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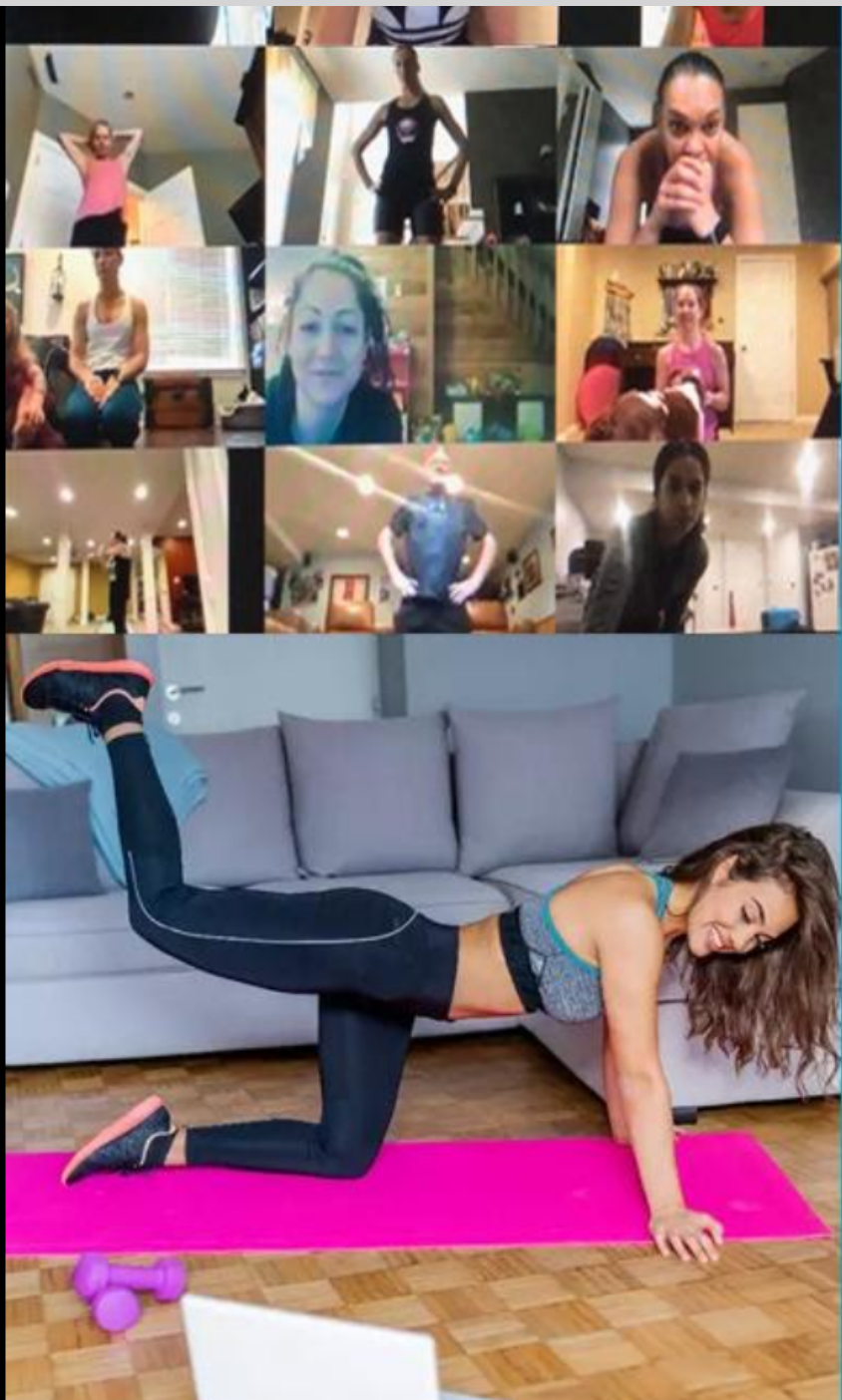
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*jeff howard*  
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# **YOUR BRAIN ON EXERCISE**





## **RYAN GLATT**

---

- **BS EXERCISE SCIENCE**
- **MS APPLIED NEUROSCIENCE (IP)**
- **BRAIN HEALTH COACH - AMEN CLINICS**
- **NSCA - CPT**
- **FUNCTIONAL AGING SPECIALIST**





# CAN THE FITNESS INDUSTRY (US) ACTUALLY MAKE AN IMPACT?

---



**5.8 MILLION**

People living with  
dementia in the US (2018)

**400,000**

Number of Trainers in US,  
Estimated (2018)

**12 - 1**

Average # of Clients to Trainer Ratio

# OTHER CONDITIONS THAT AFFECT COGNITION AND BRAIN HEALTH

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**MEDICATIONS**



**OBESITY & METABOLIC  
DISORDERS**



**CARDIOVASCULAR  
CONDITIONS**

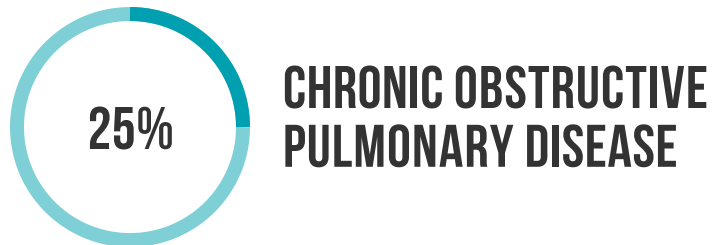


**CANCER & CHEMOTHERAPY**



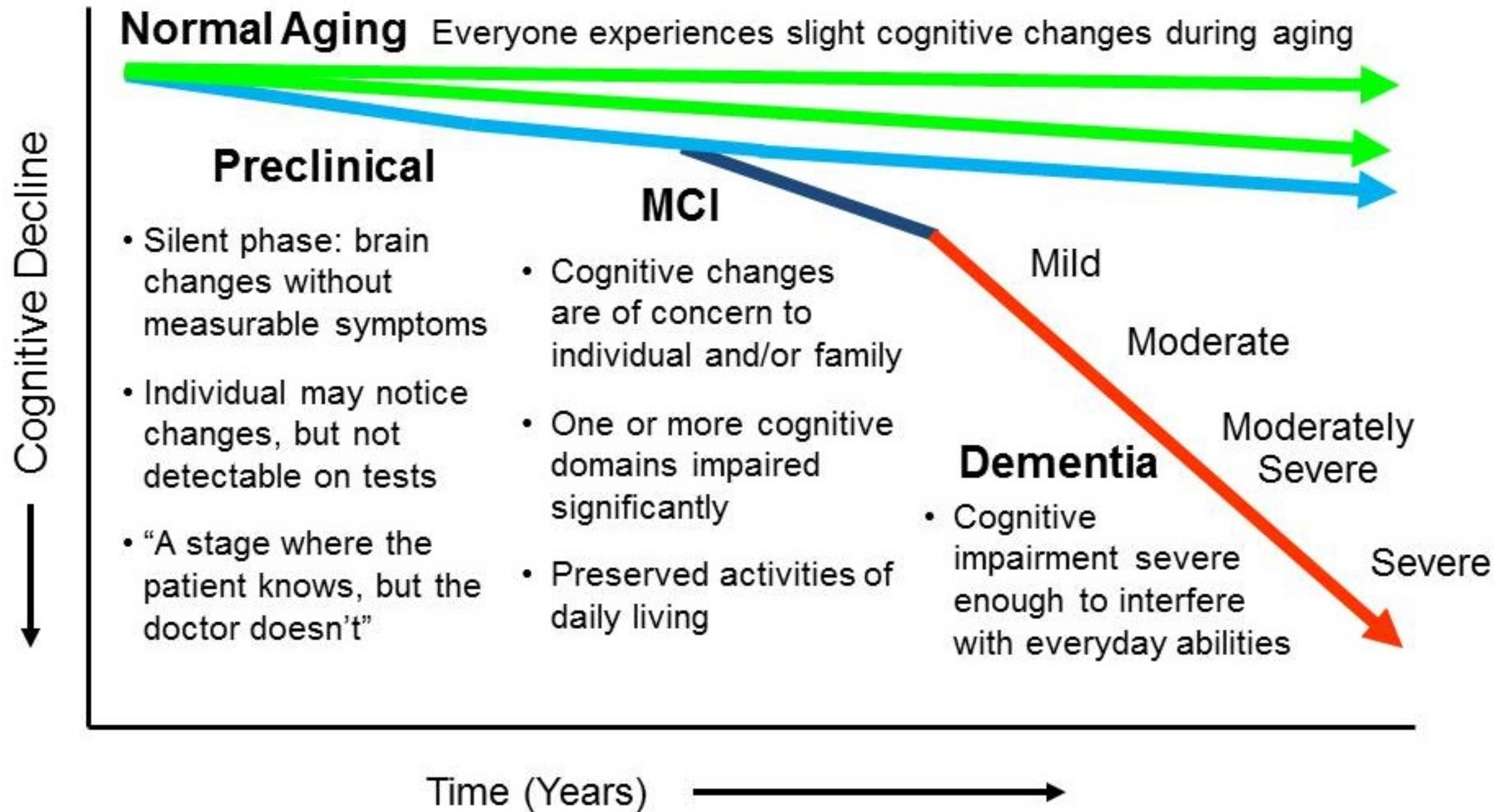
# COGNITION AND CHRONIC DISEASE - RATES OF COGNITIVE IMPAIRMENTS

Morley, J. E. (2017). *Cognition and chronic disease. Journal of the American Medical Directors Association, 18(5), 369-371.*



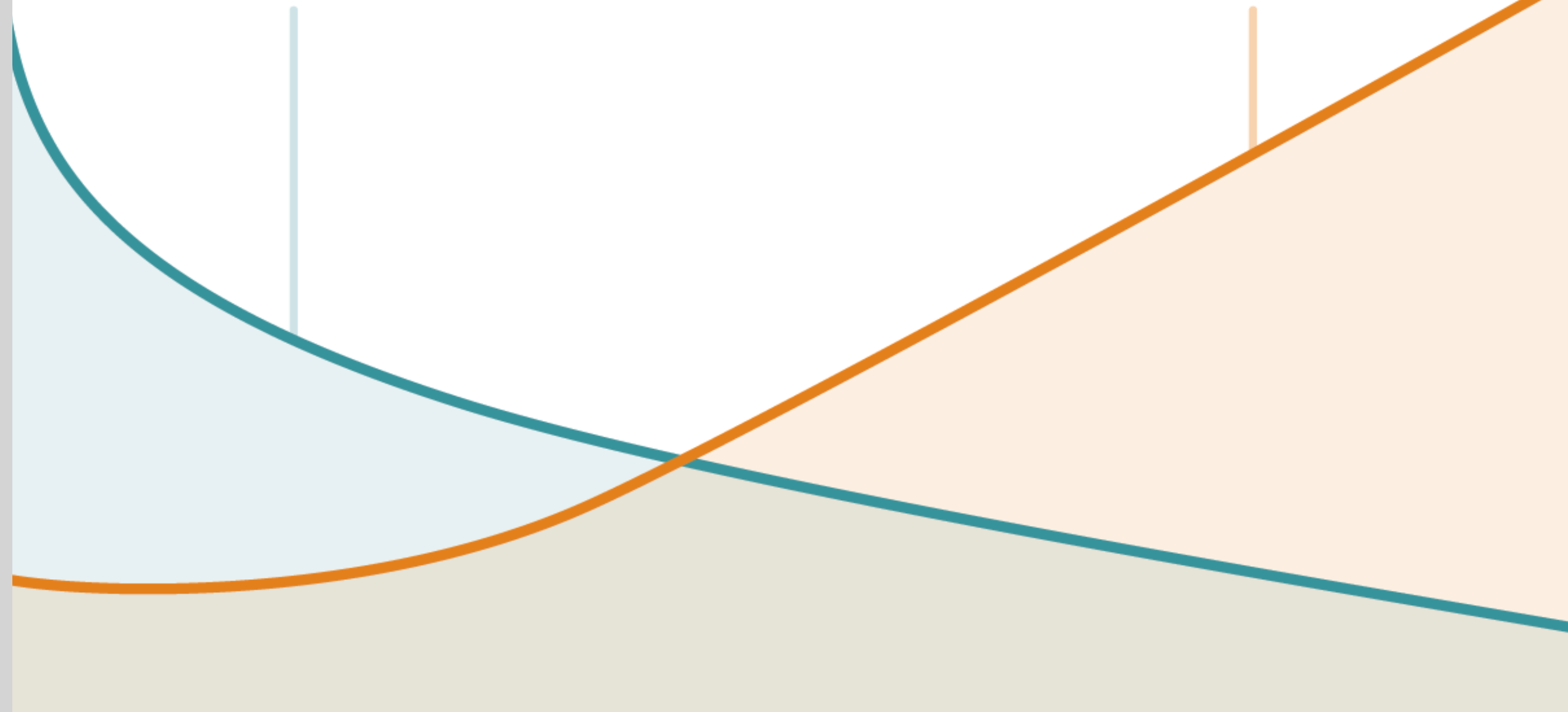
# BRAIN “BASICS”



