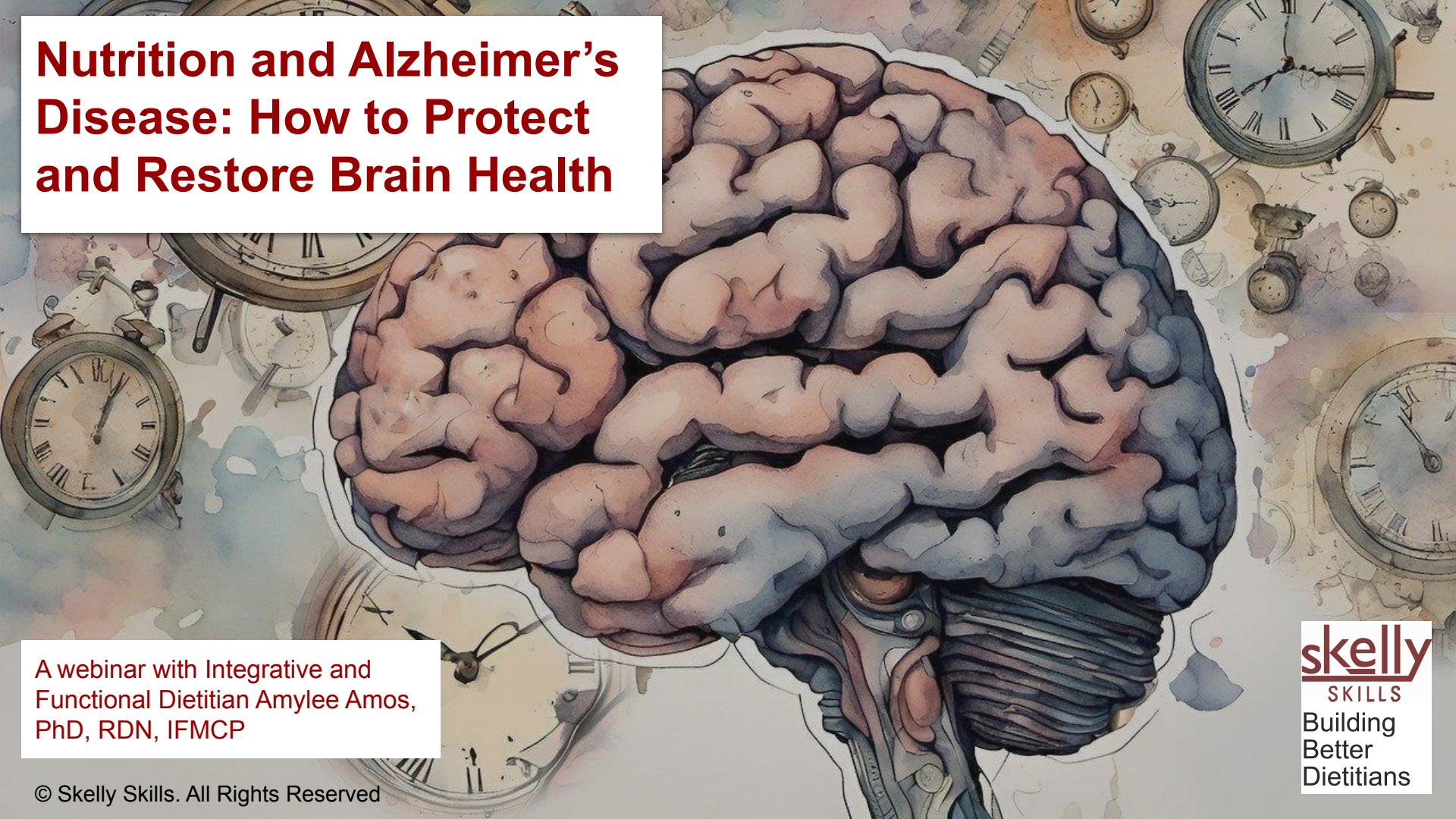


# Nutrition and Alzheimer's Disease: How to Protect and Restore Brain Health



A webinar with Integrative and Functional Dietitian Amylee Amos, PhD, RDN, IFMCP

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# Disclosure to Participants

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## Notice of Requirements For Successful Completion

Please refer to learning goals and objectives

Learners must attend the full activity and complete the evaluation in order to claim continuing education credit/hours

## Conflict of Interest (COI) and Financial Relationship Disclosures

Amylee Amos has no conflicts of interest or financial relationships to disclose.

