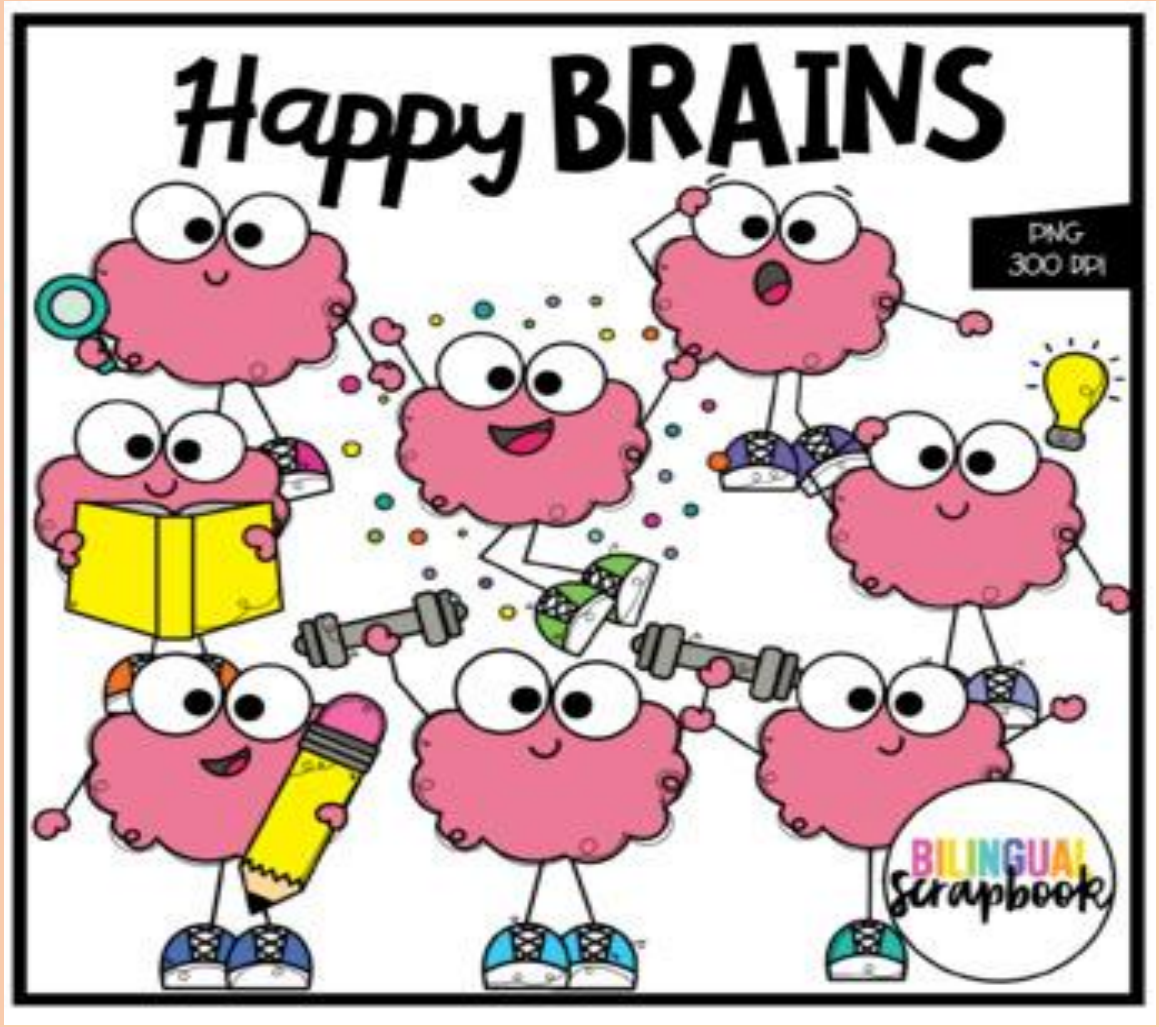


Barbara Cherry
Professor Emeritus, Psychology
Aging Studies Associate Coordinator

Road Map

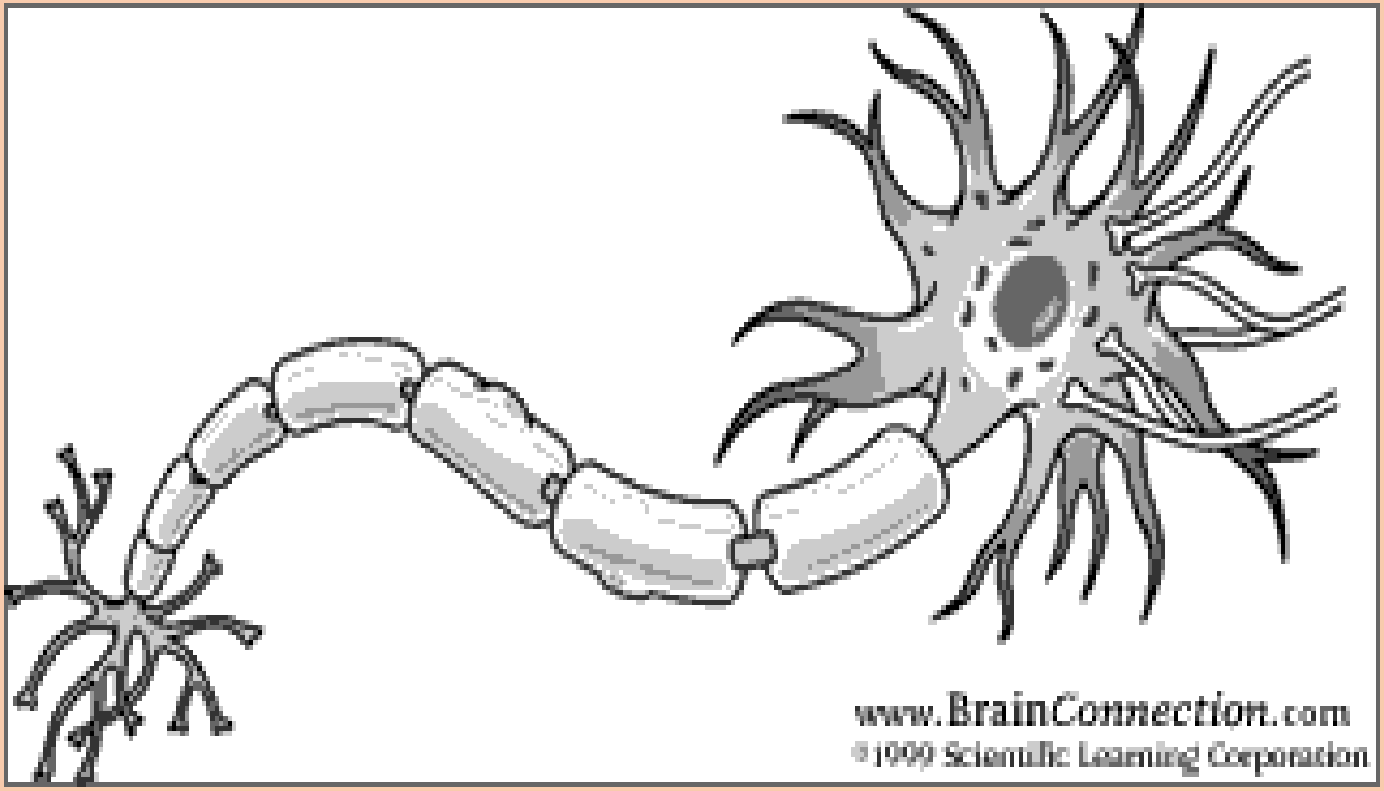
- A little brain science
- What can go wrong
- What can go right!
- It’s all about your environment!!

