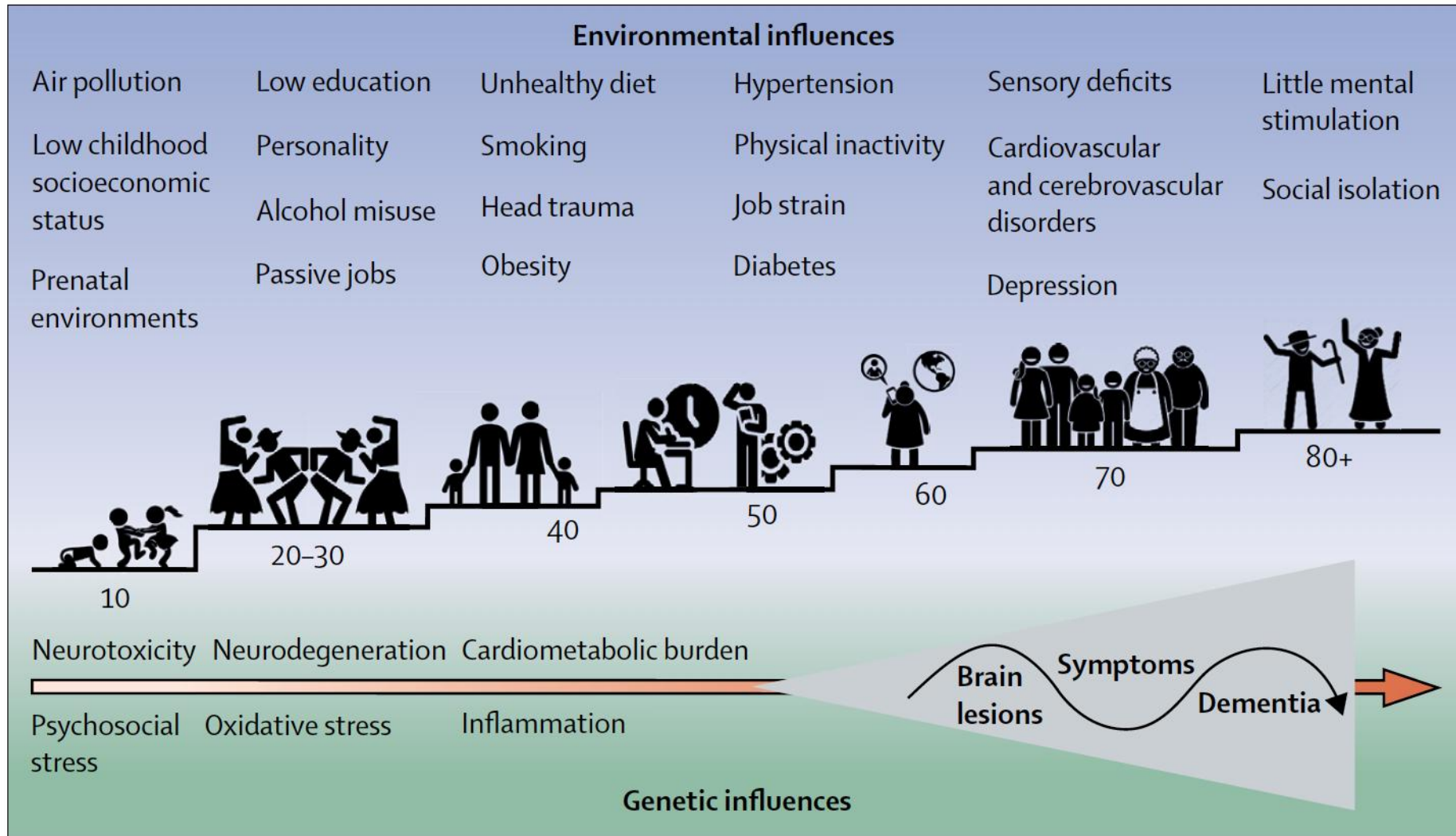
<https://doi.org/10.1002/bjs.10053>

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

# We can change our aging trajectory



# Factors throughout life impact aging





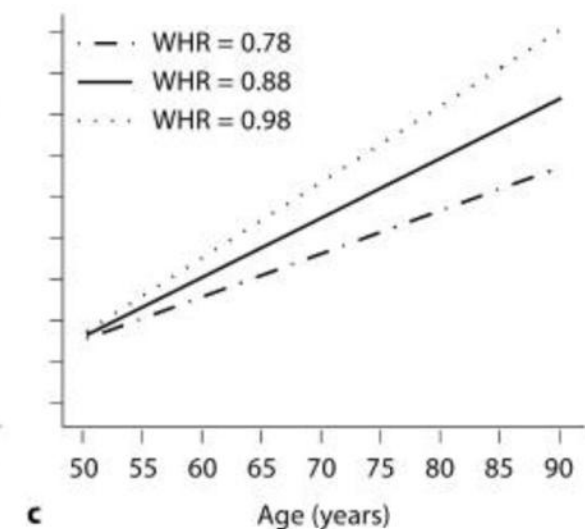
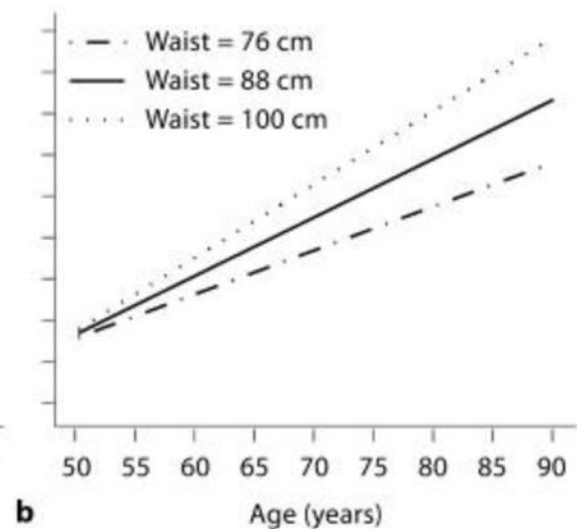
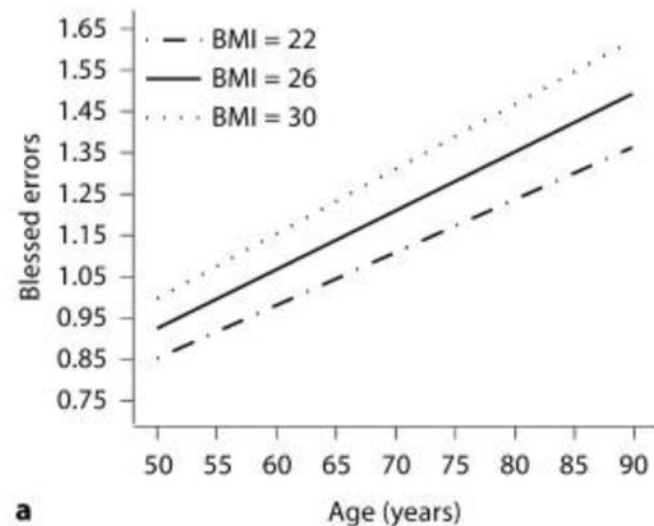
