#ideaworld

IDEA WORLD CONVENTION

FITNESS • NUTRITION • BUSINESS

Boosting the Brain with Cognitive Tasks

PRESENTED BY

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ACE MOVER ACADEMY 2022

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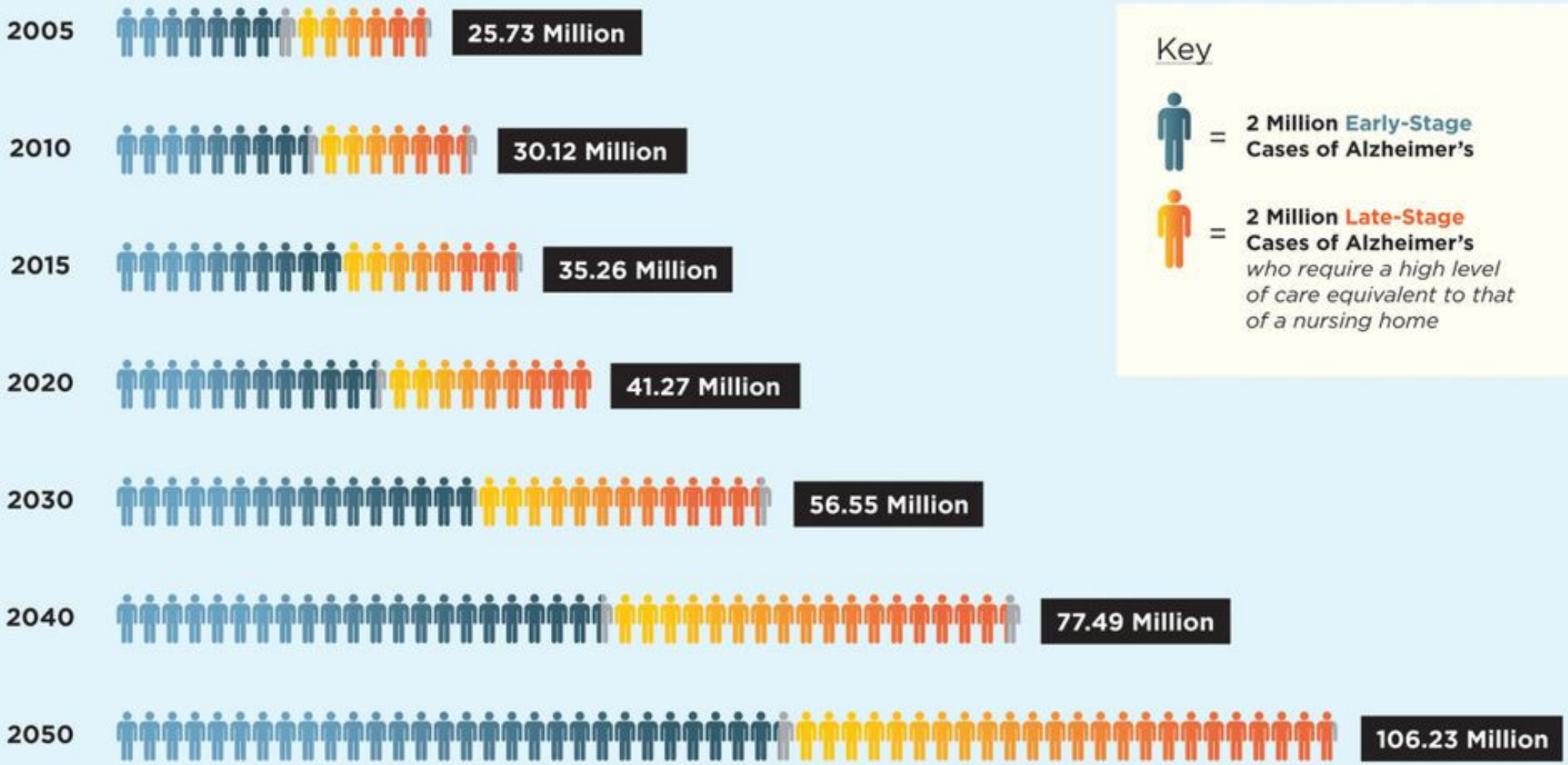
WORLDWIDE PROJECTIONS OF ALZHEIMER'S PREVALENCE

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



*Adapted from "Forecasting the global burden of Alzheimer's disease," by Ron Brookmeyer, Elizabeth Johnson, Kathryn Ziegler-Graham, and H. Michael Arrighi, 2007, Alzheimer's & Dementia, volume 3, p. 189. Copyright 2007 by The Alzheimer's Association.