A Little Brain Science

- Neurons and Brains
- Brain issues as we age

Neurons and Brains

The Neuron



Neuron
A myelinated neuron.

http://faculty.washington.edu/chudler/synapse.html

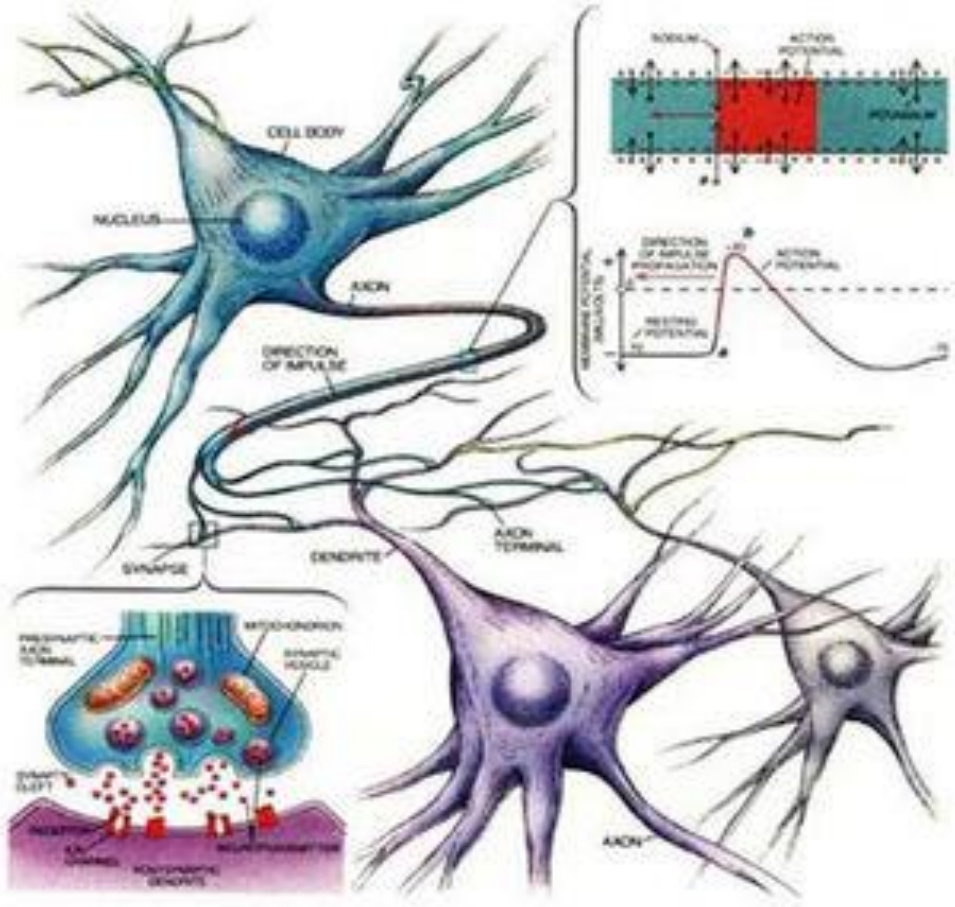
The Neuron

- Dendrites
- Axons
- Cell body/Soma
- Synaptic terminals
- Synapse
- Neurotransmitters--chemical
- EEG’s/ERP’s--electrical

Neurons

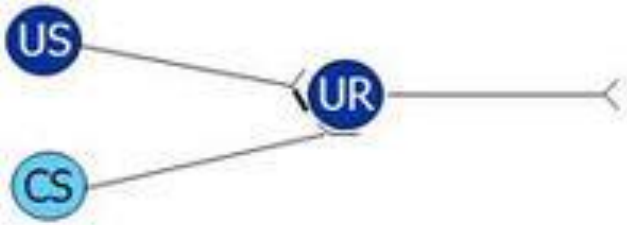
- Knowledge is not located in a single neuron
- Hebbian learning
  - *When an axon of cell A is near enough to excite a cell B and repeatedly or persistently takes part in firing it, some growth process or metabolic change takes place in one or both cells such that A's efficiency, as one of the cells firing B, is increased.* ([44], p.62; his italics)
  - 44 D. O. Hebb. *The Organization of Behaviour*. John Wiley & Sons, New York, 1949.

Hebbian Learning



Hebbian learning:

- When two joining cells fire simultaneously, the connection between them strengthens (Hebb, 1949)
- Discovered at a biomolecular level by Lomo (1966) (Long-term potentiation).



Learned assocations through the strengthening of connections....

Neurons (con’t.)

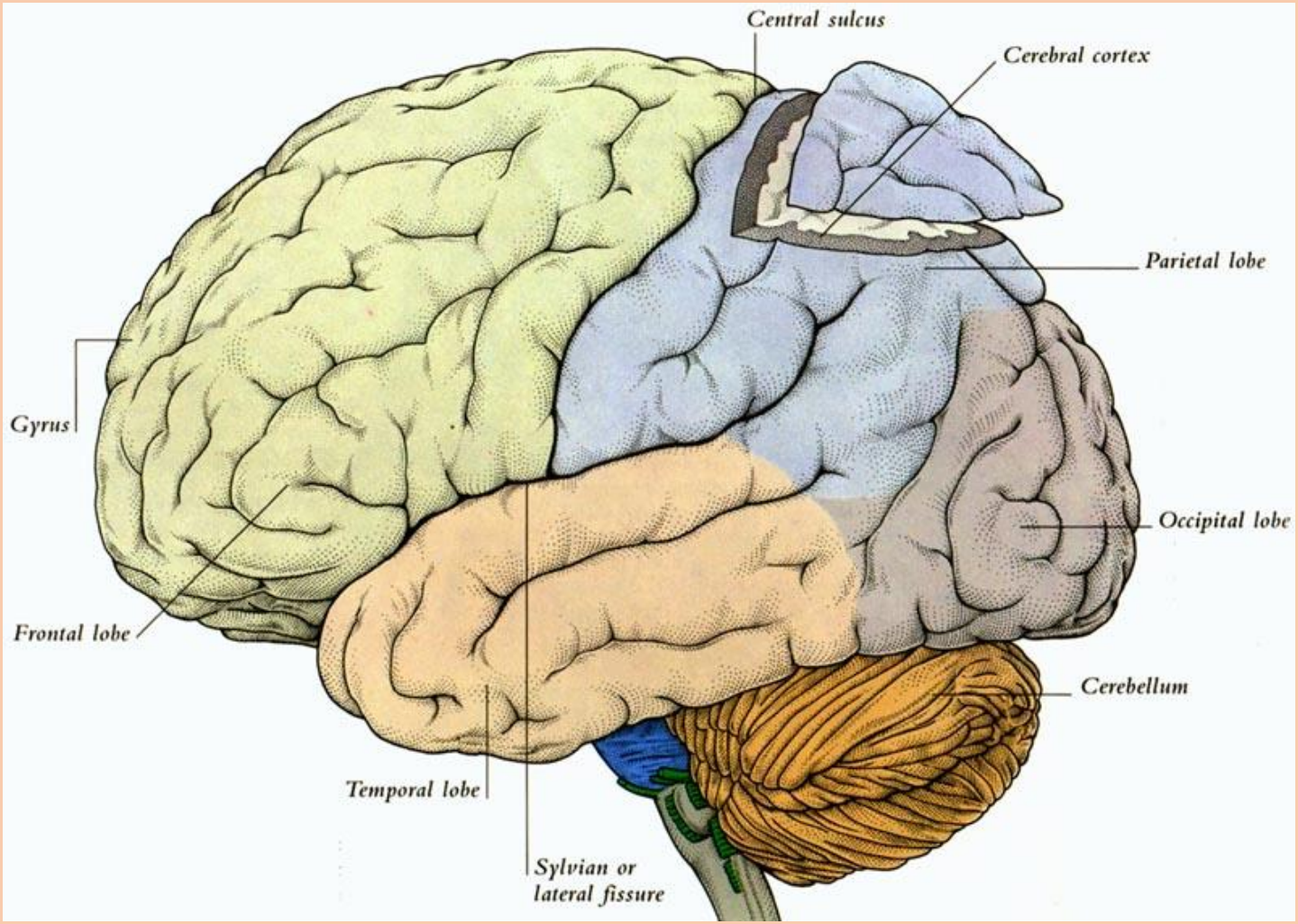
- Gray vs. white matter
  - Gray: Cell bodies
    - Soma
    - Integrity of cell (soma) important for particular neurochemicals—Ach, DA, NE, E, 5HT
  - White: Axons
    - Nerves = multiple axons
    - Fiber structures—corpus callosum, commissures