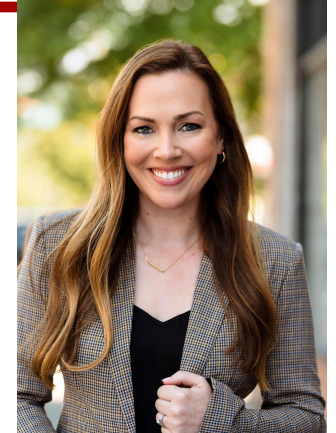
Sara Garbin is employed by Skelly Skills.



# Amylee Amos, PhD, RDN, IFMCP

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Dr. Amylee Amos PhD, RDN, IFMCP received her PhD from Saybrook University in Integrative and Functional Nutrition. She is a registered dietitian, nutritionist and completed her Master of Science in Nutrition, Healthspan, & Longevity from the University of Southern California. In addition to her education at USC, Amylee trained under world-renowned biogerontologist and cell biologist Valter Longo, PhD at the University of Genoa, Italy. She also trained under the distinguished Dale Bredesen, MD at the Buck Institute for Research on Aging. She completed comprehensive post-graduate training and certification in functional medicine and functional nutrition at the Institute for Functional Medicine. Amylee founded the Amos Institute in 2017, which offers self-paced nutrition courses, provides concierge nutrition services for highly complex cases, and conducts nutrition research.



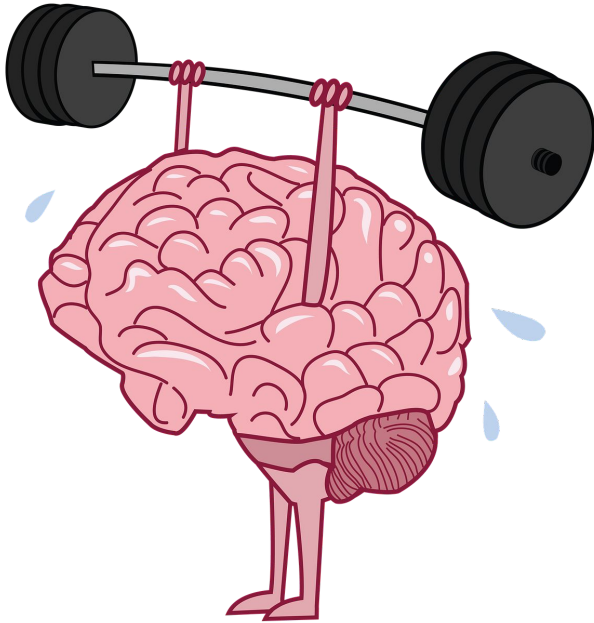
Dr. Amos is passionate about expanding access to functional medicine and studying the efficacy of utilizing the functional medicine model as a cost-effective means of preventative medicine. Her professional interests include tackling the profound issue of nutrition misinformation by educating on nutrition science with all of the necessary nuance, exposing predatory tactics used by the food industry that contribute to poor health outcomes, and reconciling the relationship between planetary and human health. Amylee regularly publishes and presents her research and shares her expertise at the local, national, and international level.

# Learning Objectives

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At the conclusion of this webinar, the learner will be able to:

1. Identify the six integral components of a healthy brain
2. Describe the two types of Alzheimer's disease
3. Identify six modifiable risk factors of dementia and Alzheimer's disease
4. Identify the diet that optimizes brain health
5. Identify three ways that ketone bodies benefit brain health
6. State three ways in which exercise is beneficial to brain health
7. State four lifestyle changes that reduce toxic exposure