conditions that affect cognition and brain health

Medications

Obesity & Metabolic disorders

Cardiovascular Conditions

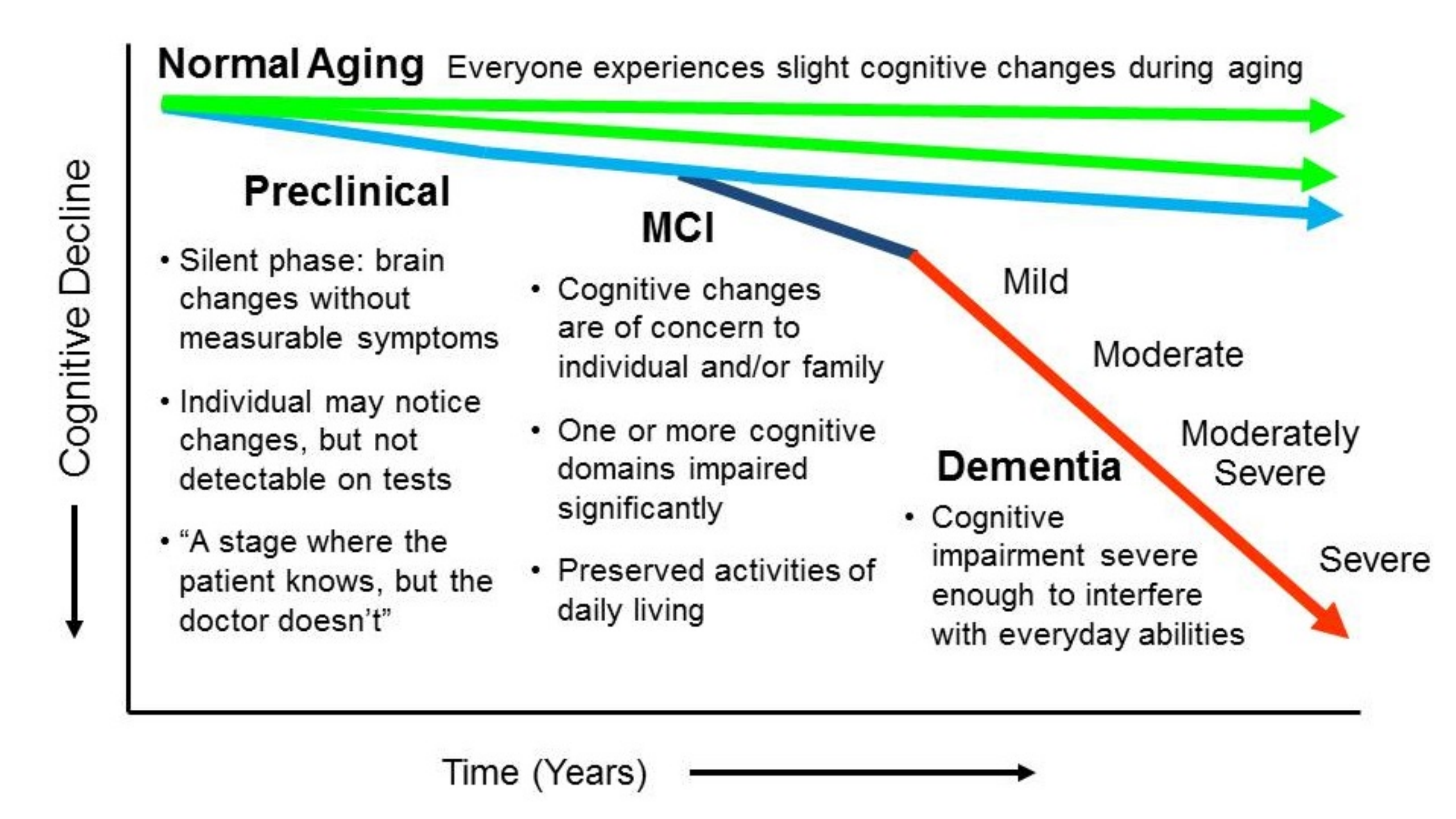
Cancer & Chemotherapy

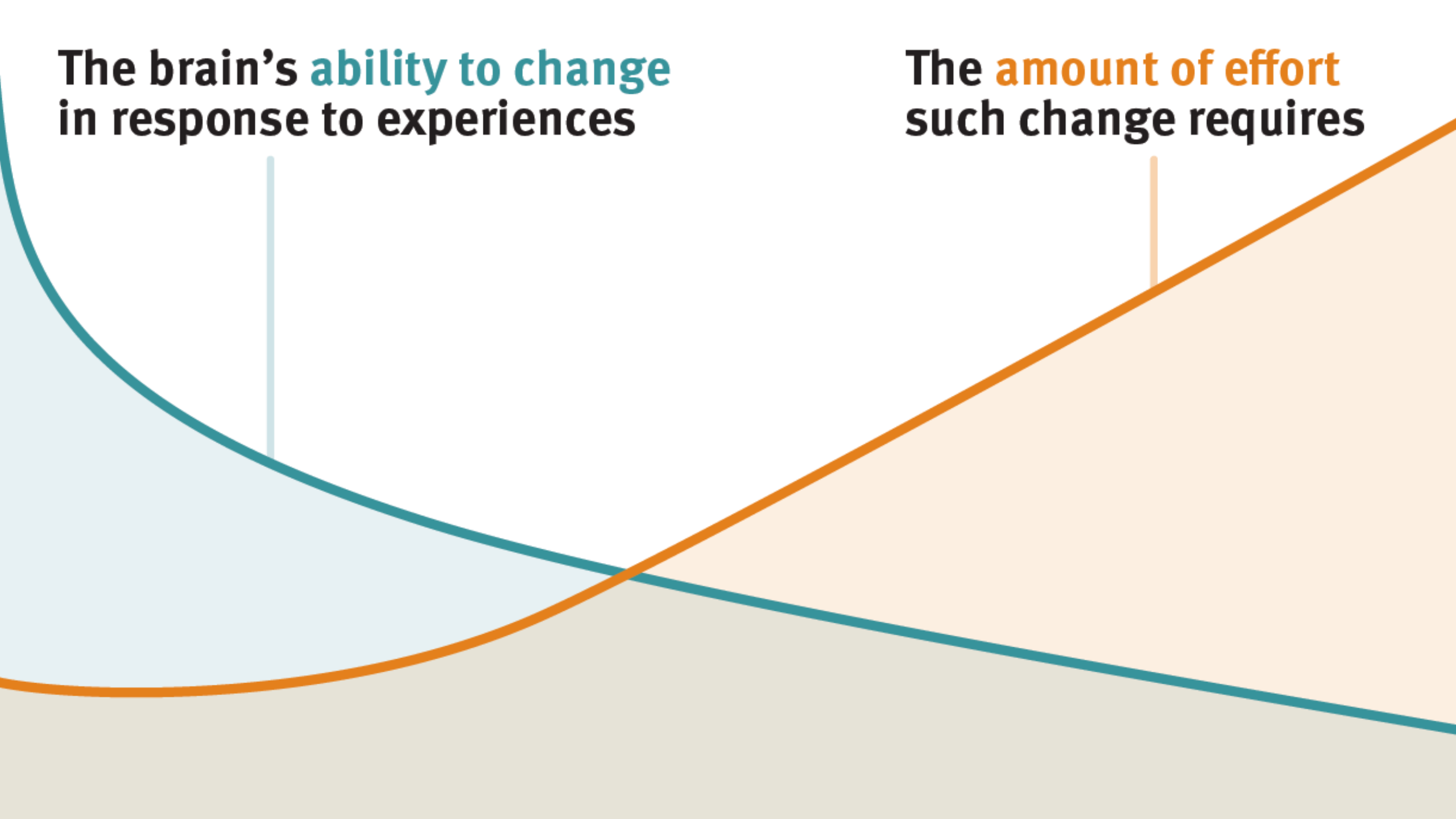
Neurological & Neurodegenerative Conditions