http://www.humanconnectomeproject.org/

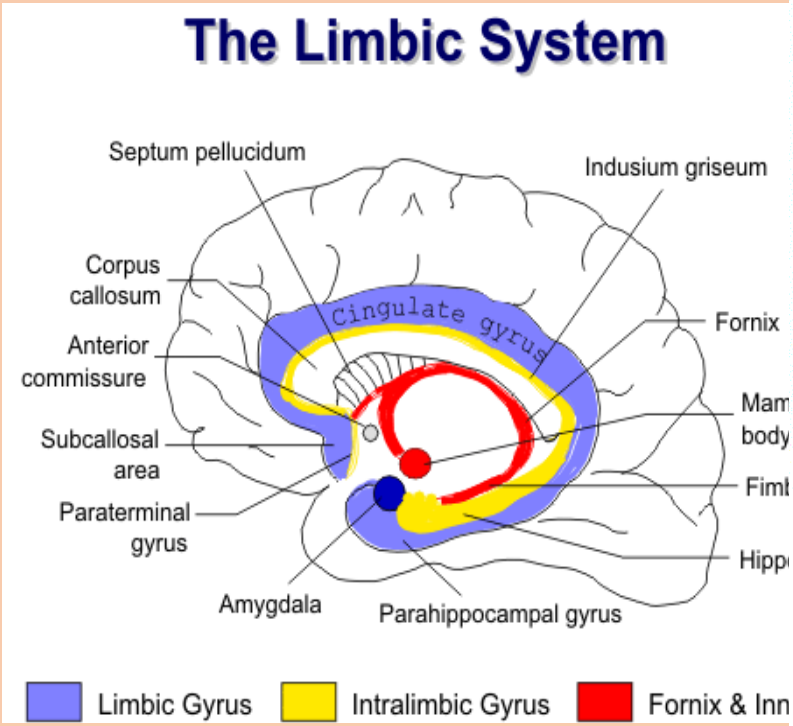
The Nervous System

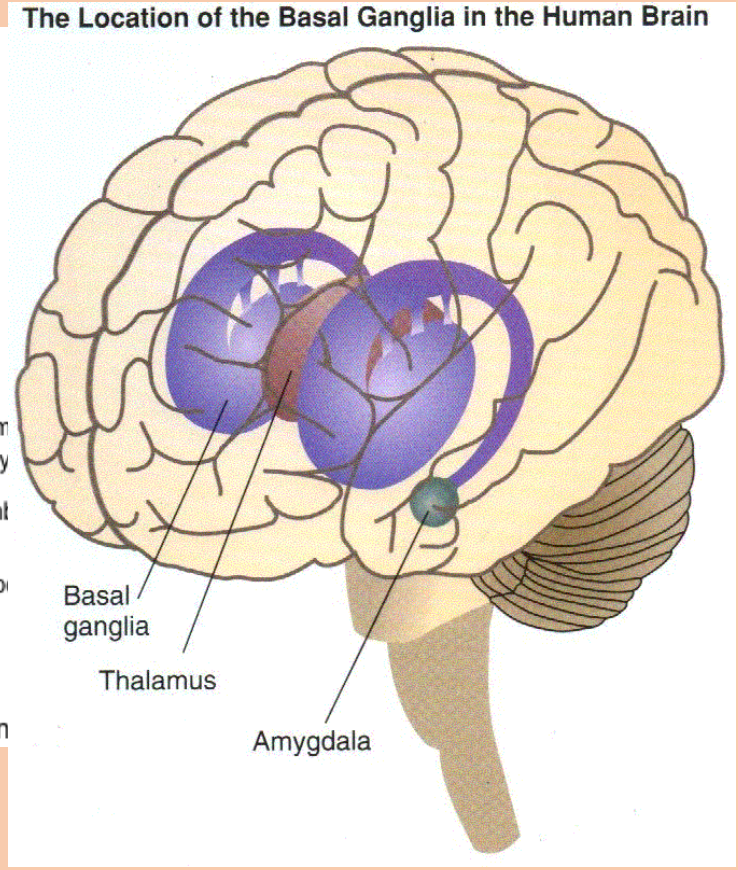
- Spinal cord
- Brain
  - >100 billion neurons
  - ~ 3 pounds
  - Size of a grapefruit
  - Soft jello
  - Each cubic inch of brain tissue contains ~10,000 miles of nerve fibers

Cerebral Cortex



On the Inside….





http://da.si.washington.edu/da.html

Brain anatomy

- Neurons vs. support cells
  - Glia
  - http://faculty.washington.edu/chudler/glia.html

- Sulci vs Gyri, Fissures—surface area, landmarks

Brain Issues as We Age

- Executive Function
- Memory

What can go wrong

- The pandemic……

- Health issues


NONE OF
YOU ARE
INVITED

When you work from home

And somebody wants to have a video call

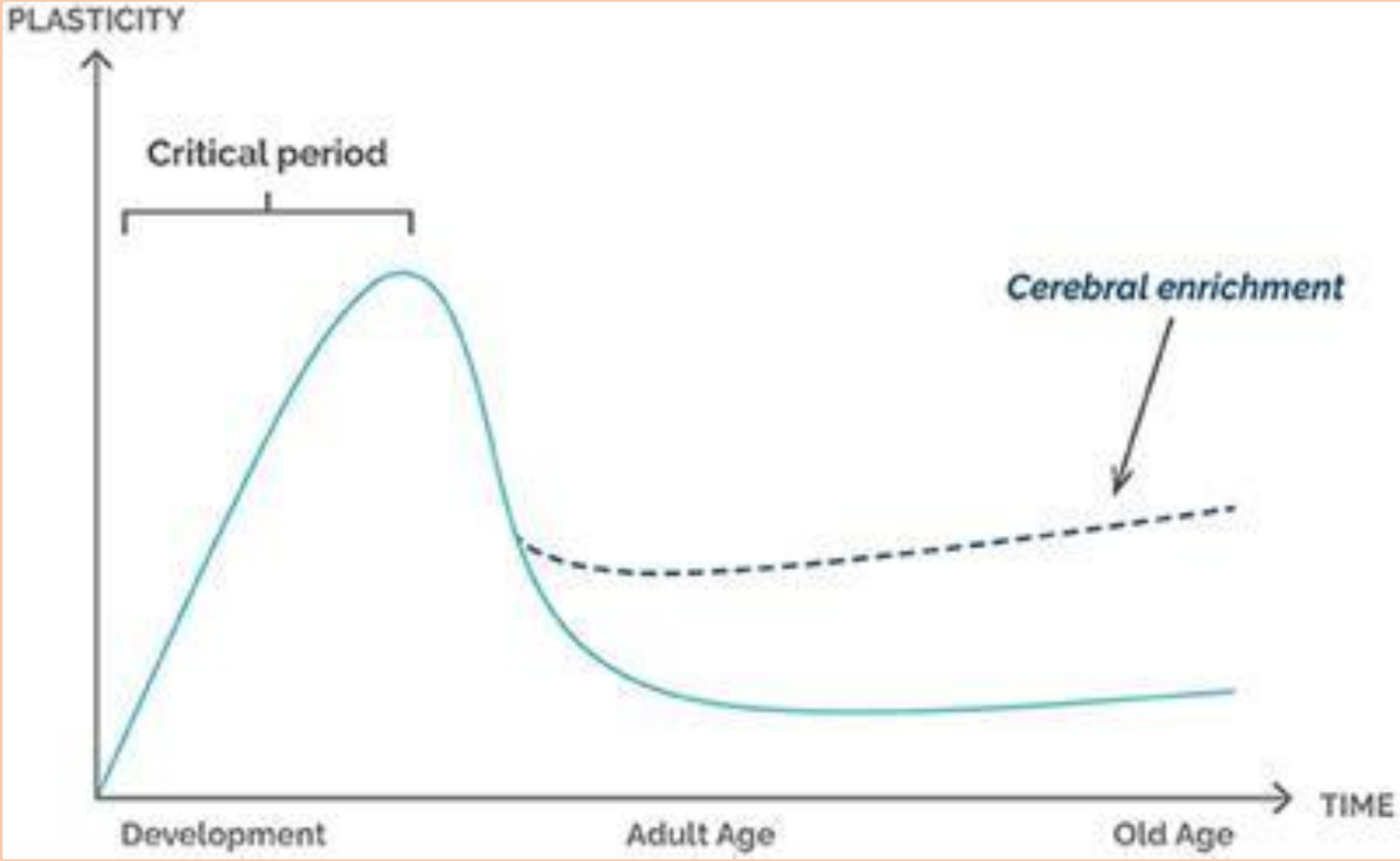
Health Issues

- Physical
- Cognitive
- Mental/Emotional

What can go right!