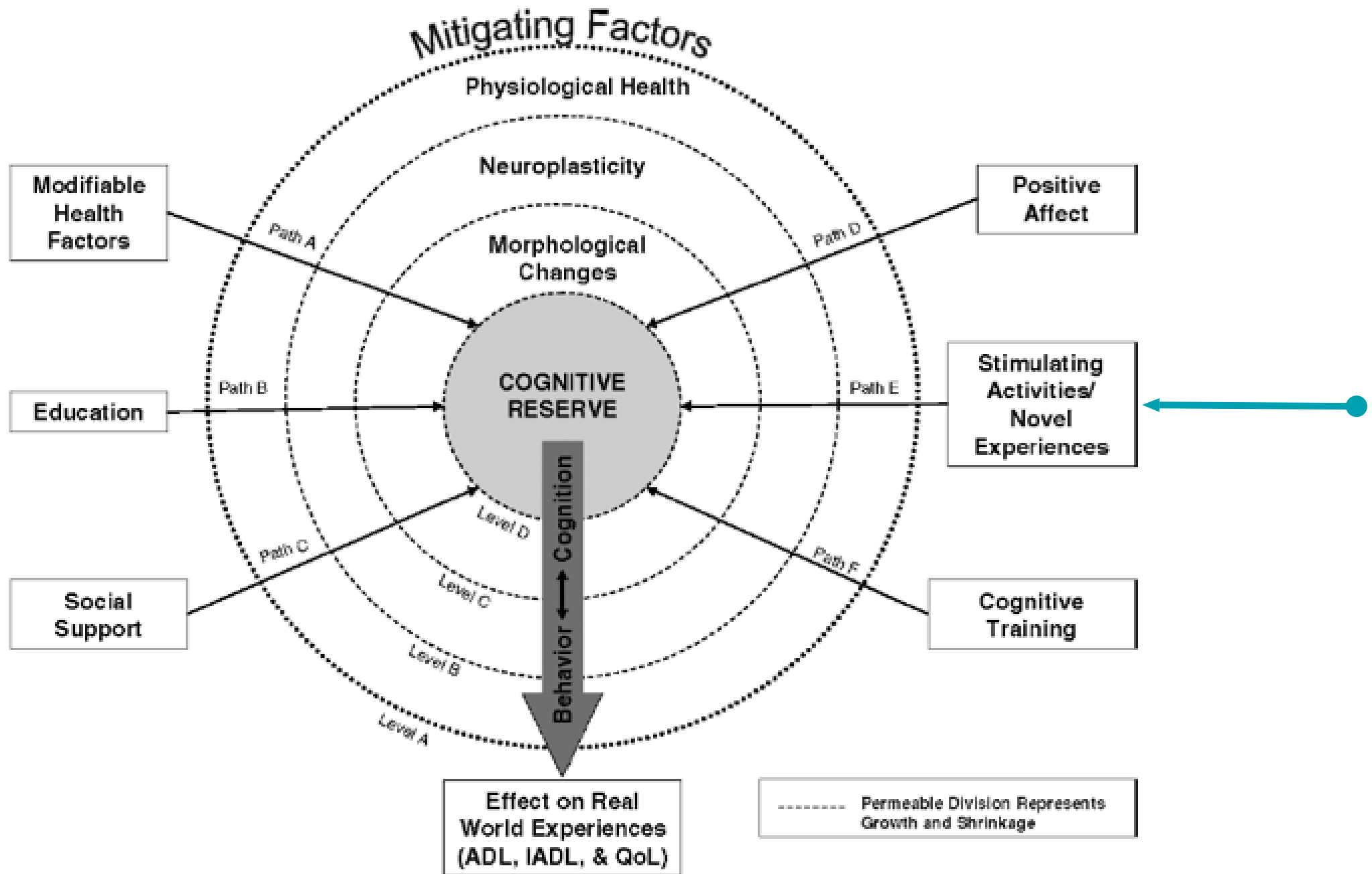


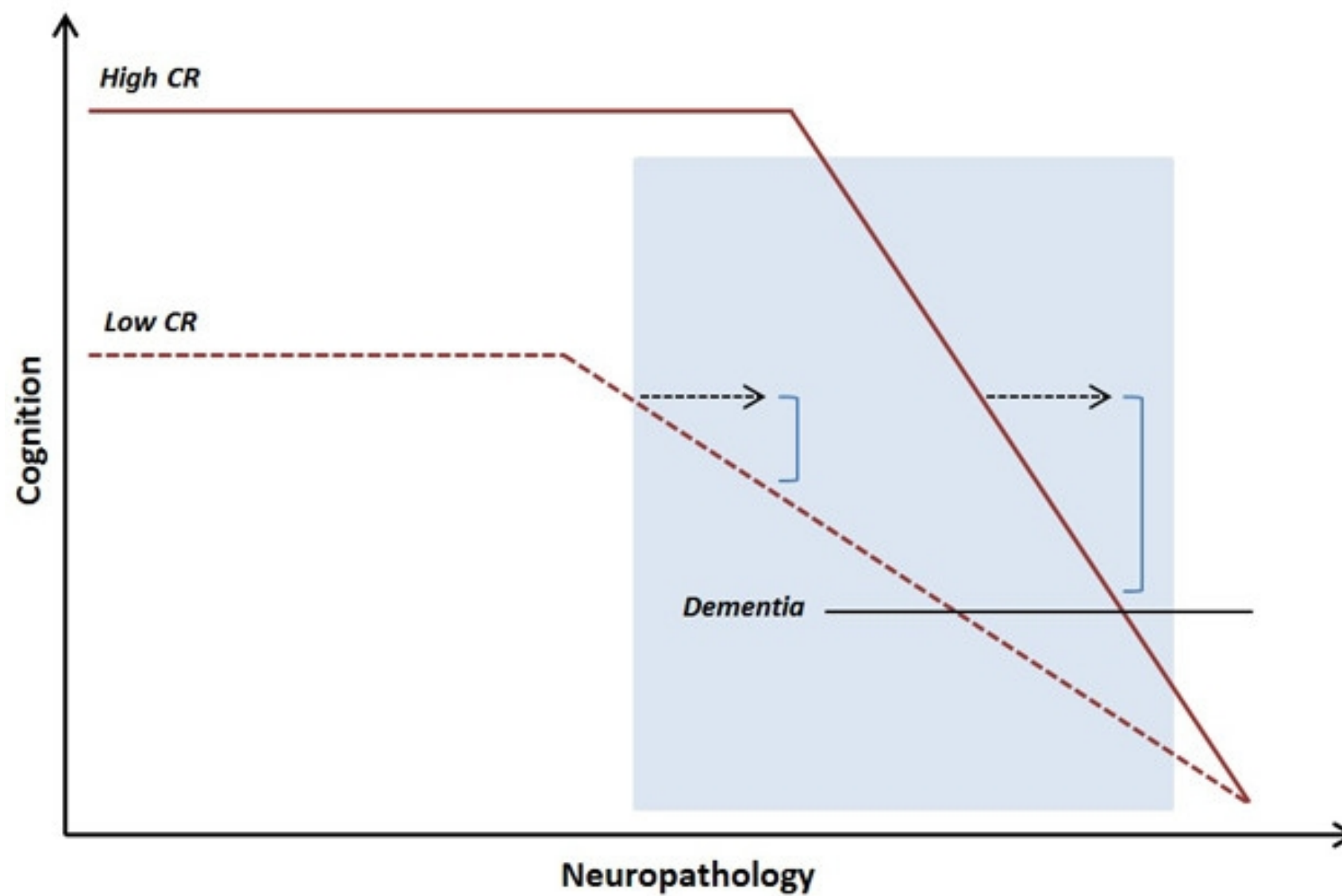
The brain's **ability to change**  
in response to experiences

The **amount of effort**  
such change requires

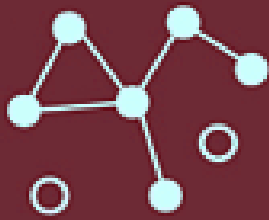








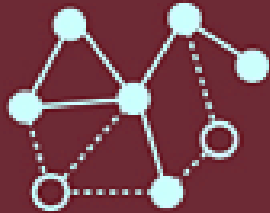




## NEUROGENESIS

Continuous generation of new neurons in certain brain regions

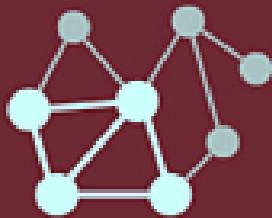
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## NEW SYNAPSES

New skills and experiences create new neural connections

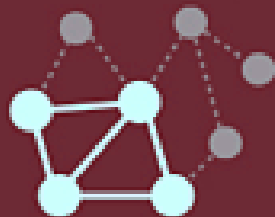
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## STRENGTHENED SYNAPSES

Repetition and practice strengthens neural connections

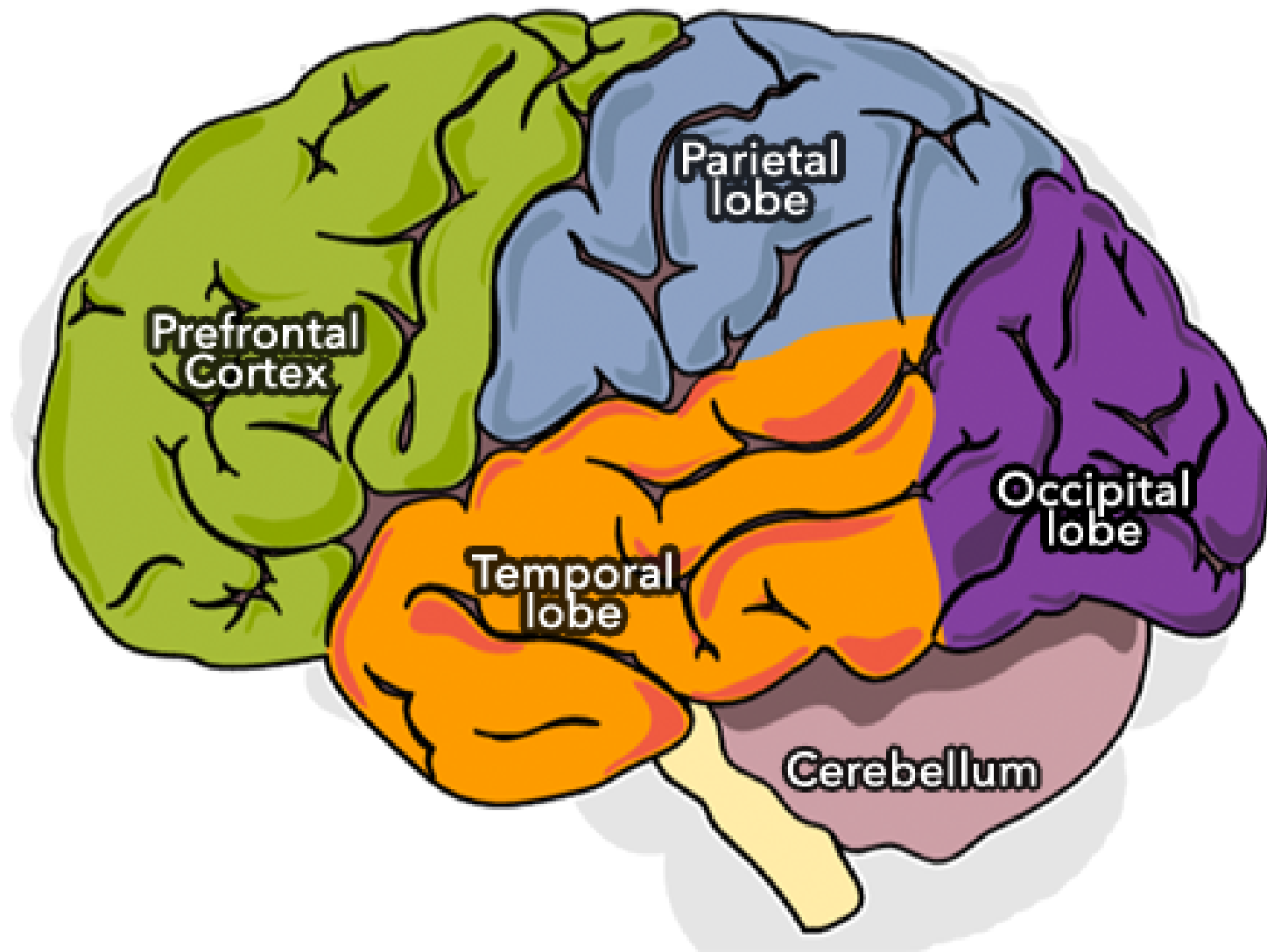
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## WEAKENED SYNAPSES