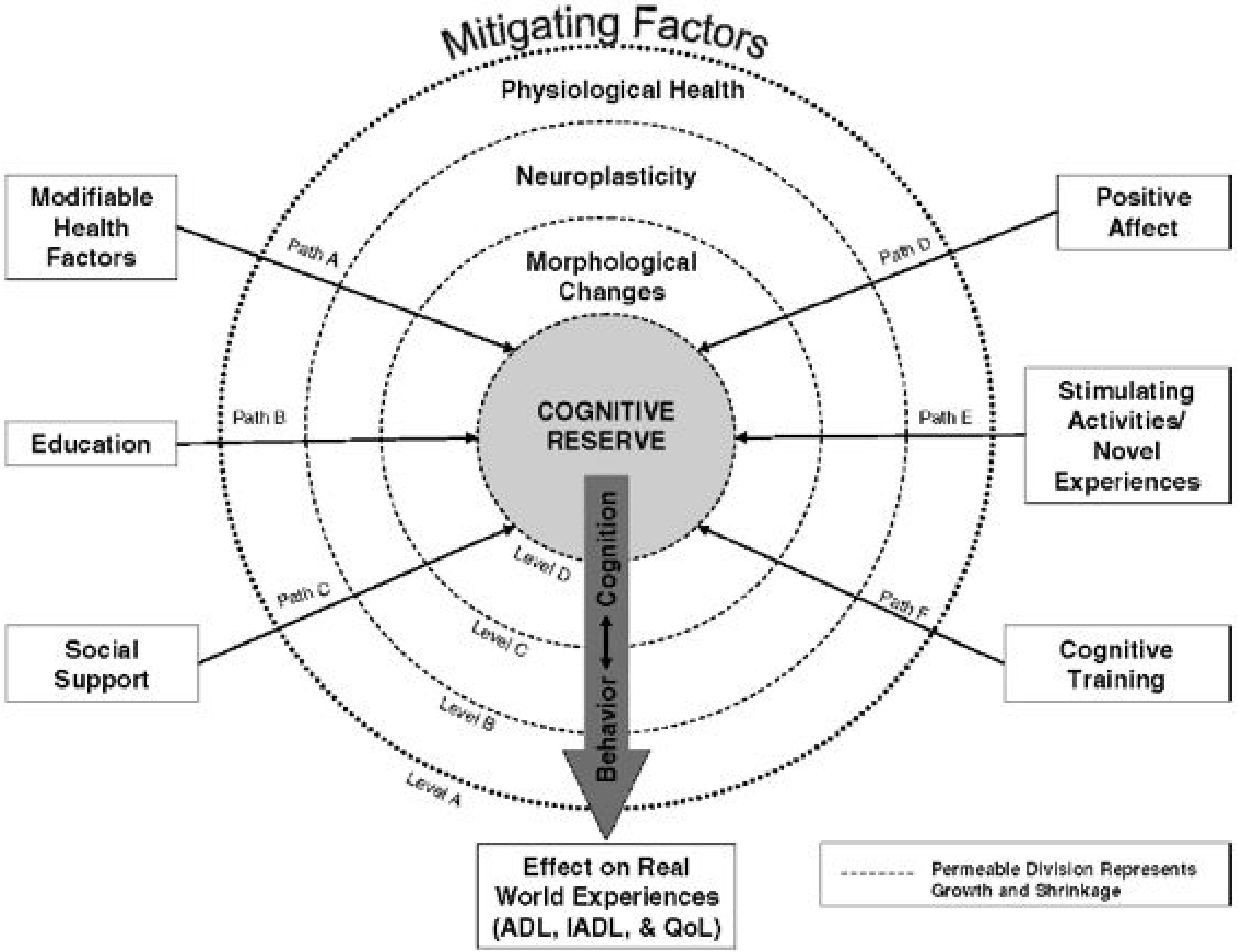
Mental Health

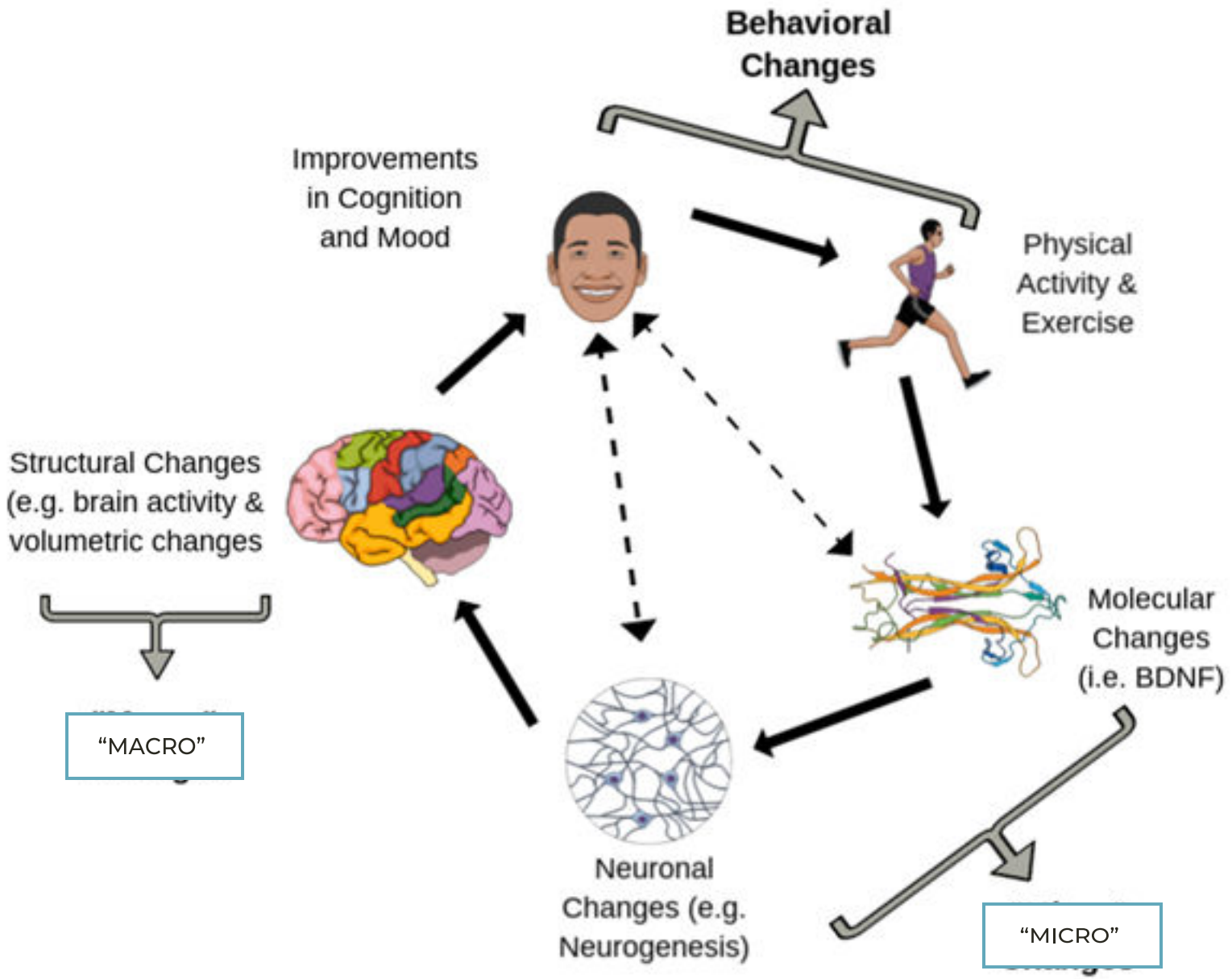
what constitutes brain health (respective to age)?