- Neuroplasticity
- Epigenetics
- Rebuilding your Brain

Neuroplasticity



Building Cognitive and Neural Reserve

Mind-Body Issues

Mind

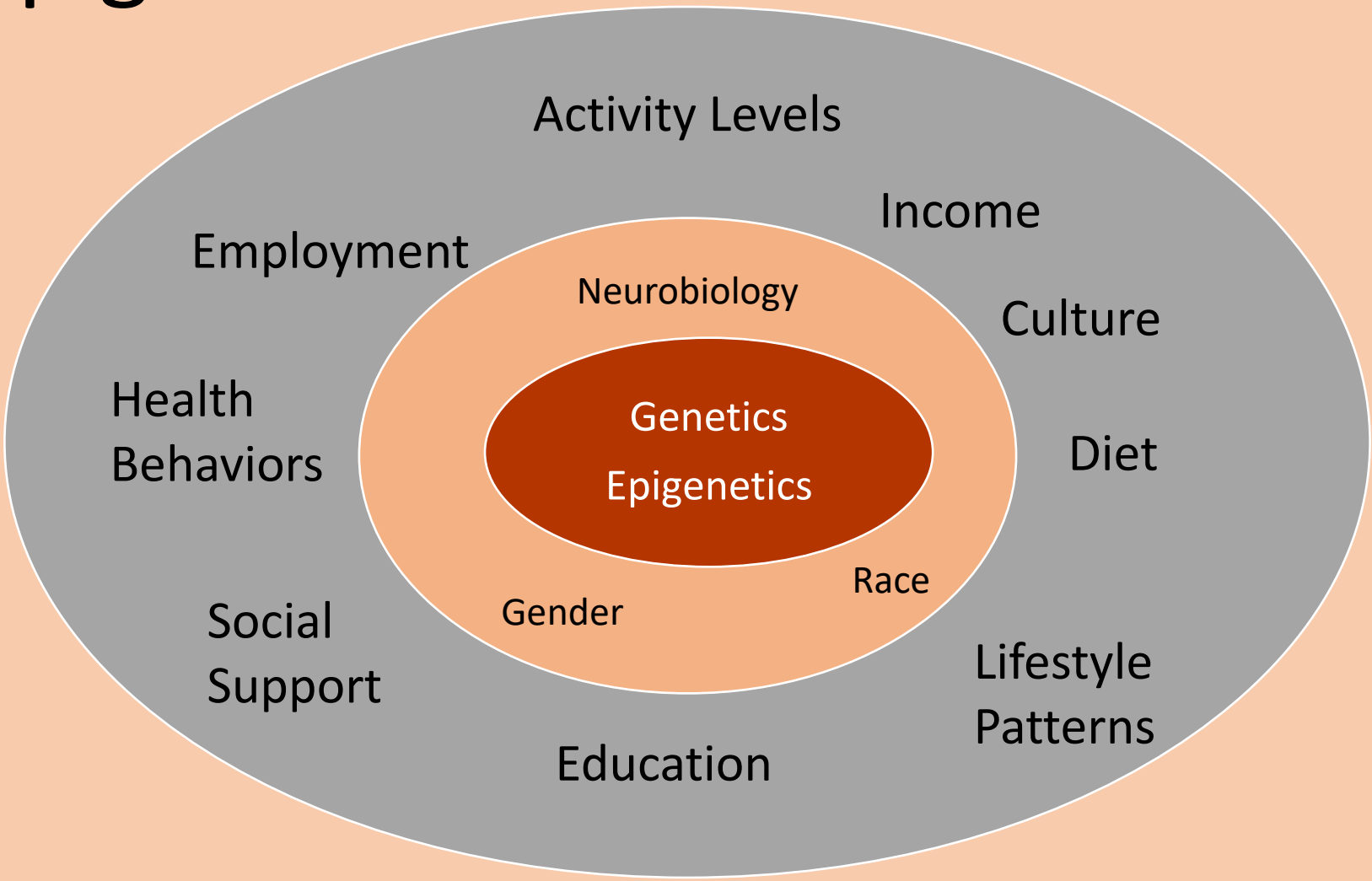
- Memories
- Perceptions
- Ideas
- Thoughts
- Decisions

Body

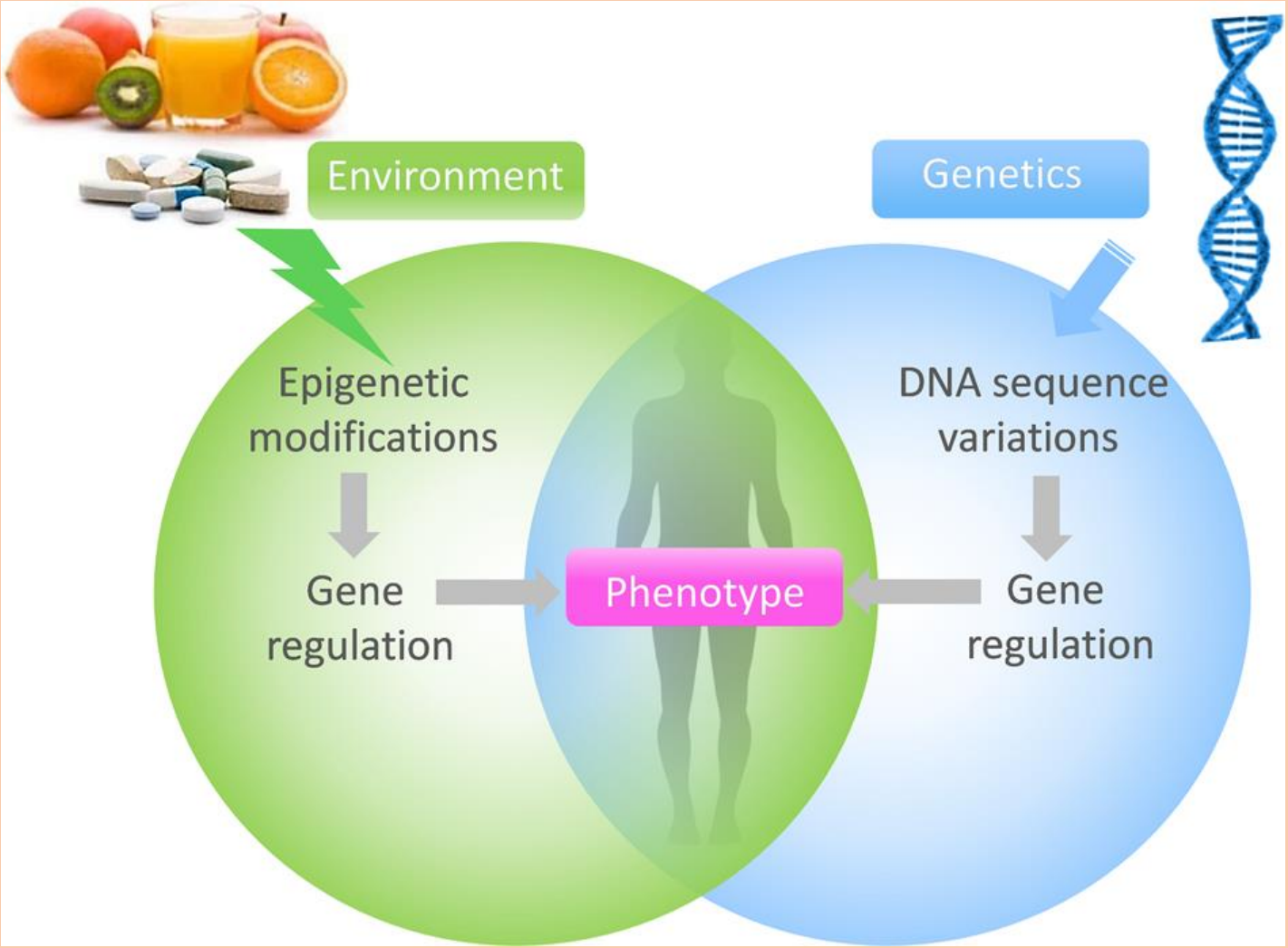
- Neurons
- Neurochemicals
- Transmissions of impulses (electrochemical)

All cognition is a result of neurological activity

Epigenetics



Epigenetics con’t.



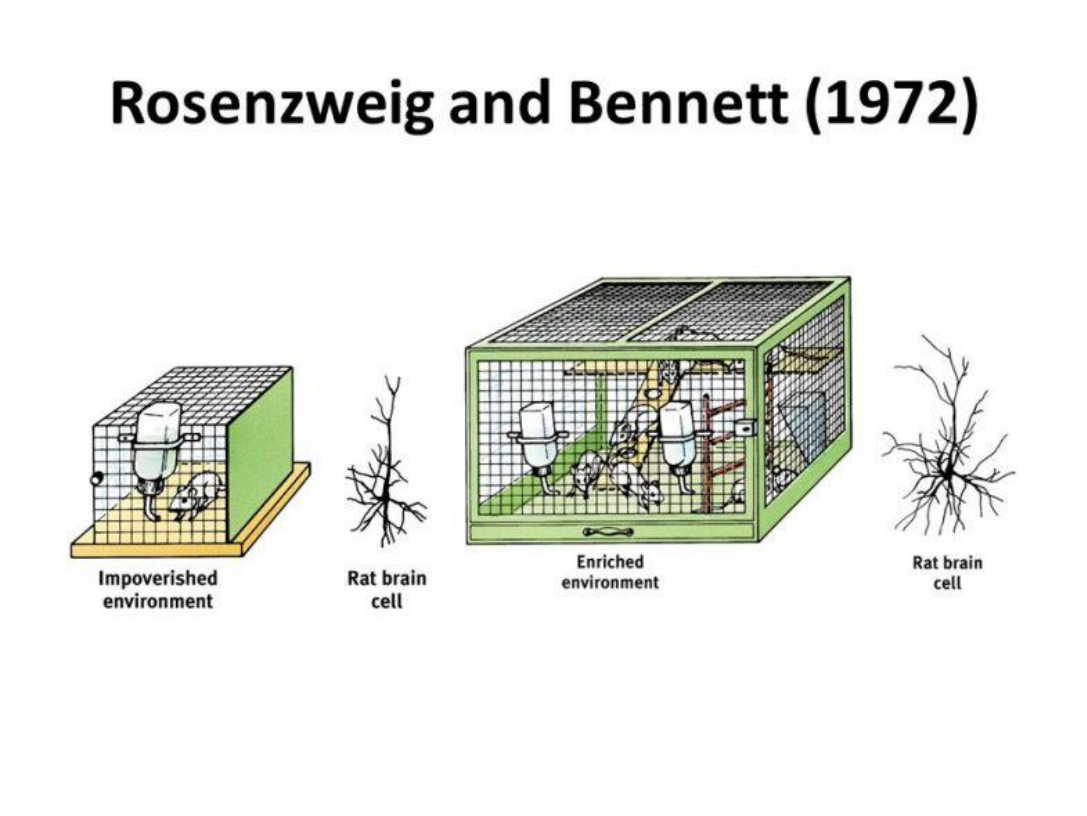
Rebuilding your Brain

Building Happy Brains

- Physical activity
- Meaningful activity
- Cognition
- Gut Health
- Emotional Health