# Part 1:

## Brain Health

# Six Determinants of Brain Health

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- **Toxins:** can lead to inflammation
- **Nutrients:** amino acids, vitamins, minerals, fats
- **Stress:** enough to promote new neuronal connections, but not too much to chronically ↑ cortisol levels → neurotoxic
- **Structure:** includes genetics, chronic pain, airway structure, h/o brain injury
- **Infections:** can directly cause damage to the brain and stimulate inflammation
- **Signaling:** chemical messengers, reproductive hormones, peptides & brain-derived neurotrophic factor (BDNF)

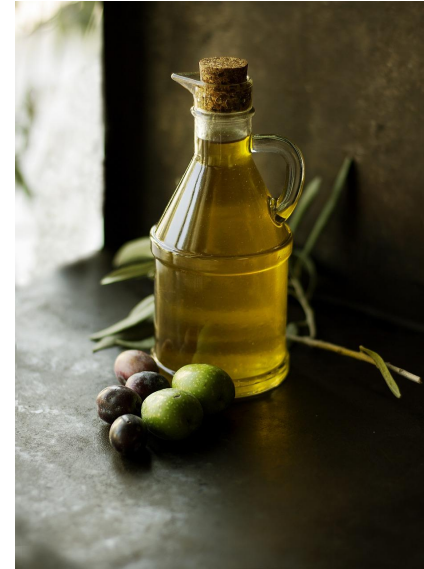


(Costa M et al., 2021; Erickson, K. I. et al., 2010; Gosztyla M. L. et al., 2018; Krikorian, R. et al., 2022; Liu, Y. H. et al., 2022; Lopatko L. K. et al., 2021; Miklossy, J. et al., 2004; Ouanes & Popp, 2019; Trova, S. et al., 2021; Tzeng N. S. et al., 2018; Uchoa, M. F. et al., 2016; Wormser, G. P. et al., 2022; Wyss-Coray & Rogers, 2012)

# Brain Nutrition

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- Brain consumes 20% of required daily calories
- Necessary for neurotransmitter formation and function
- Main nutrients:
  - **Amino acids:** manufacture neurotransmitters & signaling peptides
  - **Vitamins & minerals:** neurotransmitter utilization & metabolization
    - B vitamins, vitamin C, zinc, magnesium
  - **Fats:** fatty acid metabolism & ketone formation
    - Ketones are the brain's preferred fuel source



(Croteau, E. et al., 2018; Cunnane, S. C. et al., 2016; Fortier, M. et al., 2019; Krikorian, R. et al., 2022; Roy, M. et al., 2021)

# Brain Detoxification

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- Nutrients & energy are required to process toxins in the brain
- Glymphatic system in the brain: network of glial cells that remove toxic waste products during sleep
- Common toxins:
  - Heavy metals
  - Chemical toxins (pesticides, herbicides, drinking H<sub>2</sub>O, personal care & household products)
  - Biological toxins (mycotoxins from mold spores)
- Excess toxic exposure = diversion of nutrients & energy for detoxification & less is available for cognitive processes



(Aggarwal, V. et al., 2022; Jia J et al., 2023; McCann & Maguire-Zeiss, 2021; Mosconi, L., 2022; Wyss-Coray & Rogers, 2012)

# Brain Health and Genetics

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Apolipoprotein E (APOE) gene codes for apolipoprotein E: protein involved in fat metabolism & distribution of cholesterol via bloodstream

- Impacts risk of developing dementia & cardiovascular disease
- Three variants (one allele comes from each parent):
  - APOE2: least common, may be protective against Alzheimer's
  - APOE3: most common, neutral impact on risk
  - APOE4: ↑ risk of Alzheimer's development
    - Risk is greatest with 2 copies of allele
    - 25% have 1 copy
    - 2-3% have 2 copies



(Liu, C. C. et al., 2013; Verghese, P. B. et al., 2011)

# Alzheimer's Disease: Two Types

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- Early-onset Alzheimer's Disease (familial or presenile Alzheimer's)
  - Severe cognitive impairment starting in 40s & 50s, rapid progression
  - Strong genetic component
    - Genetic mutations contribute to amyloid plaque formation
    - Rare, only 1% of the population has genetic mutations
  - Majority of research has focused on this type
- Late-onset Alzheimer's disease (sporadic Alzheimer's)
  - More common
  - Starts to develop after age 65
  - Genetic component believed to ↑ risk (APOE)



(Braak, H. et al., 2011; Garrett, M. 2018; Herrup, K., 2021; Katzman, R., 2976; Liu, C. C. et al., 2013; Verghese, P. B. et al., 2011)

# Poll Question

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Approximately what percentage of worldwide dementia cases are attributed to modifiable risk factors?

