



#ideaworld



LIMITLESS

Boosting the Brain with Cognitive Tasks

PRESENTED BY

Ryan Glatt, MS, CPT

Ryan Glatt, MSc, CPT, NBHWC

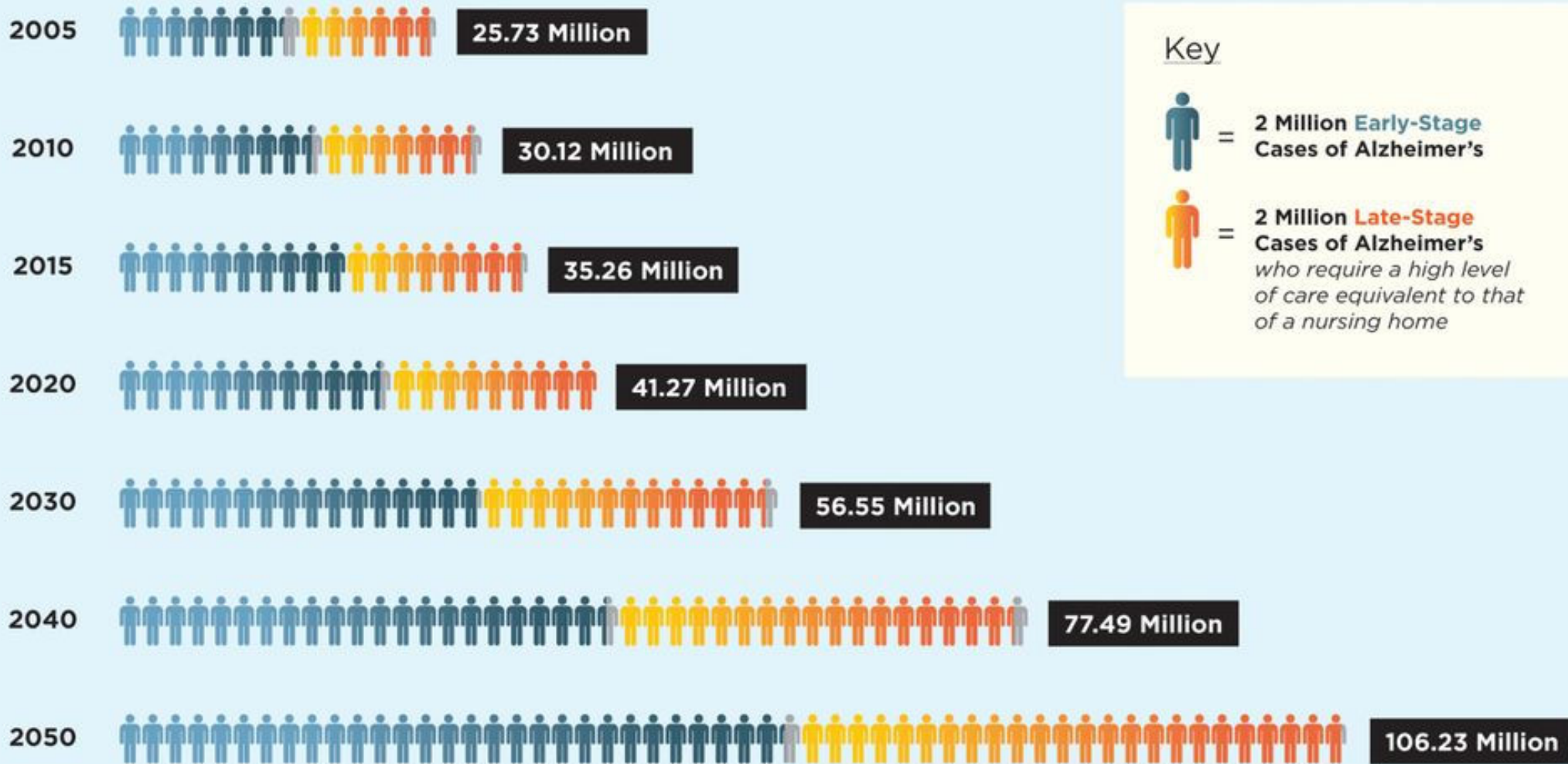
@glatt.brainhealth

- **Pacific Brain Health Center**
Research, Education, FitBrain Program
- **Msc applied neuroscience**
- **PhD Student: Health & Human Performance**
Focus in Gerontology
- **BS Exercise Science**
- **Brain Health Coach**
- **NSCA - CPT**



WORLDWIDE PROJECTIONS OF ALZHEIMER'S PREVALENCE

FOR THE YEARS 2005-2050, BY STAGE OF DISEASE (IN MILLIONS)