Physical Activity: Exercise your Body

- Oxygen to the brain
- Running in rats
  - Improves learning
  - Stimulates synaptic plasticity
- AD mice and exercise
  - Improves learning
  - Less beta-amyloid



- 5-6 million U.S.; 3-6% worldwide affected; ~80% women

- Brain Fog

Fibromyalgia & Chronic Pain Center

Six waves of data: 2012 through 2018

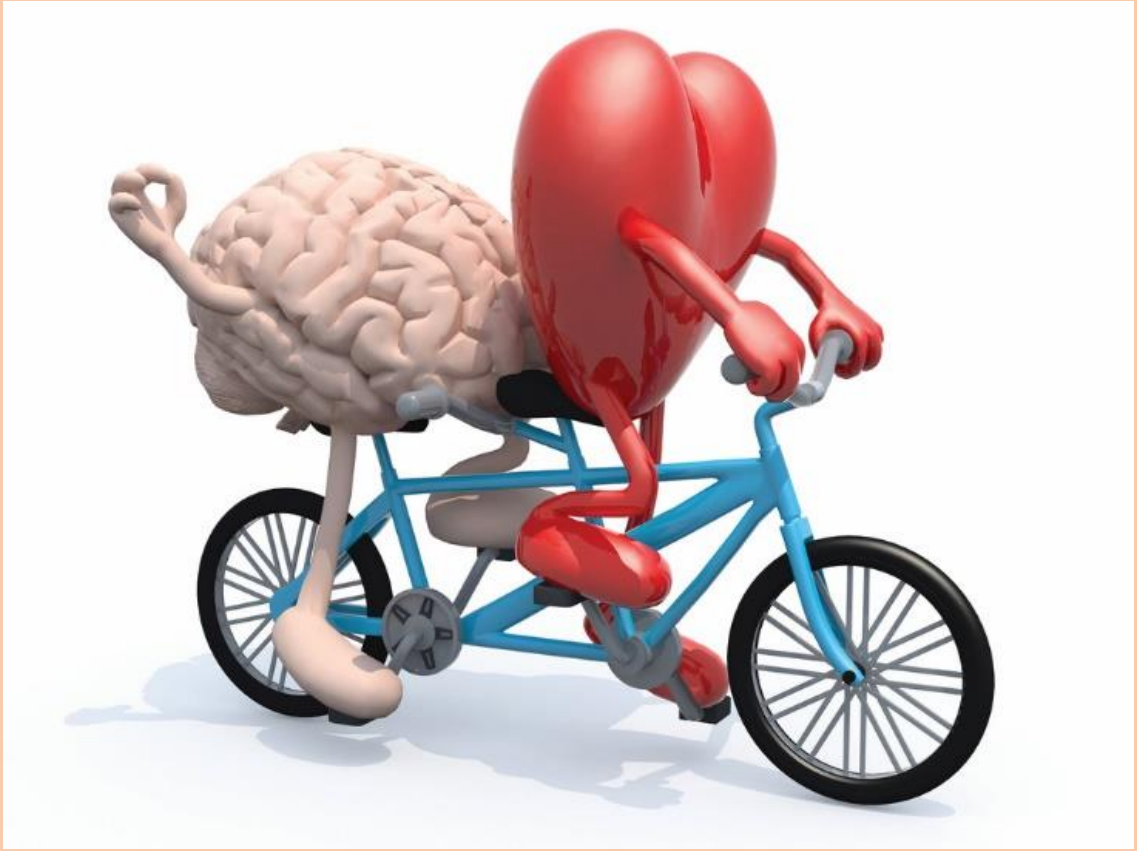
- Participants with and without FM 50 years+
- Measures
  - Medical history, medications, BMI, physical activity level (RAPA), MOS social support survey
  - 19 symptoms (NFAQ), Composite Physical Function, Beck Depression Inventory
  - Physical performance
  - Cognitive performance

http://fmcp.fullerton.edu/

Physical Activity Improves Cognition

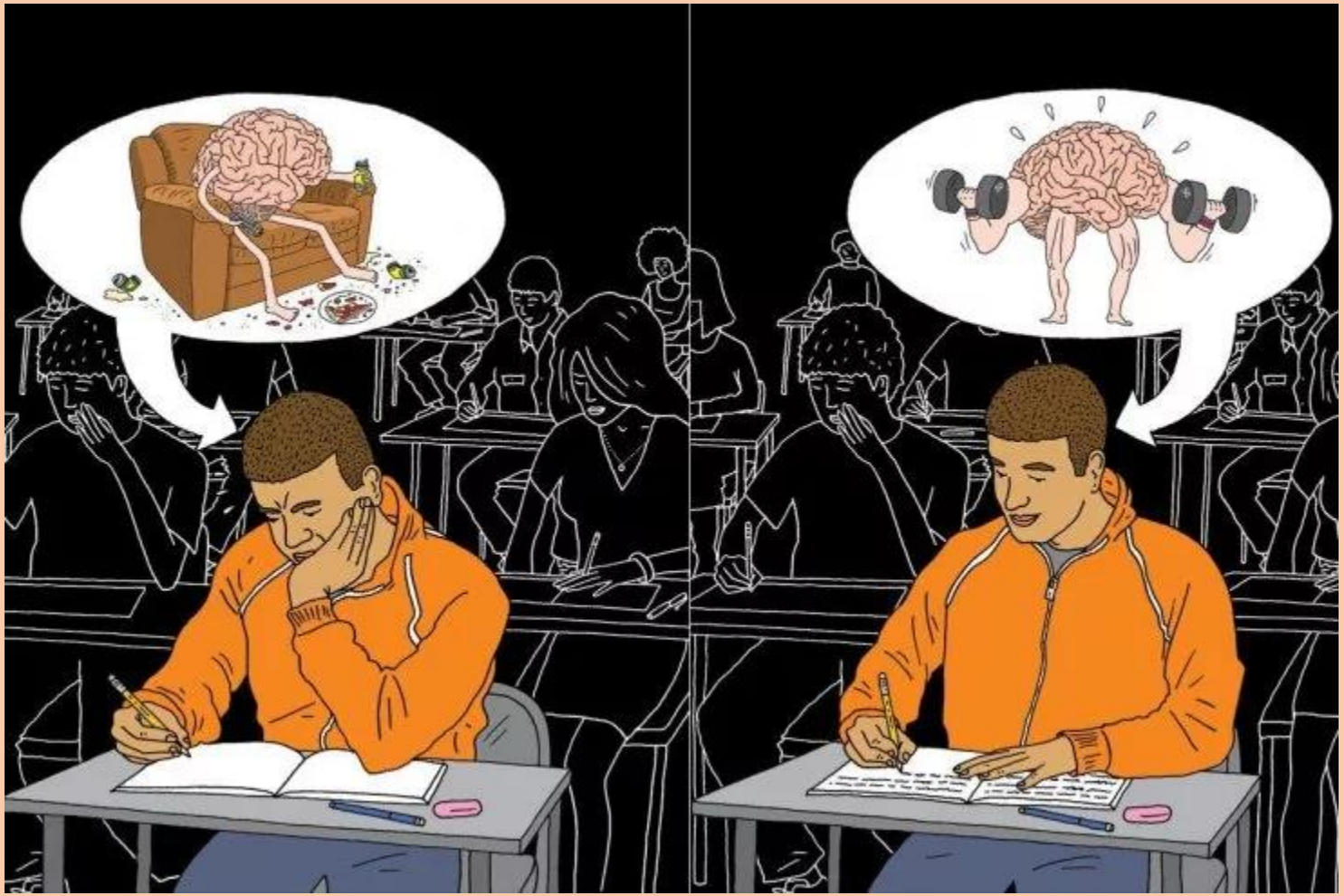
- 2009
  - 51 participants with fibromyalgia
  - Physical performance predicted cognitive function
- 2012
  - Physical & cognitive status of participants (50+ yrs.) with fibromyalgia
  - Physical performance predicted cognitive function
- 2015
  - Well older adults: Balance and aerobic endurance predicted processing speed, inhibition, and working memory

Keep moving!

