



The Chilmark Longevity Series, #4

Smart Body – Healthy Brain

Using movement and exercise to support brain health and slow cognitive decline



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The Chilmark Series on Longevity



#1: Longevity: A Start-up Guide



#2: Mobility: Priming the Body for Movement



#3: How to Train Your Balance



#4: Smart Body – Healthy Brain: Movement for brain health



#5: Eating for Longevity

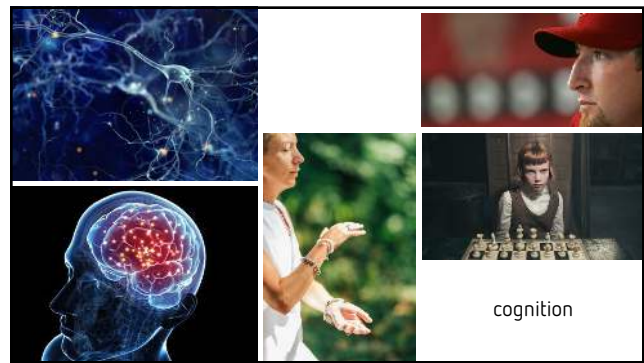


#6: Cracking the Stress/Sleep Code

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Defining cognition

The **mental functions** that allow us to acquire knowledge and understanding through **sensory input, experience, emotion and thought**, allowing us to **interact** with the world around us, and within us.

4 domains of cognitive function:

- 1. Executive Function** (organizing, planning, impulse control, emotional regulation)
- 2. Attention** (sustained focus, productivity, time management, multi-tasking)
- 3. Memory** (task sequence, names / faces, words, conversations)
- 4. Processing Speed** (thought to action, reaction time)

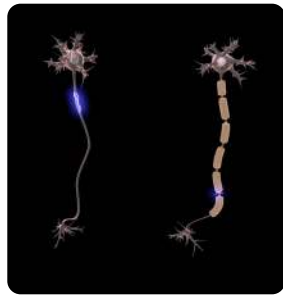
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- Motor Cortex:**
 - Processing Speed
 - Planning, execution, and control of movement
- Parietal Lobe:**
 - Language
 - Processing proprioceptive and visuospatial info to create a sensory picture of the world
 - Arm-hand-eye coordination and action
- Hippocampus:**
 - Memory
 - Short- and long-term, and spatial memory formation
- Prefrontal Cortex:**
 - Executive functioning
 - Motor planning
 - Short-term memory
 - Decision making
 - Impulse control
- Cerebellum:**
 - Motor control
 - Attention
 - Language
 - Emotion
- Occipital Lobe:**
 - Attention
 - Visual-spatial processing & motor control
 - Processing visual attention
 - Associated with memory formation and recognition

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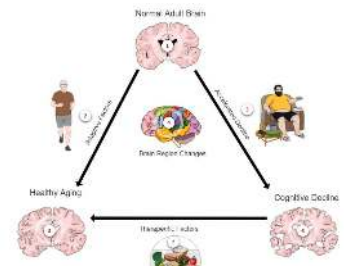
The normal course of cognitive aging

- Micro-level changes include:
- Changes to **size** and **function** of neurons
 - Reduction in **myelin sheath**, resulting in **slower nerve signal** transmission
 - Decrease in the number of **functioning synapses**



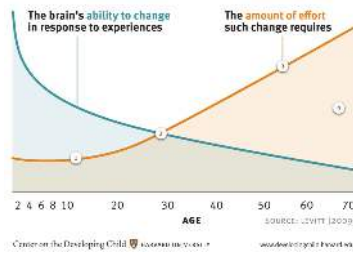
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Cognitive aging and brain volume



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Cognitive Reserve, Neuroplasticity, & F#min



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Exercise and the Brain



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movement vs. exercise



movement



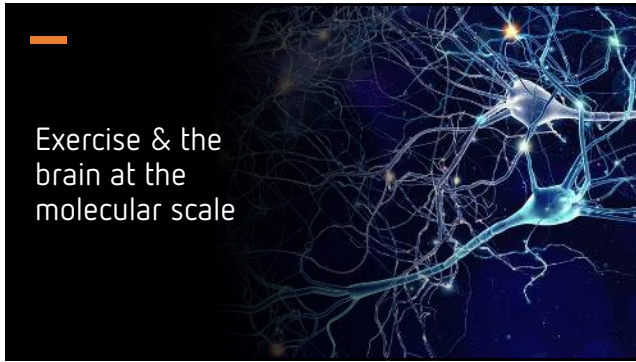
exercise

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How exercise changes the brain



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Neurotrophins


Growth-promoting proteins expressed during exercise

1. BDNF (Brain Derived Neurotrophic Factor)
 - Promotes new neuron growth and **neuroplasticity**
 - Produced during muscle contraction, as well as in the brain
2. VEGF (Vascular Endothelial Growth Factor)
 - Stimulates the production of blood vessels (angiogenesis), thereby...
 - increasing **vascular density** in the brain






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the molecular scale, cont'd...