- a) 10%
- b) 20%
- c) 30%
- d) 40%

# Modifiable Risk Factors

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Modifiable risk factors estimated to account for 40% of worldwide dementias:

1. Traumatic brain injury (TBI)
2. HTN
3. Weight
4. Excessive ETOH consumption
5. Physical inactivity
6. T2DM
7. Depression
8. Air pollution
9. Toxin exposure from food, water, personal care products/ OTC meds



(Aggarwal, V. et al., 2022; Barnes, D. E. et al., 2012; Byers & Yaffe, 2011; Coupland, C.A.C. et al., 2019; Islam, F. et al., 2022; Jia J et al., 2023; Joung, K. et al., 2019; Livingston, G. et al., 2020; McCann & Maguire-Zeiss, 2021; Mosconi, L., 2022; Schwarzingler, M. et al., 2018; Wang, S. et al., 2021; Yan, S. et al., 2020)

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# Part 2:

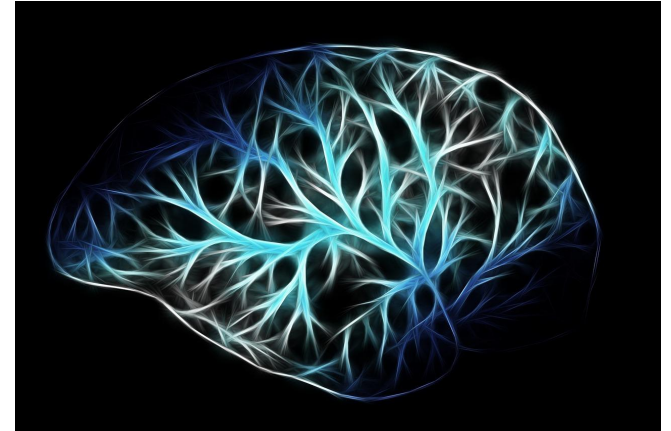
## Nutrition and Lifestyle Interventions for Brain Health



# Nutrition for Brain Protection and Restoration

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- Optimal diet: nutrient-dense, high-fat, low-carb ketogenic diet
- When higher carbs & glucose are the main source of brain fuel:
  - Creates harmful by-products from burning glucose that can lead to oxidative stress & inflammation
    - Excess glucose & insulin accumulates and undergoes glycation → advanced glycation end products (AGEs) → cognitive decline



(Barnes, L.L. et al., 2023; Cunnane, S., 2022; Du, F. et al., 2008; Harvard T.H. Chan School of Public Health, 2023; Hawkins, M. A. W. et al., 2018; Gomes Goncalves, N. et al., 2023; Phillips, M. C. L. et al., 2021; Sheffler, J.L. et al., 2022)

# The Ketogenic Diet

- High-fat, high-veggie, low-carb, moderate-protein
  - Aim for a maximum of < 100 grams daily carb intake
  - < 50 g per day spread out may be necessary for nutritional ketosis
- 3-6 months of a ketogenic diet promotes brain healing in a person with cognitive decline
- 25% of the year spent in nutritional ketosis can extend the number of years the brain stays healthy & functional
- Nutritional ketosis: ketone levels at least 1 mmol (ideally 2-3 mmol)



(Barnes, L.L. et al., 2023; Cunnane, S., 2022; Du, F. et al., 2008; Harvard T.H. Chan School of Public Health, 2023; Hawkins, M. A. W. et al., 2018; Gomes Goncalves, N. et al., 2023; Phillips, M. C. L. et al., 2021; Sheffler, J.L. et al., 2022)

# Poll Question

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Which of the following is true of nutritional ketosis?