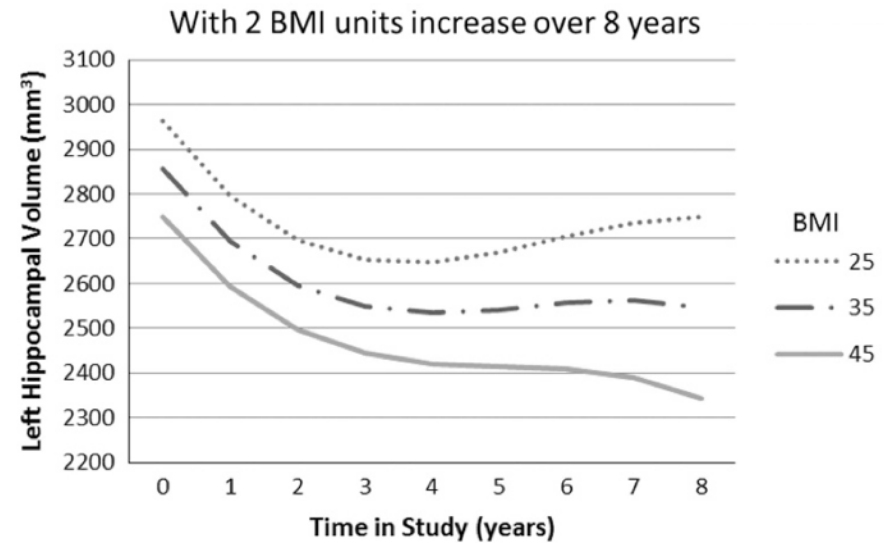
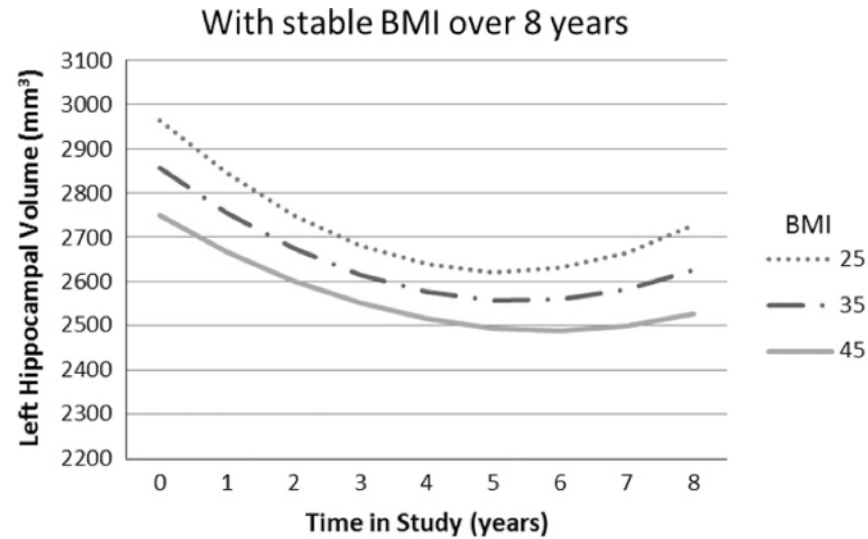
# There are positive and negative influences on aging



# There are positive and negative influences on aging



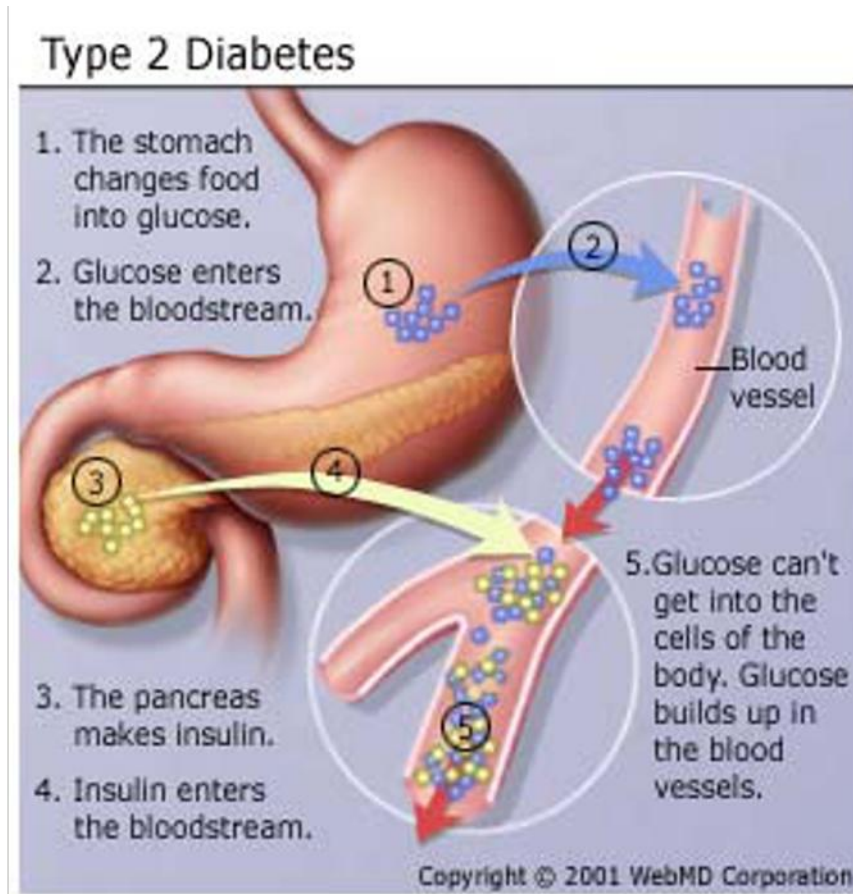
# Higher BMI is associated with reduced hippocampal volume and poorer memory performance