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


Normal Aging
Everyone experiences slight cognitive changes during aging
Preclinical
• Silent phase: brain changes without measurable symptoms
• Individual may notice changes, but not detectable on tests
• "A stage where the patient knows, but the doctor doesn't"
MCI
• Cognitive changes are of concern to individual and/or family
• One or more cognitive domains impaired significantly
• Preserved activities of daily living
Dementia
• Cognitive impairment severe enough to interfere with everyday abilities
Mild
Moderate
Moderately Severe
Severe
Cognitive Decline
Time (Years)

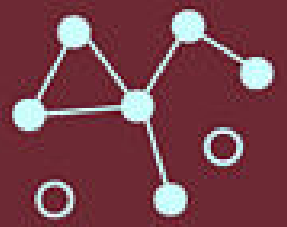

The brain's ability to change in response to experiences
The amount of effort such change requires


Mitigating Factors
Physiological Health
Neuroplasticity
Morphological Changes
COGNITIVE RESERVE
Modifiable Health Factors
Education
Social Support
Positive Affect
Stimulating Activities/ Novel Experiences
Cognitive Training
Path A
Path B
Path C
Path D
Path E
Path F
Level D
Level C
Level B
Level A
Behavior
Cognition
Effect on Real World Experiences (ADL, IADL, & QoL)
Permeable Division Represents Growth and Shrinkage



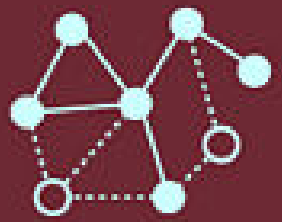
how exercise can affect the brain

- **behavioral**
  - Mood
  - Cognition
- **"Micro"**
  - Neurons
  - Vessels
  - Growth Factors
- **"Macro"**
  - Function
  - Structure



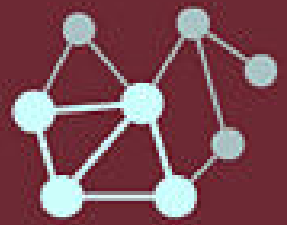
NEUROGENESIS

Continuous generation of new neurons in certain brain regions



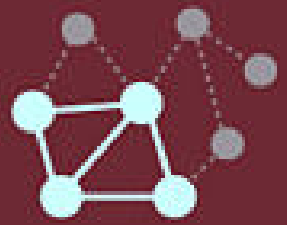
NEW SYNAPSES

New skills and experiences create new neural connections



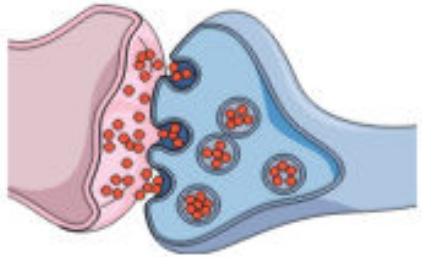
STRENGTHENED SYNAPSES

Repetition and practice strengthens neural connections

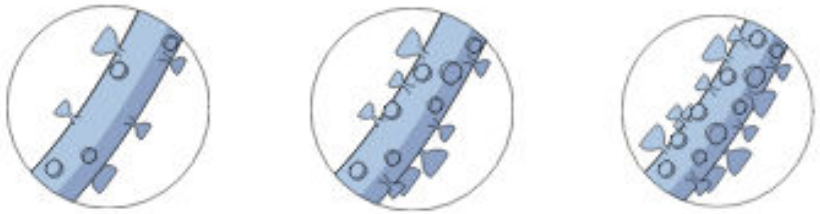


WEAKENED SYNAPSES

Connections in the brain that aren't used become weak

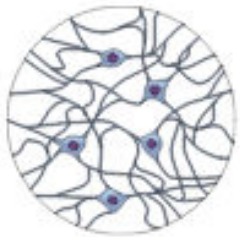


Synaptic Modification → **Milliseconds**

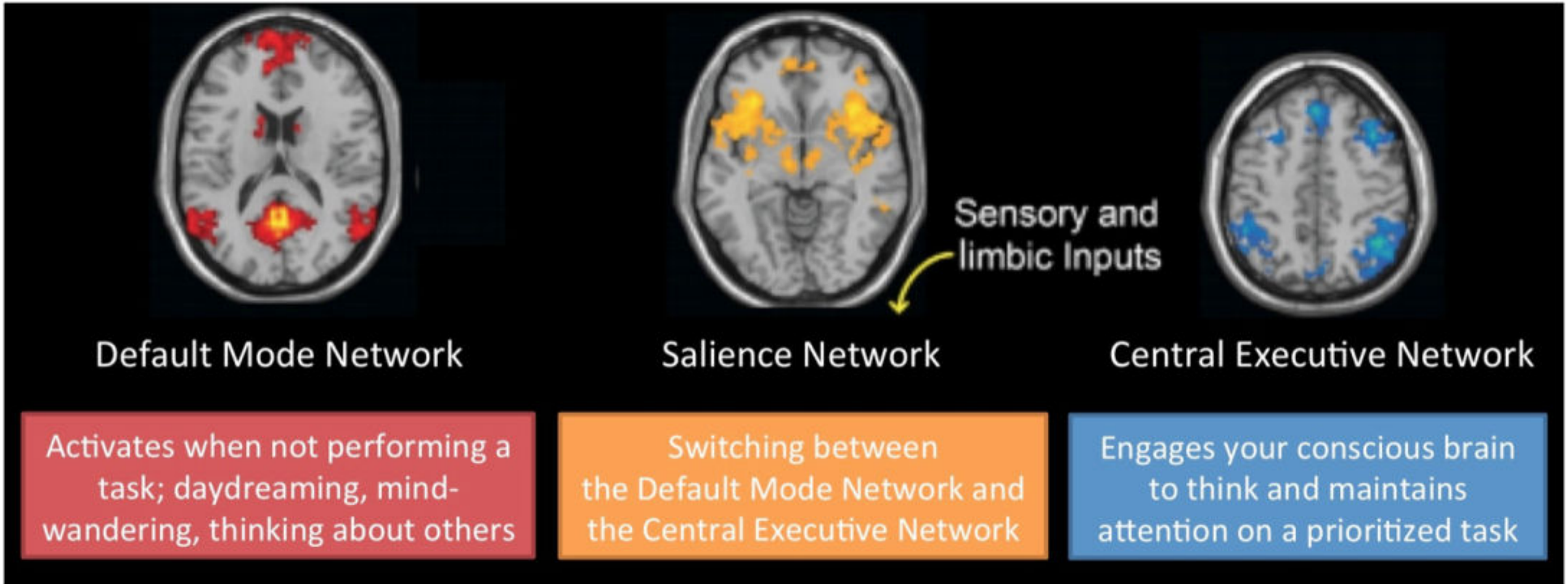


Branching of Synapses & Dentrites → **Several Hours**

New Brain Cells → **Several Days**



Neuronal Network Changes → **Several Weeks and Months**


Sensory and
limbic Inputs
Default Mode Network
Salience Network
Central Executive Network
Activates when not performing a task; daydreaming, mind-wandering, thinking about others
Switching between the Default Mode Network and the 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