Connections in the brain that aren't used become weak

Video

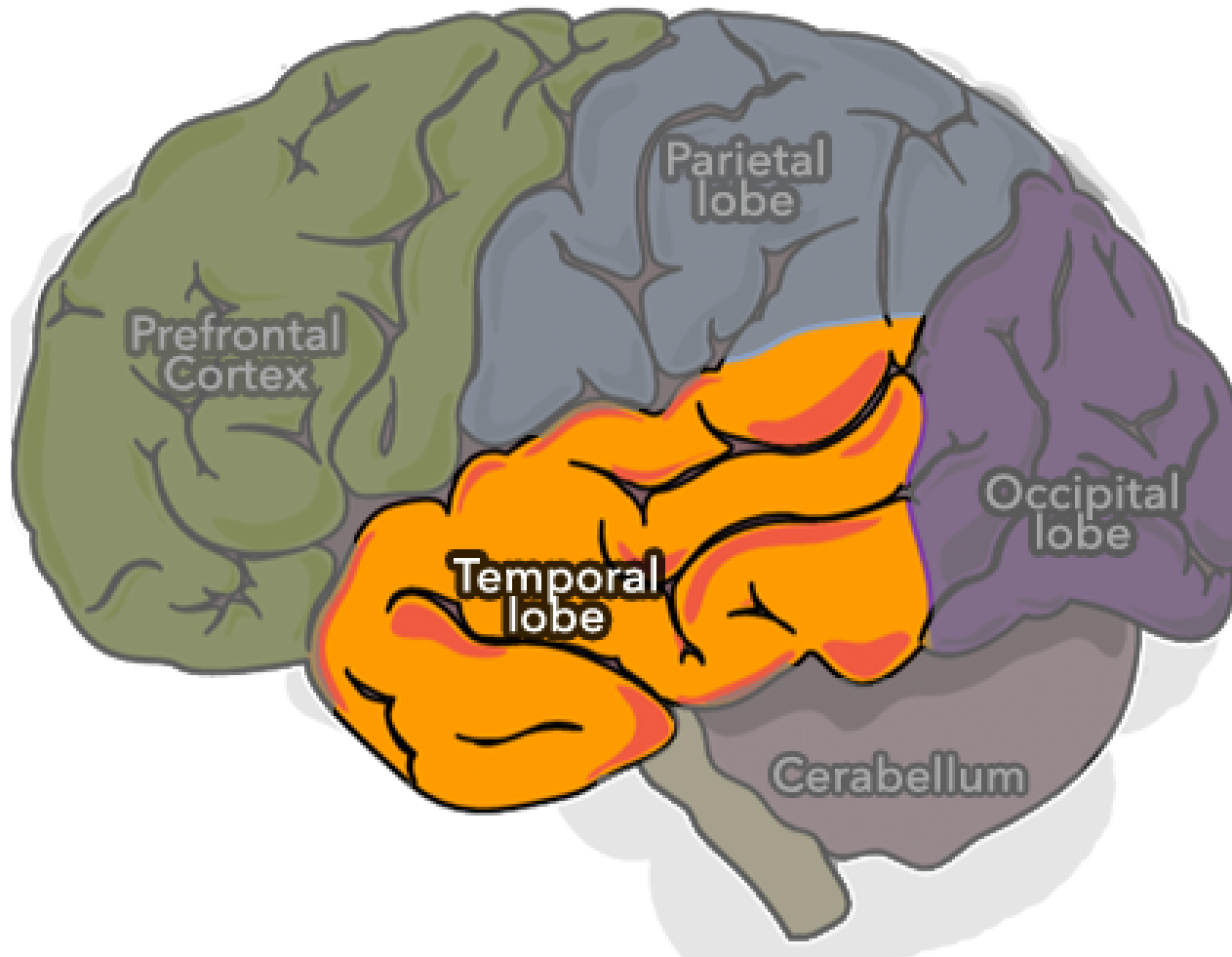




Video

# TEMPORAL LOBES

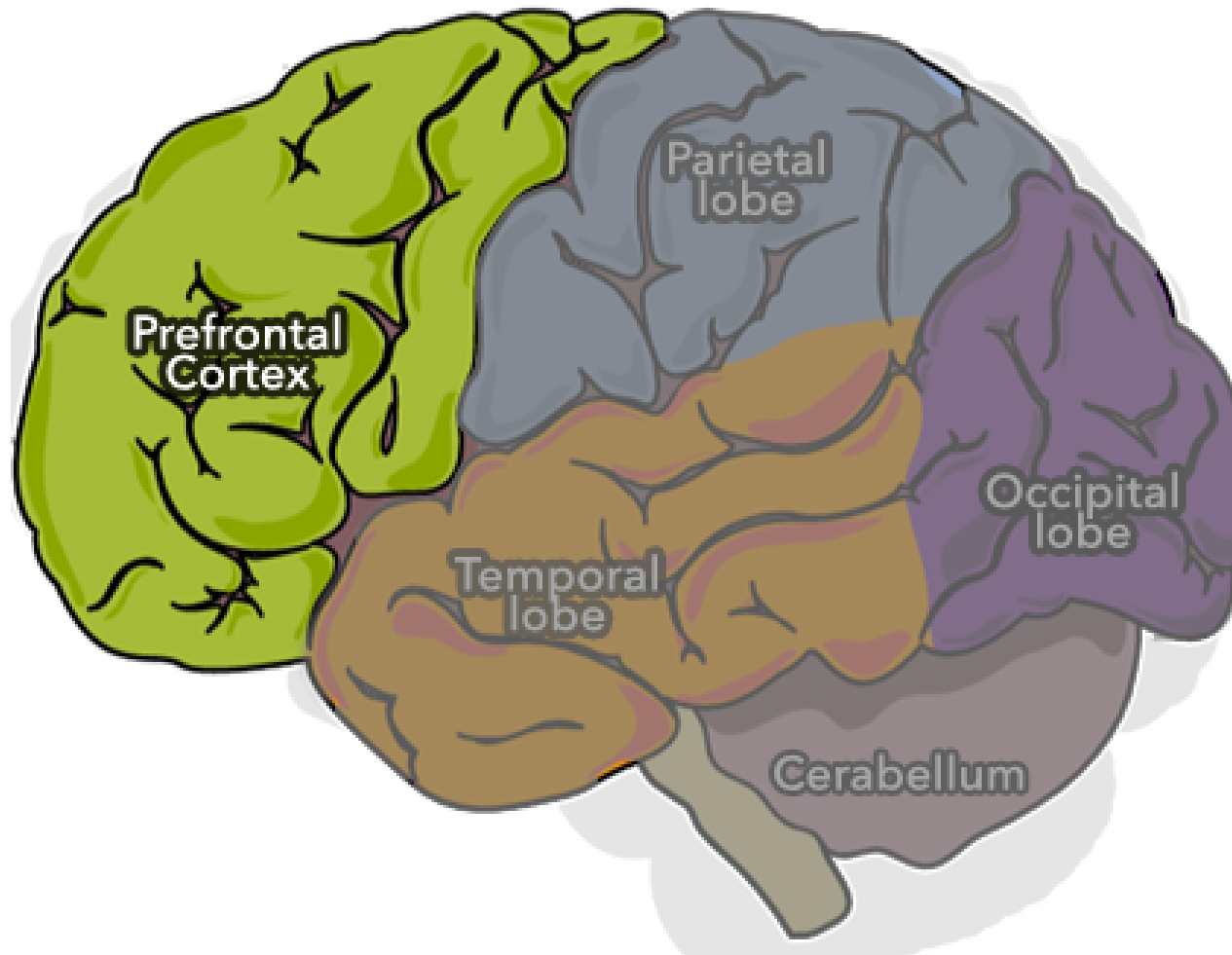
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- **PROCESSES SENSORY INPUT**
- **VISUAL MEMORY, LANGUAGE COMPREHENSION, EMOTIONAL ASSOCIATION**
- **MEDIALY - HIPPOCAMPUS, CRITICAL FOR MEMORY FORMATION AND STORAGE**
- **PLAYS ROLES IN AUDITORY & VISUAL**

# PREFRONTAL CORTEX / FRONTAL LOBES

---

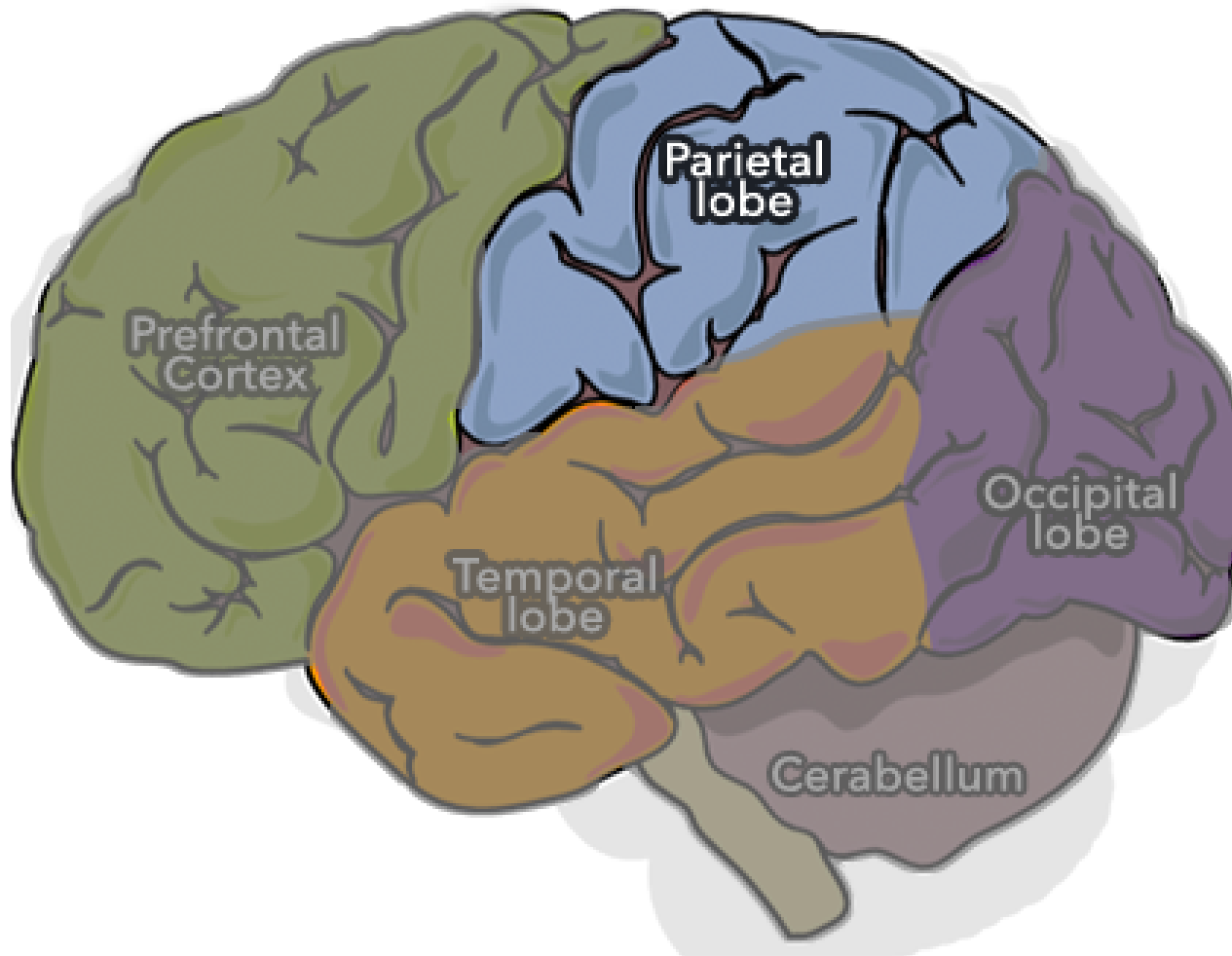


- **PLANNING COMPLEX COGNITION AND MOVEMENT**
- **ORCHESTRATES FOR GOALS**
- **DECISION-MAKING, SOCIAL BEHAVIOR, LANGUAGE**
- **HOUSES EXECUTIVE FUNCTIONS (CEO OF THE BRAIN)**



# PARIETAL LOBES

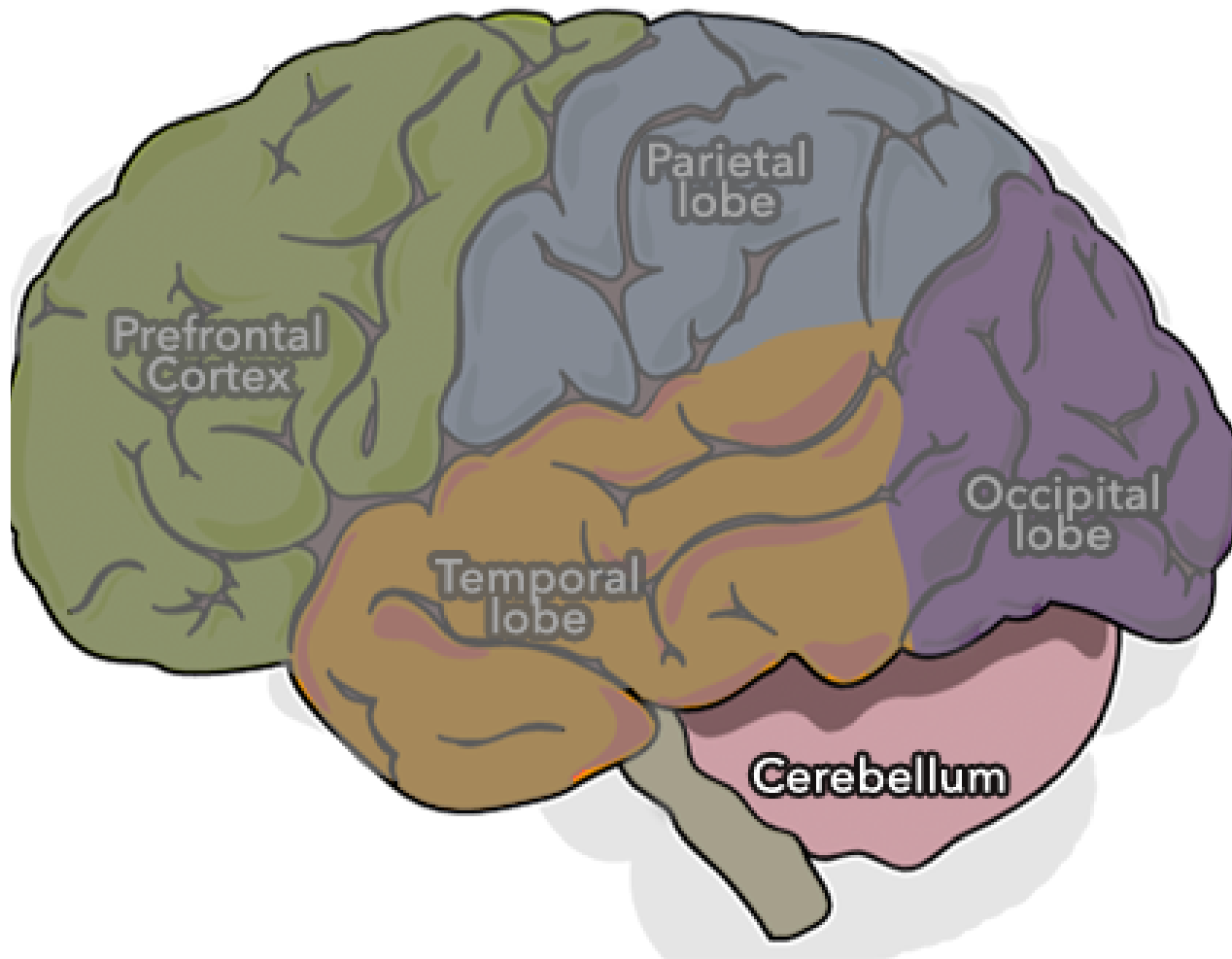
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- **INTEGRATES SENSORY INFORMATION (SMELL, TOUCH, PAIN, ETC)**
- **VISUOSPATIAL & NAVIGATION, PROPRIOCEPTION**
- **IMPORTANT FOR LANGUAGE PROCESSING**

# THE CEREBELLUM

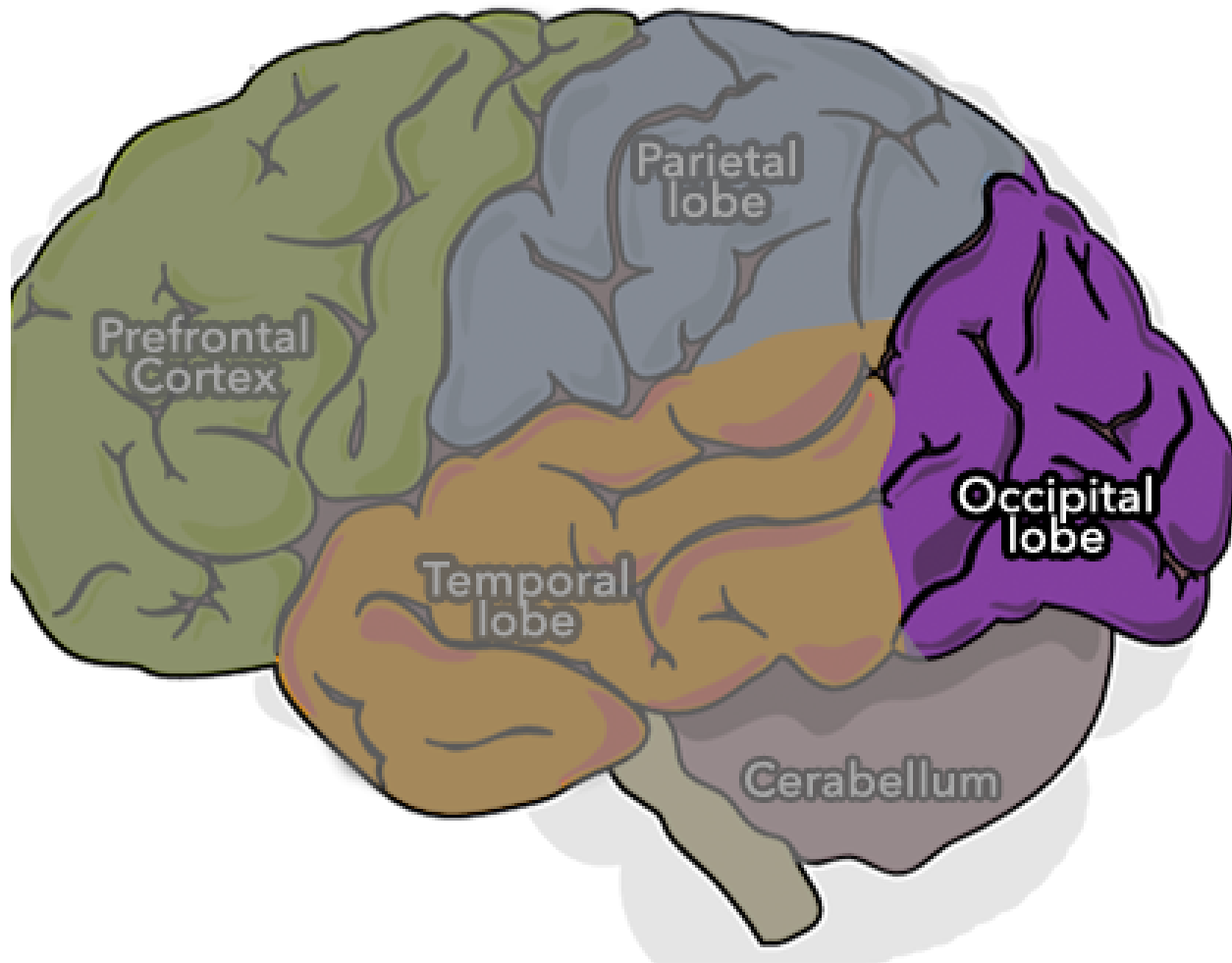
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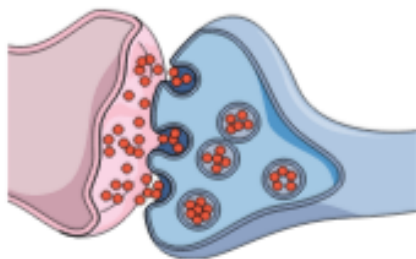
- RECEIVES INFORMATION FROM SENSORY SYSTEMS
- REGULATES MOTOR MOVEMENTS
- COORDINATES POSTURE, BALANCE, COORDINATION, SPEECH
- COORDINATES EYE MOVEMENT
- NECESSARY FOR MOTOR LEARNING