# There are positive and negative influences on aging

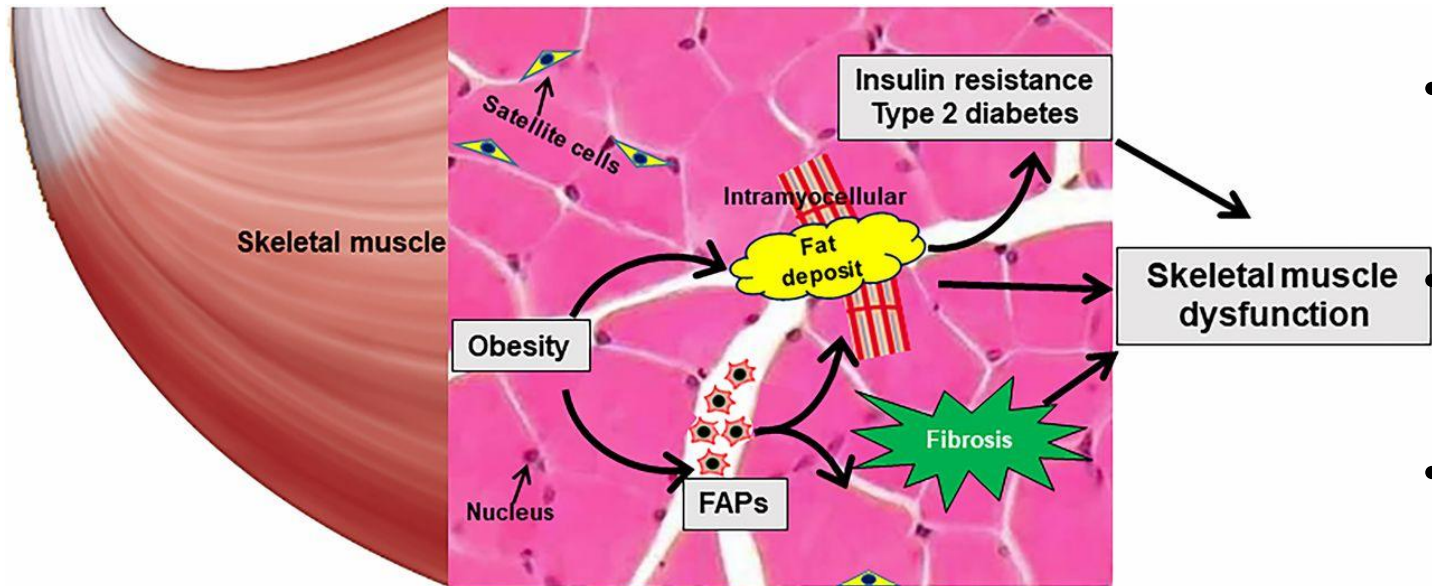


# Type 2 diabetes (T2D) affects the way your body metabolizes sugar



- 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



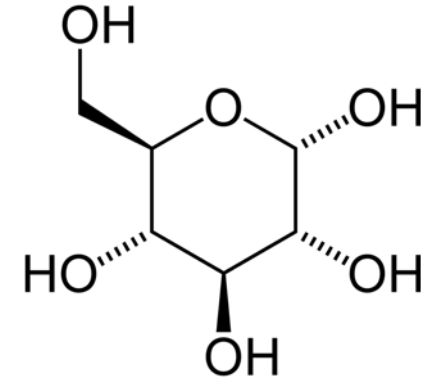
- Changes within muscle can contribute to type 2 diabetes
- Type 2 diabetes reduces muscle quality and function
- Some studies suggest that type 2 diabetes can reduce muscle mass