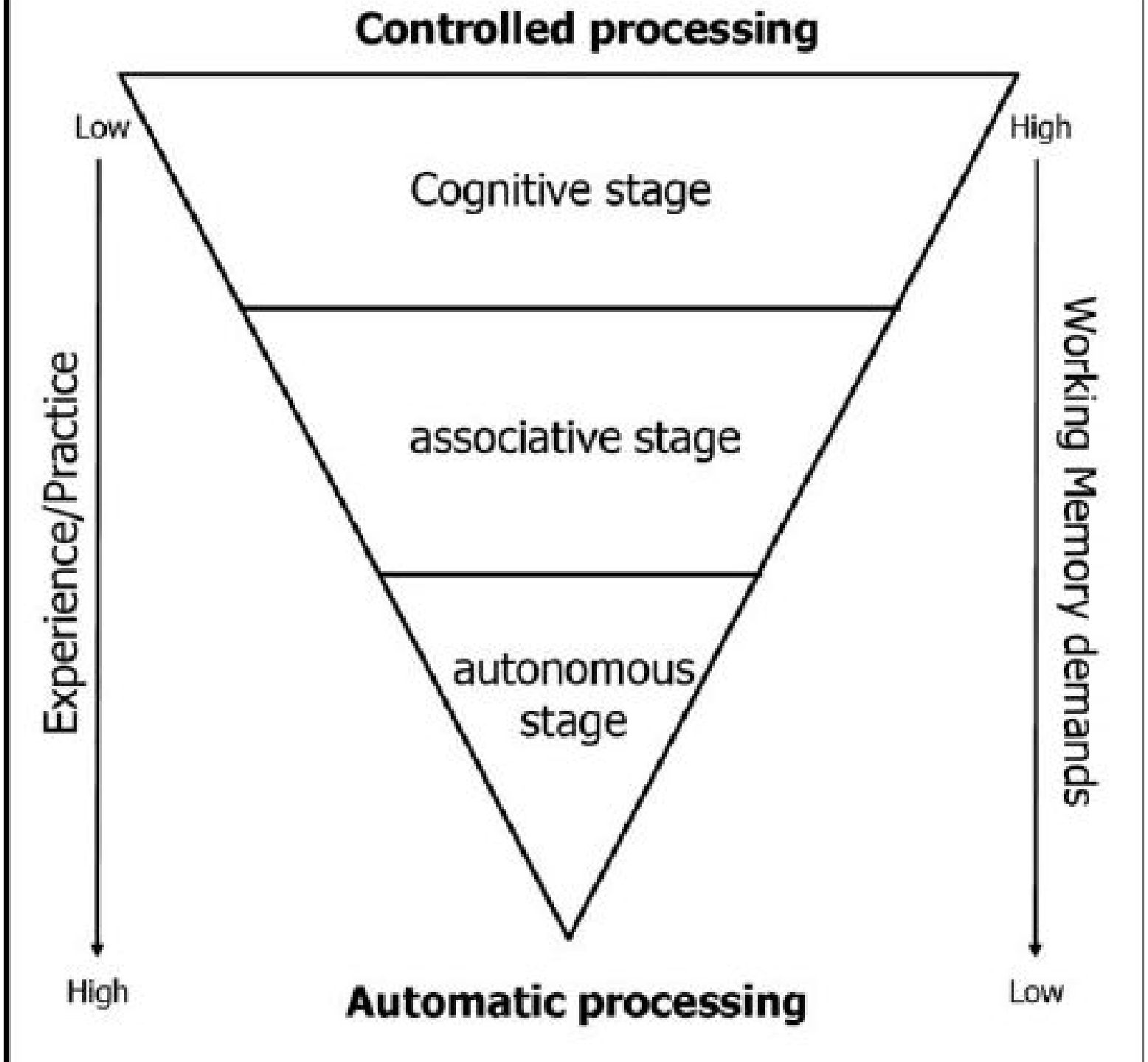
- 52 hours of exercise leads to improvements in EF's & processing speed in older adults - regardless of modality

  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 Exericse 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

Movements have to be continually adapted

Predominately externally paced

Stable & predictable environement

Movements have a clear beginning & end

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

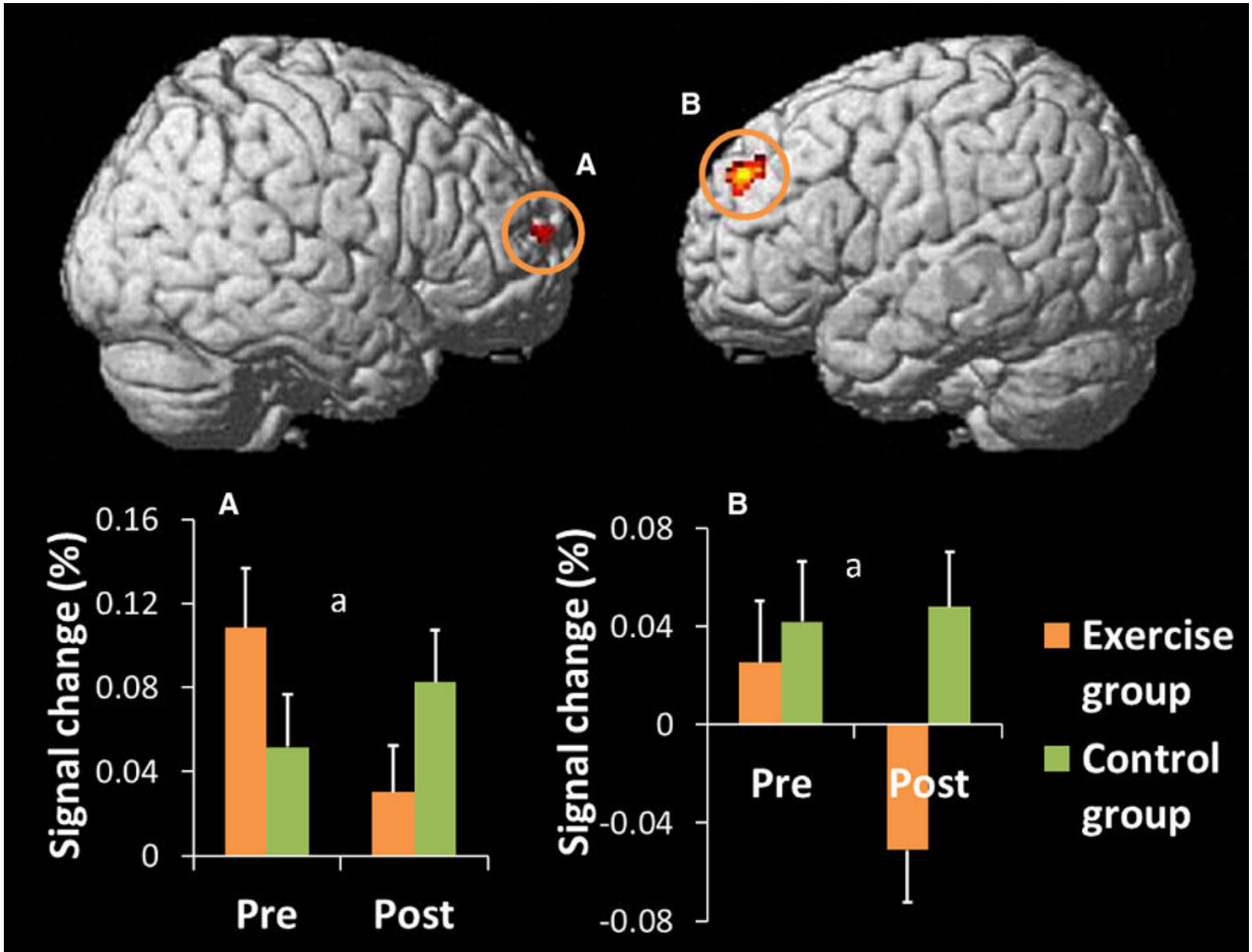
Is Dual Tasking Better than Physical Exercise Alone?