- a) Some people are unable to metabolize ketones.
- b) It helps to restore metabolic flexibility.
- c) The brain's ability to utilize ketones decreases with age.
- d) It increases insulin secretion.

# Benefits of a Ketogenic Diet

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- Restores metabolic flexibility: the ability to burn either glucose or fat
- Normalizes glucose & insulin levels
- ↓ inflammation
- Fuels the brain optimally (ketones)
- Mobilizes & detoxifies toxins from the body



(Barnes, L.L. et al., 2023; Cunnane, S., 2022; Du, F. et al., 2008; Harvard T.H. Chan School of Public Health, 2023; Hawkins, M. A. W. et al., 2018; Gomes Goncalves, N. et al., 2023; Phillips, M. C. L. et al., 2021; Sheffler, J.L. et al., 2022)

# Ketones and Brain Health

- Alternative fuel source for the brain
- Produces more stable energy levels, less glucose spikes & crashes
- Ability to metabolize ketones is unaffected by age
  - brain becomes less efficient at utilizing glucose with age
- Ketosis ↑ apoptosis to clean up dysfunctional cells

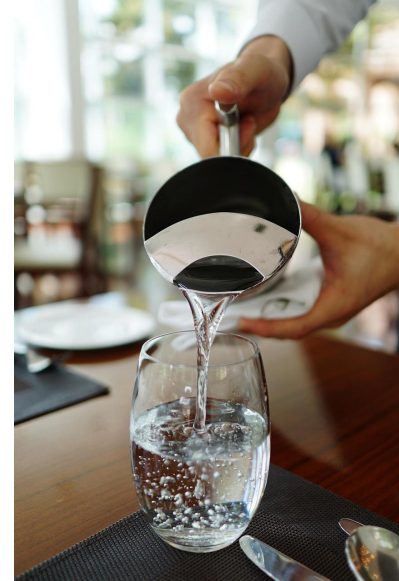


(Barnes, L.L. et al., 2023; Cunnane, S., 2022; Cunnane, S.C. et al., 2016; Du, F. et al., 2008; Harvard T.H. Chan School of Public Health, 2023; Hawkins, M. A. W. et al., 2018; Gomes Goncalves, N. et al., 2023; Phillips, M. C. L. et al., 2021; Sheffler, J.L. et al., 2022)

# Keto Diet Considerations

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- APOE4 gene: difficult to metabolize saturated fats
- Eating disorder
- T1D - should be closely monitored
- Hydration is key
- Weight loss - may need to focus on fats
- Cholesterol
- 'Keto flu' - toxin mobilization, mineral depletion from frequent urination, sugar detox
- Constipation - ensure adequate fiber



(Barnes, L.L. et al., 2023; Cunnane, S., 2022; Du, F. et al., 2008; Gomes Goncalves, N. et al., 2023; Harvard T.H. Chan School of Public Health, 2023; Hawkins, M. A. W. et al., 2018; Liu, C. C. et al., 2013; Phillips, M. C. L. et al., 2021; Sheffler, J.L. et al., 2022; Verghese, P. B. et al., 2011)

# Nootropic Supplements

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- Supports cognitive function
- Caution: some nutrients & herbs can interact with Rx medication
- Vitamin D with K
  - Adequate vitamin D protects against cognitive decline
  - Vit K works with vit D to direct calcium into bones
  - ↑ levels of circulating vit K associated with ↑ cognitive function
- Omega-3 fatty acids:
  - helps ↓ neuroinflammation & heart disease risk
  - Important for brain cell structure & function
  - ↑ levels associated with larger hippocampus & stronger ability to use logical reasoning
- Probiotics
  - Helps to maintain gut balance & ↓ inflammation
  - Promotes neurotransmitter synthesis
  - Fermented foods: kimchi, sauerkraut, kefir, miso soup