conditions that affect cognition and brain health



Medications



Obesity & Metabolic disorders



Cardiovascular Conditions



Cancer & Chemotherapy



Neurological & Neurodegenerative
Conditions

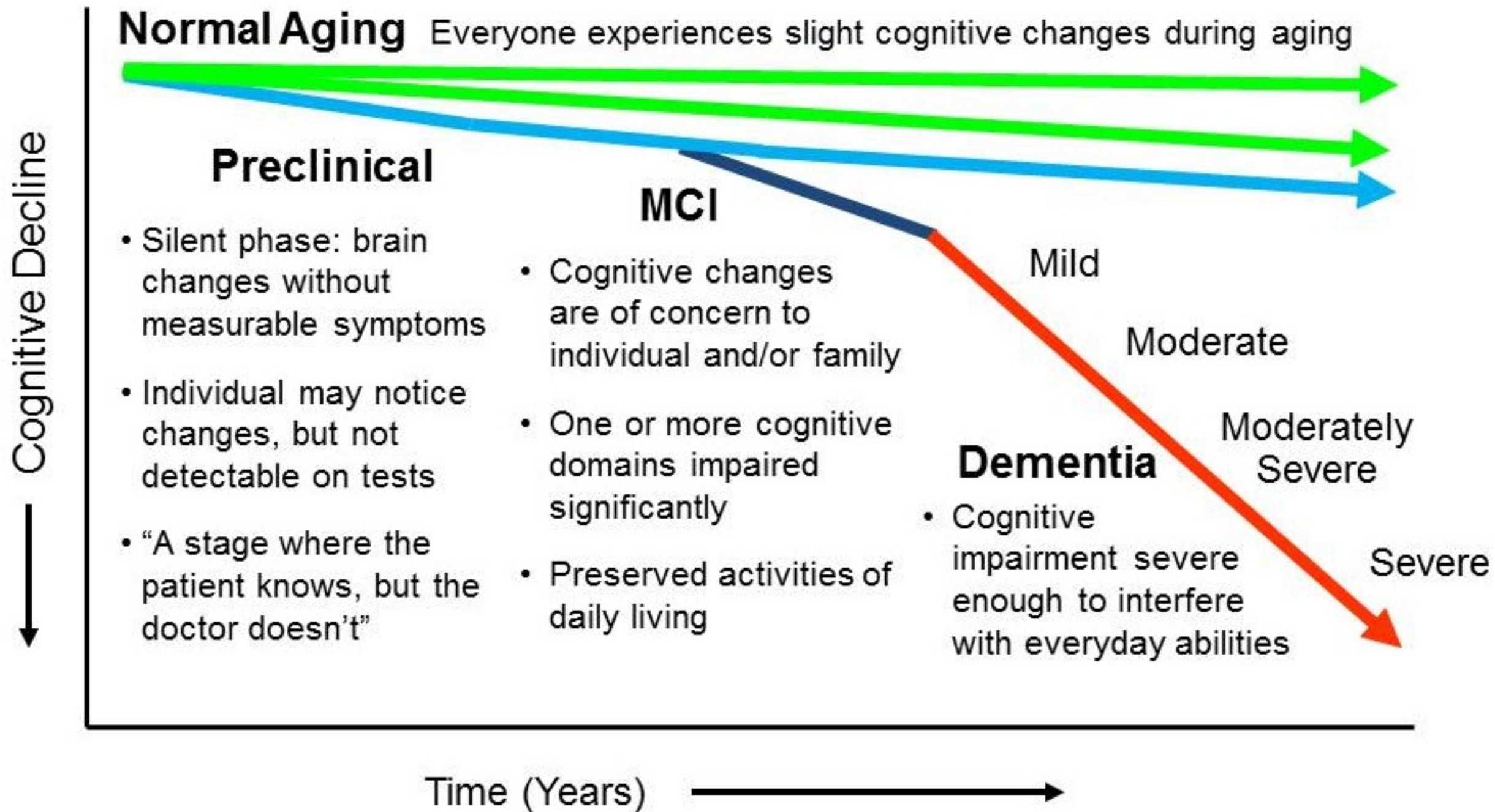


Mental Health

what constitutes brain health (respective to age)?

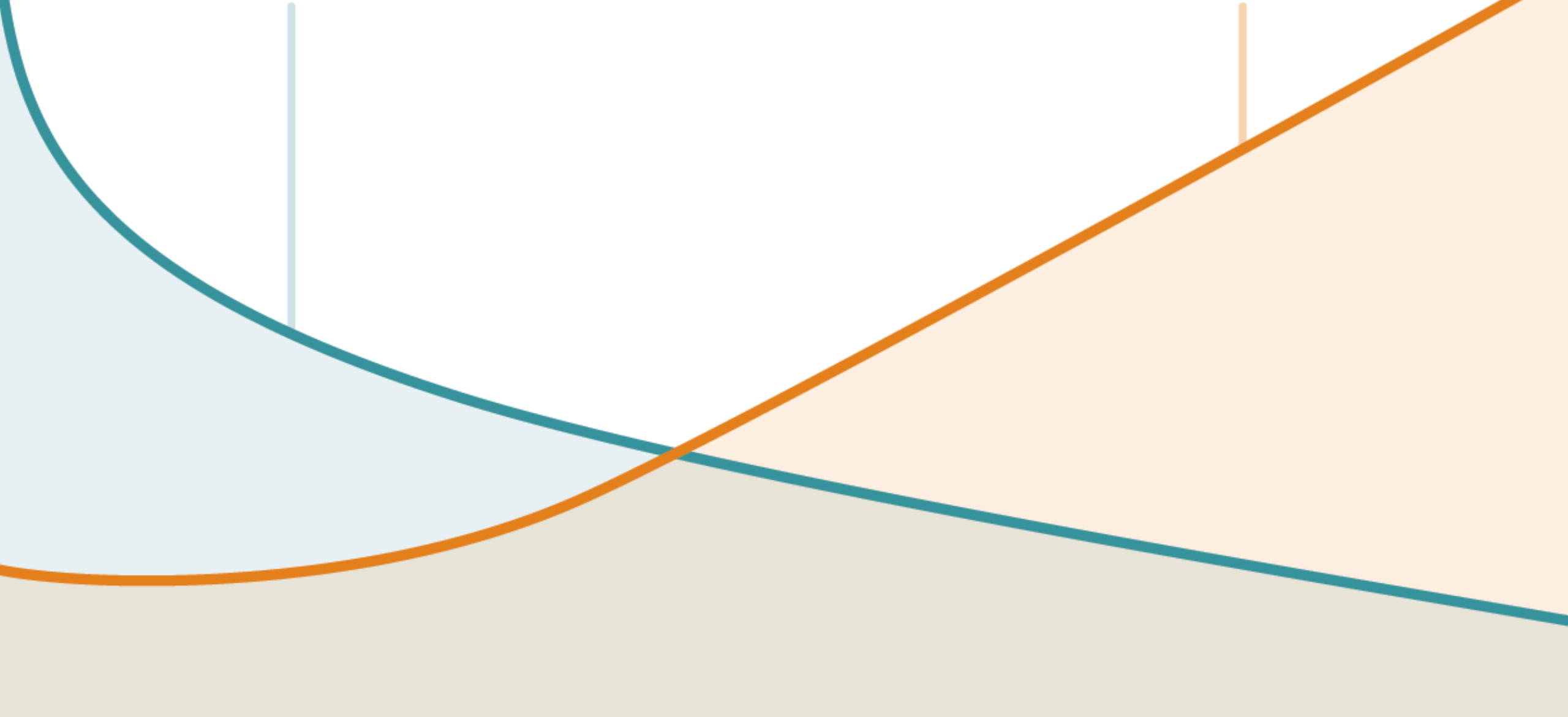


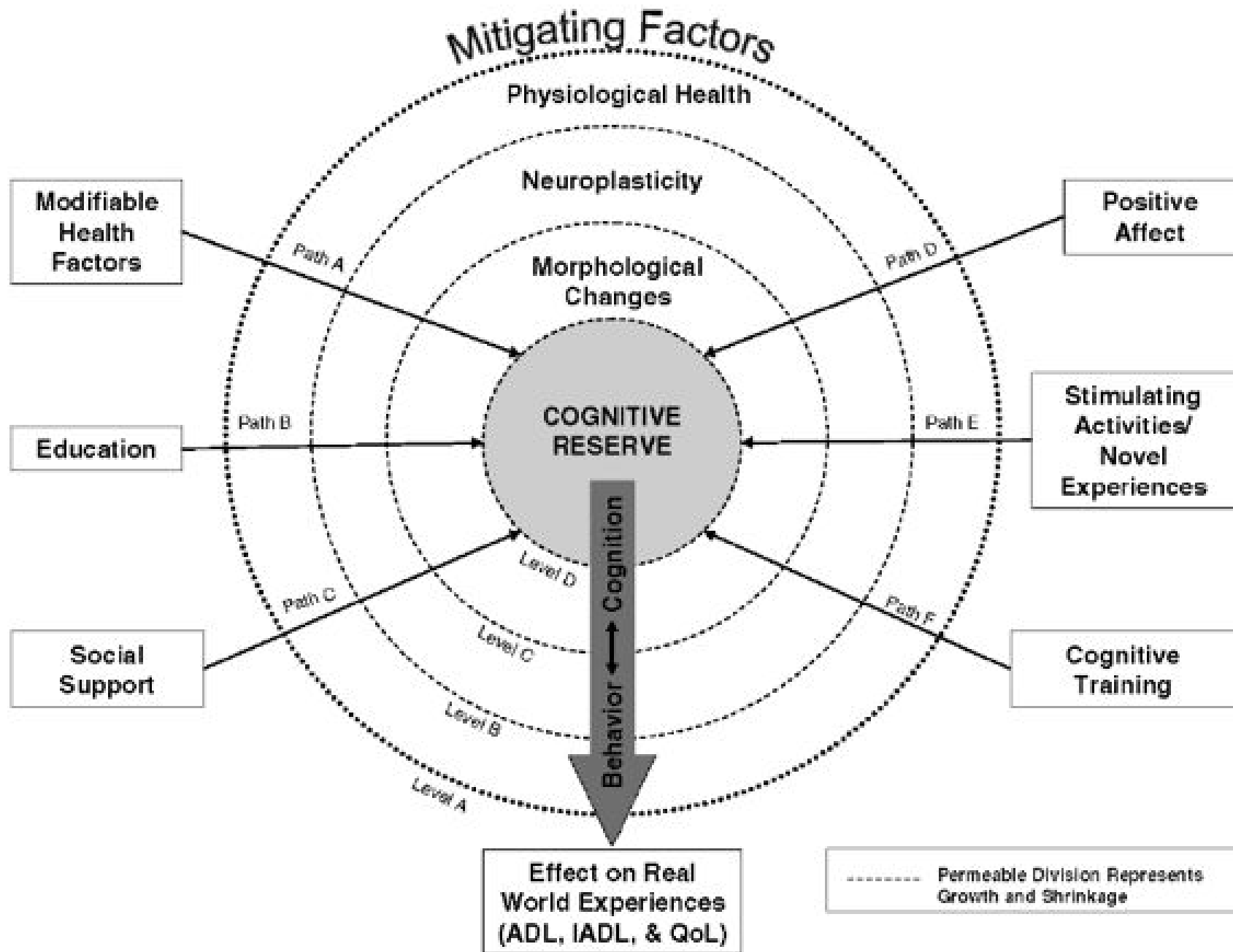
- preservation of brain volume
- preservation of brain function
- maintained/improved cognition
- regulation of mental health
- resilience to insults/stressors