# THE OCCIPITAL LOBE

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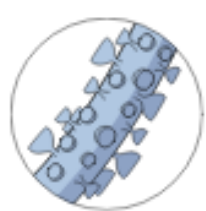
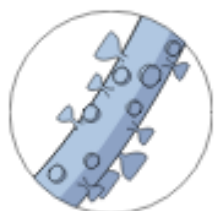
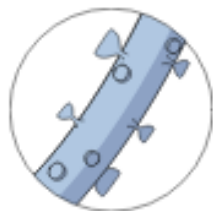
- **PRIMARILY RESPONSIBLE FOR VISION**
- **THE CENTER OF HOW WE PERCEIVE VISUAL INPUT**
- **IN PERCEIVING OBJECTS, SENDS INFO TO TEMPORAL**
- **IN PERCEIVING LOCATION, SEND TO PARIETAL LOBE**



Synaptic  
Modification



Milliseconds



Branching of  
Synapses & Dendrites



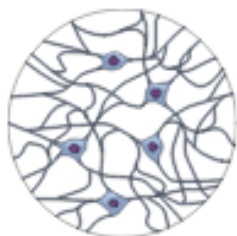
Several Hours



New Brain Cells



Several Days



Neuronal Network  
Changes

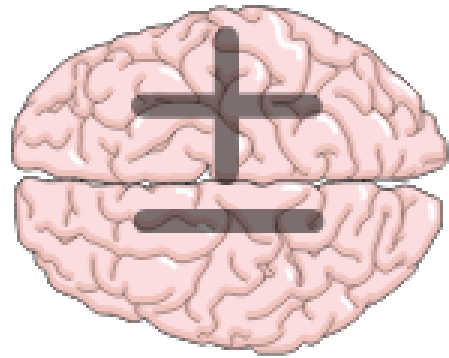


Several Weeks and Months



Video

Video



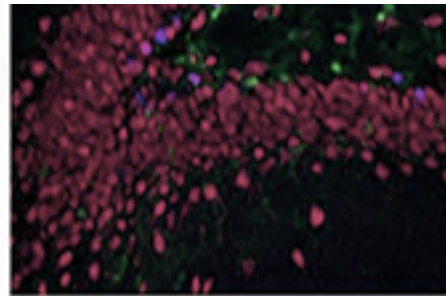
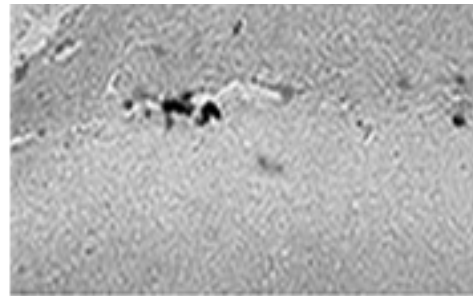
Higher Level  
Brain Changes



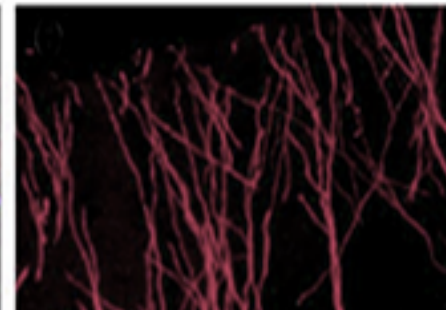
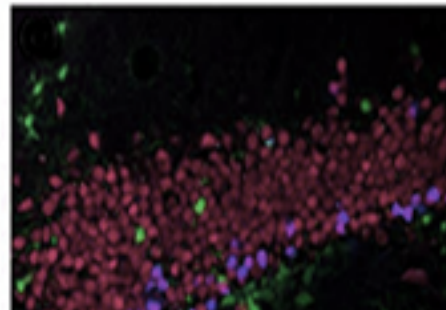
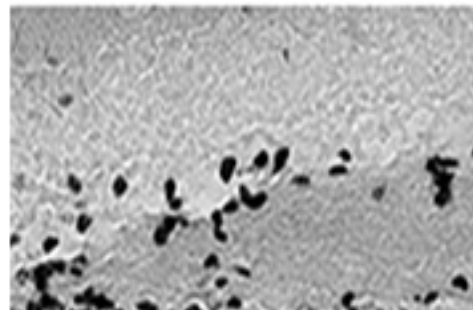
Several Months and Years



CONTR



INERS



## CHAPTER 3

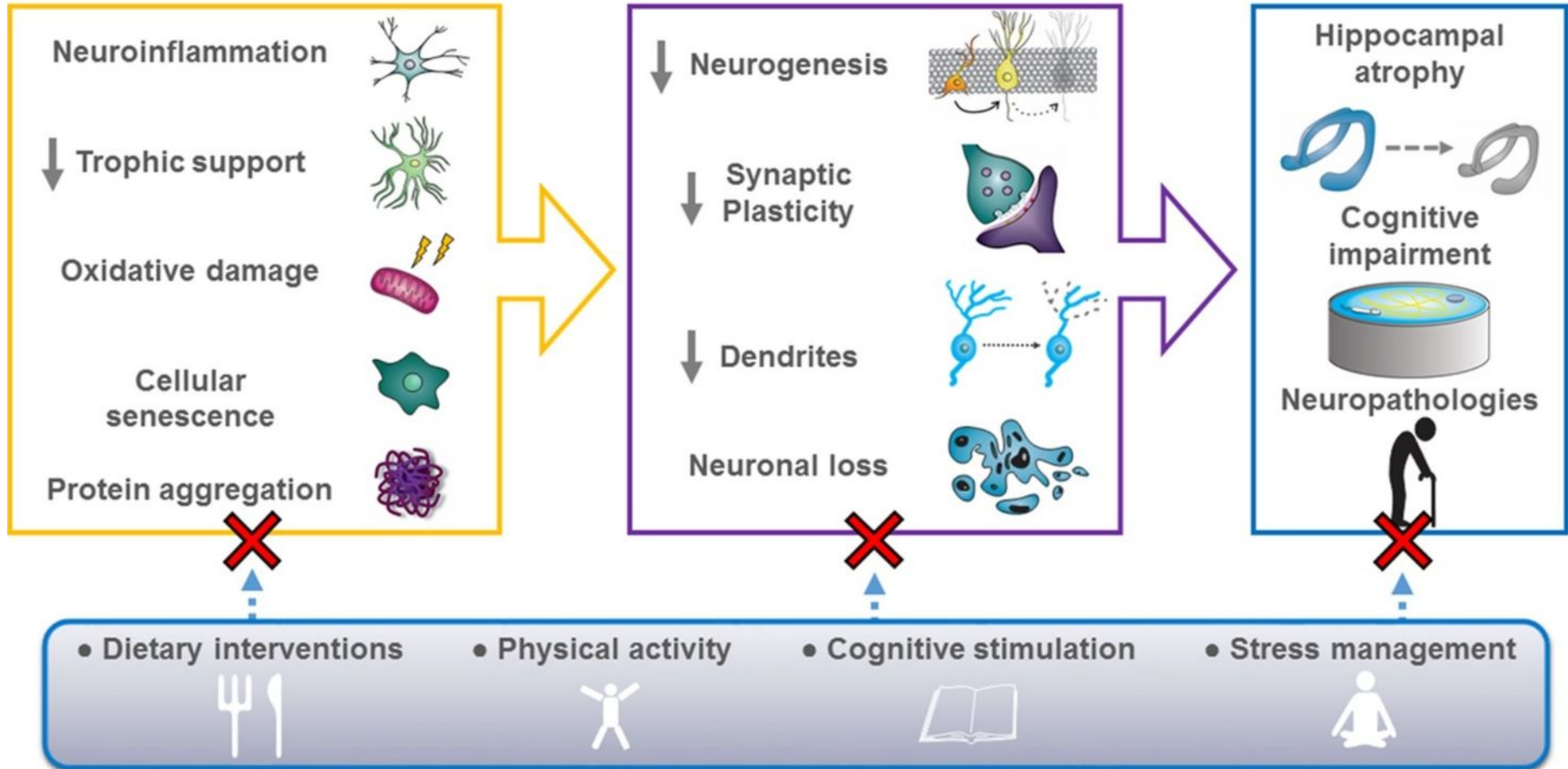
# THEORIES OF AGING

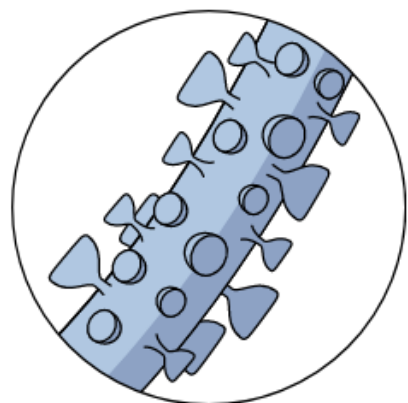


# BRIEF OVERVIEW OF VARIOUS THEORIES OF AGING

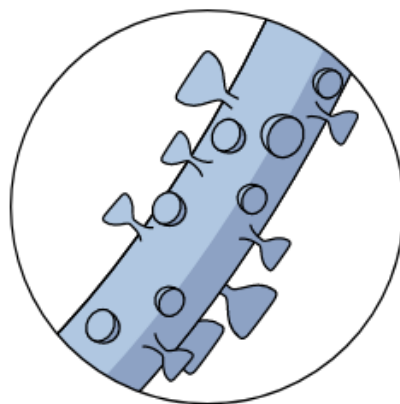
Theory	Structure	Function	Biology	Communication
White Matter	X	X		
Frontal Lobe	X	X		
Neural Activity		X		X
Scaffolding	X		X	
Senescence			X	X
Neuro-Endocrine		X	X	
Common Cause	X	X	X	X
Sensory Deprivation		X		X

# Aging hippocampus

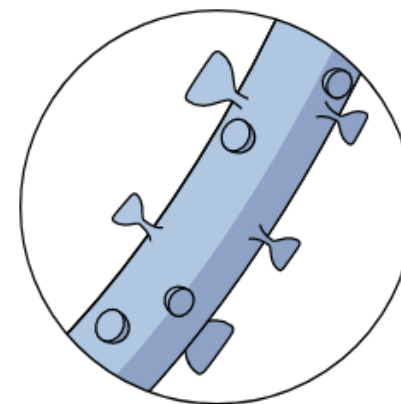




Synaptic Spine (young)



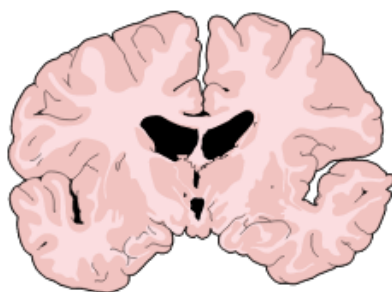
Synaptic Spine (middle aged)



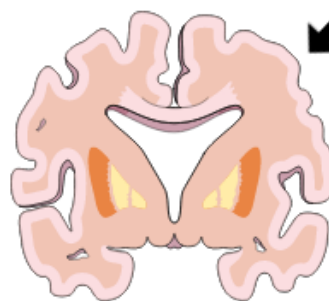
Synaptic Spine (old)



Young, Healthy Brain



Mild AD



Severe AD

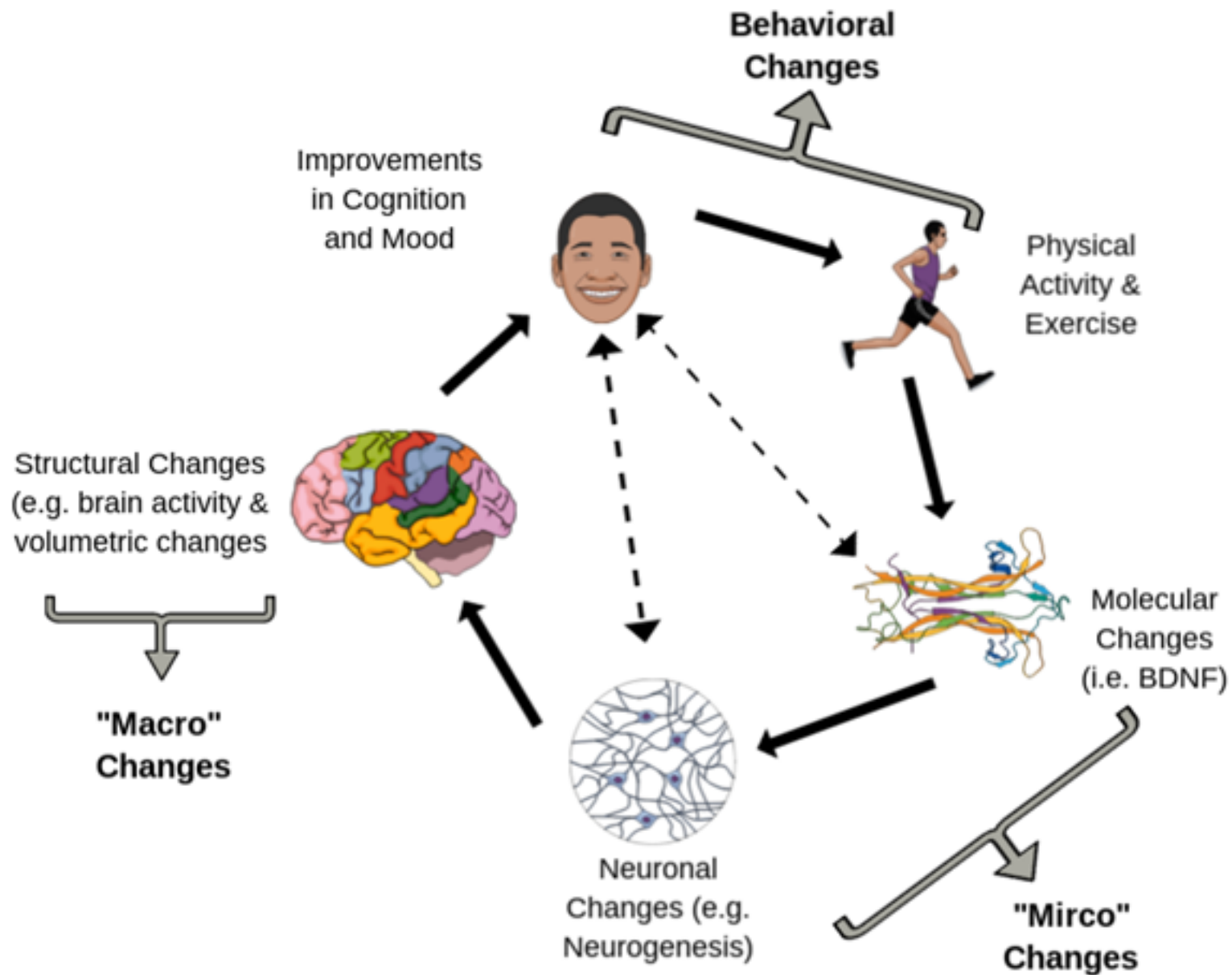


Video



# EXERCISE & THE BRAIN

# HOW EXERCISE CAN AFFECT THE BRAIN



- **BEHAVIORAL**

Mood  
Cognition

- **"MICRO"**

Neurons  
Vessels  
Growth Factors

- **"MACRO"**

Function  
Structure

Video

# HIPPOCAMPUS

---

- **DECLINE ATTRIBUTED TO AGE-RELATED MEMORY ISSUES**
- **INCREASES IN SIZE WITH AEROBIC EXERCISE & GENERAL “PA”**

Perhaps due to “less thought” w/aerobic???

Relationship with lower extremities?
- **INVOLVED IN LOCOMOTION & RHYTHMIC STEPPING**

Larger volumes = larger stride time....