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

# Insulin impacts brain function



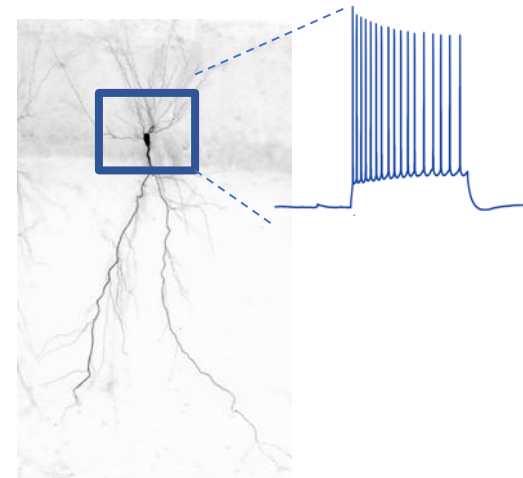
**Food intake and  
body weight**



**Glucose metabolism**

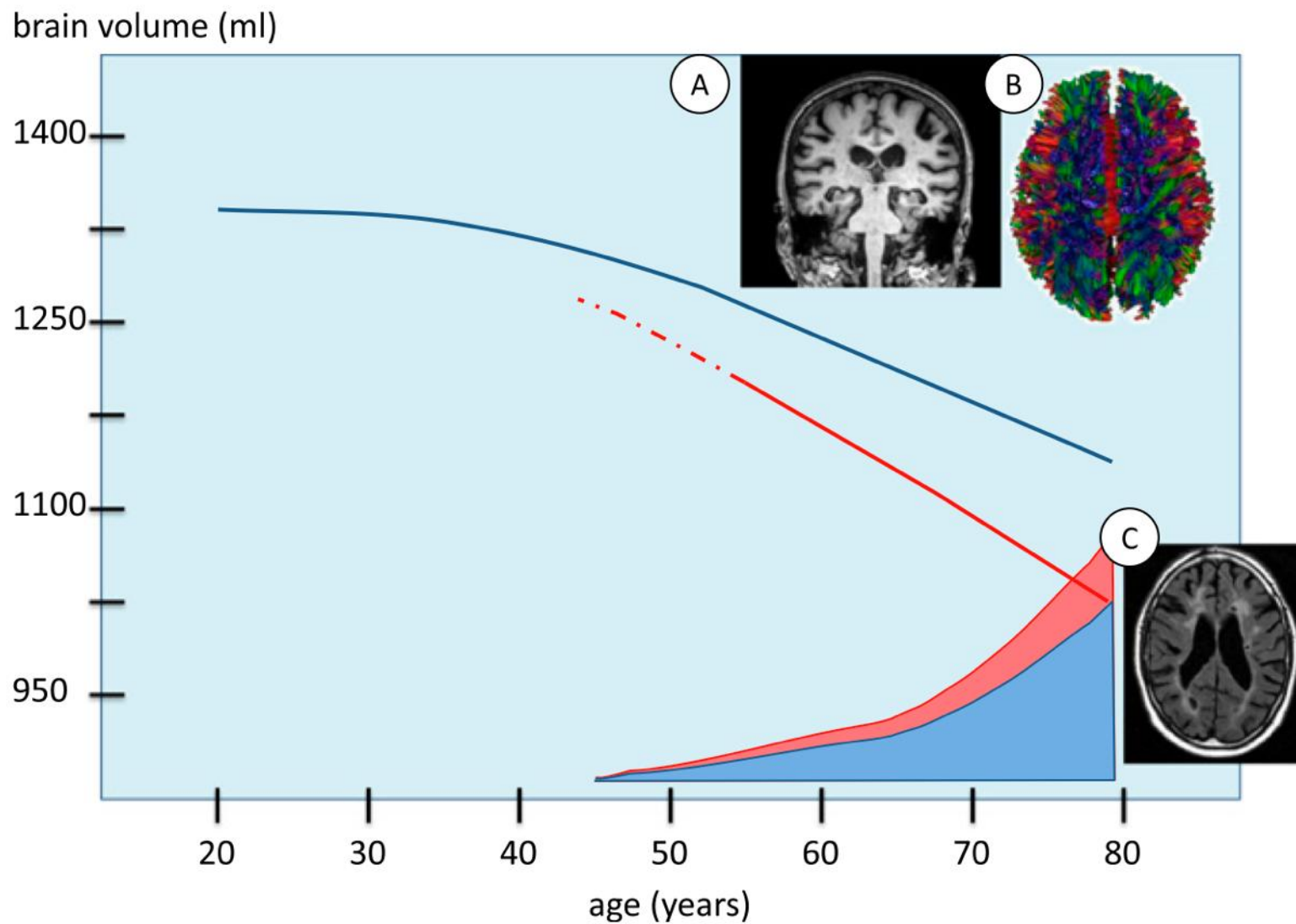


**Learning and Memory**



**Cellular function**

# Type 2 Diabetes decreases brain volume and connectivity over time

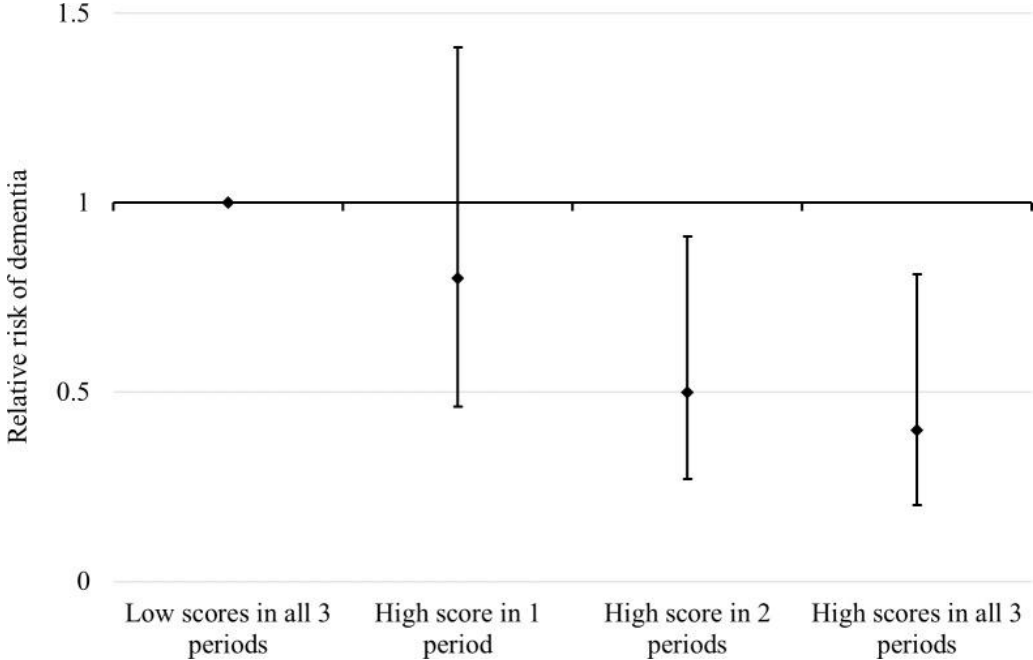
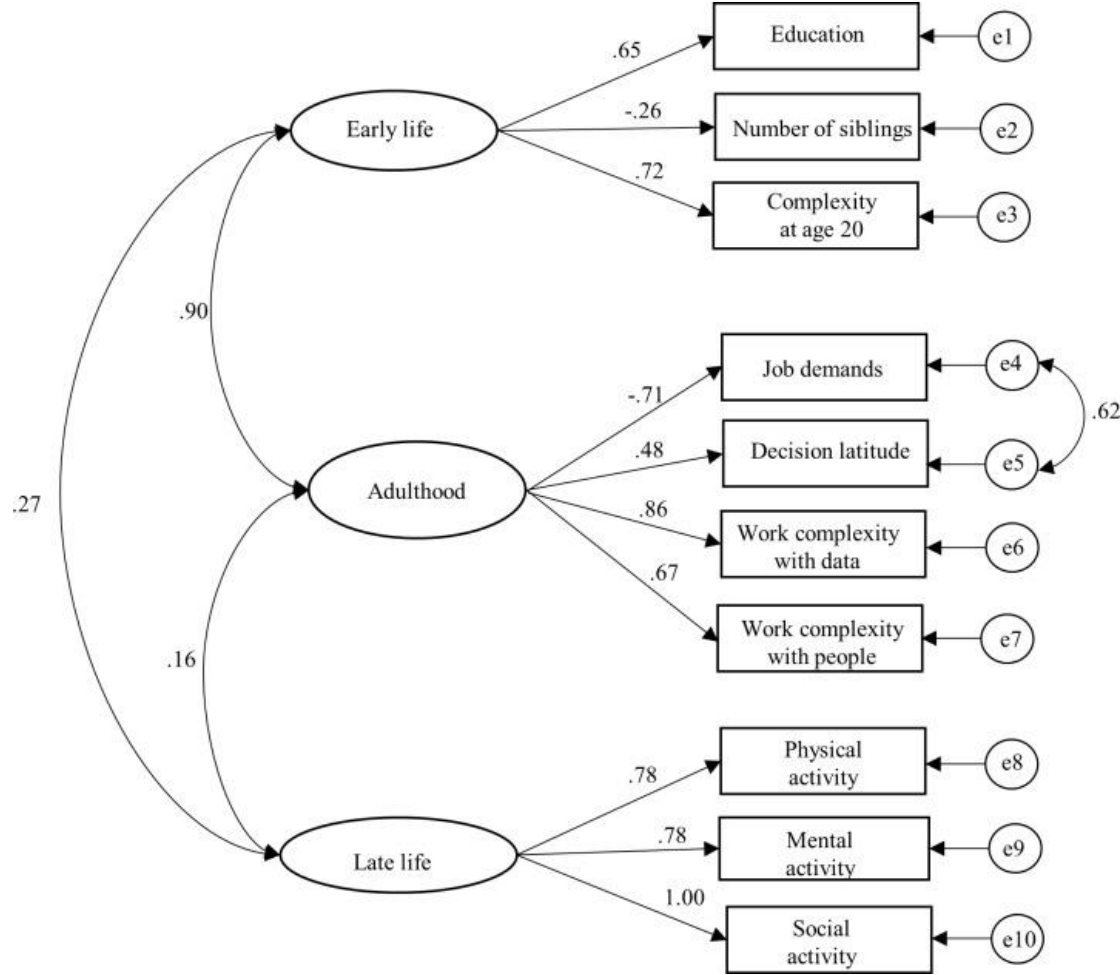




# There are positive and negative influences on aging



# Cognitive reserve reduces dementia risk



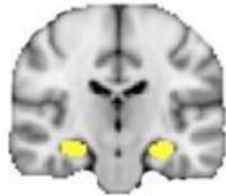
# There are positive and negative influences on aging