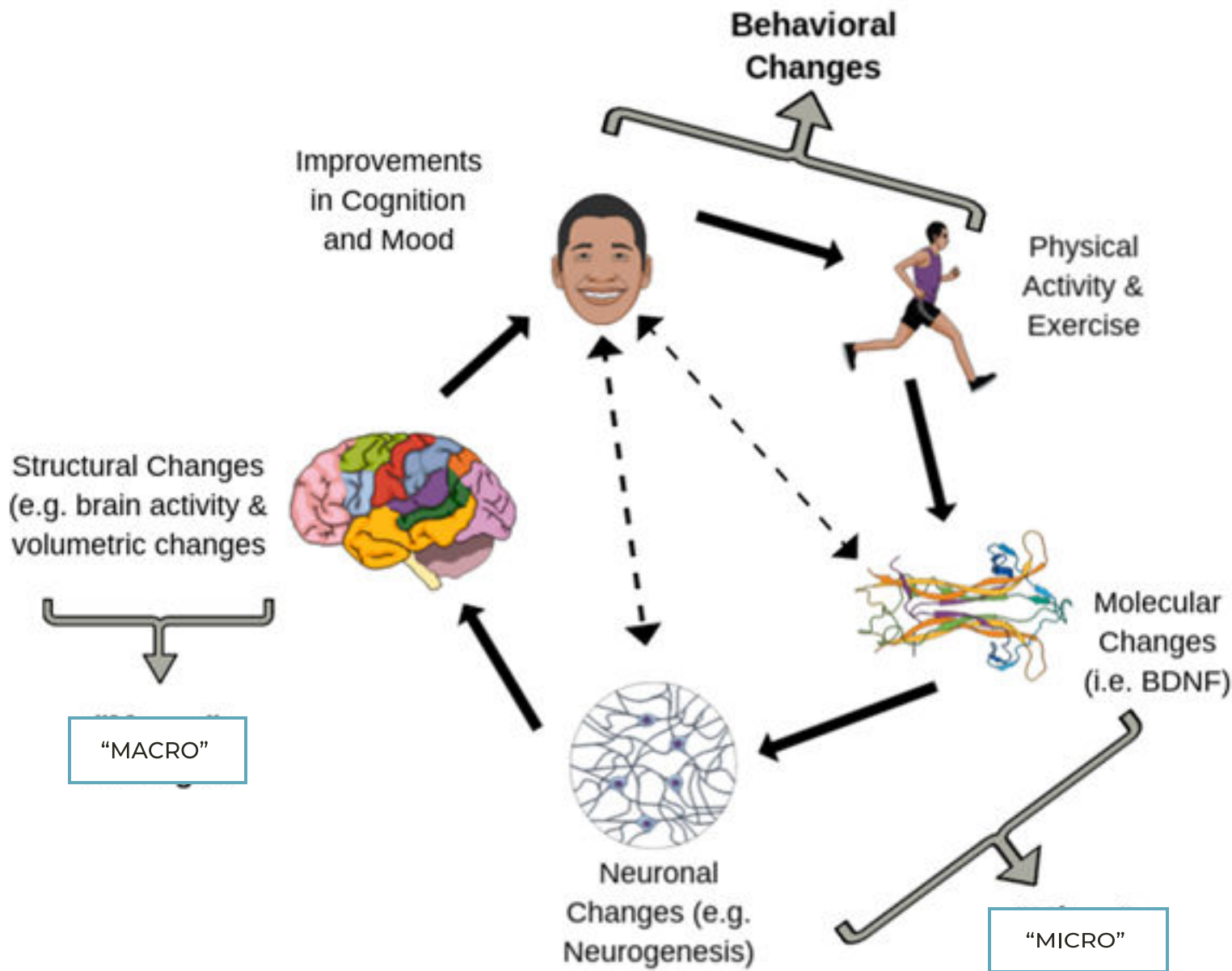
The brain's **ability to change**
in response to experiences

The **amount of effort**
such change requires





how exercise can affect the brain



- behavioral

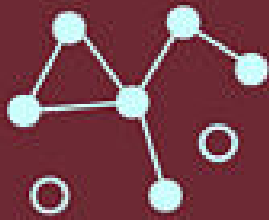
Mood
Cognition

- “Micro”

Neurons
Vessels
Growth Factors

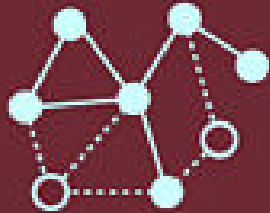
- “Macro”

Function
Structure



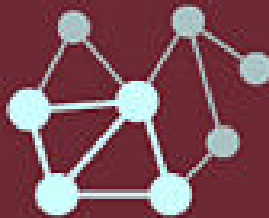
NEUROGENESIS

Continuous generation of new neurons in certain brain regions



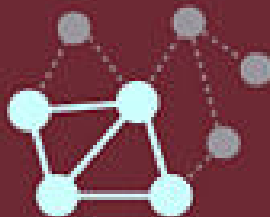
NEW SYNAPSES

New skills and experiences create new neural connections



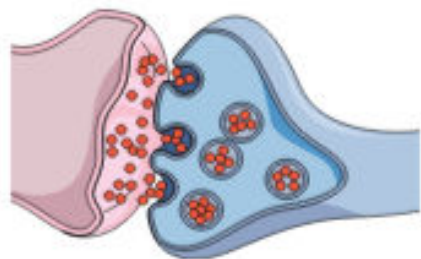
STRENGTHENED SYNAPSES

Repetition and practice strengthens neural connections



WEAKENED SYNAPSES

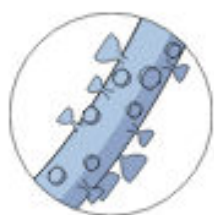
Connections in the brain that aren't used become weak