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 improved cognition better than physical exercise by itself
- Dual tasking improves cognition more in older participants
- 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

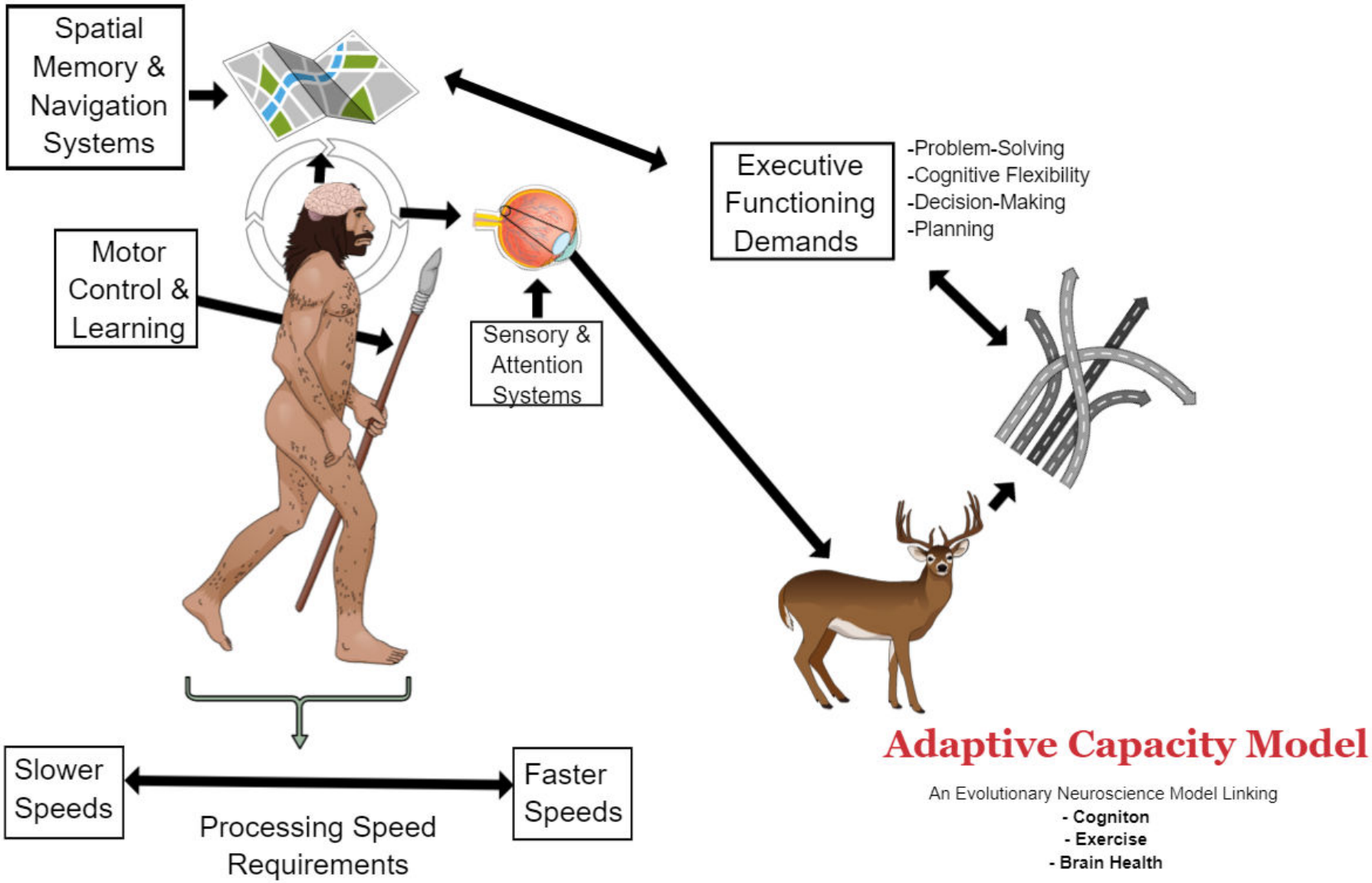
Short term recall of a password while setting up

types of dual-tasking

cognitive-motor

Motor-Motor

sensory-motor



Adaptive Capacity Model

An Evolutionary Neuroscience Model Linking

- Cogniton

- Exercise

- Brain Health

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.