# EFFECTS OF RESISTANCE TRAINING ON THE BRAIN

---

- **STRUCTURAL & FUNCTIONAL IMPROVEMENTS IN THE FRONTAL LOBE**
- **LOWER WHITE MATTER ATROPHY & LESIONS**
- **INCLUDES IMPROVEMENTS IN EXECUTIVE FUNCTIONS**

the “CEO” of the brain (coordinates other skills and functions)

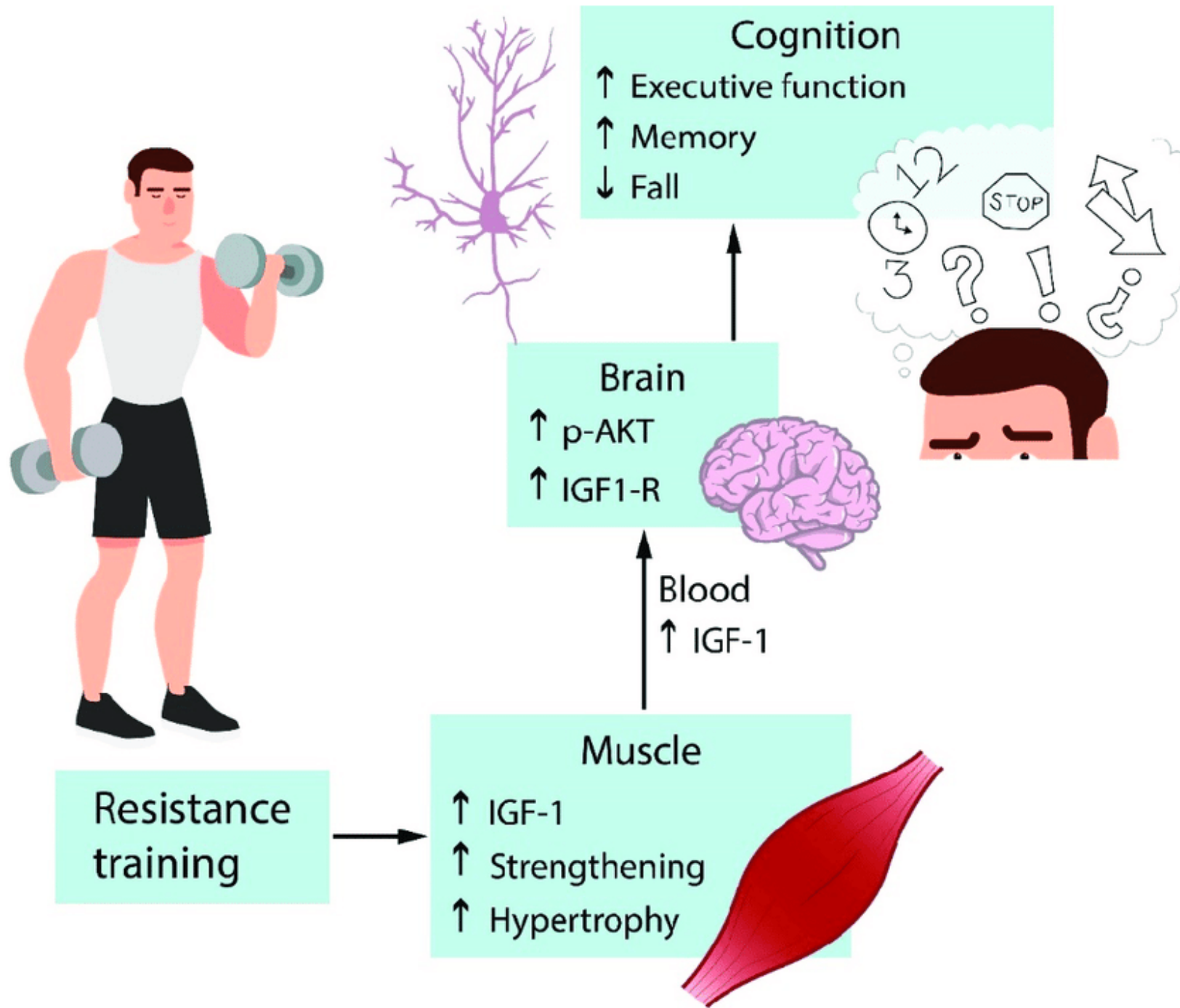


# MOTOR FITNESS EFFECTS

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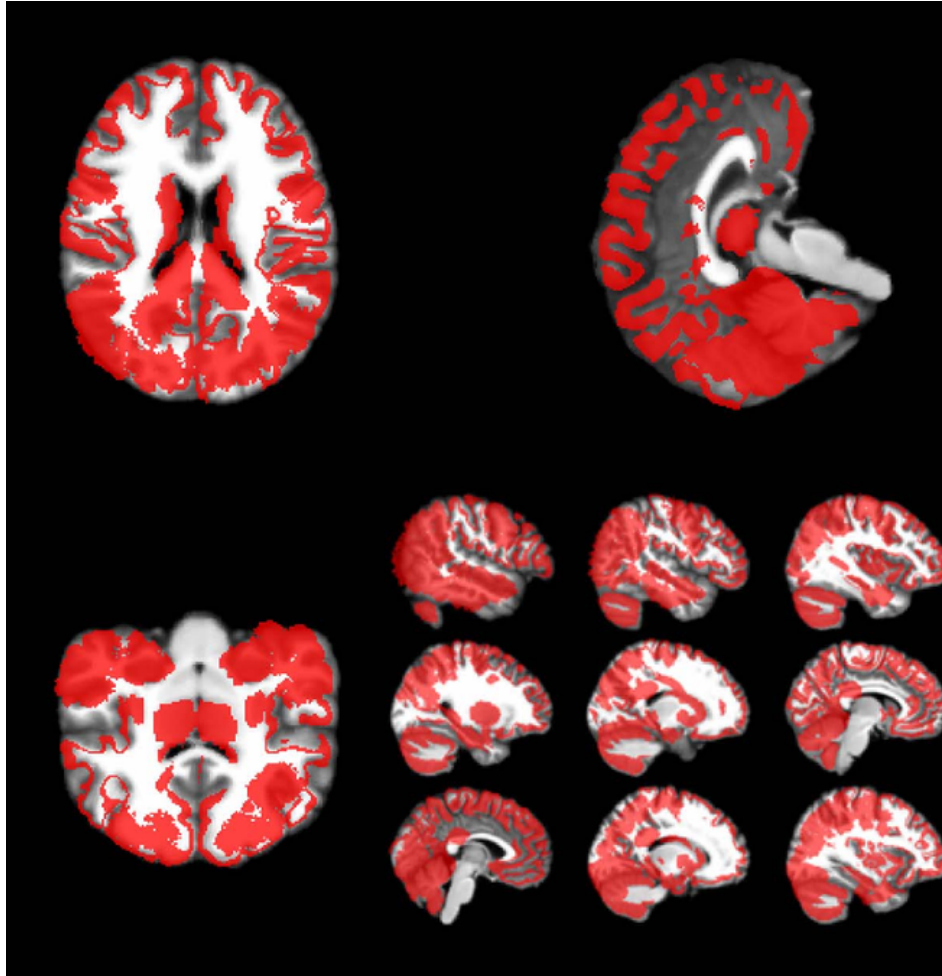


- **IMPROVES CEREBELLAR + BASAL GANGLIA SIZE AND STRUCTURE**
- **SPECIALIZED SKILL-BASED PATHWAYS THAT MEDIATE COGNITIVE IMPROVEMENTS**
- **INTERESTING CORRELATIONS...**
  - Clumsy before or after cerebellar atrophy/dysfunction?
  - Relationship to emotional regulation?
  - The cerebellar-thalamic-prefrontal pathway?

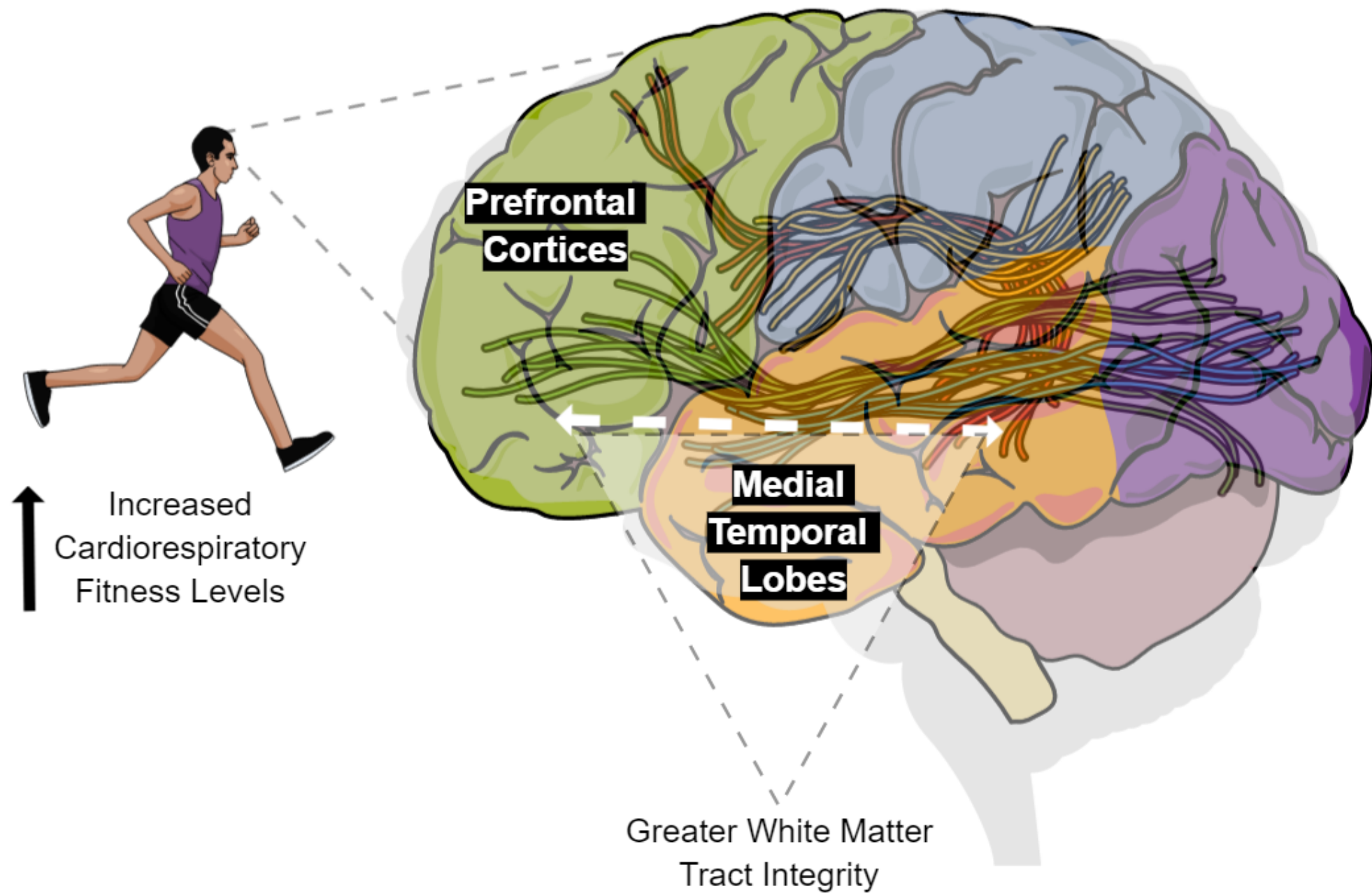


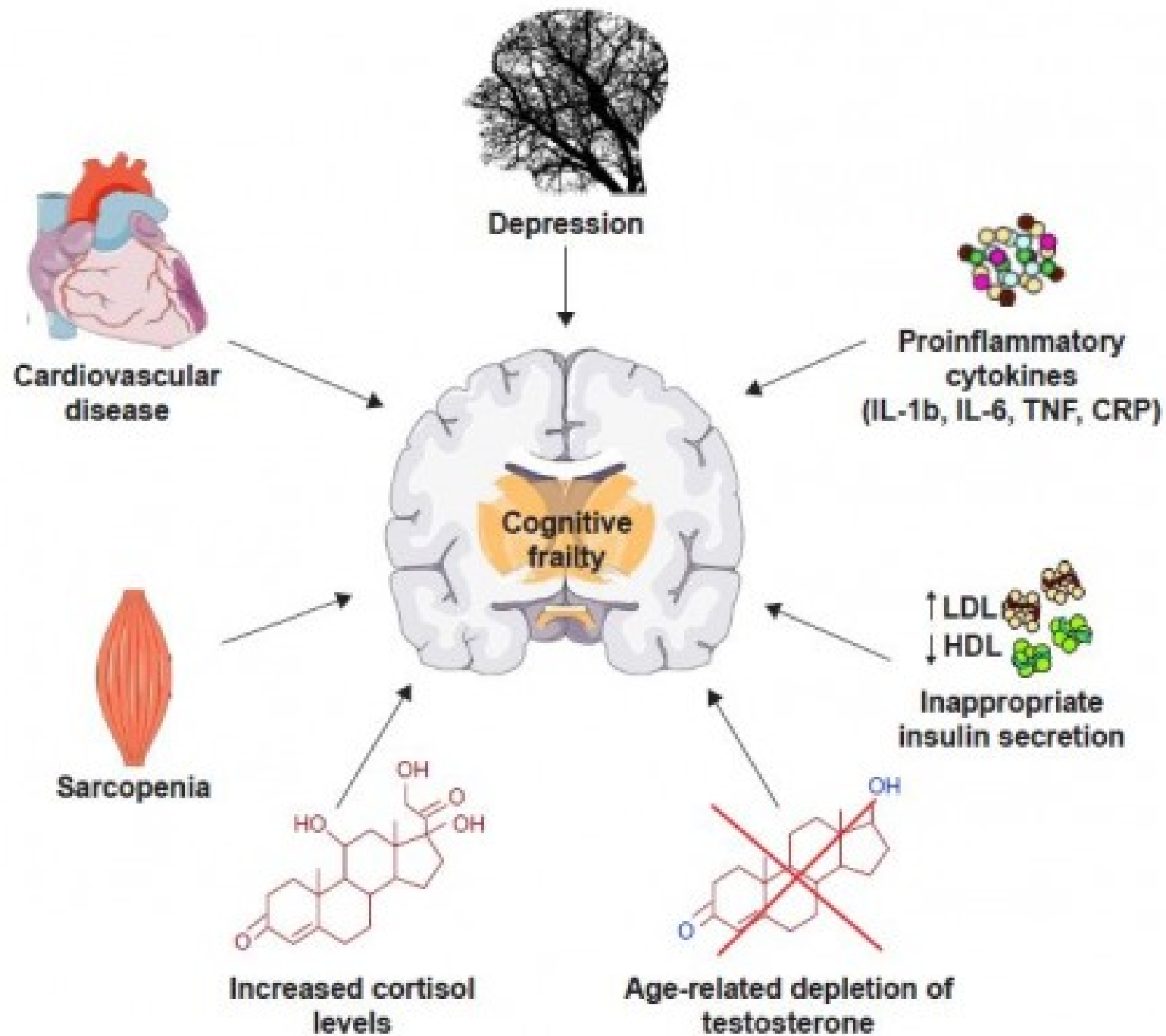
# 80% + OF THE BRAIN'S GRAY MATTER IS MODIFIABLE BY PHYSICAL ACTIVITY

Batouli, S. A. H., & Saba, V. (2017). At least eighty percent of brain grey matter is modifiable by physical activity: A review study. *Behavioural brain research*