Synaptic
Modification



Milliseconds



Branching of
Synapses & Dendrites



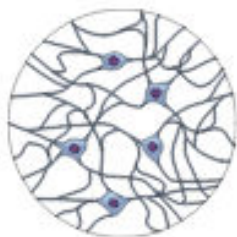
Several Hours



New Brain Cells



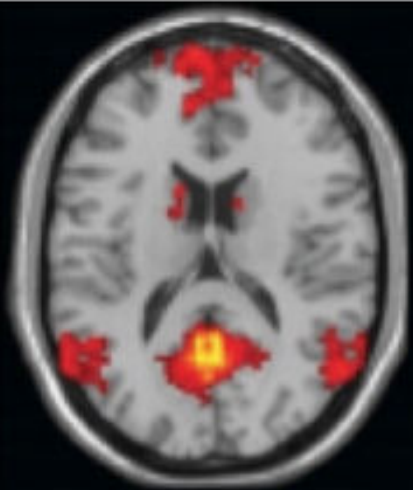
Several Days



Neuronal Network
Changes



Several Weeks and Months



Default Mode Network

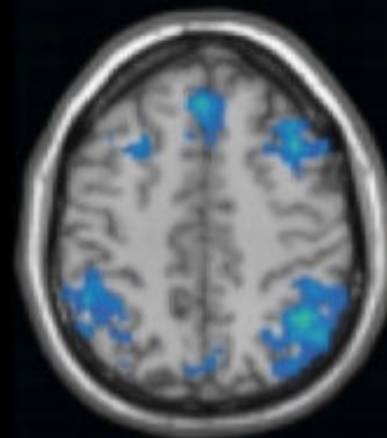
Activates when not performing a task; daydreaming, mind-wandering, thinking about others



Salience Network

Switching between the Default Mode Network and the Central Executive Network

Sensory and limbic Inputs



Central Executive Network

Engages your conscious brain to think and maintains attention on a prioritized task

is the general recommendation enough for brain health?



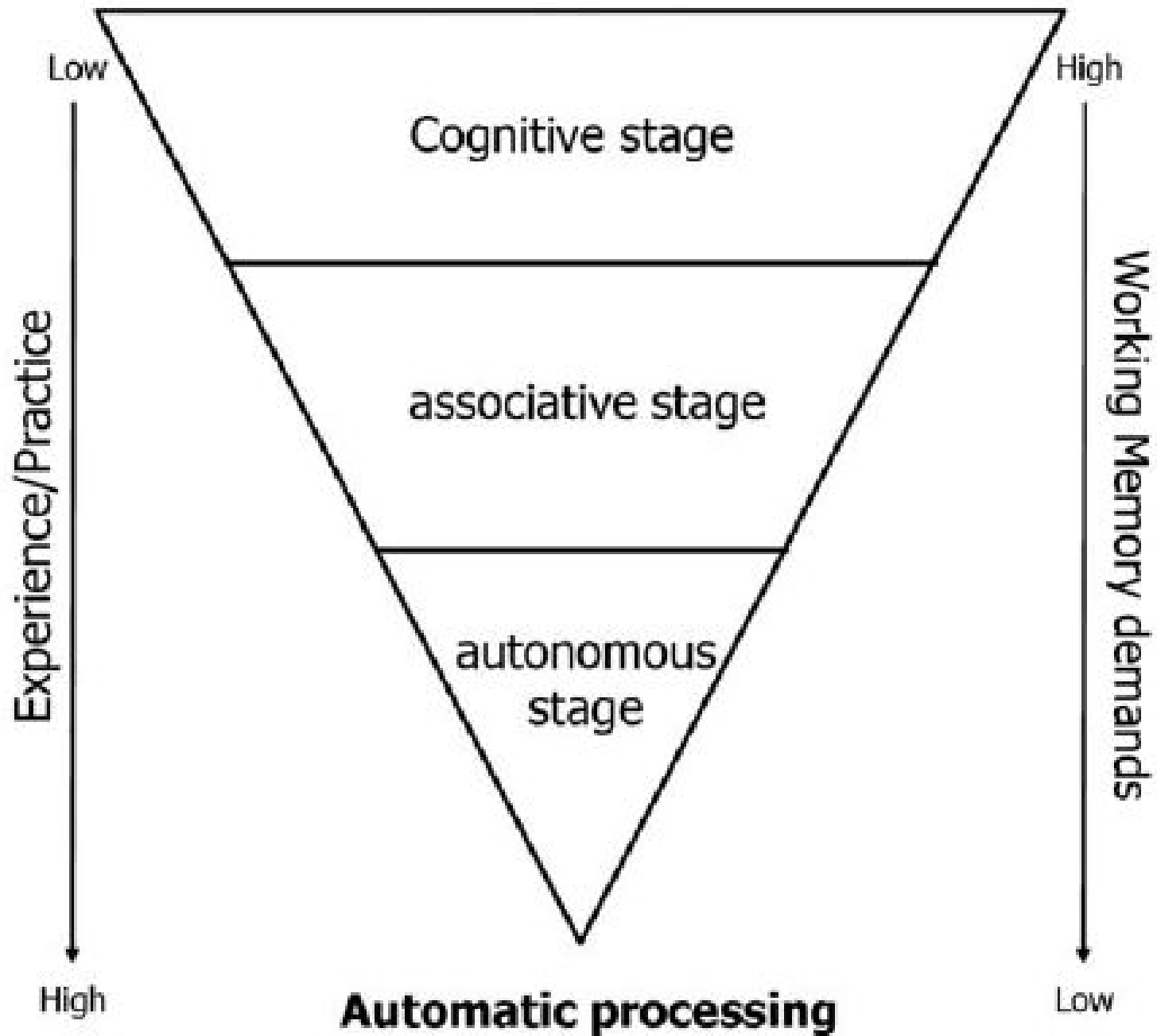
- “For substantial health benefits, adults should do at least 150 minutes (2 hours and 30 minutes) to 300 minutes (5 hours) week of moderate to vigorous intensity aerobic exercise ...or equivalent”
Additional benefits for “neuromotor” training, strength training, and more minutes (i.e. 300)
- Multidomain 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

what's wrong with “basic” exercise for brain health?

“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 cognition**
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

Controlled processing



Low

High

Cognitive stage

associative stage

autonomous stage

Experience/Practice

Working Memory demands

High

Low

Automatic processing

“Open Skill Exercise is more effective for improving some aspects of cognitive function compared with Closed Skill Exercise.”

Gu, Q., Zou, L., Loprinzi, P. D., Quan, M., & Huang, T. (2019). Effects of open versus closed skill exercise on cognitive function: A systematic review. *Frontiers in psychology*, 10, 1707.