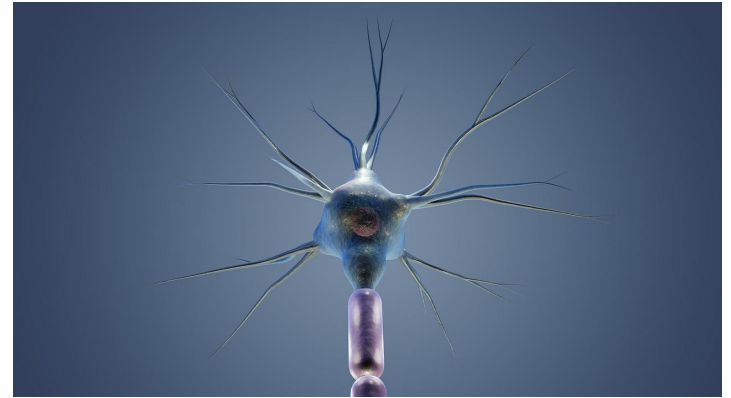


(Booth, S.L. et al., 2022; Satizabal, C.L. et al., 2022; Shea, M.K. et al., 2022)

# Exercise and Neuroprotection

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- Triggers release of neuroprotective signaling molecules (exerkines, neurotransmitters, neurotrophic factors) → cues the brain to ↑ function & capacities
  - Neurotransmitters: ↑ serotonin & norepinephrine (help to ↑ the brain's information-processing abilities)
  - Exerkines: contribute to angiogenesis & gene expression
  - Neurotrophic factors foster growth & health of neurons (BDNF, insulin-like growth factor-1 (IGF-1))
    - IGF-1 promotes neuron differentiation, neuroplasticity, new neuron generation, angiogenesis in the brain, spatial learning



(Dimauro, I. et al., 2020; Grazioli E. et al., 2017; Jia, J. et al., 2023; Liu, P. Z. et al., 2018; Magliulo, L. et al., 2022; Nieman & Wentz, 2019; Rody, T. et al., 2022; Sanchis-Gomar, F. et al., 2012)

# Brain-derived Neurotrophic Factor (BDNF)

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- Generated by muscle tissue
- Exercise triggers BDNF release
- Promotes the survival of developing neurons & helps them with specialized functions
- Related to learning, memory, mood
  - BDNF amount directly correlates with size of hippocampus (brain region associated with memory)
- Promotes neuroplasticity



(Erickson, K. I. et al., 2010; Gomez-Pinilla, F. et al., 2011; Liu, P. Z. et al., 2018)

# Exercise and Brain Health Benefits

- Produces a hormetic response: beneficial stress that enhances the body's efficiency at using resources & overall resiliency
- ↑ cardiovascular capacity, boosts circulation, delivers O<sub>2</sub> & nutrients to the brain
- ↓ stress hormone cortisol
- ↓ inflammation & promotes detoxification
- Regular aerobic exercise at midlife is shown to:
  - ↑ volume of the hippocampus (impacts learning & memory)
  - Improve spatial memory & cognitive scores
- Helps improve cognitive function in mild cognitive impairment (MCI) & dementia

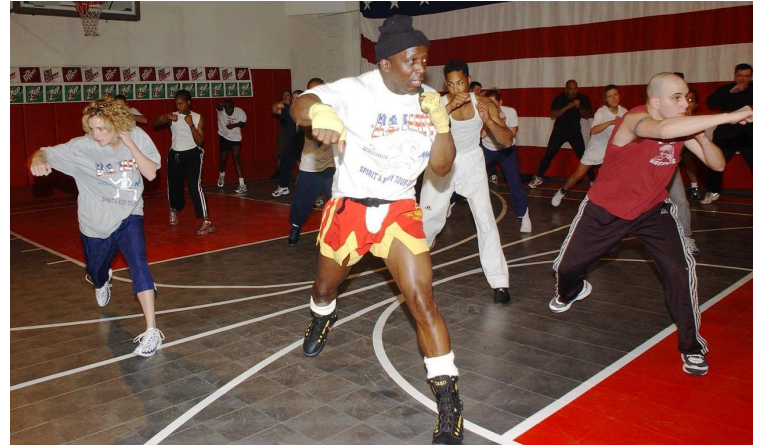


(Ahlskog, J. E. et al., 2011; Del Pozo Cruz, B. et al., 2022; Dimauro, I. et al., 2020; Grazioli, E. et al., 2017; Jia, J. et al., 2023; Karssemeijer, E. G. A. et al., 2017; Liu, P. Z. et al., 2018; Magliulo, L. et al., 2022; Nieman & Wentz, 2019; Rody, T. et al., 2022; Sanchis-Gomar, F. et al., 2012)

