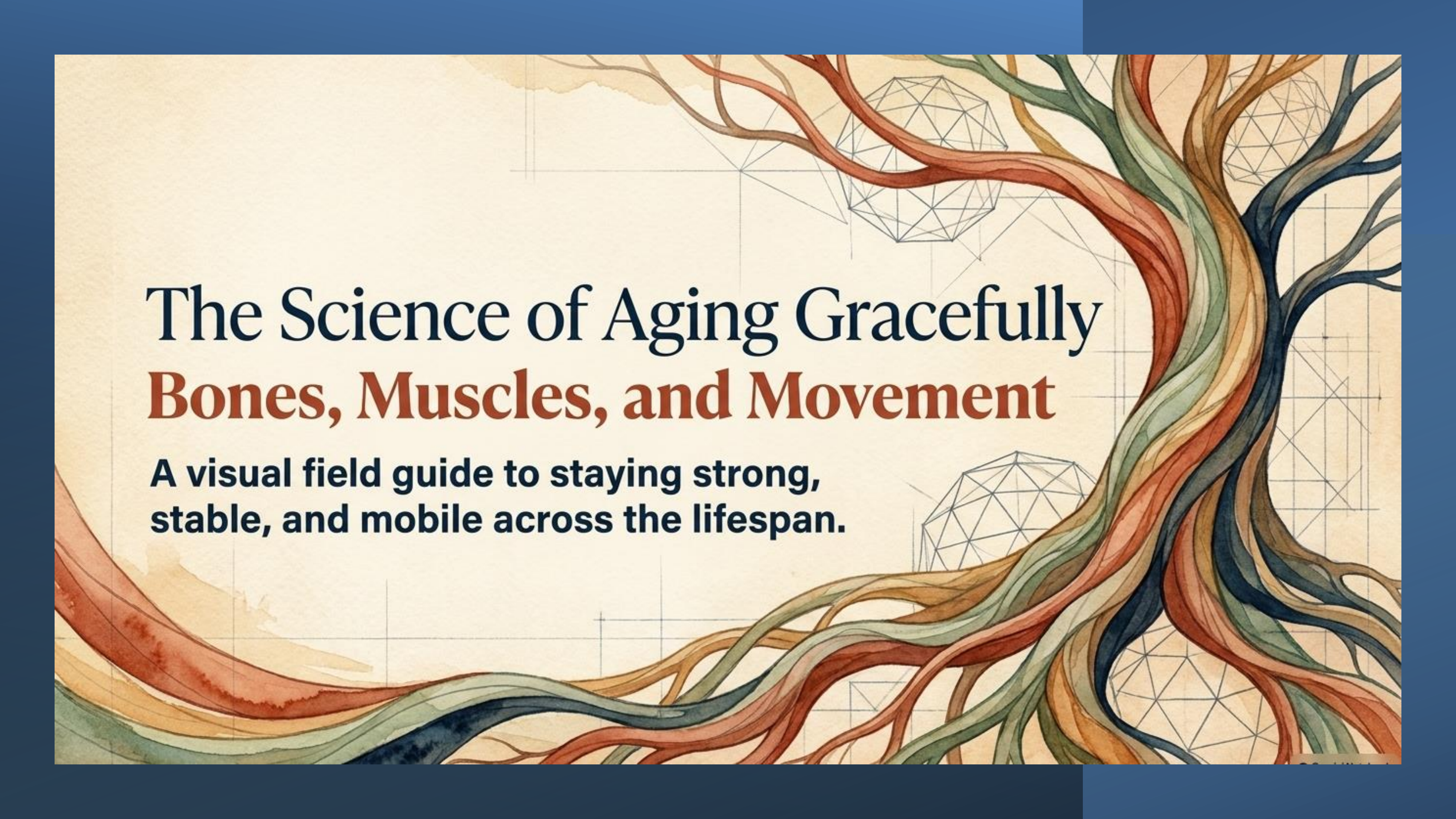


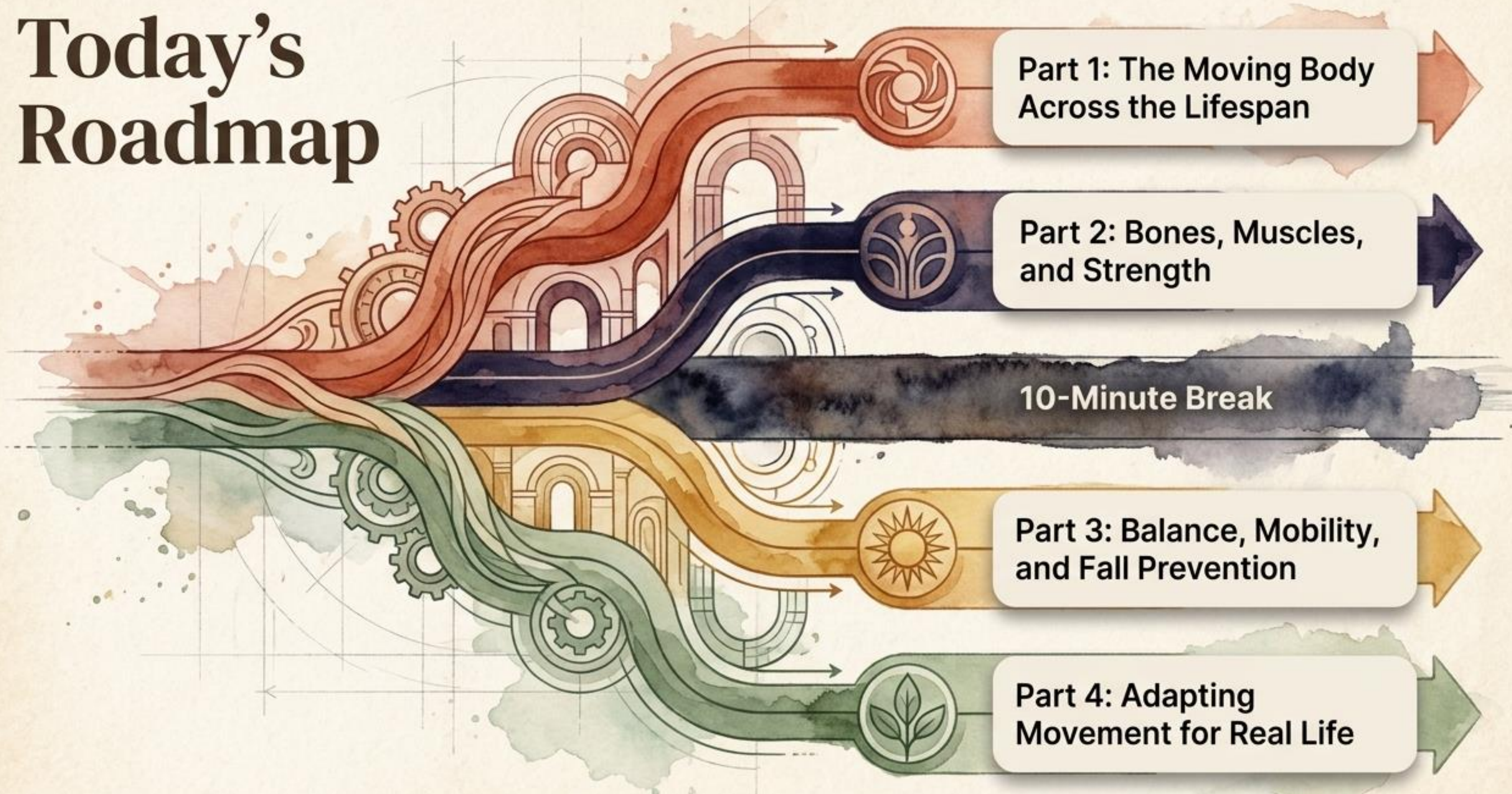


# The Science of Aging Gracefully

## **Bones, Muscles, and Movement**

**A visual field guide to staying strong,  
stable, and mobile across the lifespan.**

# Today's Roadmap



Part 1: The Moving Body  
Across the Lifespan

Part 2: Bones, Muscles,  
and Strength

10-Minute Break

Part 3: Balance, Mobility,  
and Fall Prevention

Part 4: Adapting  
Movement for Real Life

# The Moving Body Across the Lifespan



What actually happens  
to our ability to move as  
we age?