Open



Closed

Environment is constantly changing

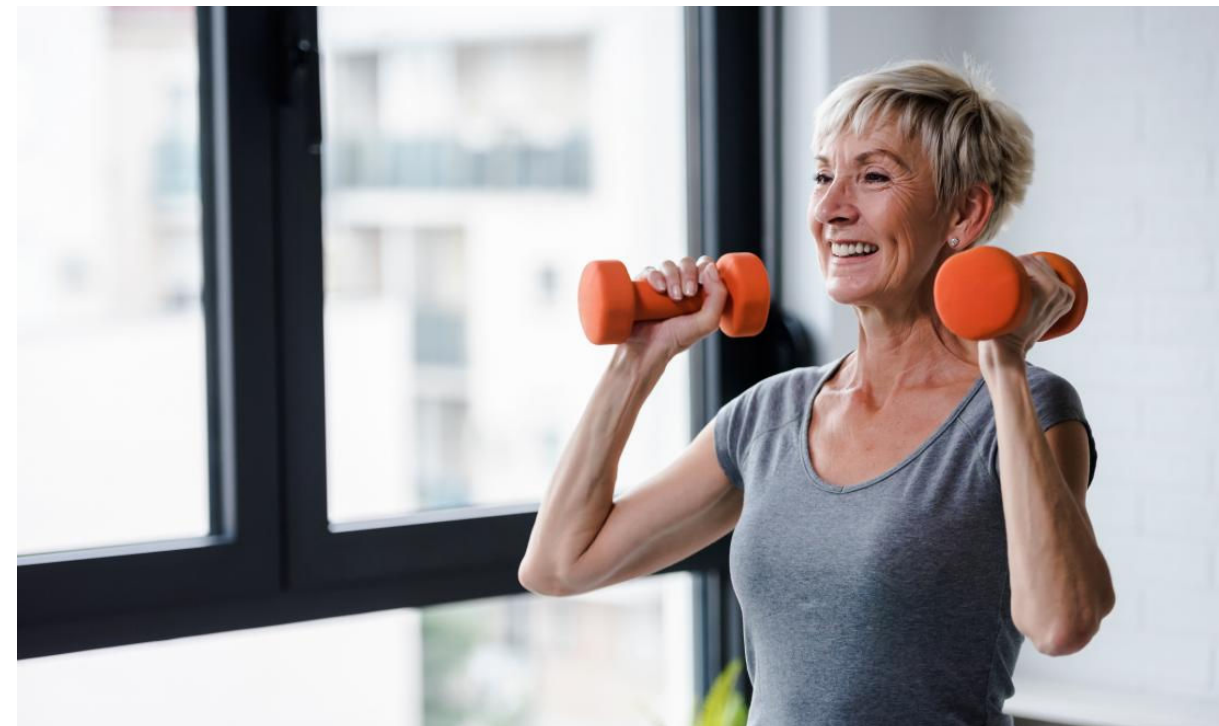
Stable & predictable environment

Movements have to be continually adapted

Movements have a clear beginning & end

Predominately externally paced

Performer knows what to do & when



Dual task definition

- To train individuals to be able to perform two tasks simultaneously, one primary and other secondary, that can be:
 - performed independently
 - measured separately
 - have distinct goals.

Adapted from McIsaac et al, Building a framework for a dual task taxonomy. Biomed Res Int 2015



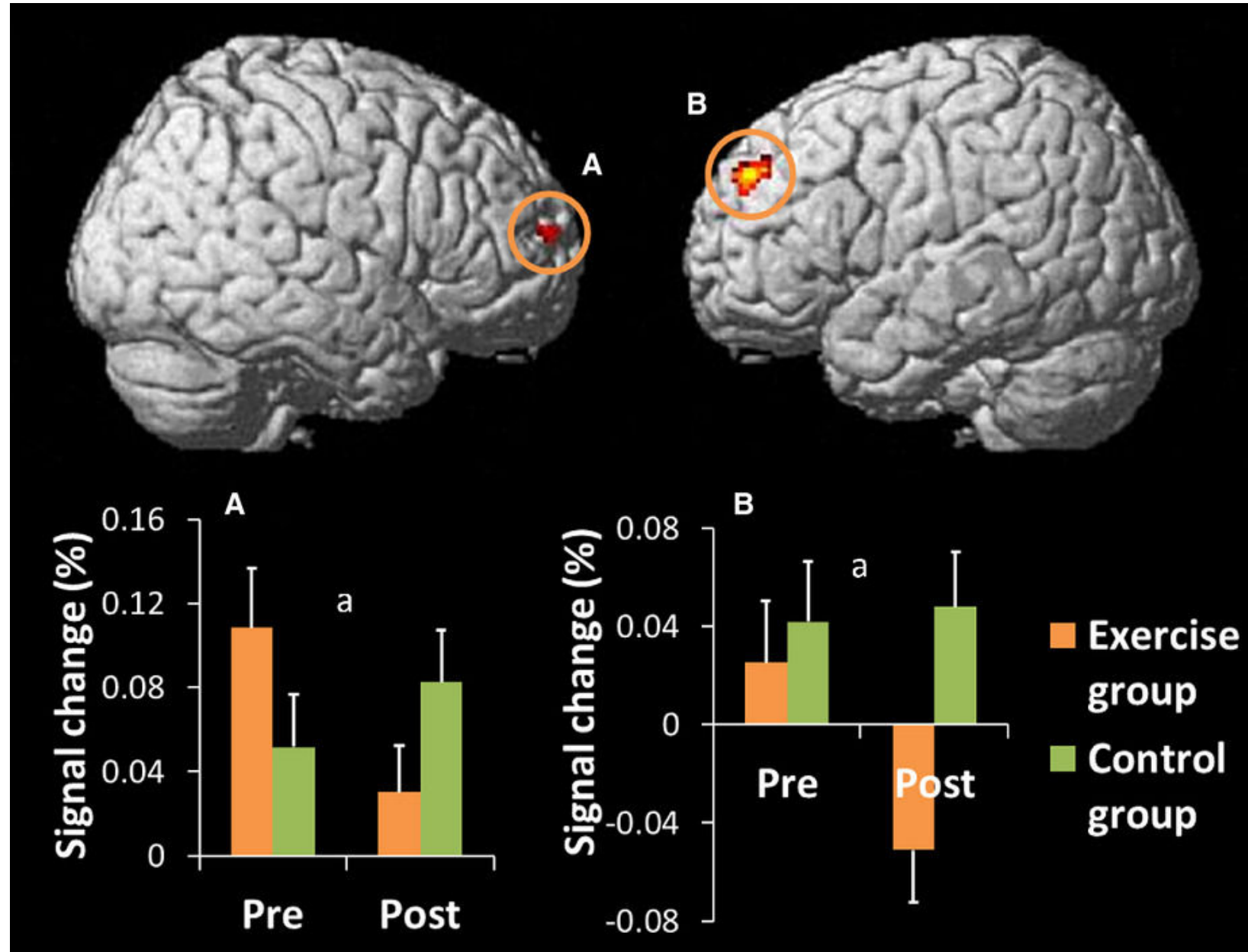
Is Dual Tasking Better than Physical Exercise Alone?