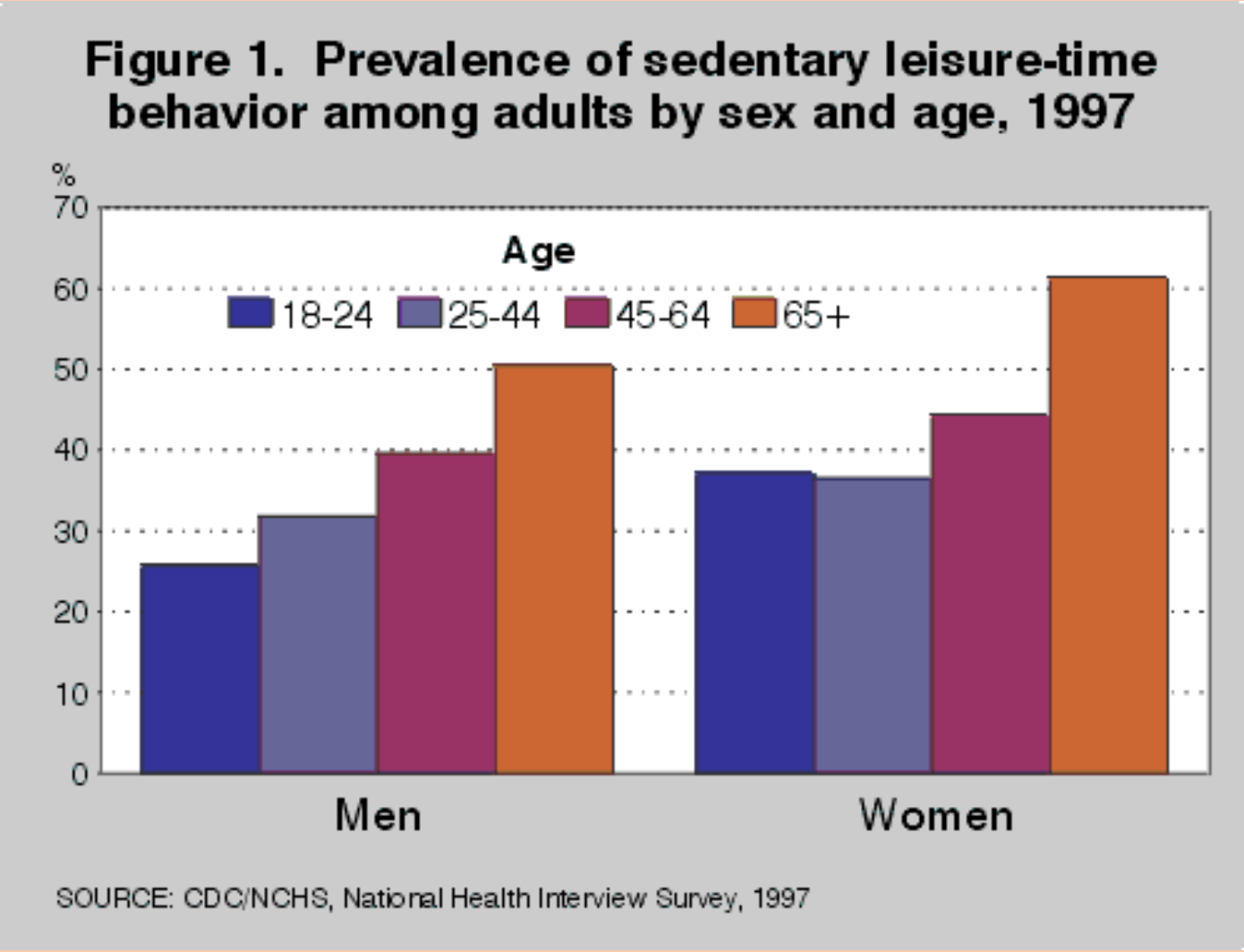


- Take the stairs
- Park farther from the door
- Walk a dog
  - borrow a dog

No Physical Activity
Sedentary Behavior



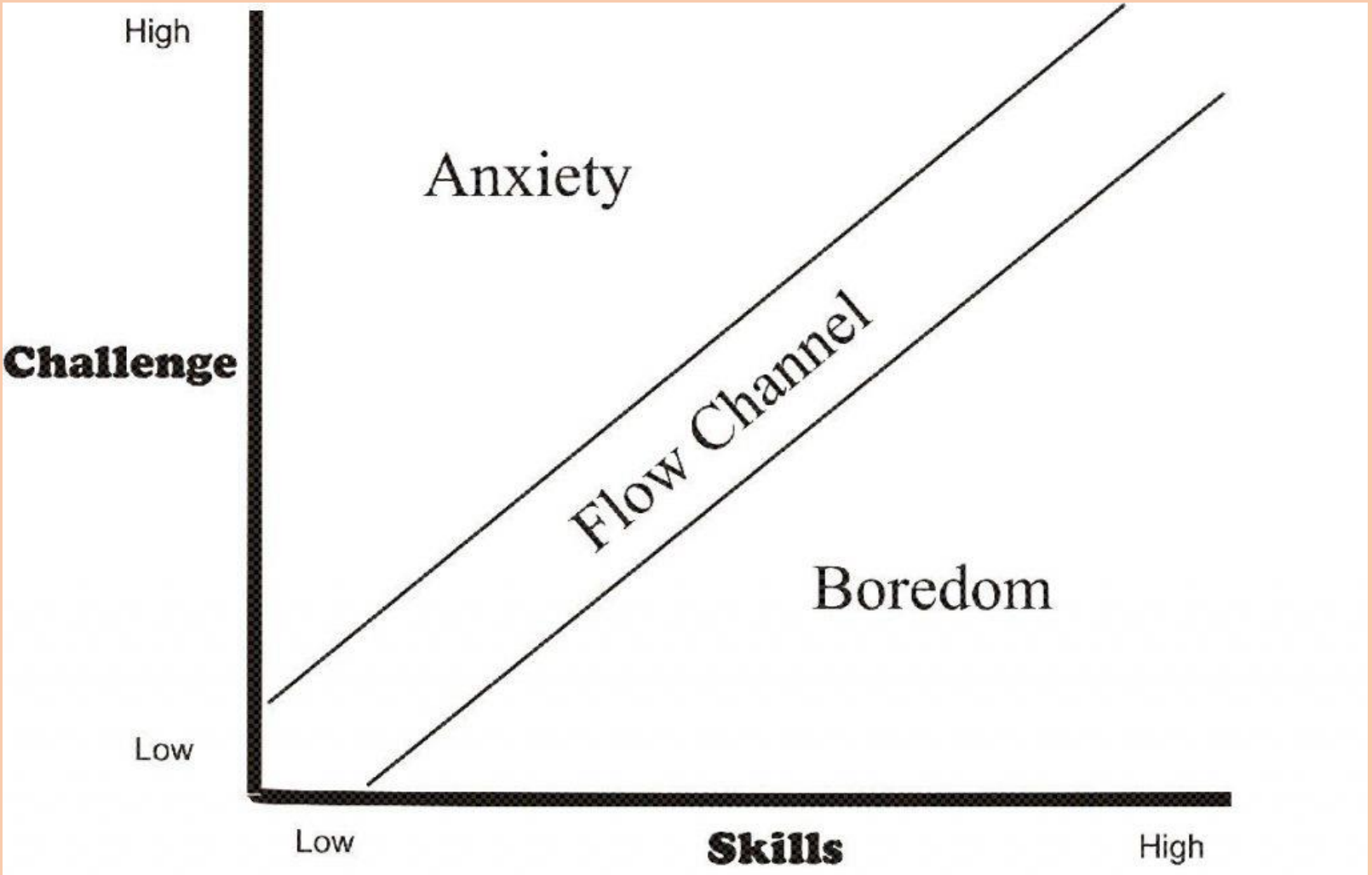
Sedentary Behavior



https://www.cdc.gov/nchs/data/hestat/sedentary/sedentary.htm

Meaningful Activity

- Could be physical activity
- But also social and\or artistic and\or cognitive activity and\or other
- Csikszentmihalyi and flow



The Flow. After Mihaly Csikszentmihalyi, *The Flow (1990)*, p. 74

Meaningful Activity

Robot and Frank

https://www.google.com/search?q=robot+and+frank+trailer&rlz=1C1GCEA_enUS850US850&oq=robot+and+frank&aqs=chrome.3.0i271j46i433i512j0i512l8.6381j0j7&sourceid=chrome&ie=UTF-8

Table 1. Top Meaningful Activities

Activity	Meaningfulness M (SD)
Spending time with loved ones	3.48 (0.78)
Supporting family members' or friends' goals and interests	3.34 (0.71)
Caring for children and other family members	3.12 (0.91)
Helping others	3.08 (0.77)
Education/Learning/School	3.03 (0.89)
Persevered at a valued goal even in the face of obstacles	2.98 (0.92)
Expressed my gratitude either verbally or in writing	2.93 (0.92)
Traveling	2.90 (1.03)
Listened carefully to another's point of view	2.90 (0.86)
Sleeping	2.86 (0.95)

M: mean (average); SD: Standard deviation

note. adapted from Hooker et al., 2020, Table 3.