# Exercise: Key Factors

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- Recommended to switch up current exercise routine to challenge the brain & ↑ intensity
  - Triggers signaling molecules that protect & repair the brain
  - Cognitively stimulating → promotes creation of new neuronal connections



(Jia, J. et al., 2023; Nieman & Wentz, 2019)

# Environmental Toxins and Brain Health

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- Toxin overload can lead to cells in constant defense mode & nutrients & energy used for detoxing
  - ↓ available for generating neurons & neuron connections
- Aim to:
  - Reduce toxin exposure in air, water & food
  - Minimize exposure to chemical fertilizers, pesticides, herbicides, mold, & toxic chemicals
    - Mold produces neurotoxic & immunosuppressive chemicals: mycotoxins
      - Can cause mental confusion & cognitive decline



(Aggarwal, V. et al., 2022; Coupland, C.A.C. et al., 2019; Islam, F. et al., 2022; Jia J et al., 2023; Joung, K. et al., 2019; McCann & Maguire-Zeiss, 2021; Mosconi, L., 2022)

# Reducing Toxic Exposure

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1. Air quality improvement
  - Open windows, houseplants, air purifiers, avoid artificial scents
2. Cookware
  - Stainless steel, cast iron & ceramic pans
  - Glass, silicon & storage containers
3. Water
  - Spring water & filtered water (carbon filters, reverse osmosis (RO))
  - Stainless, ceramic, or glass H2O containers
4. Non-toxic personal care & cleaning products
  - Stay mindful of fragrances and products that make contact with skin



(Aggarwal, V. et al., 2022; Jia J et al., 2023; McCann & Maguire-Zeiss, 2021; Mosconi, L., 2022)



# Part 3:

## Case Study

# Case Study

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- 69 y.o. F
- ApoE 3/4
- BMI 19.4
- Family Hx of AD (mother died of AD), chronic UTIs, anxiety, osteopenia, recent general anesthesia after which cognition seemed worse
- Geriatrician referred her to a neuro for f/u after reporting brain fog and SCI
- MoCA (performed by neuro) 19 - at this appt she was dx with AD and her driver's license was suspended
- Diet Hx: "healthy diet" per report
  - was basically a mostly organic standard American diet with "healthier" versions of junk food
  - Rich in saturated fat from animal products, lacking fiber, lacking phytonutrients

# Case Study (Cont.)

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- Started on the ReCODE protocol (MD and RD on health care team with a very supportive family)
- Labs
  - Homocysteine: 16.2
  - B12: 235
  - Hs CRP: 4.1
  - Elevated Cu:Zn ratio
  - Vit D: 32
  - A1c: 6.7
  - Fasting insulin: 10
  - LDL: 169
  - TG: 188
- Began Ketoflex diet (plant-based, mildly ketogenic diet)
- Beginning ketone readings: 0.0-0.2 mM BHB

# Case Study (Cont.)

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- Began the following supplements: methyl B12, methyl folate, P5P, berberine, SPMs, omega 3 1 g, Vit D 5000 IU
- Began exercise regimen with a personal trainer (necessary d/t osteopenia) that included resistance training 2x per week, with 5x per week cardio (water aerobics class)
- Brain HQ training 15 min 5x/week
- Regular meditation
- Worked to improve sleep quality
- Referral to therapist for management of anxiety

# Case Study (Cont.)

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- 1 year on the program and she and her family reported massive improvements
- We re-tested her labs:
  - Homocysteine: 8.1
  - B12: 690
  - Cu:Zn ratio: 0.9
  - Vit D: 61
  - A1c: 4.6
  - Insulin: 5.4
  - LDL: 150
  - TG: 79
- Average ketone level: 1.8mM BHB
- Went back to the same neuro, MoCA was 27 with “no indication of cognitive impairment”
- Her license was reinstated

# Questions?

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