3. Promotes **metabolic health** in brain
 - **Blood flow** delivers oxygen and nutrients to active regions of the brain
 - Occurring in parallel with electrical impulses resulting from neurochemical signals
4. Improves the function of the **glymphatic system**
 - A network of vessels that clear waste from the brain



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How the brain changes

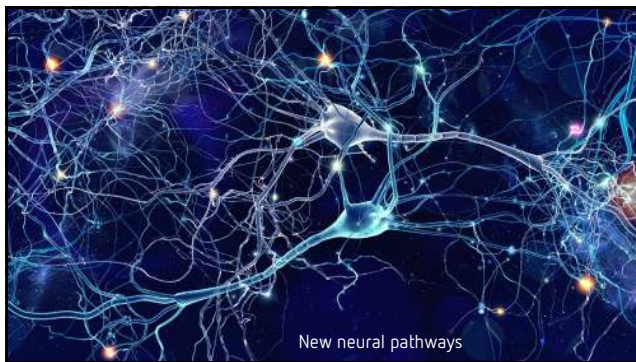
Neurogenesis

Myelination

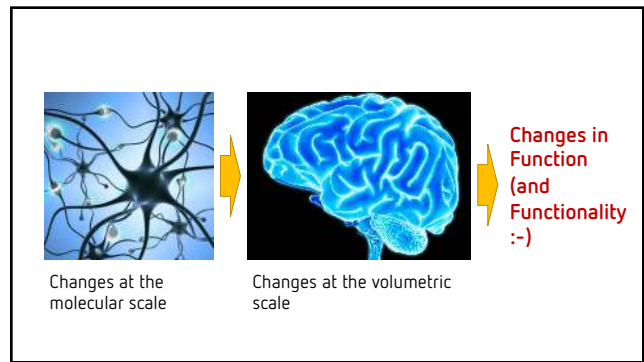
Synaptogenesis

Angiogenesis

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Recommended weekly dose:

- 150 – 300 mins (2 ½ to 5 hrs) per week of **moderate intensity**, or...
- 75 – 150 mins of **vigorous-intensity** aerobic physical activity, or...
- An equivalent combination of moderate- and vigorous-intensity aerobic activity.


In addition...

- **Muscle-strengthening** activities of moderate or greater intensity involving all major muscle groups, 2+ days/week
- Add **neuromotor training**, referred to as **motor and coordination training**, which includes **balance, hand-eye coordination, coordinative exercise, and dual-task training.**

Physical Activity Guidelines for Americans, 2nd Ed.

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Exercise variables



1. Frequency

2. Intensity

- 1. Low intensity**
 1. ~ 50% of Max Heart Rate
 2. 1-3/10 on Rate of Perceived Exertion (RPE)
 3. Yoga, Tai Chi, walking, gardening, etc.
- 2. Moderate intensity**
 1. 60-70% of Max HR
 2. 4-6/10 RPE
 3. Treadmill, light jogging, easy rowing, biking, Dynamic Flow
- 3. High intensity**
 1. 70+% of Max HR
 2. 7-10/10 RPE
 3. HIIT class, interval training, etc.

Max Heart Rate = 220 – Your Age

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Exercise variables, cont'd...

3. Duration

- A recent (2018) systematic review found that **52 hours of an exercise (3-6 months)**, regardless of modality or intensity, was required to achieve significant improvements in processing speed, executive functioning, and global cognition in older adults.

4. Modality (type of exercise)

1. Aerobic
2. Resistance training
3. Mobility training
4. Sport-specific training
5. Balance/agility/reactive training



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Movement and the Brain



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Closed Skill

- Environment is relatively **stable** and **predictable**.
- Movements have clear beginning and end.
- Includes **routines, learned** motor skills, and **repetitive movements** and sequences.



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Open Skill

- Environment is constantly **changing**.
- Movements have to be continually **adapted**, requiring **timing** and/or **spatial accuracy**.
- Predominantly **externally paced**.