Arash Emamzadeh

Meaningful Activities (con't.)

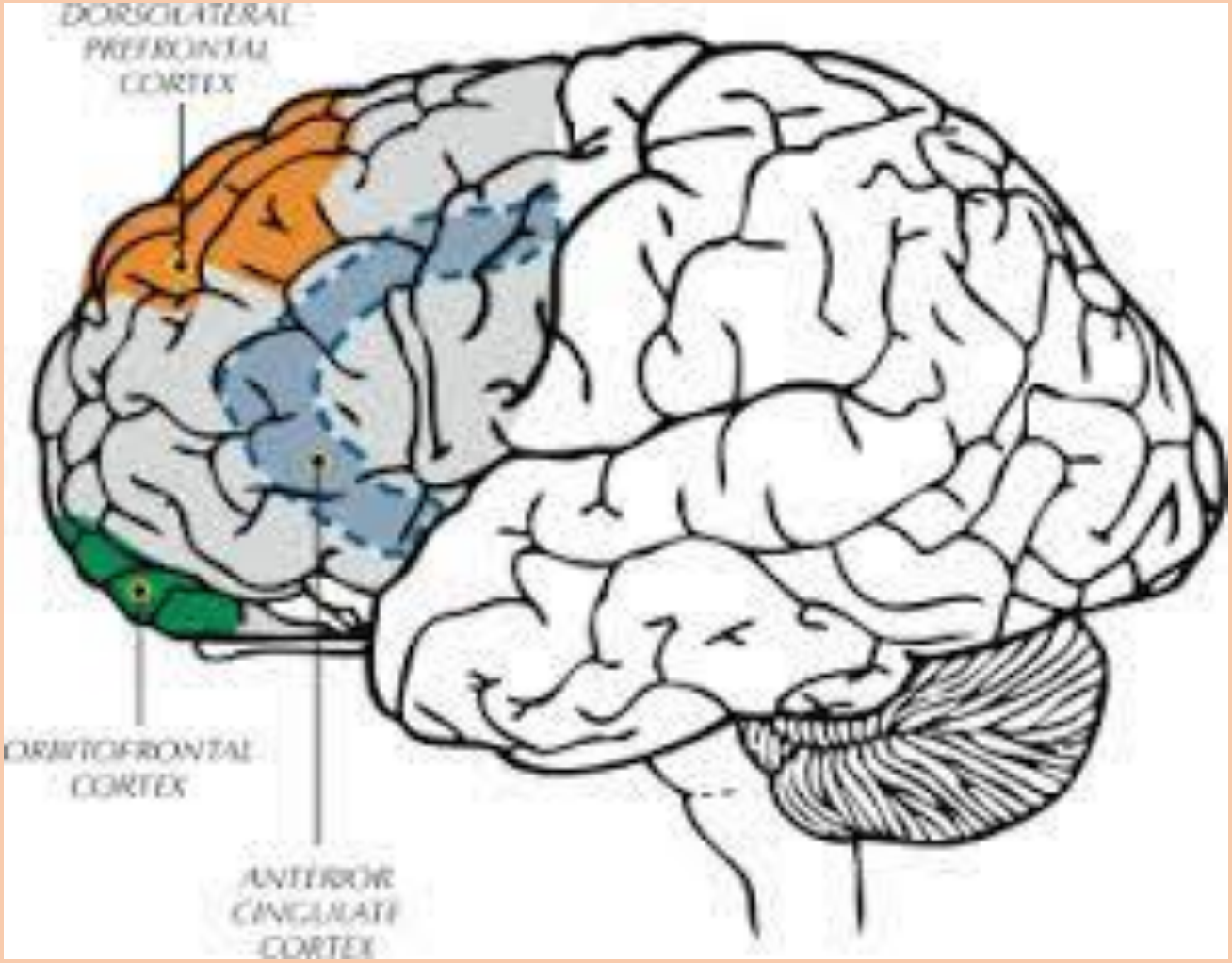
- In an hour or two
- In a day or two
- In a week or two

Cognition

- Executive Function
- Memory
- Building Reserve

Executive Function

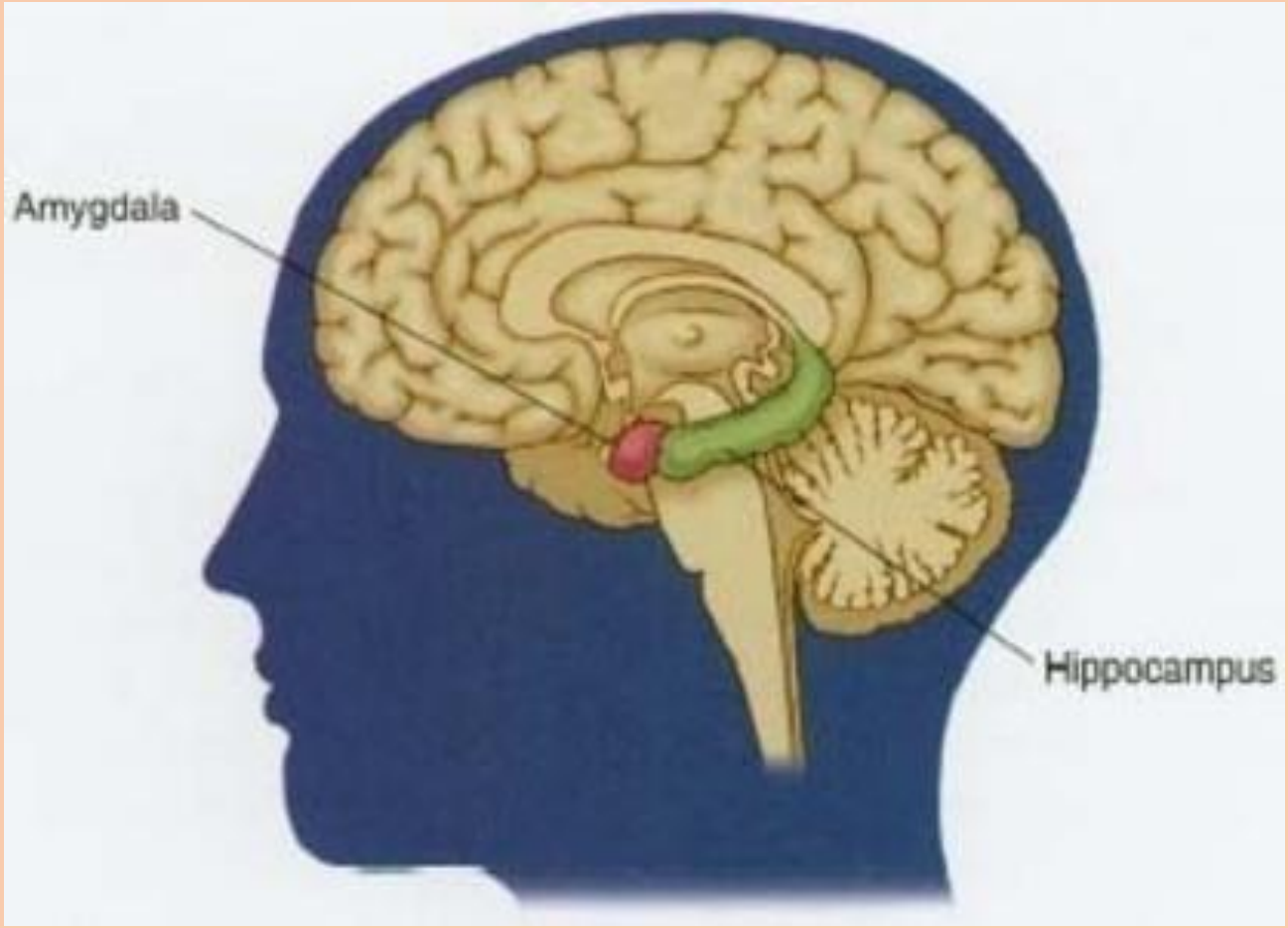
Executive Function (con't.)



Memory

Memory (con’t.)