# Exercise increases brain volume and correlates with improved memory

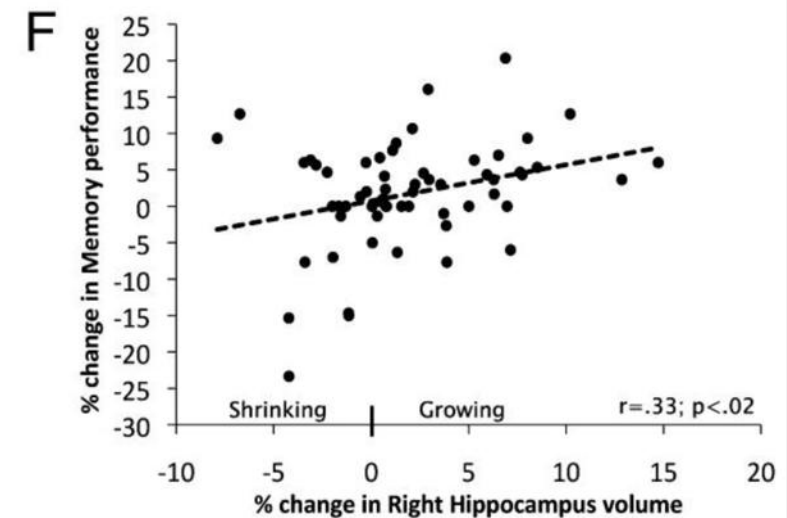
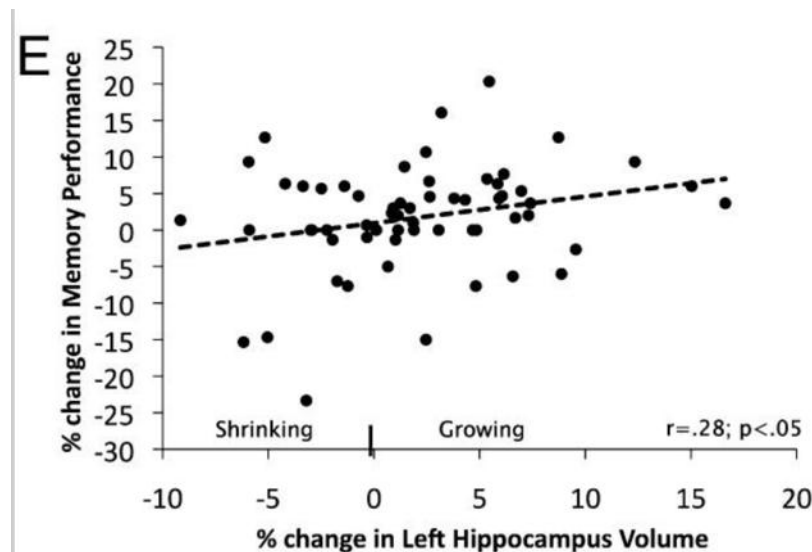
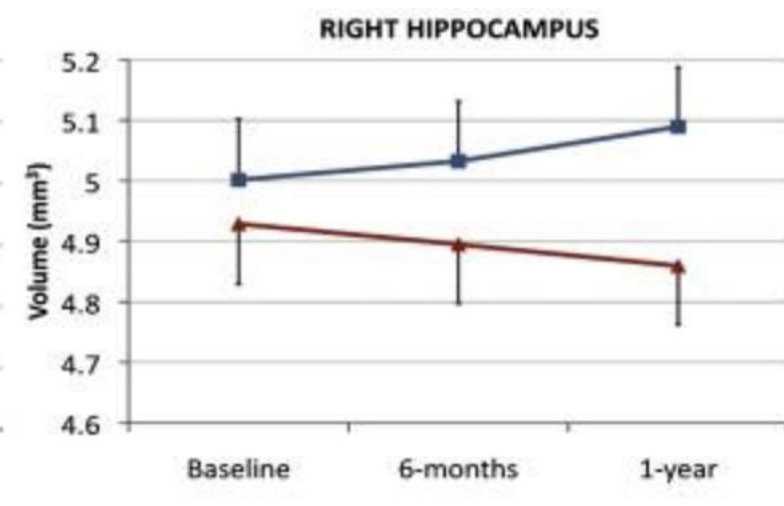
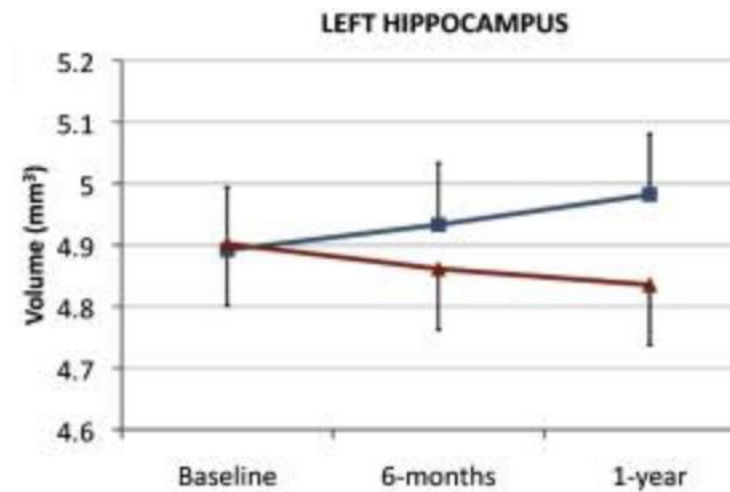


## A Hippocampus



■ Exercise  
▲ Stretching

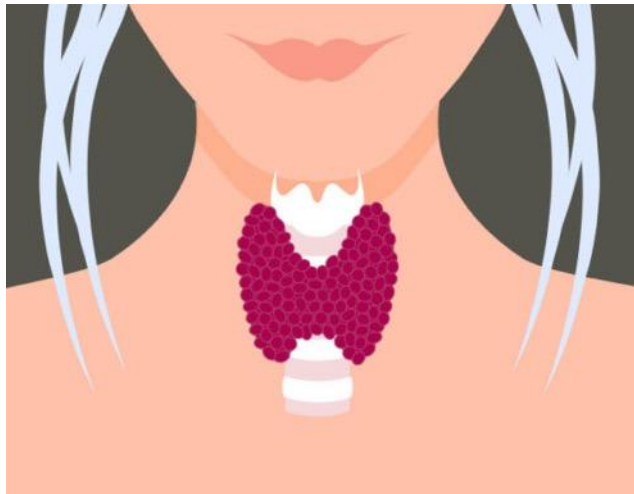
Show Panorama View



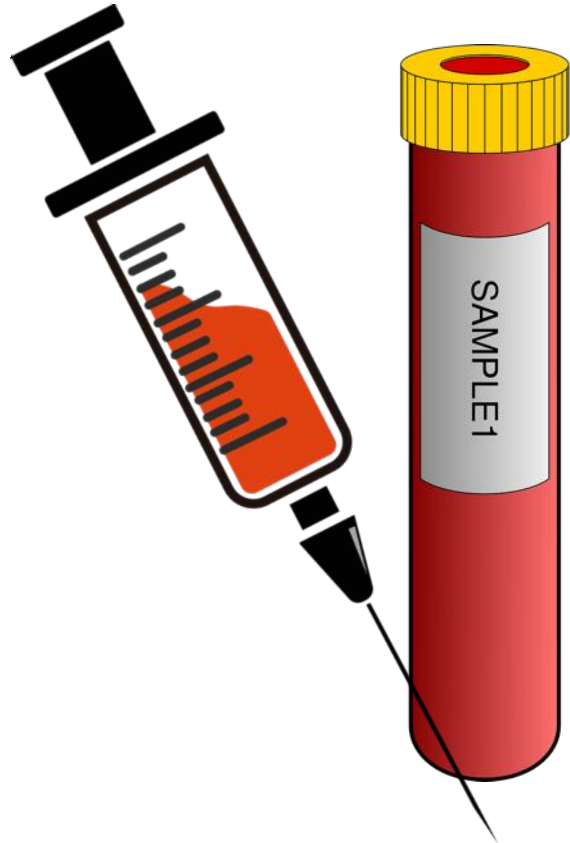
## Normal aging or something more?