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Exercise modalities for cognition



- 1 Exercises & movement activities that are **good** for the brain
- 2 Exercises & movement activities that **target** certain brain functions



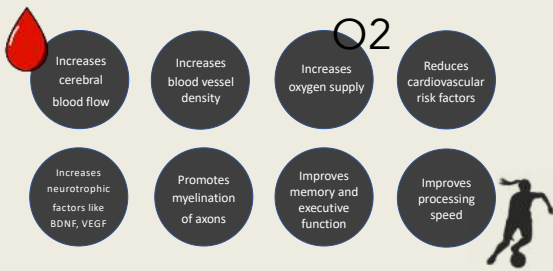
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Aerobic Exercise



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Brain benefits of aerobic exercise



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Resistance training: (closed skill)

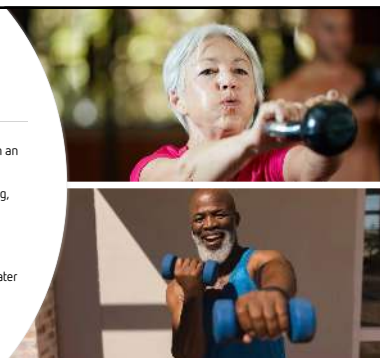
- Movements are controlled (constrained), often repeat, allowing for greater incremental loading
- Found to release various growth factors including irisin, IGF-1, and BDNF
- Found to positively affect the function and structure of the frontal lobes and hippocampus



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Resistance training: (open skill)

- Unconventional movement patterns with an external load (functional training)
- Involves greater degree of motor learning, **movement (and load) variability**
- **Complex movements** requiring coordination place **higher attentional demands** on the brain and promote greater **plasticity**



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Neuromotor/coordinative training


- Includes:
- Hand-eye coordination
 - Balancing exercises
 - Leg-arm coordination
 - Spatial orientation
 - Reacting to moving objects or persons
 - Generally open-skill activities
 - Dance, yoga, mind-body exercise, etc.



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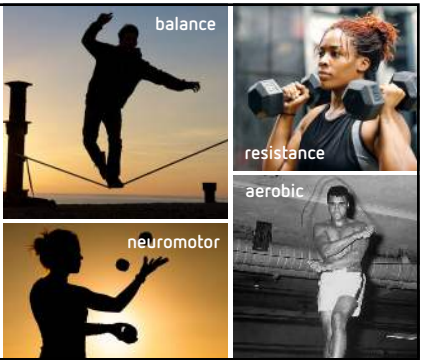
Dual-task training

- Training **motor** and **cognitive** tasks **simultaneously**
- Shown to improve **executive function, processing, and attention**.
- Seems to improve cognitive functions significantly more than sequential or separate cognitive and physical training.



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Multi-modal training



balance

resistance

aerobic

neuromotor

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Movement activities to improve... Executive function



- Motor planning
- Short-term memory
- Decision making
- Impulse control



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Movement activities to improve... Attention



- Focus
- Sustained focus
- Selective focus
 - Tracking
- Multi-sensory awareness



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Movement activities to improve... Memory



- Sequences
- Task recall
- Social cues
- Working memory
- Short & long-term



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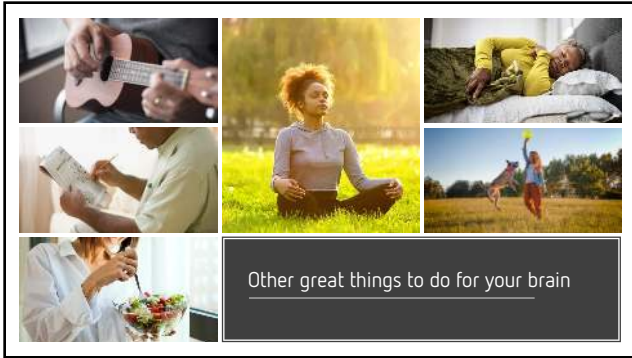
Movement activities to improve... Processing Speed



- Response time
- Motor control
- Rapid hand-eye coordination



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Next month's lecture:




The Chilmark Longevity Series, #5

Eating for Longevity

Wednesday, Jan 3 @ 4pm

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Current and upcoming classes

Dynamic Flow - Full body mobility and balance practice – online, ongoing

- Tues – Friday mornings
- 8 – 8:30 am
- Register online at: thelonggame.coach/schedule

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Short courses in January

Playing the Inner Game

3 Thursday evenings,
Jan 11, 18, 26 from 7 – 8:15 pm
\$150

Getting Started: Adopting a new habit

4 Tuesday evenings, Jan 9, 16, 23, 30
7 – 8 pm
\$100



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the long game

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