Hippocampus



Super Agers

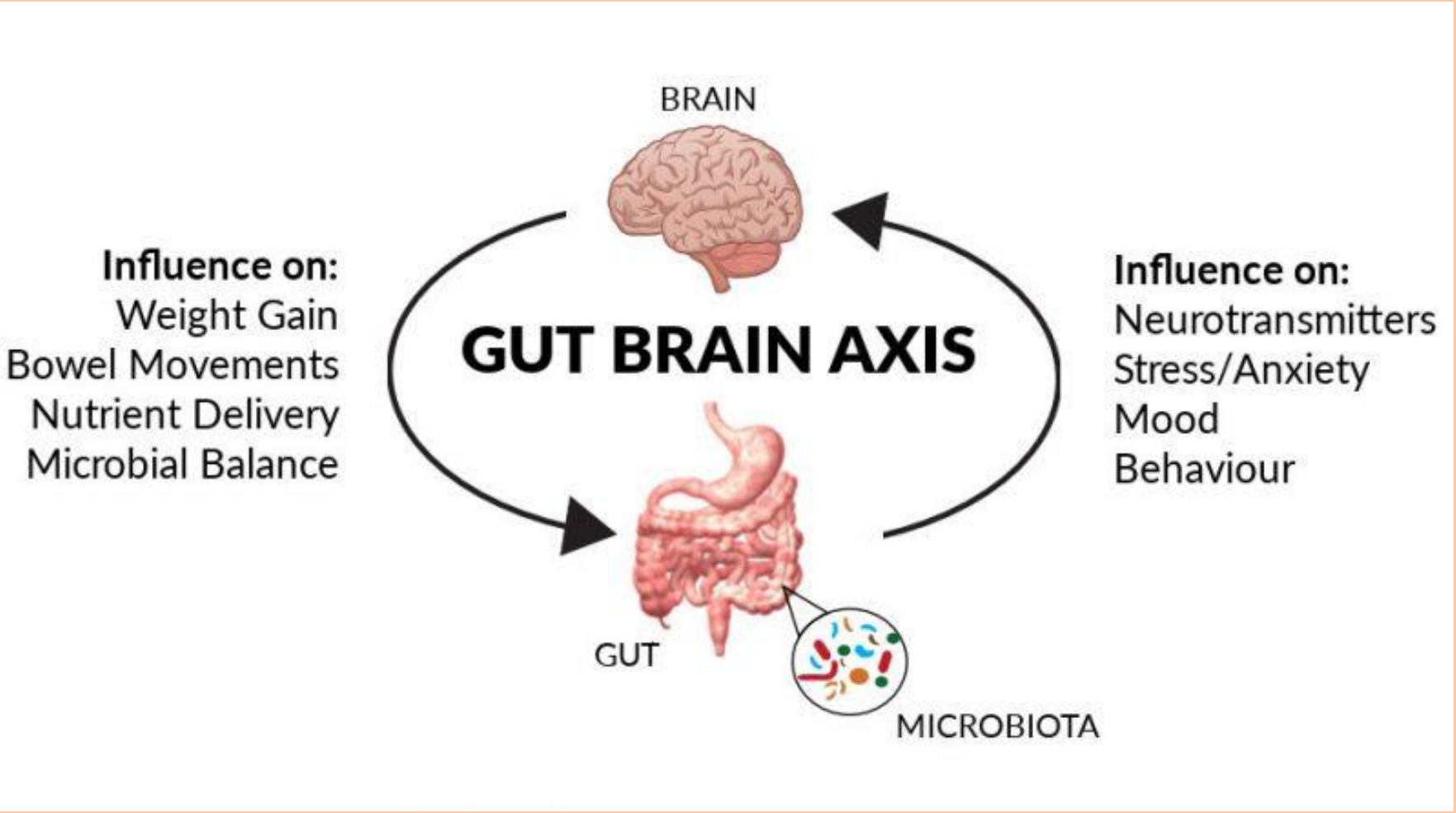
https://www.health.harvard.edu/healthy-aging/what-does-it-take-to-be-a-super-ager

Building Reserve

- Cross Word puzzles, Jumble
- Words with Friends
- Jig-Saw puzzles
- Sudoku
- Reading

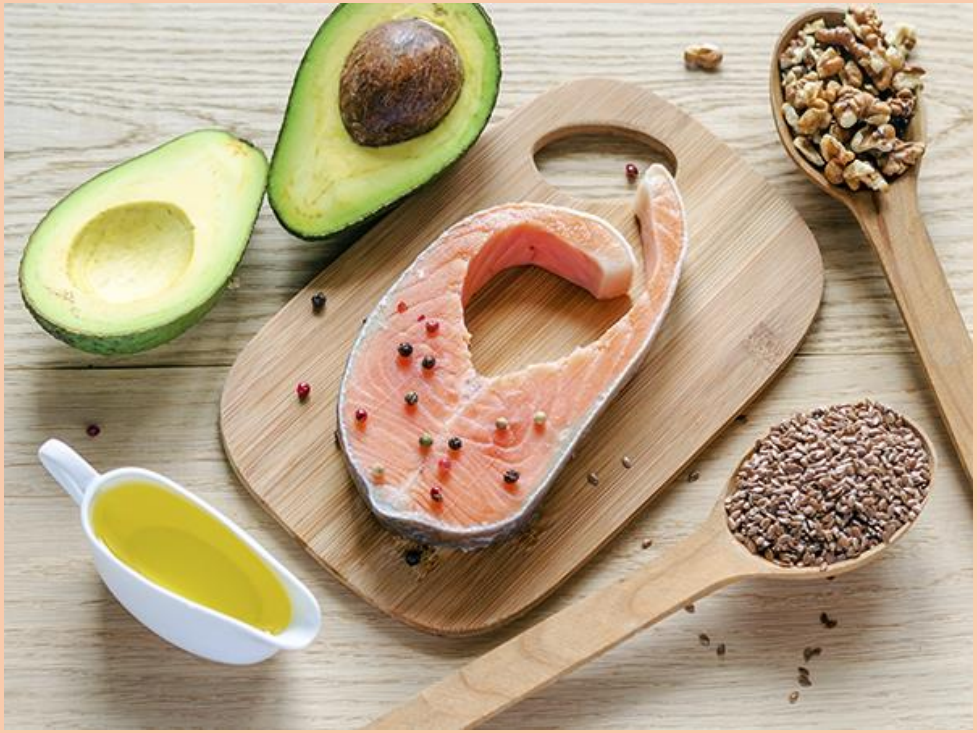
- https://www.thehealthy.com/aging/mind-memory/free-brain-games/

Gut Health


BRAIN
Influence on:
Weight Gain
Bowel Movements
Nutrient Delivery
Microbial Balance
GUT BRAIN AXIS
Influence on:
Neurotransmitters
Stress/Anxiety
Mood
Behaviour
GUT
MICROBIOTA

Gut Health Tips

- Less sugar
- Choose healthy fats



Emotional Health

- Seligman & Csikszentmihalyi, 2000
  - The Science of Happiness
- Master's in Positive Psychology, U. of Penn.
- Seligman et al., 2005
  - Online clinical trial

Background
The Nun Study

Positive affect in writing samples predicted longer life 50 years later

Eichstaedt et al., 2014

Positive tweets (short messages of up to 140 characters) related to reduced risk of heart disease

Happiness Exercises

- Gratitude visit
  - Write and deliver a letter of gratitude
- Three good things in life
  - Write down 3 things each day that went well and why
- You at your best
  - Write about when you were at your best and reflect on personal strengths in the story. Review story each day.

Happiness Exercises (con't.)

- Identifying signature strengths (top five)
  - www.authentichappiness.org
  - www.viacharacter.org
  - Use one of these each day in a new and different way.
- Using signature strengths
  - Use five highest strengths more often during the next week.

Conclusions

- Gratitude -- highest increase in happiness
- "Lasting" happiness
  - Three good things
  - Using signature strengths
- Those who persisted with exercises showed highest gain

Quinn et al., 2021

- Happiness minus sadness

- PANAS
  - 10 questions on happiness
  - 10 questions on sadness
- Physical Activity
  - Performance
  - Self-report
- Cognition
  - Performance
  - Self-report

Physical Activity

- Fullerton Advanced Balance Scale
  - Balance
- 30 s Chair Stand
  - Lower body strength
- 30 ft Walk
  - Gait velocity

- Composite Physical Function
  - Perceived Activities of Daily Living

Cognition

- 10-item word list
  - Immediate recall
  - Delayed recall
  - Recognition

- How forgetful have you been in the last week?

Forgetfulness

0 1 2 3 4 5 6 7 8 9 10

Not forgetful Extremely forgetful

Results--Physical

- More happiness predicted
  - Better balance, $\Delta R^2 = .22$
  - Better lower body strength, $\Delta R^2 = .10$
  - Better self-reported ADL's $\Delta R^2 = .39$

More happiness predicted better physical performance and function

Results--Cognitive

- More happiness predicted
  - Immediate Recall, $\Delta R^2 = .13$
  - Recognition, $\Delta R^2 = .12$
  - Self-reported Forgetfulness, $\Delta R^2 = .36$

More happiness predicted better cognitive performance

Conclusions

- More happiness improved both physical and cognitive performance and function.

- Activities which promote happiness can help adults (both with and without chronic conditions) to maintain healthier lifestyles

It’s all about your environment!!

- Activity Levels
- Health Behaviors
- Social Support
- Culture
- Diet
- Lifestyle Patterns
- Education

Environment (con’t.)

Happy Brains

https://www.youtube.com/watch?v=C7dPqrmDWxs