## Not all issues with memory and thinking are dementia



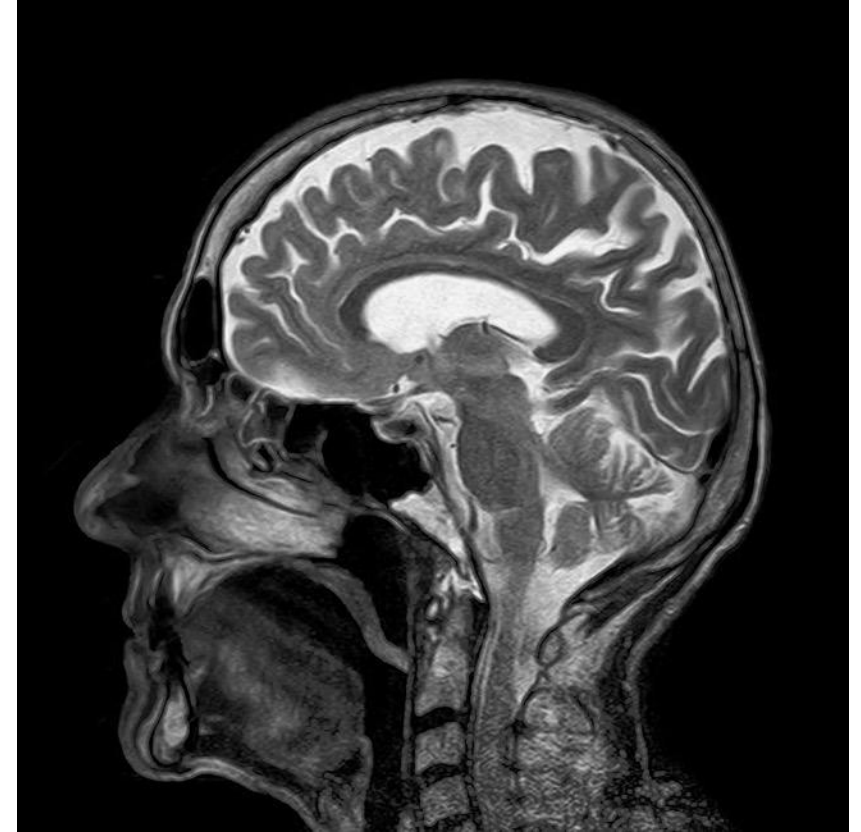
# Testing can help determine if there is a concern



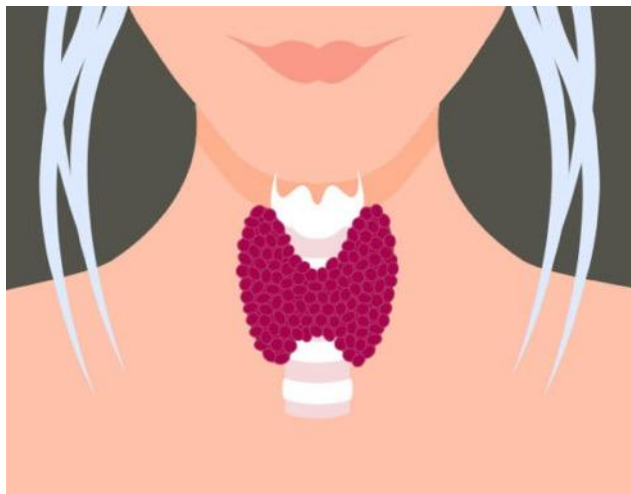
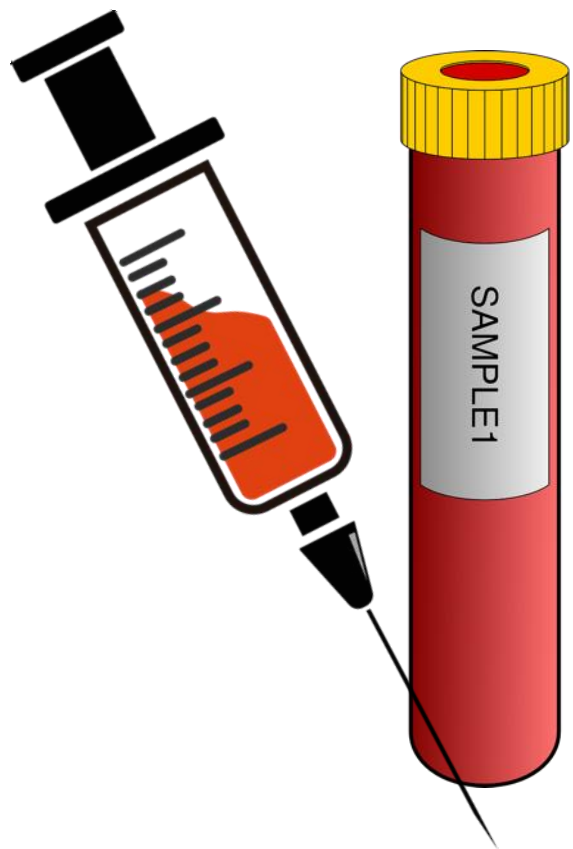
MONTREAL COGNITIVE ASSESSMENT (MOCA)  
Version 7.1 Original Version

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

VISUOSPATIAL / EXECUTIVE		Copy cube	Draw CLOCK (Ten past eleven) (3 points)	POINTS			
		<input type="checkbox"/>	<input type="checkbox"/>	___/5			
<p><b>NAMING</b></p>		<input type="checkbox"/>	<input type="checkbox"/>	___/3			
<p><b>MEMORY</b> Read list of words, subject must repeat them. Do 2 trials, even if 1st trial is successful. Do a recall after 5 minutes.</p>		FACE	VELVET	CHURCH	DAISY	RED	No points
		1st trial					
		2nd trial					
<p><b>ATTENTION</b> Read list of digits (1 digit/ sec.). Subject has to repeat them in the forward order [ ] 2 1 8 5 4 Subject has to repeat them in the backward order [ ] 7 4 2</p>							___/2
<p>Read list of letters. The subject must tap with his hand at each letter A. No points if ≥ 2 errors [ ] F B A C M N A A J K L B A F A K D E A A A J A M O F A A B</p>							___/1
<p>Serial 7 subtraction starting at 100 [ ] 93 [ ] 86 [ ] 79 [ ] 72 [ ] 65 4 or 5 correct subtractions: 3 pts. 2 or 3 correct: 2 pts. 1 correct: 1 pt. 0 correct: 0 pt</p>							___/3
<p><b>LANGUAGE</b> 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. [ ]</p>							___/2
<p>Fluency / Name maximum number of words in one minute that begin with the letter F [ ] _____ (N ≥ 11 words)</p>							___/1
<p><b>ABSTRACTION</b> Similarity between e.g. banana - orange = fruit [ ] train - bicycle [ ] watch - ruler</p>							___/2
<p><b>DELAYED RECALL</b> Has to recall words WITH NO CUE [ ] FACE [ ] VELVET [ ] CHURCH [ ] DAISY [ ] RED [ ]</p>							___/5
<p><b>Optional</b> Category cue [ ] Multiple choice cue [ ]</p>							
<p><b>ORIENTATION</b> [ ] Date [ ] Month [ ] Year [ ] Day [ ] Place [ ] City</p>							___/6
<p>© Z.Nasreddine MD <a href="http://www.mocatetest.org">www.mocatetest.org</a> Normal ≥ 26 / 30 TOTAL</p>							___/30
<p>Administered by: _____</p>							Add 1 point if ≤ 12 yr edu