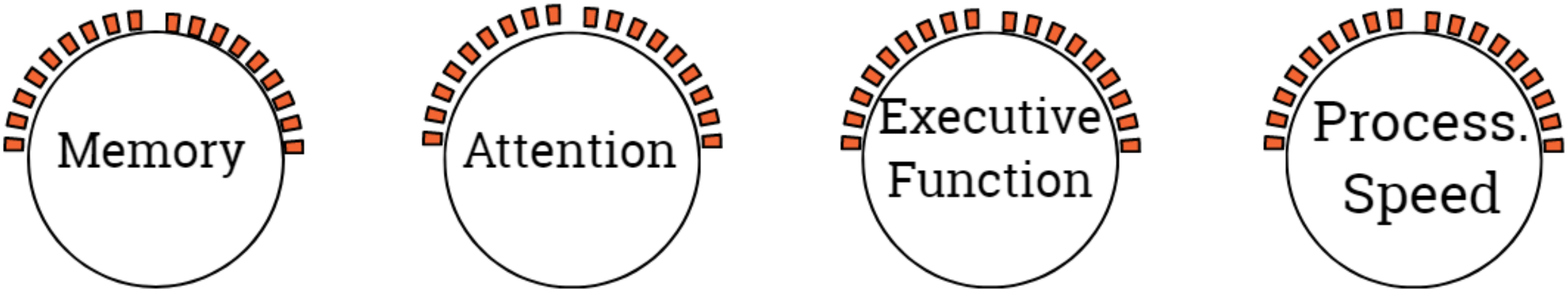
executive functioning

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

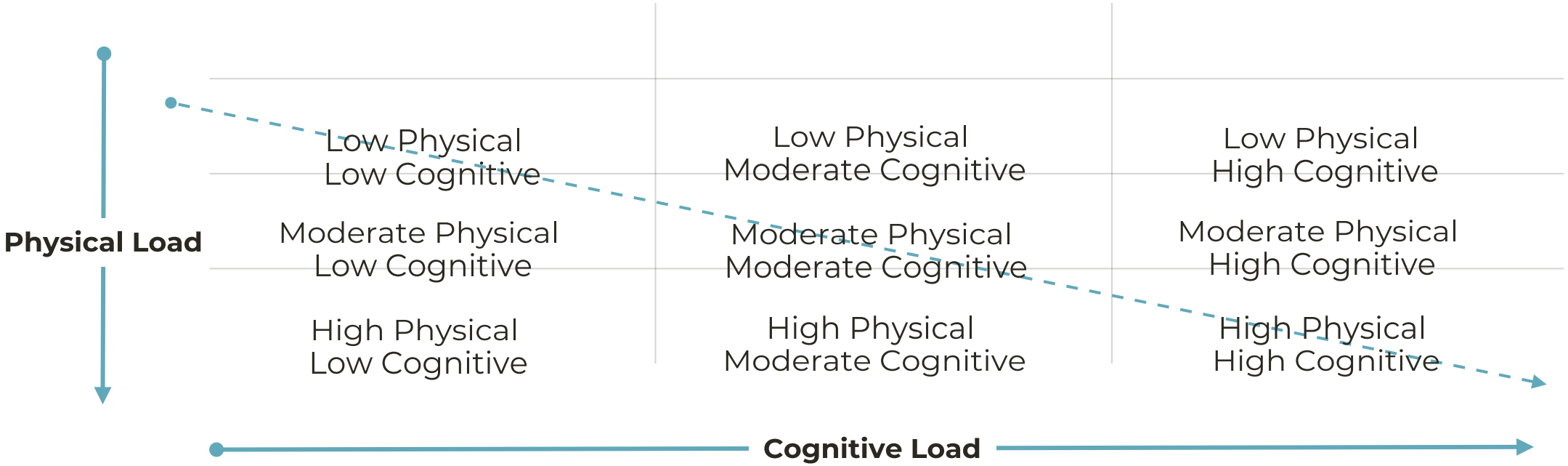
memory

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

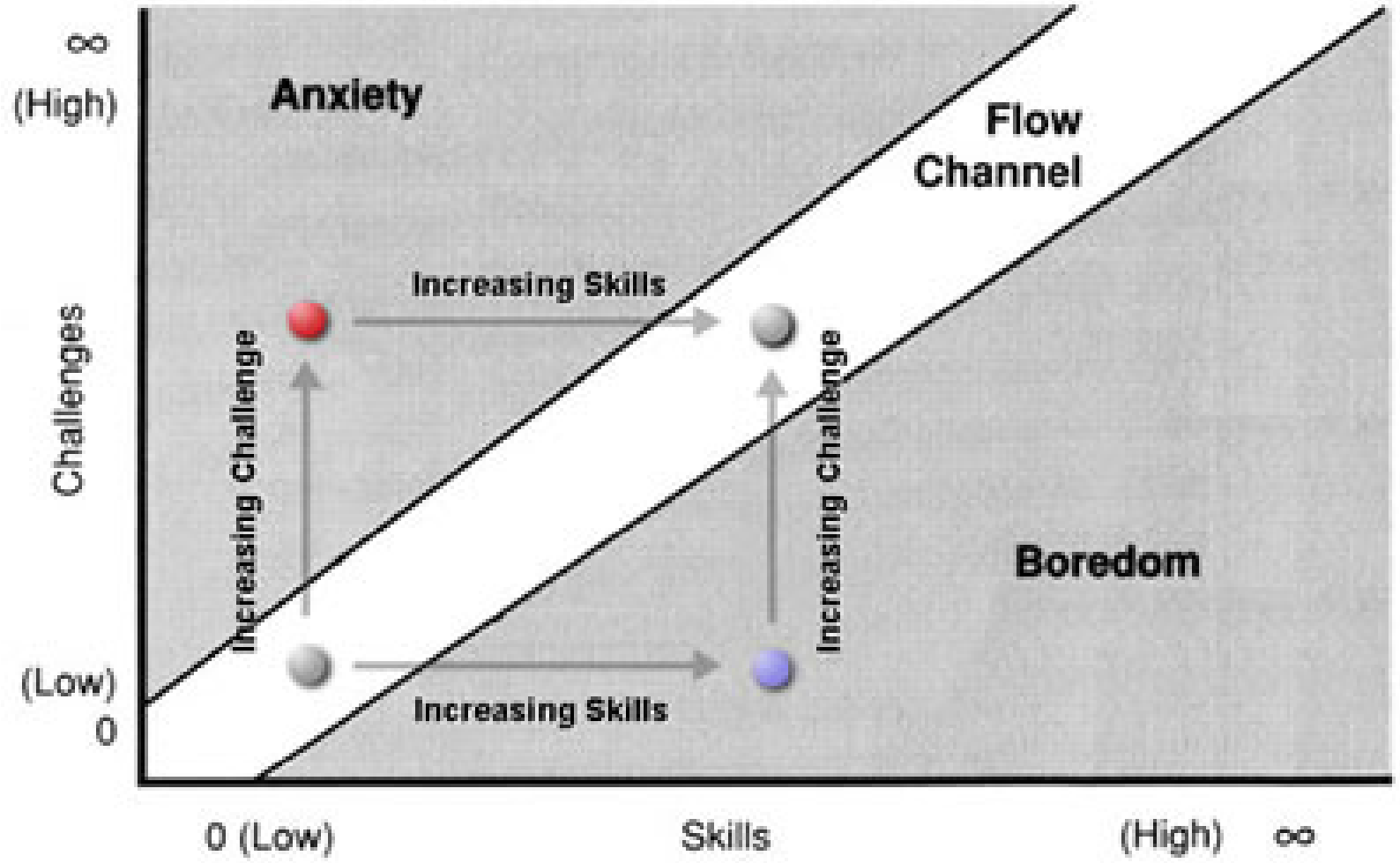


Leveling Cognitive + Physical Load

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

GAMIFICATION CONCEPT

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 0r 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 of 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
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  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