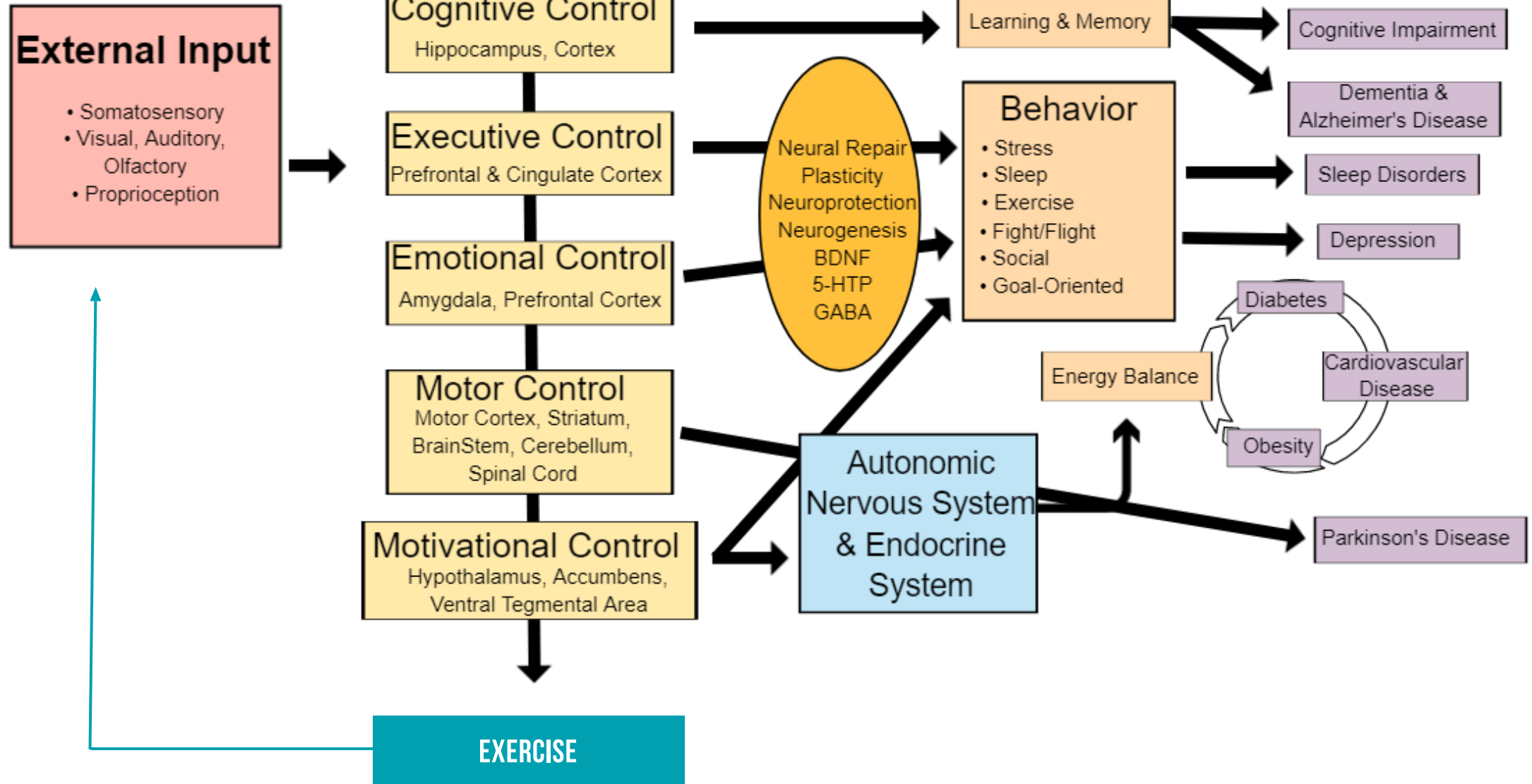
- **REVIEW: ALL STUDIES (<2017) THAT DEMONSTRATED STRUCTURAL CHANGES TO THE BRAIN IN ASSOCIATION TO PHYSICAL ACTIVITY WERE COLLECTED**
- **A LARGE NETWORK (82%) OF BRAIN AREAS WERE ASSOCIATED WITH PHYSICAL ACTIVITY**
- **HOWEVER, DIFFICULT TO CONCLUDE**
  - Statistical issues = may be more like 10%
  - Certain regions (temporal, parietal, frontal) are most changed
  - Physical activity vs. physical exercise
  - Study populations (kids vs older adults, neurological conditions, etc)



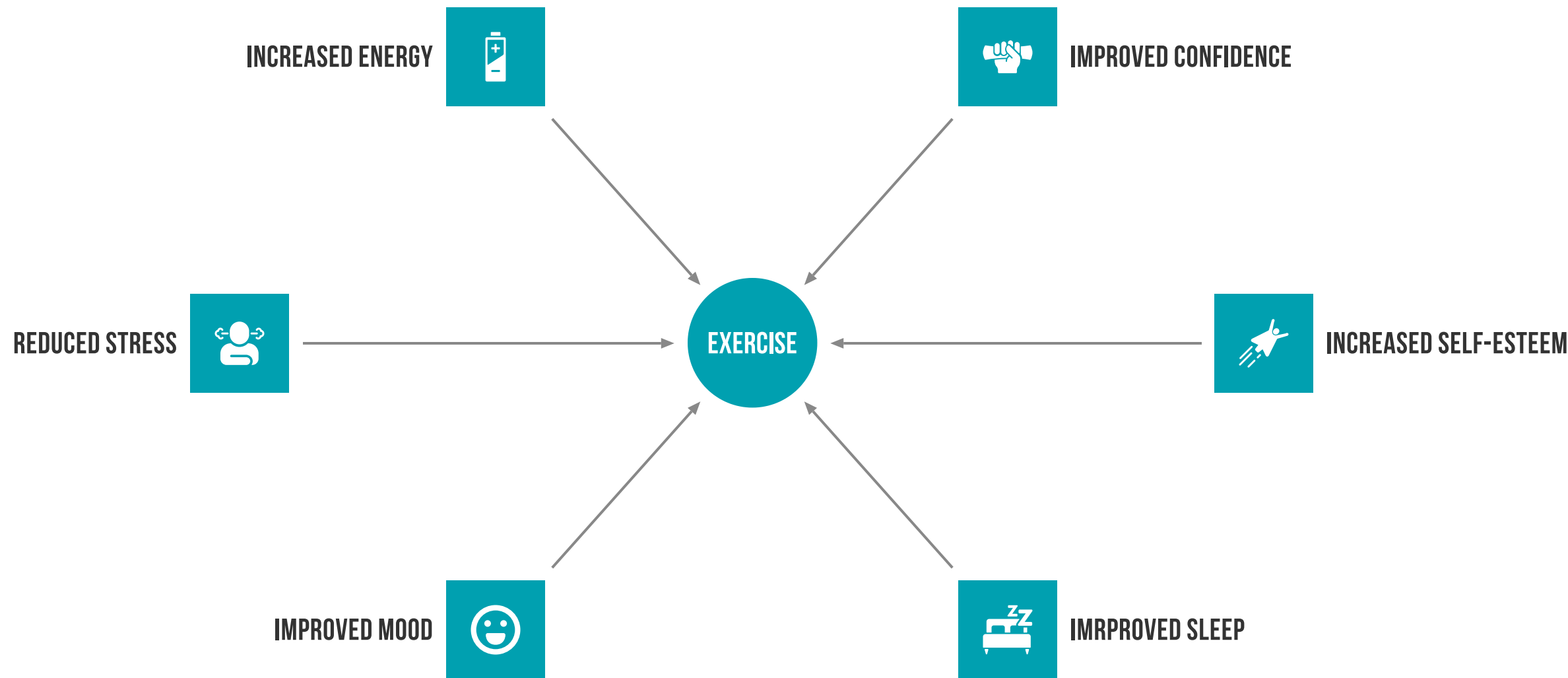




# The Neurobiology of Exercise



# EXERCISE EFFECTS ON MENTAL HEALTH



## FRONTAL LOBE

Cognitively-Demanding Activities  
Open Skill Activities  
Resistance Training  
Mind-Body Exercise

- Increased Gray Matter
- Improved Executive Functions
- More Efficient Brain Activity

## PARIETAL LOBE

Sensory-Rich Activities  
Visuo-spatial Demands  
Object-Based Activities

- Increased white matter & volume
- Improved sensory network activity
- Improved task-switching abilities

## OCCIPITAL LOBE

Visuo-spatial Demands  
Visual Attention Demands  
Motor Control & Stimulation

- Increased white & gray matter
- Improved visual skills & attention
- Increased volume & function

## TEMPORAL LOBES

Cardiovascular Exercise  
Closed Skill Activities  
Generalized Physical Activity

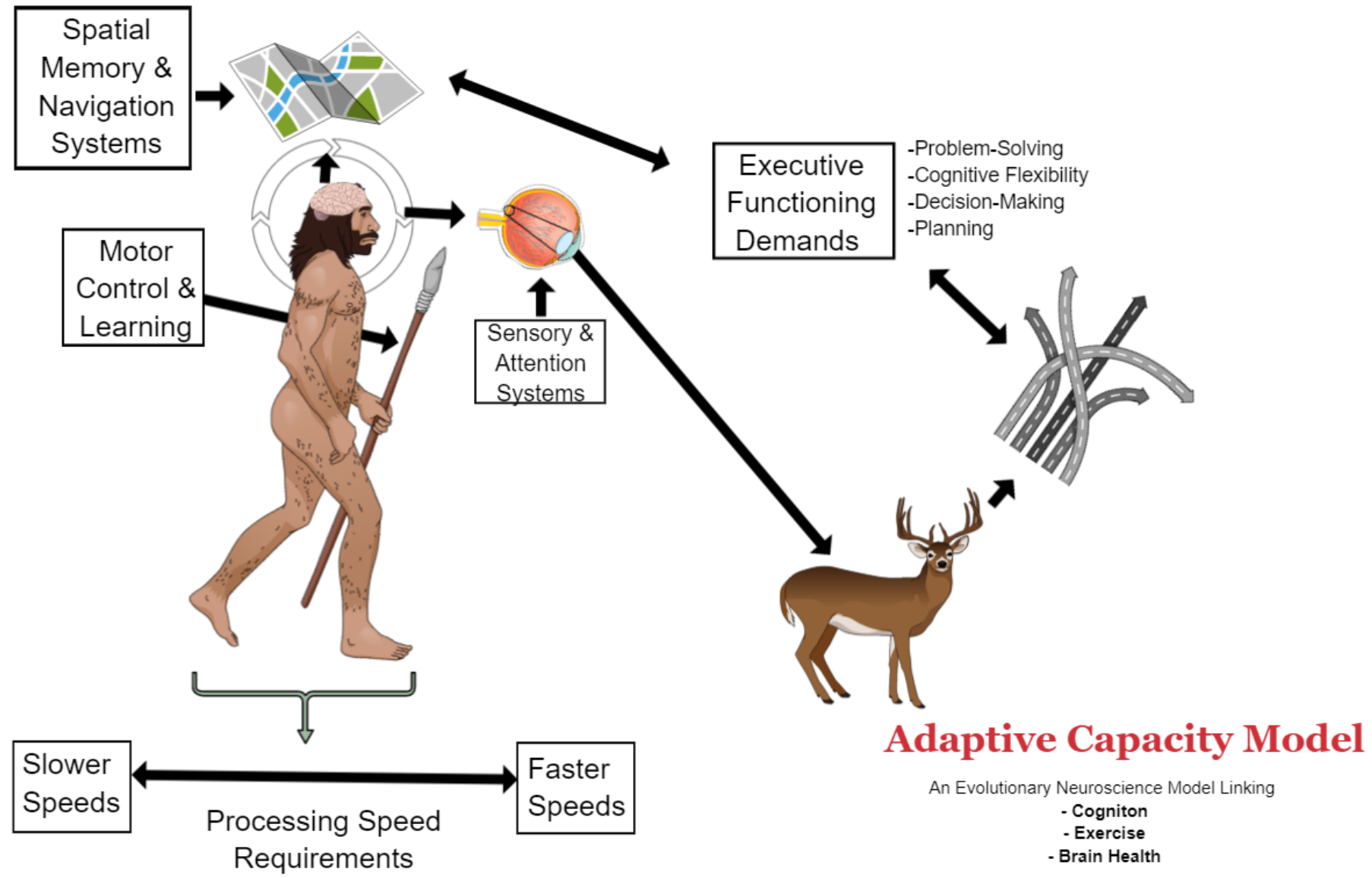
- Improved Learning & Memory
- Increased Neurogenesis
- Increased Hippocampal Volumes

## CEREBELLUM

Coordinative Exercise  
Skill & Motor Learning  
Open Skills Activities

- Increased cerebellar volume & function
- Improved coordination & attention
- Higher nerve cell & blood vessel volume





# WHAT'S WRONG WITH “BASIC” EXERCISE FOR BRAIN HEALTH?

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“Going simply beyond moving to moving with thought” - Dr. Adele Diamond

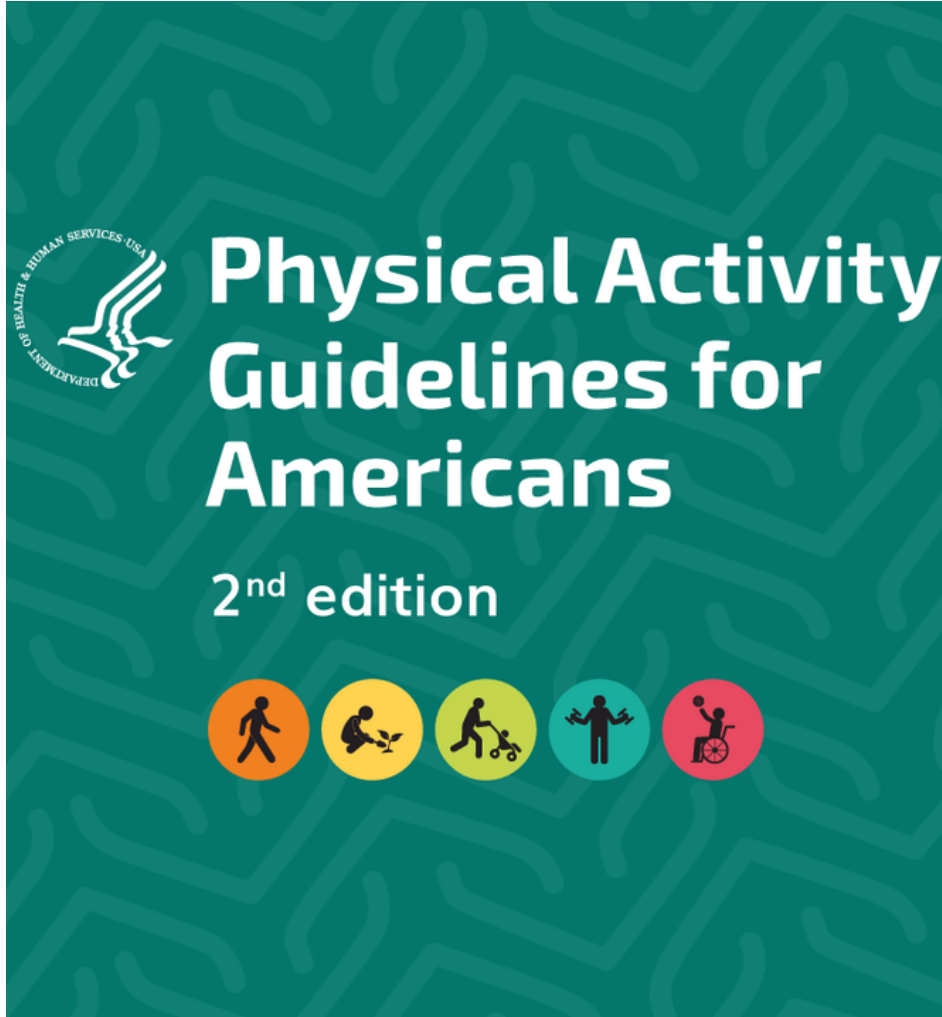
- **MOST EXERCISE ACTIVITIES REQUIRE LITTLE THOUGHT**  
Cardio exercise machines, basic weight machines, brisk walking  
These are helpful, but perhaps not enough
- **“COGNITIVELY-ENGAGING EXERCISE APPEARS TO HAVE A STRONGER EFFECT THAN NON-[COGNITIVELY]-ENGAGING EXERCISE”**
- **EXERCISES THAT TRAIN & CHALLENGE DIVERSE EF'S**  
Dance, Sports, Martial Arts - what can we learn from these?
- **EXERCISES THAT BRING JOY, PRIDE & CONFIDENCE**  
A balance of challenge, but not frustration or amotivation