## Testing can help determine if there is a concern







**This is a memory test**

**This is a memory test**

**Book**

**Goat**

**Church**

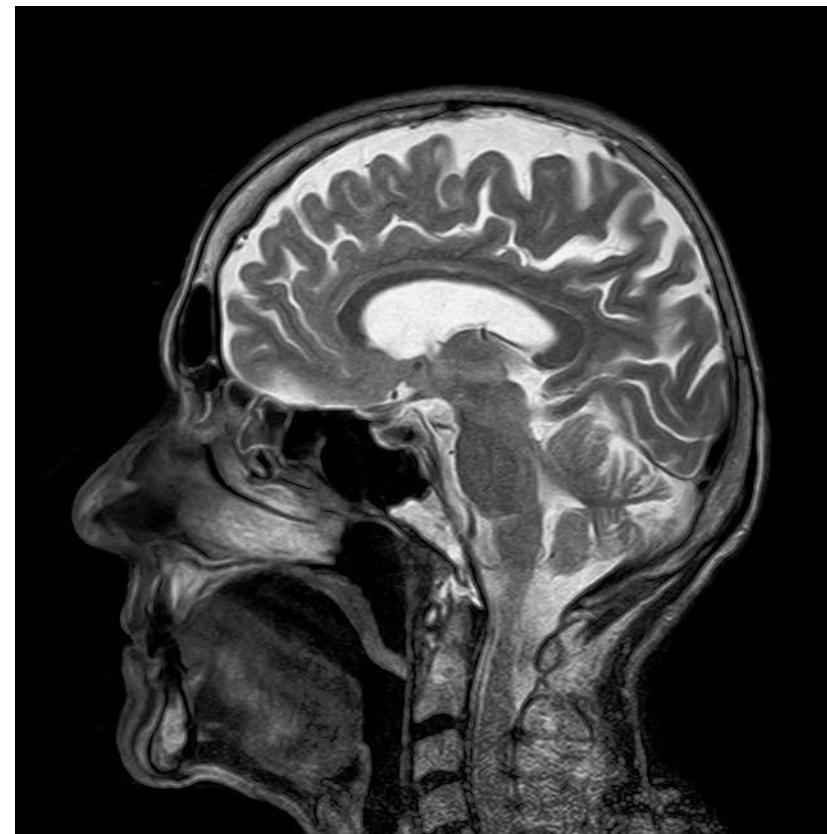
**Happy**

**Square**

**This is a memory test**

**Try to remember those 5 words.**

# Magnetic Resonance Imaging



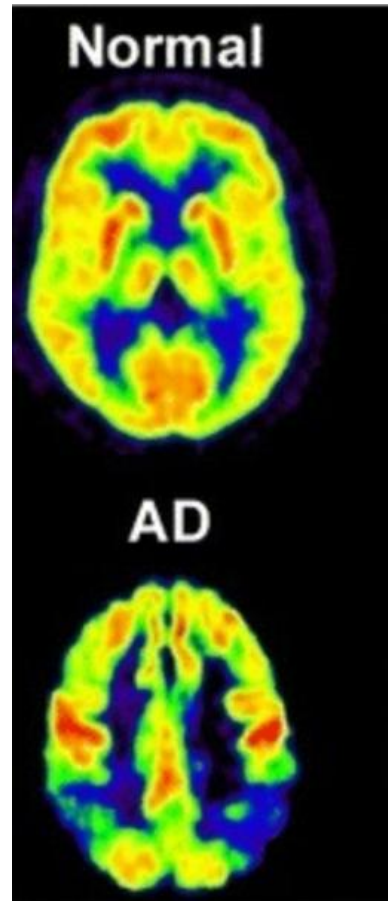
# Positron Emission Tomography



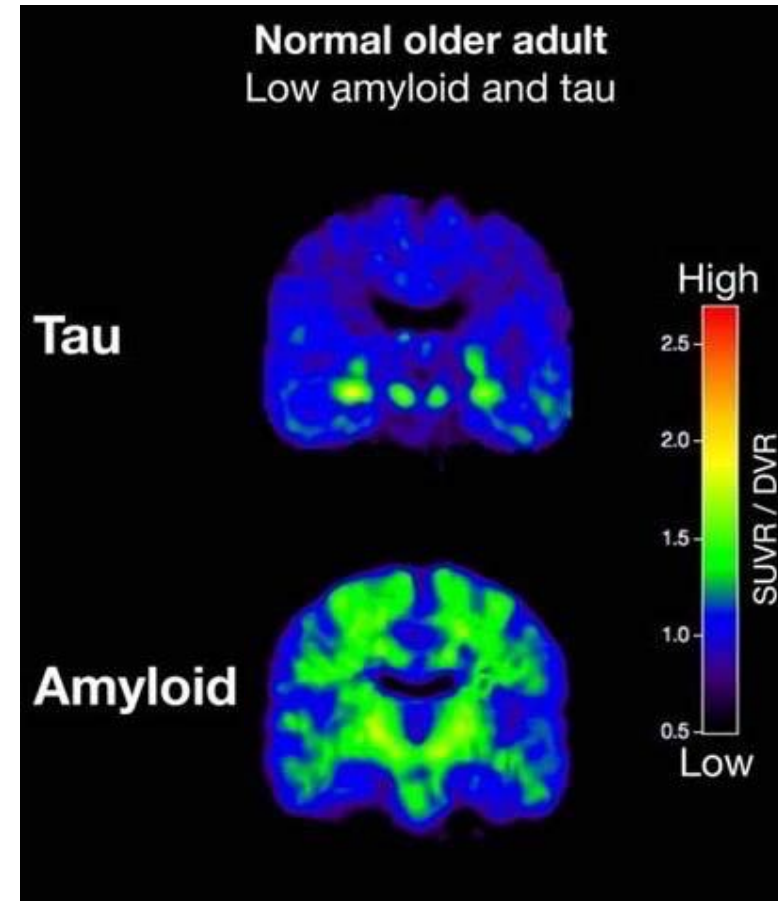
**PET scanner**



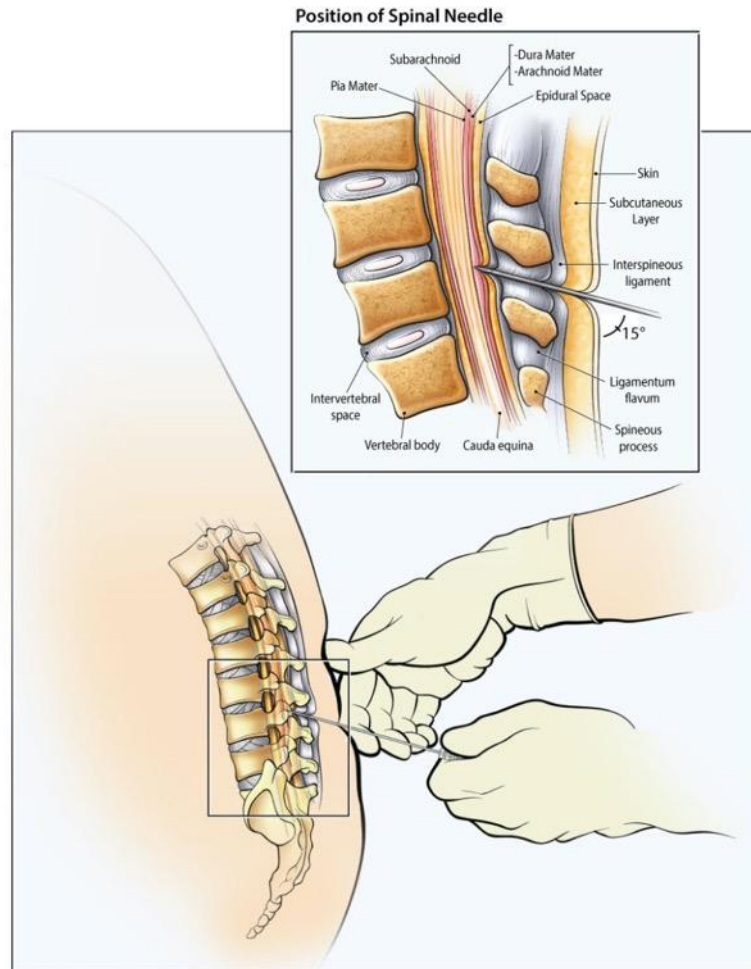