Zhu et al. (2016) combined data from 20 randomized controlled studies with 2667 participants and found:

- Dual tasking improved cognition greater than no intervention
- Dual tasking improves cognition more in older participants
- Dual tasking improved cognition better than physical exercise by itself
- Dual tasking effects appear to last longer than single tasking effects

Dual Tasking Leads to More Efficient Frontal Lobe Activity

Nishiguchi et al. (2015) reported that a 12-week program that combined physical and cognitive exercise yielded not only improvements in executive functioning performance (e.g., attention) but also led to more efficient brain activity (in the pre-frontal cortex) as measured by fMRI.



Dual-task interference increases with aging

Credit to John Dean & Josefa Domingues



Stop walking to talk



Word finding to talk while walking



Eating and talking



Short term recall of a password while setting up

types of dual-tasking



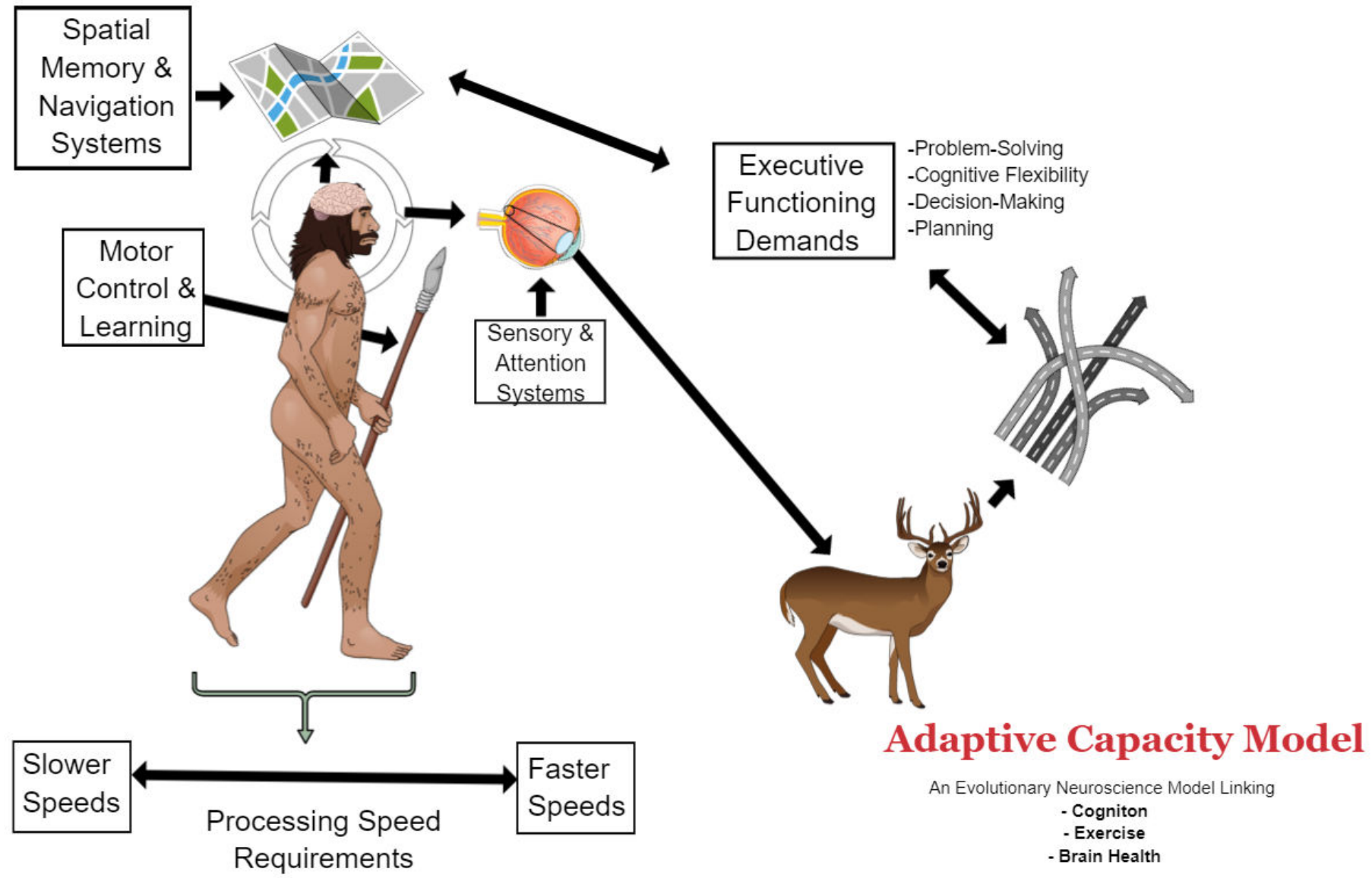
cognitive-motor



Motor-Motor



sensory-motor



Raichlen et al., 2017, Trends in Neuroscience

the 4 primary cognitive domains



attention

Includes attending (visually or auditory) to a stimulus in sustained, selective, switching, or divided capacities



processing speed

Less complex (bottom-up) processing that is based in time to response or reaction. Present in all tasks and measured by time.



executive functioning

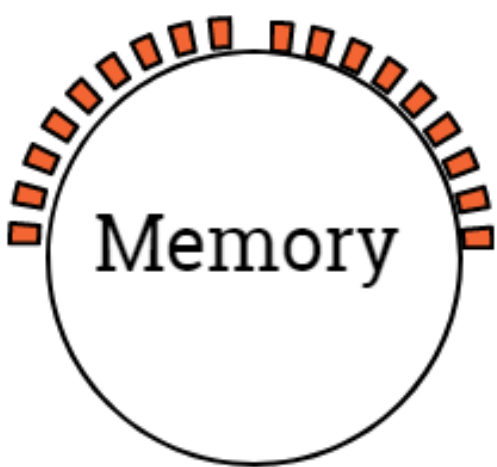
More complex (top-down) cognition. Inhibition, cognitive flexibility, planning, organizing, etc.