# EXERCISE PRESCRIPTIONS

# IS THE GENERAL RECOMMENDATION ENOUGH FOR BRAIN HEALTH?



- **“FOR SUBSTANTIAL HEALTH BENEFITS, ADULTS SHOULD DO AT LEAST 150 MINUTES (2 HOURS AND 30 MINUTES) TO 300 MINUTES (5 HOURS) WEEK OF MODERATE TO VIGOROUS INTENSITY AEROBIC EXERCISE ...OR EQUIVALENT”**

Additional benefits for “neuromotor” training, strength training, and more minutes (i.e. 300)

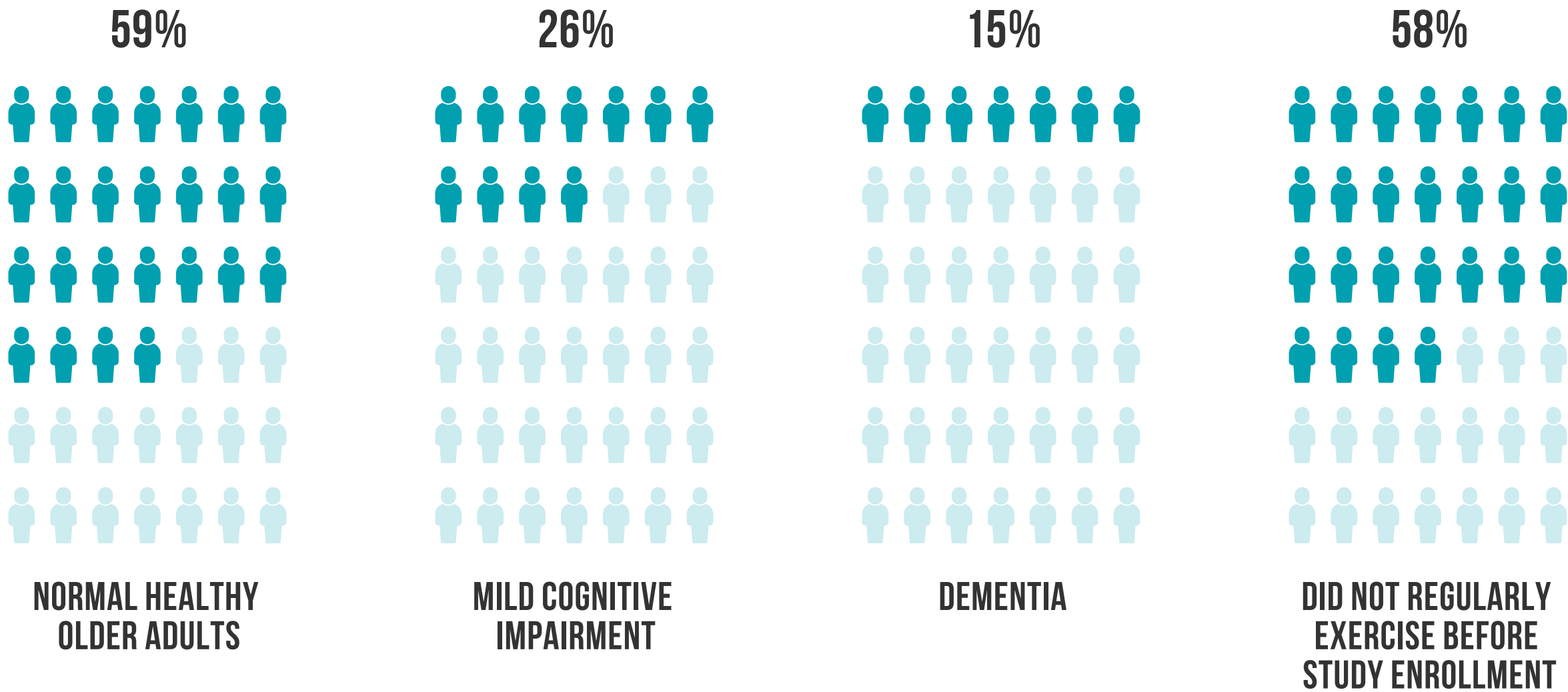
- **MULTIDOMAIN EXERCISE PROGRAMS SLOW PROGRESSION OF COGNITIVE DECLINE MORE THAN SHORTER SINGLE MODALITY**

Brasure, M., Desai, P. et al (2018). Physical activity interventions in preventing cognitive decline and Alzheimer-type dementia

- **52 HOURS OF EXERCISE LEADS TO IMPROVEMENTS IN EF'S & PROCESSING SPEED IN OLDER ADULTS - REGARDLESS OF MODALITY**

Gomes-Osman, J. et al. (2018). Exercise for cognitive brain health in aging: a systematic review for an evaluation of dose

# REVIEW OF 98 RCTS OF 11,061 PARTICIPANTS OVER AGE OF 73



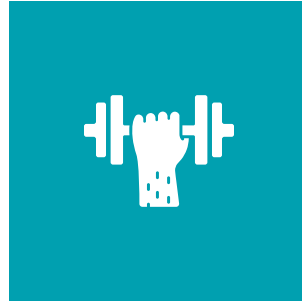
# PRIMARY EXERCISE MODALITIES

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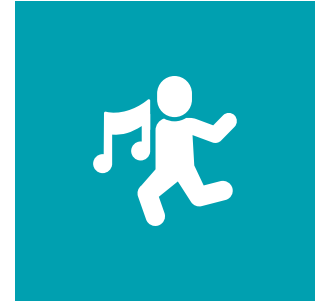
## AEROBIC

Steady State  
Interval



## STRENGTH

Closed Skill Training  
Open Skill (Functional) Training

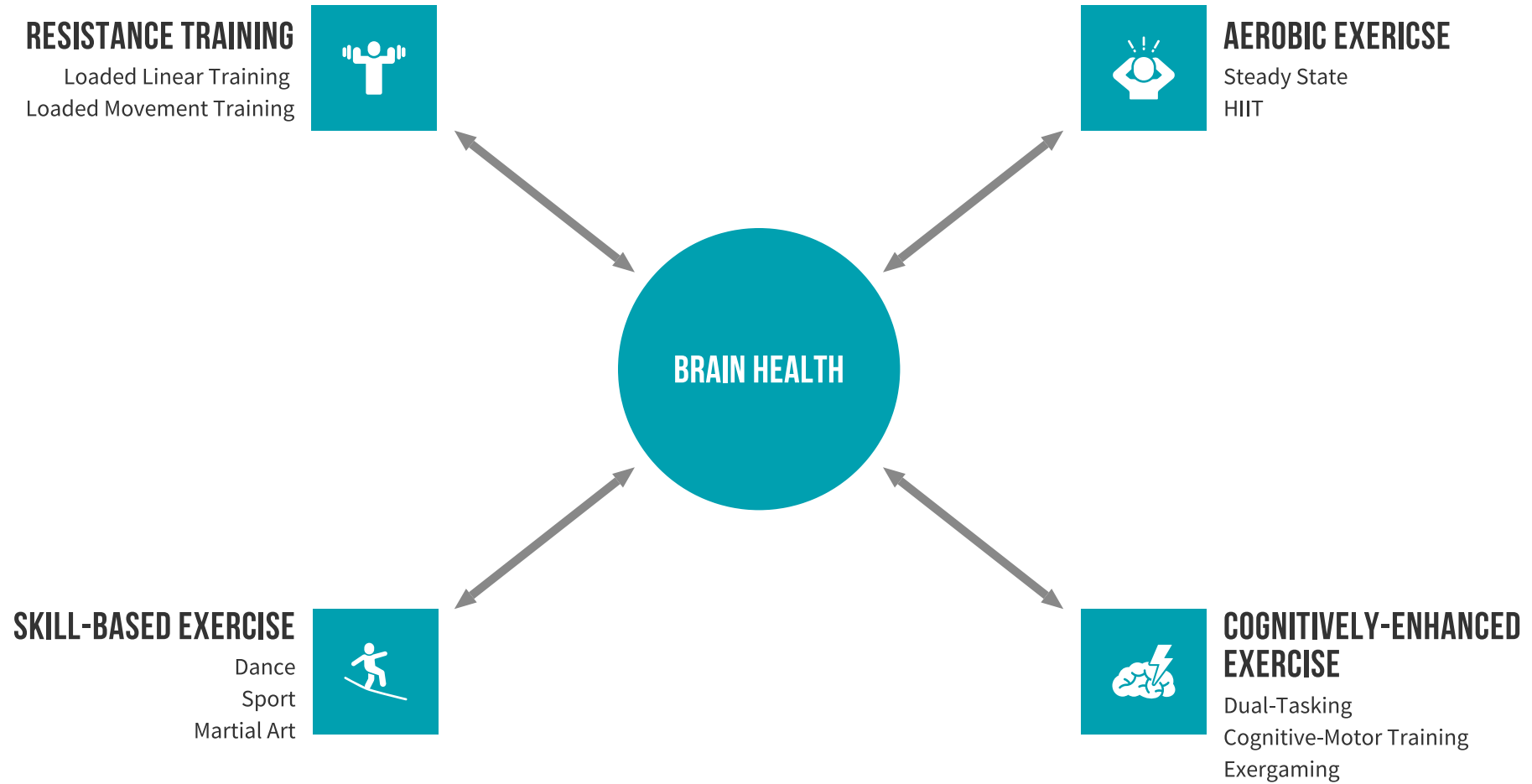


## MOTOR/SKILL

Sports, Dance, Martial Arts  
Mind-Body Exercise



# “BRAIN HEALTH” INGREDIENTS



# EXERCISE RECOMMENDATIONS FOR BRAIN HEALTH

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## CARDIOVASCULAR EXERCISE

2-3 days/week



## RESISTANCE TRAINING

2-3 days/week



## SKILL-BASED EXERCISE

2-3 days/week

## ◆ **COGNITIVE**

**“WHAT TO DO”**

- Conveyance & Acquisition of New Information • Trial and Error
- Verbal, Visual, Motor • Learning Skill Objectives • Organizing Information
- Processing Environmental Variables • Understanding Skill

## ◆ **ASSOCIATIVE**

**“HOW TO DO IT”**

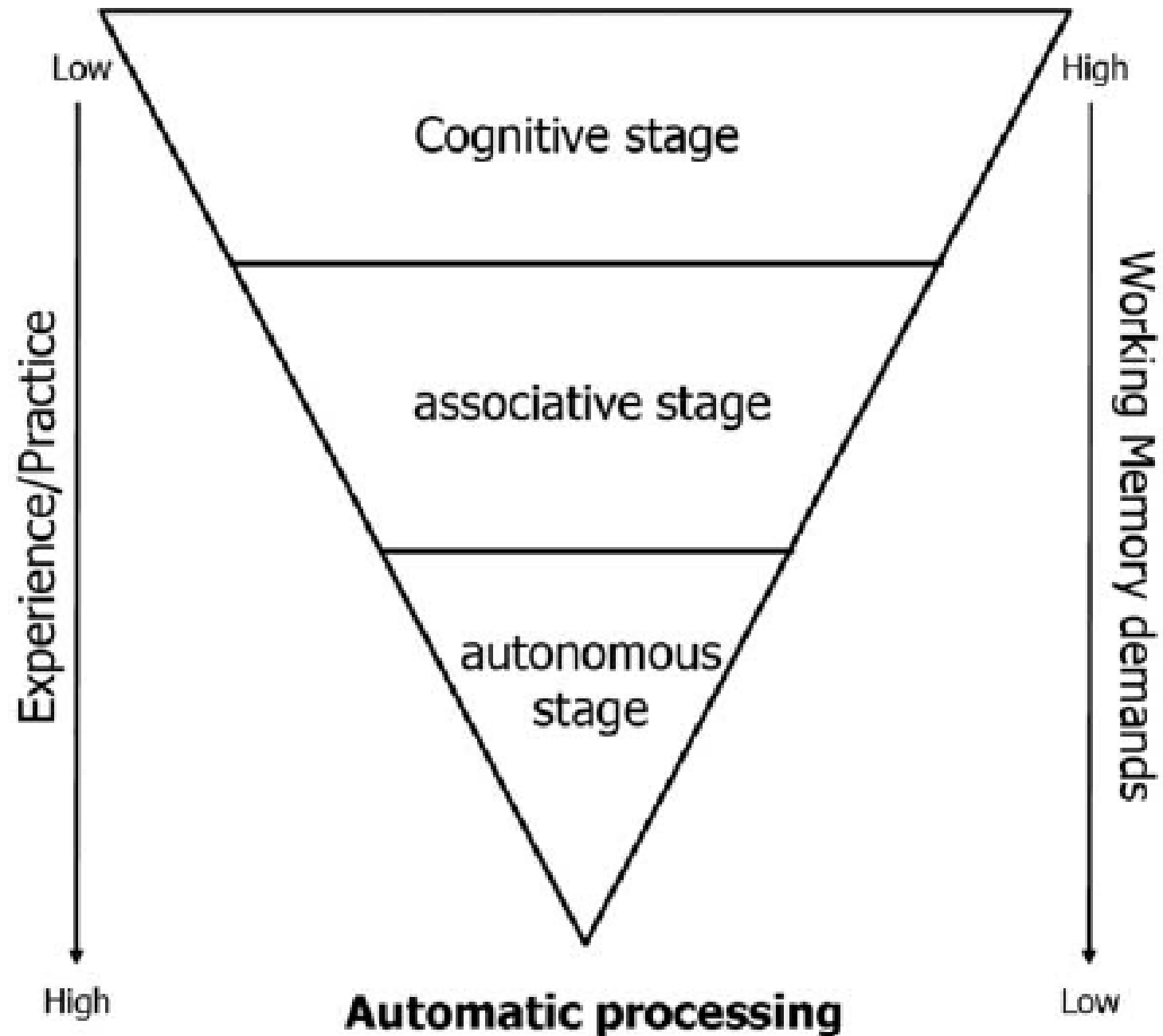
- Translation of Declarative Knowledge into Procedural Knowledge
- Difficult & Awkward • Proprioceptive / Motor • Practice Phase
- Chunking • Eliminating Mistakes • Improving Selective Attention Focus