**Glucose Metabolism**



**AD pathology**



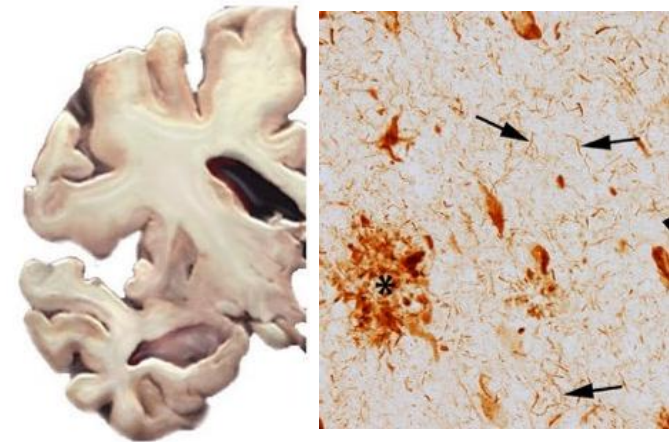
# Cerebral spinal fluid gives information about the brain



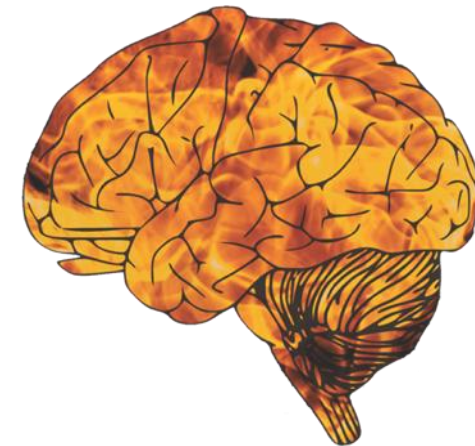
Performing a Lumbar Puncture



## 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**

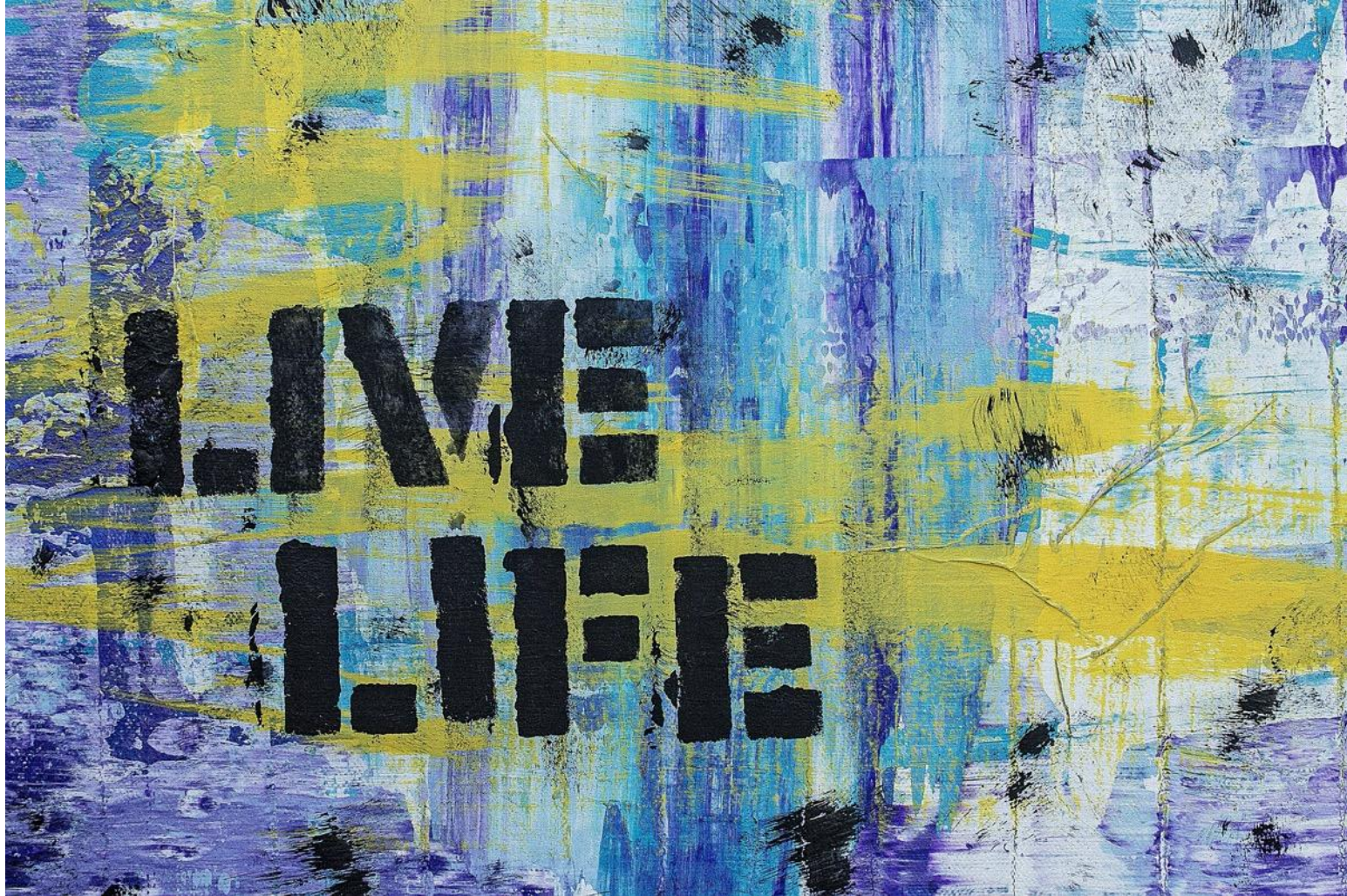
**Happy**

**Square**

# Take control of your aging process



## Focus on the positive





**THANK YOU!**

**QUESTIONS?**