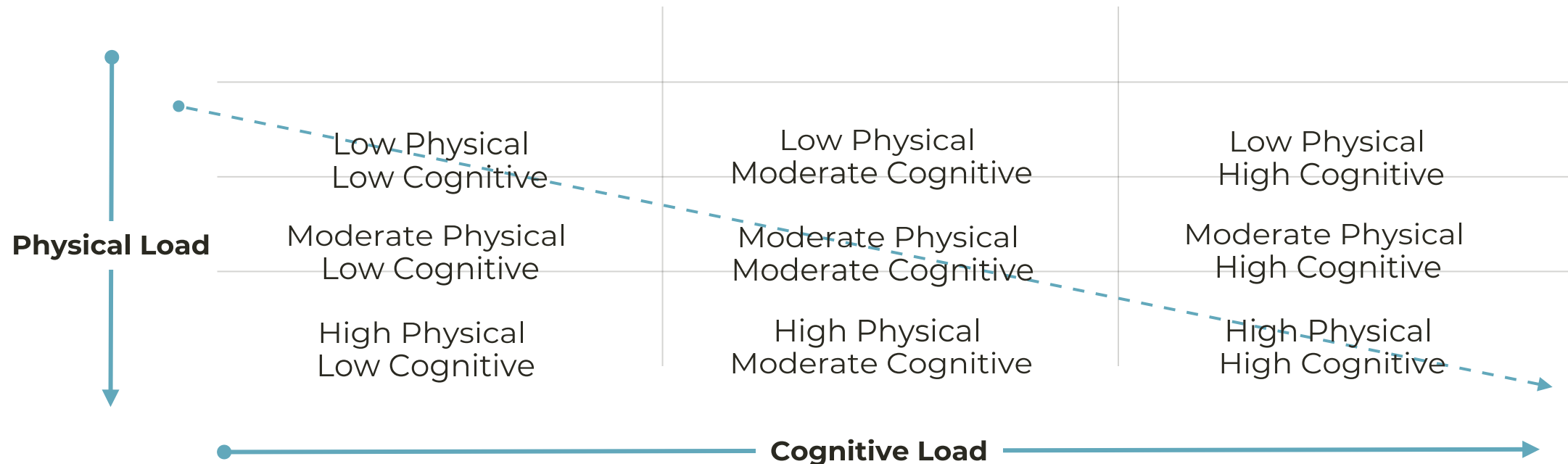
memory

The encoding, storage, and/or retrieval of information (verbal, visual, procedural). Working memory - short term - is a part of EF.

The Cognitive Domain "Volume Knobs"



Cognitive - Physical Loading Matrix



Leveling Cognitive + Physical Load

Difficulty Levels	Physical Load	Cognitive Loads
1	Low Physical Load	Low Cognitive Load
2	Medium Physical Load	Medium Cognitive Load
3	High Physical Load	High Cognitive Load





GOAL



LEARNING



SKILL



ACHIEVEMENT

GAMIFICATION CONCEPT

CHALLENGE



REWARD



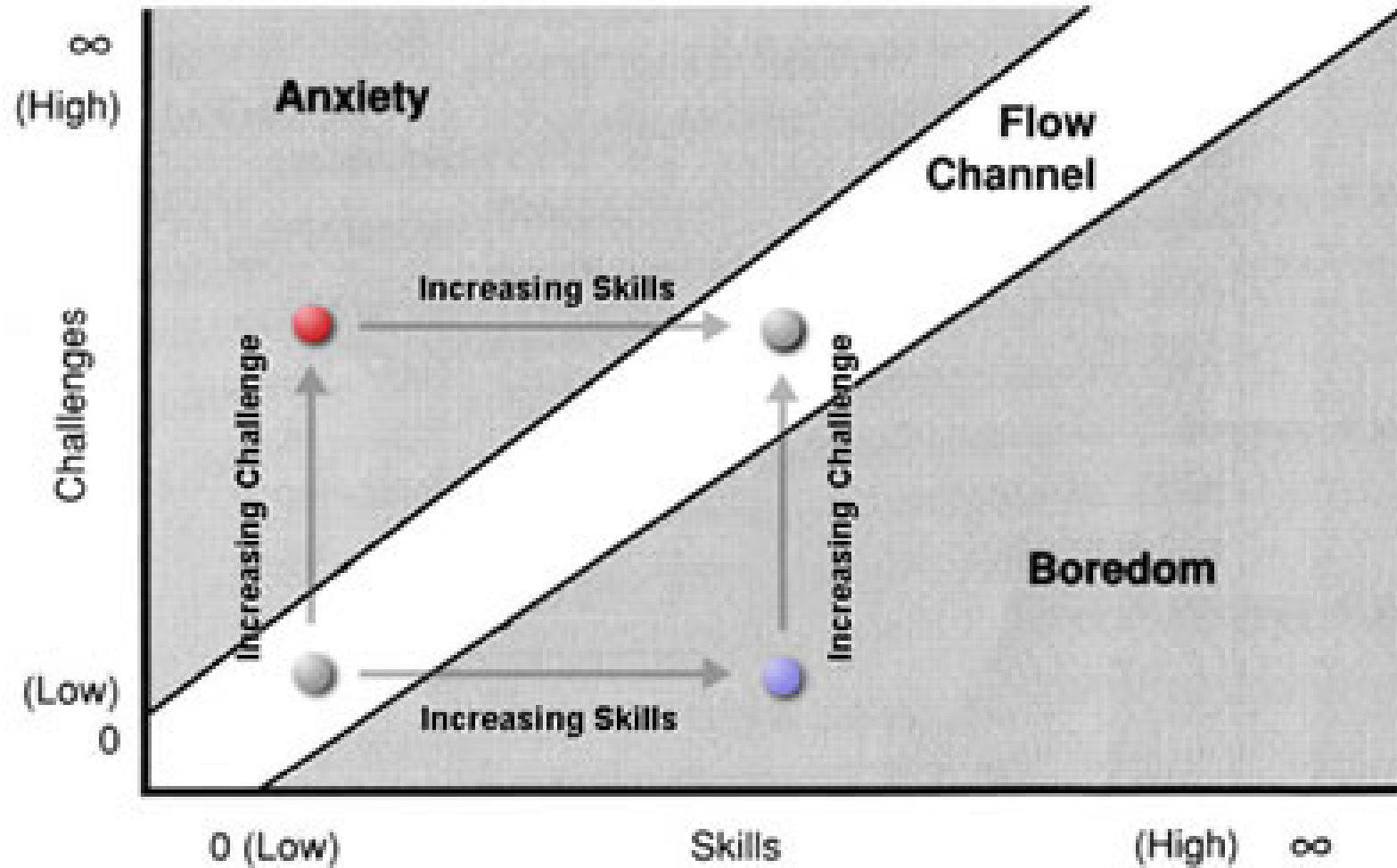
COMPETITION



USER ENGAGEMENT



flow state



Equipment

- stability balls
- medicine balls
- resistance tubing
- tennis balls
- agility dots
- cones
- balance pads
- agility ladders

Brain circuit

- **stability ball mirroring hugs**
Try Opposite/Opposing Resistance
- **medicine ball simon slams**
Reverse Cueing (Green is Now Stop, Stop in Now Go)
- **tennis ball choice reaction (l/r callouts)**
Call out sequence of L/R (LLRLRLR), Expand Distance for Larger Movements
- **agility dots callouts (or pointing)**
Reverse the Sequence of 3-5 dots
- **cone sequences**
Make Shapes by Callout OR Demonstration
- **Agility ladder sequences/movements (3-5)**
Point vs. Say (Stroop Steps)

stability ball

- **Stability ball mirroring hugs**
Sustained Attention Demand
- **Try Opposite/Opposing Resistance**
Requires Cognitive Flexibility & Impulse Control
- **Simultaneously Stand on Balance Pads**
Increases Sensory & Cognitive Flexibility Demands

medicine balls

- **Medicine ball simon slams**
- **Slam ball on “go” and/or “green”**
2-4 Stimuli Increases Working Memory Demand
Primarily Attention and Impulse Control
- **Reverse cueing**
“Go” is now “Stop” and/or “Green” is now “Red”
Increases Executive Functioning Demands

tennis balls

- **Tennis ball choice reaction**
- **left-right hand callouts (verbal Or visual)**
Impulse Control & Choice Reaction Time
- **Call out sequence of L/R (LLRLRLR)**
Increases Working Memory Demand
- **Expand Distance for Larger Movements**
Places Demands on Processing Speed (increases response time)

agility dots

- **Agility dots reactions**
Arrange in 4 Square
- **callouts (or pointing)**
Requires Sustained Attention
- **Assign Numbers and Callout Evens/Odds or color**
Increases Working Memory Demand
- **Create a sequence of 3-5 dots**
Reverse the Sequence of 3-5 dots
Increases Executive Functioning Demand

cones

- **callout or demonstrate cone sequences**
- **Assign cones by number of color**
Processing Speed to Match
- **create and reverse sequences**
Increases Working Memory Demand
- **callout or demonstrate shapes (connect dots)**
Requires Mental Rotation & Visuospatial Working Memory

agility ladder

- **Agility ladder sequences/movements**

Pick 3 Movements to Execute

Assign A Number or Other Identifier (Letter) to each Movement

- **Point vs. Say (Stroop Steps) during in-outs**

Point Left, But Say Right: Instruct to Attend to Either Visual or Verbal (alt)