## ◆ **AUTONOMOUS**

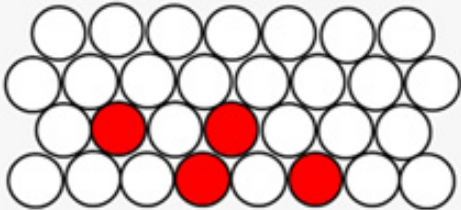
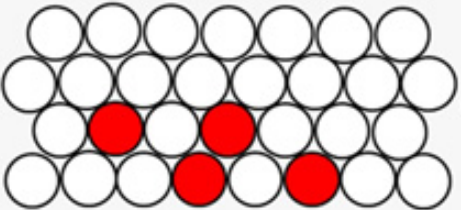
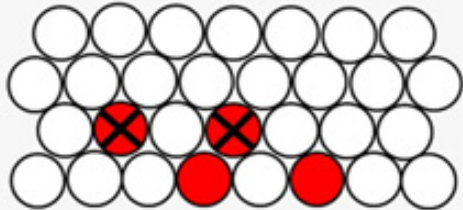
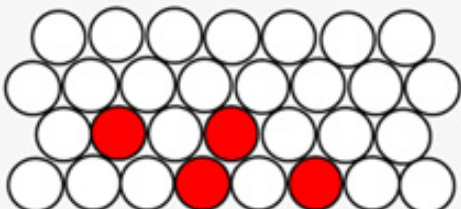
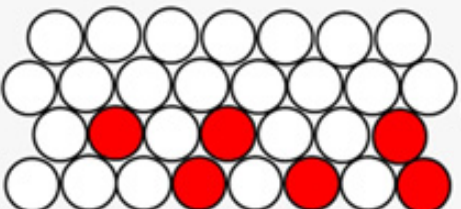
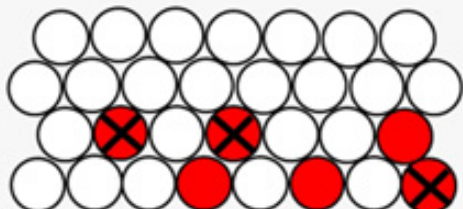
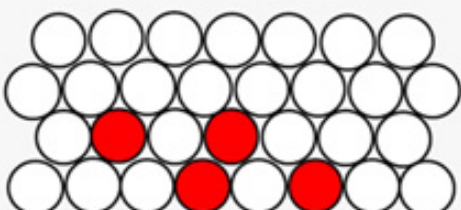
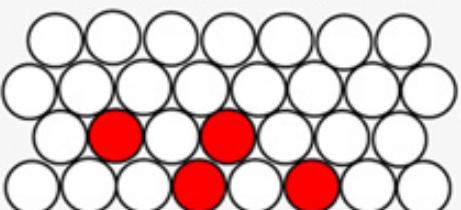
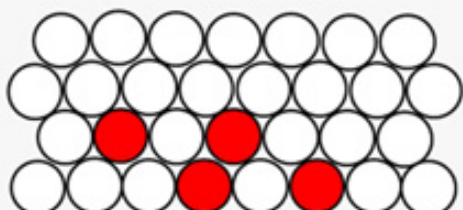
**“DO IT”**

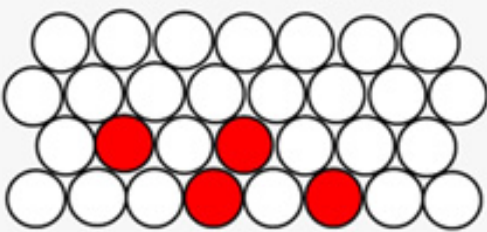
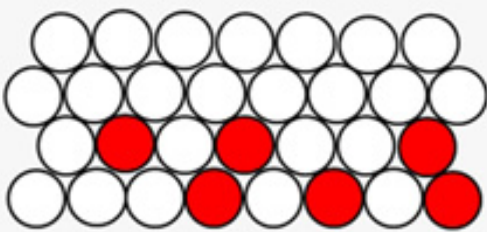
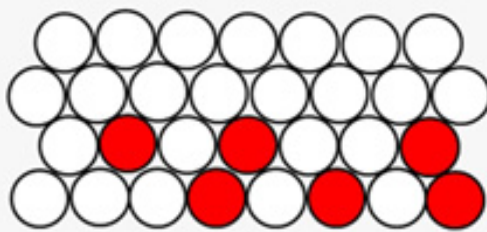
- Performance • Cognitive Demands are Minimal
- Attention Focus Can Be External • State of Flow • Habitual
- Ability to Self Correct • Unconscious

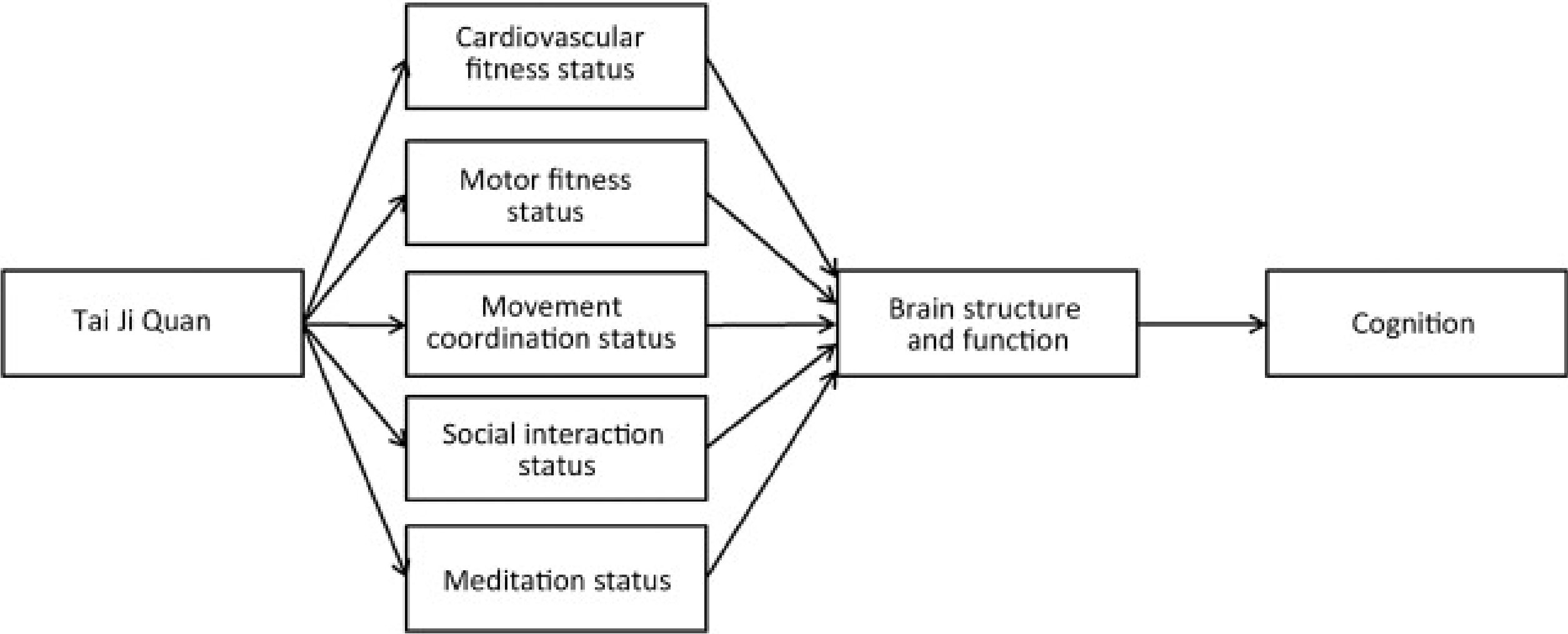
**Controlled processing**





	Before	During	After
No training			
Physical exercise			
Mental training			

Mental and Physical (MAP) training			
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# SAMPLE EXERCISE PROGRAM - BEGINNER

	Monday	Wednesday	Friday	Saturday
Type	Bike & Weights	Dance (Zumba)	Bike & Weights	Walking
Time	30 min ea (60 min total)	60 min	30 min ea (60 min total)	60 min
Intensity	6-8/10	4-7/10	6-8/10	2-5/10

# EPAP for Attention

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Multi- component (AT +RT + Balance)	Tai Chi (group)	Multi- component (AT +RT + Balance)	Dance (skill- based)	Multi- component (AT +RT + Balance)	Tai Chi (home)	Dance (skill- based)
- 60 min (20 min/type)  - Moderate intensity	-30 min  -Low Intensity	- 60 min (20 min/type)  - Moderate intensity	- 60 min  -Low to Moderate Intensity	- 60 min (20 min/type)  - Moderate intensity	-30 min  -Low Intensity	- 60 min  -Low to Moderate Intensity

# ACUTE VARIABLES

---



**FREQUENCY**



**DURATION**



**INTENSITY**



**SKILL**



**NOVELTY**



**ENVIRONMENT**

## FRONTAL LOBE

Cognitively-Demanding Activities  
Open Skill Activities  
Resistance Training  
Mind-Body Exercise

- Increased Gray Matter
- Improved Executive Functions
- More Efficient Brain Activity

## PARIETAL LOBE

Sensory-Rich Activities  
Visuo-spatial Demands  
Object-Based Activities

- Increased white matter & volume
- Improved sensory network activity
- Improved task-switching abilities

## OCCIPITAL LOBE

Visuo-spatial Demands  
Visual Attention Demands  
Motor Control & Stimulation

- Increased white & gray matter
- Improved visual skills & attention
- Increased volume & function

## CEREBELLUM

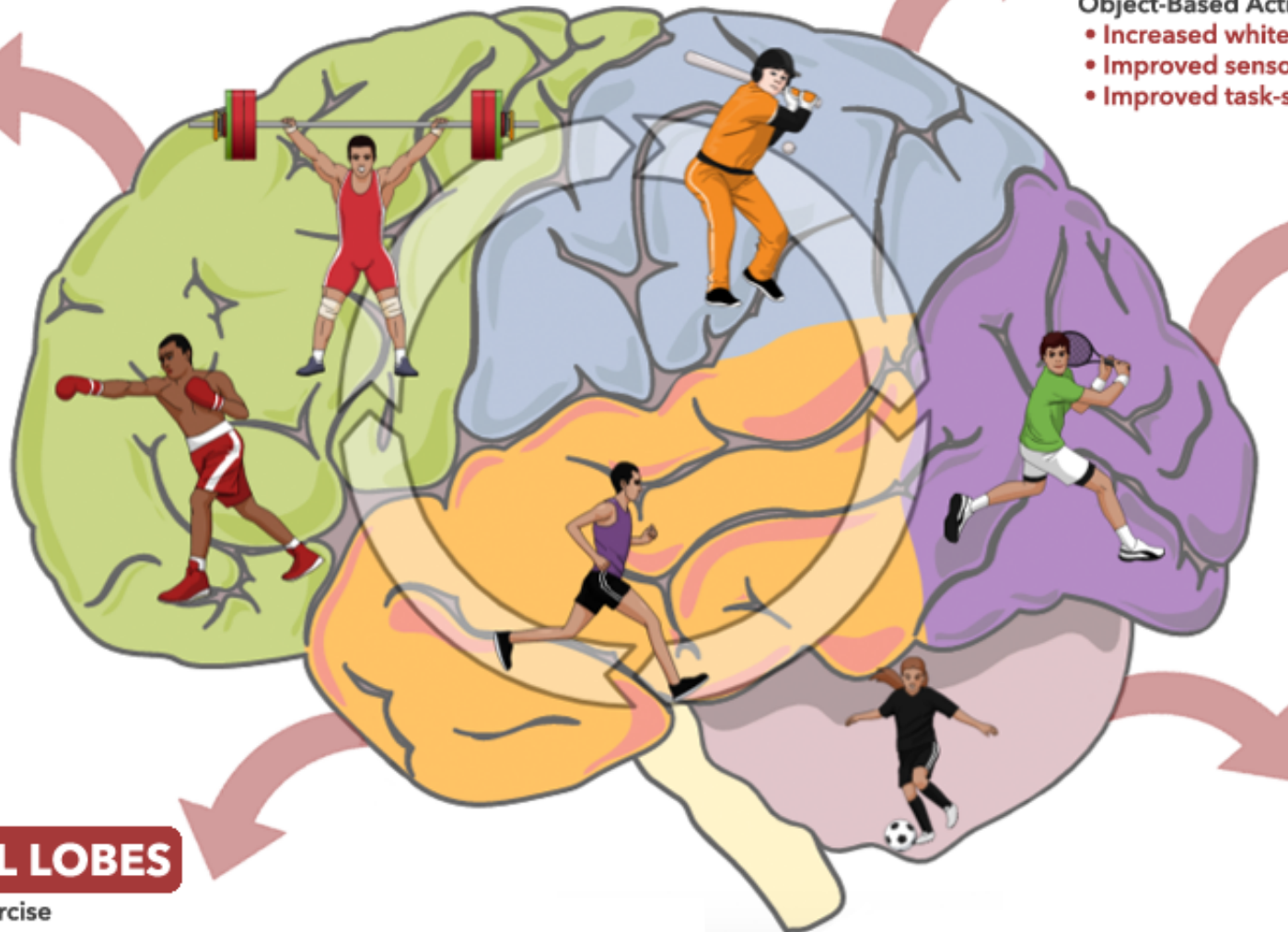
Coordinative Exercise  
Skill & Motor Learning  
Open Skills Activities

- Increased cerebellar volume & function
- Improved coordination & attention
- Higher nerve cell & blood vessel volume

## TEMPORAL LOBES

Cardiovascular Exercise  
Closed Skill Activities  
Generalized Physical Activity

- Improved Learning & Memory
- Increased Neurogenesis
- Increased Hippocampal Volumes



# LIFESTYLE FACTORS THAT INFLUENCE BRAIN HEALTH & COGNITION

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**EXERCISE & PHYSICAL  
ACTIVITY**



**SLEEP (QUALITY +  
QUANTITY)**



**DIET & FREQUENCY**



**STRESS MANAGEMENT**



**MEDICATIONS**



**COMORBIDITIES**



**COGNITIVE STIMULATION**



**SOCIAL SUPPORT**



# BRAIN HEALTH TRAINING

**ACE** →  
**APPROVED**





# **COACHING = FACILITATED SELF-DIRECTED NEUROPLASTICITY**

**FACILITATE : TO MAKE (AN ACTION OR PROCESS) EASY OR EASIER**

Italian and Spanish, “facil” = Easy

# WHAT DOES BRAIN HEALTH TRAINING DO FOR MY BUSINESS?

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Demand is high for brain health-services & programs

Not just being able to play with their grandkids, but being able to remember their grandkids' names

**ATTRACTING**

**RETAINING**

**IMPACTING**

Brain health is a long-term goal, one of many weeks, months, & years



# BRAIN HEALTH TRAINING

**ACE** →  
**APPROVED**

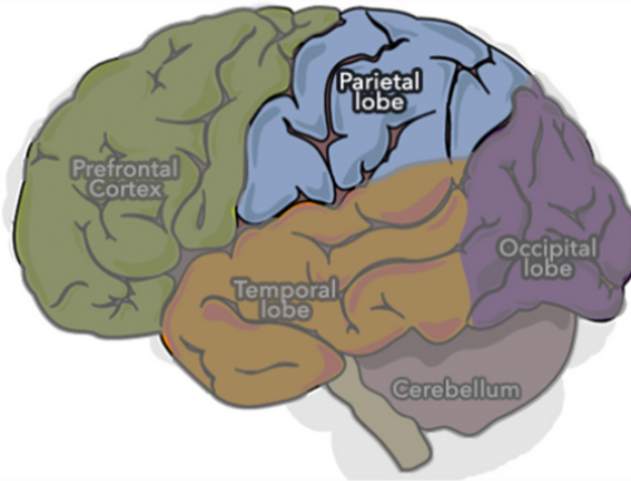


# BRAIN HEALTH TRAINER COURSE

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The Parietal Lobes are responsible for the integration of sensory and visuospatial information, including information processing demands associated with the somatosensory aspects of the central nervous system.

Continue



- INTERACTIVE GRAPHICS
- NEUROSCIENCE THEORY
- TURNKEY PROGRAMMING

# THANK YOU!

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**WWW.BRAINHEALTHTRAINER.COM**

use code **BRAIN300** at checkout for - \$200 off!

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