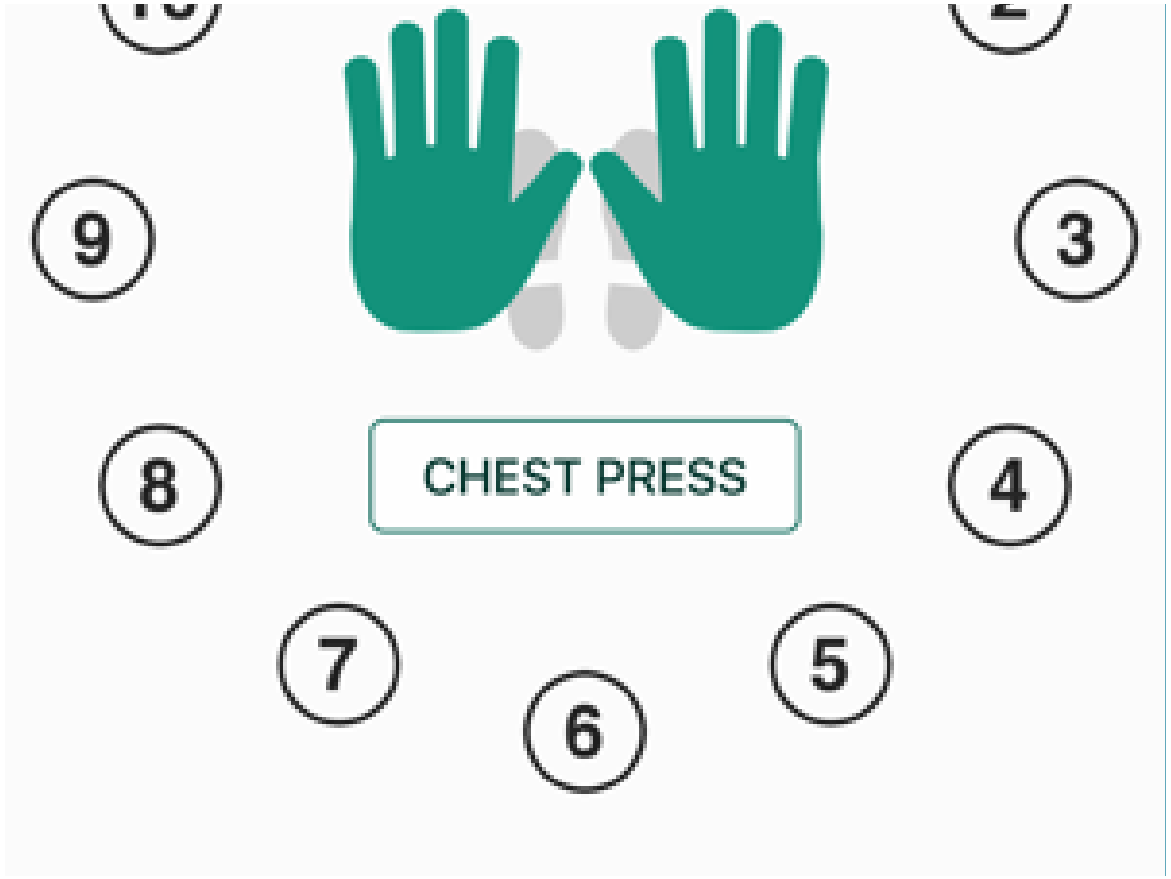
  Cerebellum vs. Prefrontal Cortex

- **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

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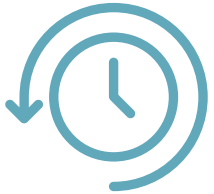
acute variables

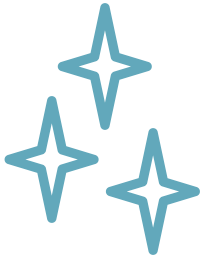
frequency



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

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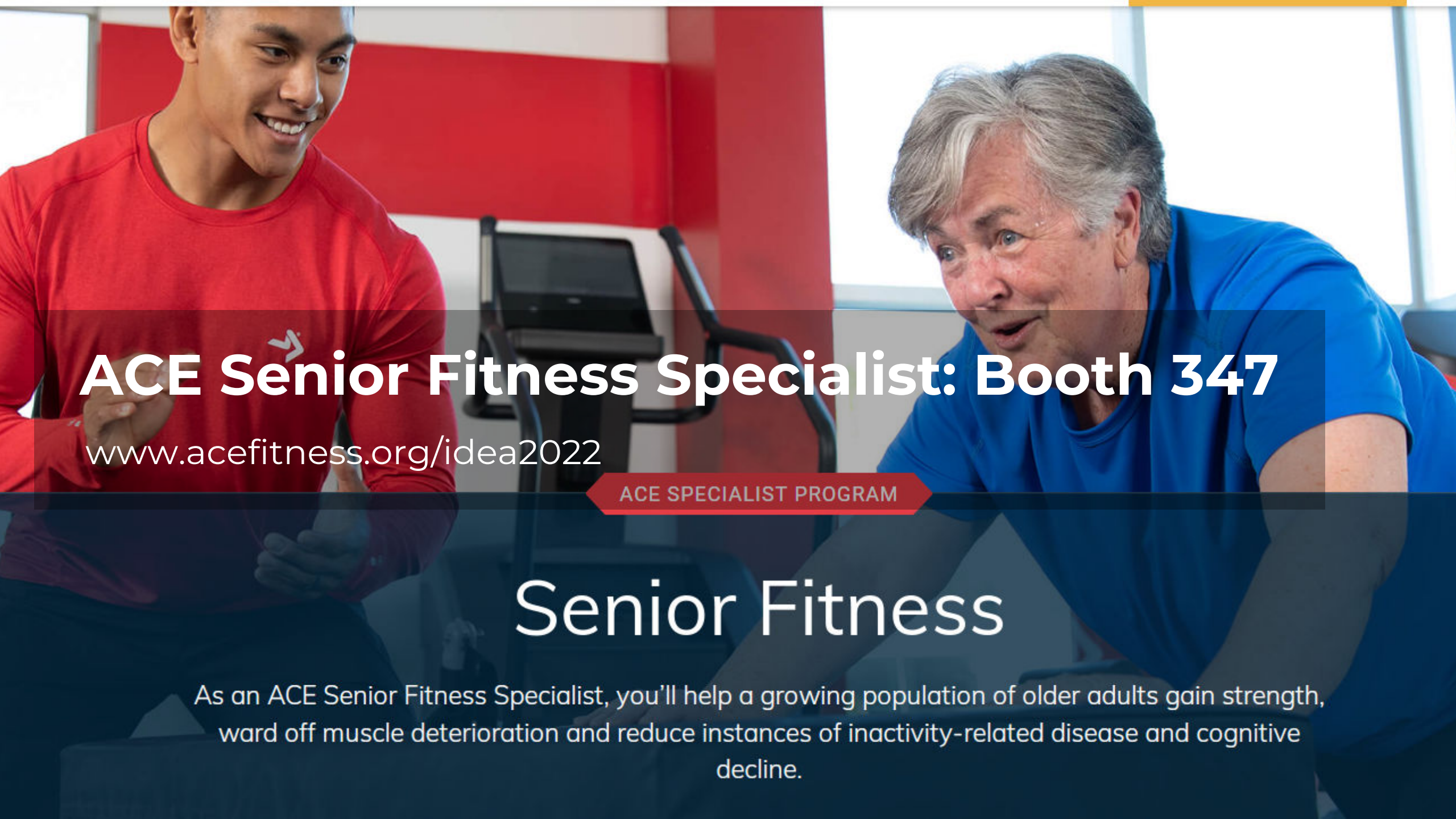
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ACE SPECIALIST PROGRAM
Senior Fitness
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