Increases Executive Functioning Demands

Brain circuit

- **stability ball mirroring hugs**
Try Opposite/Opposing Resistance
- **medicine ball simon slams**
Reverse Cueing (Green is Now Stop, Stop in Now Go)
- **tennis ball choice reaction (l/r callouts)**
Call out sequence of L/R (LLRLRLR), Expand Distance for Larger Movements
- **agility dots callouts (or pointing)**
Reverse the Sequence of 3-5 dots
- **cone sequences**
Make Shapes by Callout OR Demonstration
- **Agility ladder sequences/movements (3-5)**
Point vs. Say (Stroop Steps)

nuances of delivering cognitive load

- **to trivia or not to trivia?**

Many mainstream dual-tasks focus on trivia (presidents, media, famous people, music, foreign language, etc), but these are based on semantic memory which is not affected by age or transfer to real-life

- **are coordinative tasks cognitive tasks?**

Coordinative tasks offer more cognitive load than non-coordinative tasks in most cases, but DO NOT guarantee sufficient or targeted cognitive load

Cerebellum vs. Prefrontal Cortex

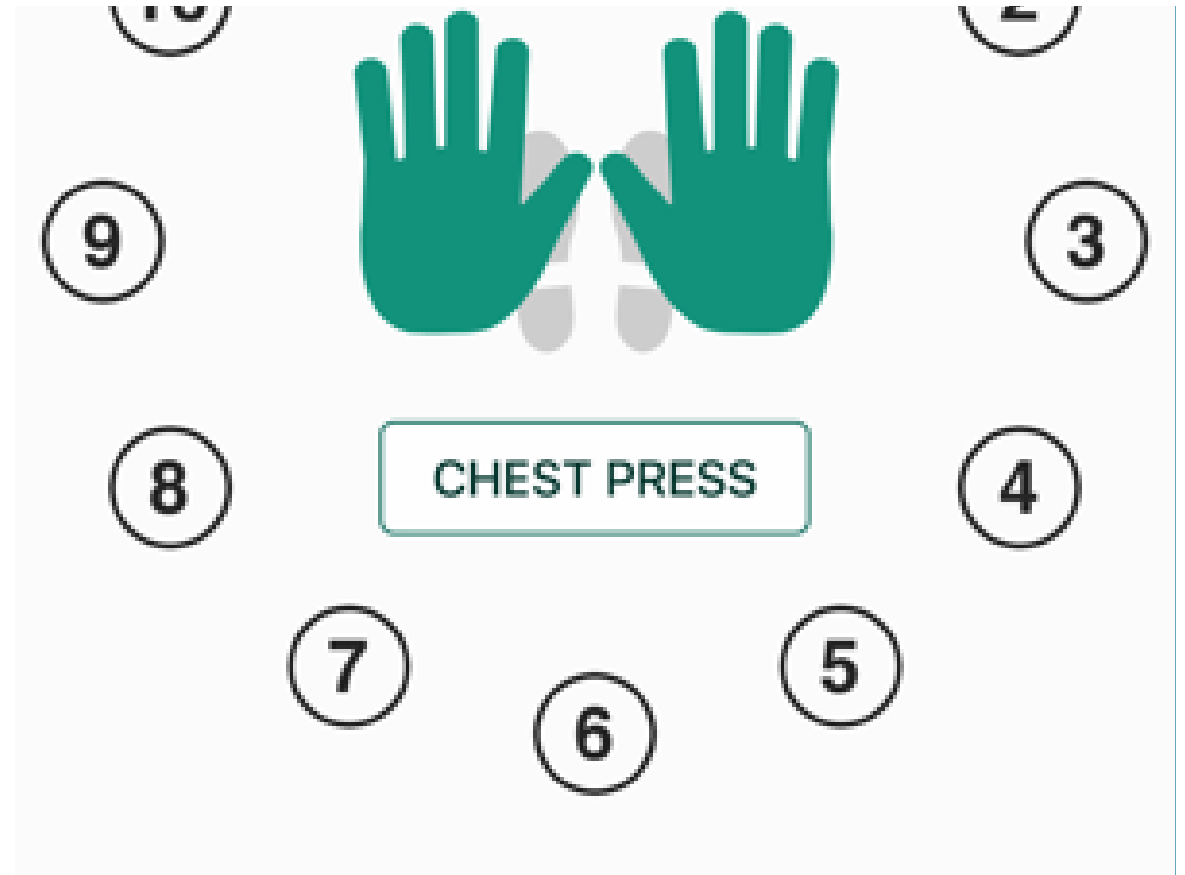
- **Full session or part?**

Cognitive tasks CAN comprise a full-session AND/OR be a component of any exercise session

apps



switched on

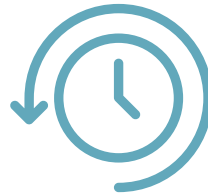


clock yourself

acute variables



frequency



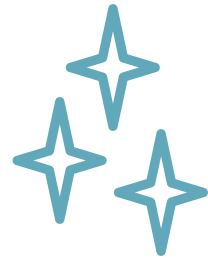
duration



intensity



skill



novelty



environment

elements of a “brain-healthy” exercise program

- minimum of 150 minutes (2.5 hours) per week
- multi-domain (aerobic + resistance + Neuromotor)
- incorporates low, moderate & high intensities
- incorporate open skill & cognitive demands
- design for enjoyment & behavior change

lifestyle factors that influence brain health & cognition



exercise & physical activity



sleep



diet



stress management



medications



comorbidities



cognitive stimulation



social support

www.brainhealthtrainer.com

Use Code **BRAIN300** for 50% off Enrollment



BRAIN HEALTH TRAINER

ACE →
APPROVED



A young man in a red long-sleeved shirt is smiling and looking towards an older man in a blue t-shirt. They are in a gym setting with a treadmill visible in the background. The older man is leaning forward, looking intently at something out of frame.

ACE Senior Fitness Specialist: Booth 347

www.acefitness.org/idea2022

ACE SPECIALIST PROGRAM

Senior Fitness

As an ACE Senior Fitness Specialist, you'll help a growing population of older adults gain strength, ward off muscle deterioration and reduce instances of inactivity-related disease and cognitive decline.



Ryan Glatt, MS, CPT, NBC-HWC

 @glatt.brainhealth

 www.brainhealthtrainer.com
BRAIN300

 rglatt8@gmail.com