Aging changes the body,  
but physical function  
remains adaptable



Movement affects far  
more than fitness

# Before We Jump In...

## Which statement is most accurate?



**A.** Most physical decline is an unavoidable result of aging.



**B.** People naturally become weaker with age, regardless of activity.



**C.** Aging changes the body, but physical function remains surprisingly adaptable.

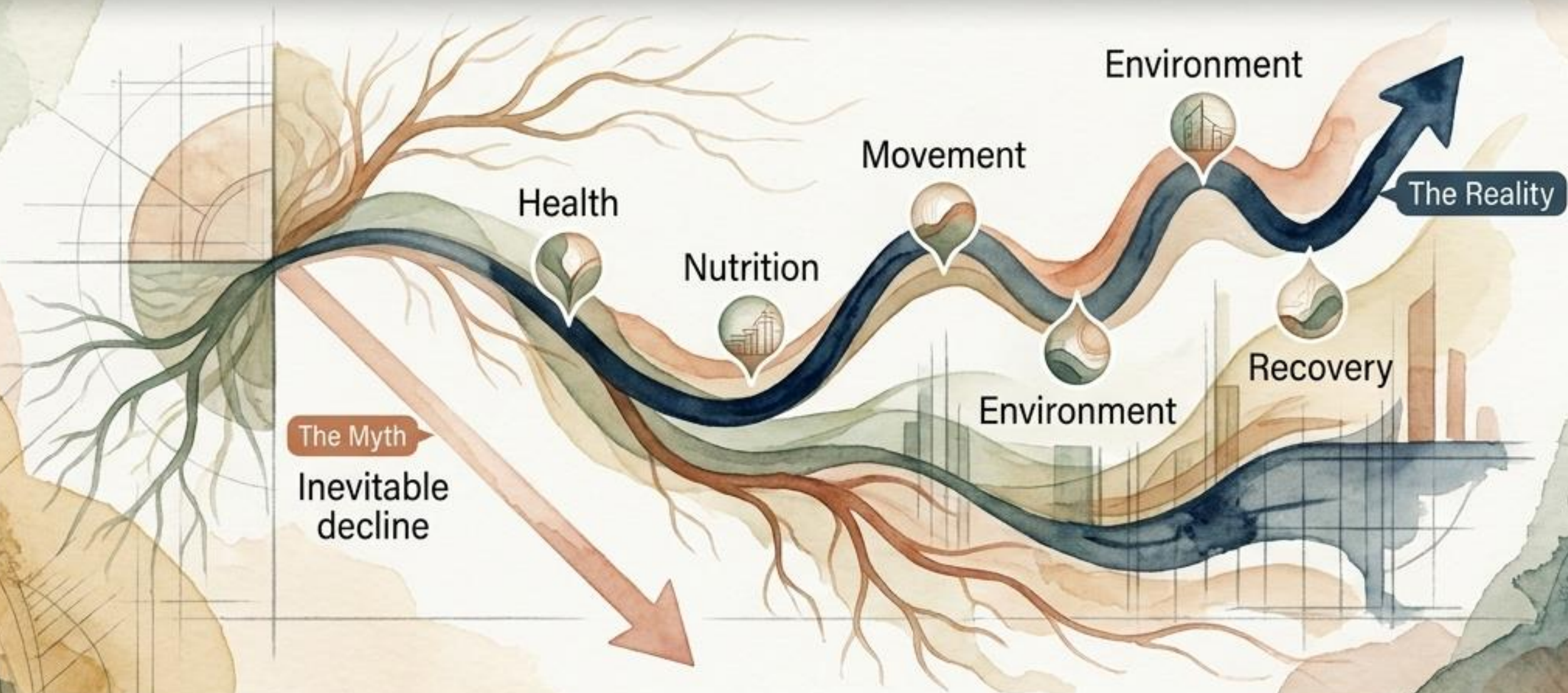


**D.** Exercise mainly affects the heart and has little effect on other aspects of aging.

**Facilitator Prompt:** Take 10 seconds to make your prediction.

# The Answer: C — The Aging Body Is Adaptable

Aging does change the body, but physical decline is not a straight, unavoidable path. Our bodies change with age, but they continue to respond to what we ask them to do.



# Movement Is More Than Exercise



Walking across  
a room



Getting out  
of a chair



Carrying groceries

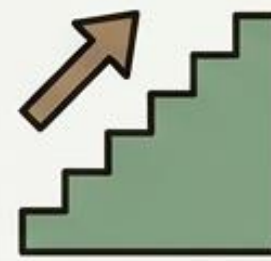
Movement is how we  
interact with the world



Gardening



Dancing



Climbing stairs



Reaching, bending,  
lifting, and balancing

# What Changes...and What Doesn't?



## Biological Shifts

- Less muscle mass or power
- Lower bone density
- More joint stiffness
- Slower reaction time
- Longer recovery



## Adaptations & Gains

- Learned movement strategies
- Better body awareness
- Endurance and balance can still improve
- Strength and skill continue to adapt

Aging is not one long decline. Some abilities remain stable, and adaptation continues.

# Why Movement Matters

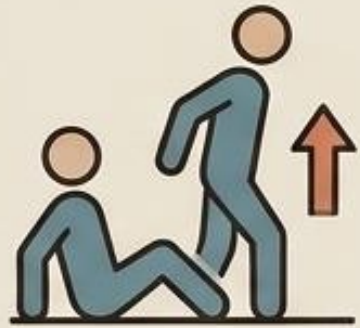
- Regular movement supports muscles, bones, joints, heart and circulation, balance, brain health, mood, sleep, confidence, and independence
- Movement is not only about fitness
- It is about function



# Function Matters More Than Fitness

The important question is not:  
**“How fit am I?”**

A better question:  
**“Can I do the things I want  
and need to do?”**



Getting off  
the floor



Carrying  
groceries



Traveling through  
an airport



Playing with  
grandchildren



Living  
independently

# Questions?

- What changes feel most relevant to everyday life?





# Bones Are Living Tissue

- Bones may seem solid and permanent, but they are continually changing
- Bone is broken down, rebuilt, and remodeled throughout life
- Earlier in life, building generally keeps pace with removal
- With age, that balance can shift
- Bone is constantly responding to the body and its environment



# What has the greatest effect on maintaining strength and bone health?



**A.** Taking it easy to avoid wear and tear.



**B.** Regularly challenging muscles and bones.



**C.** Stretching every day.

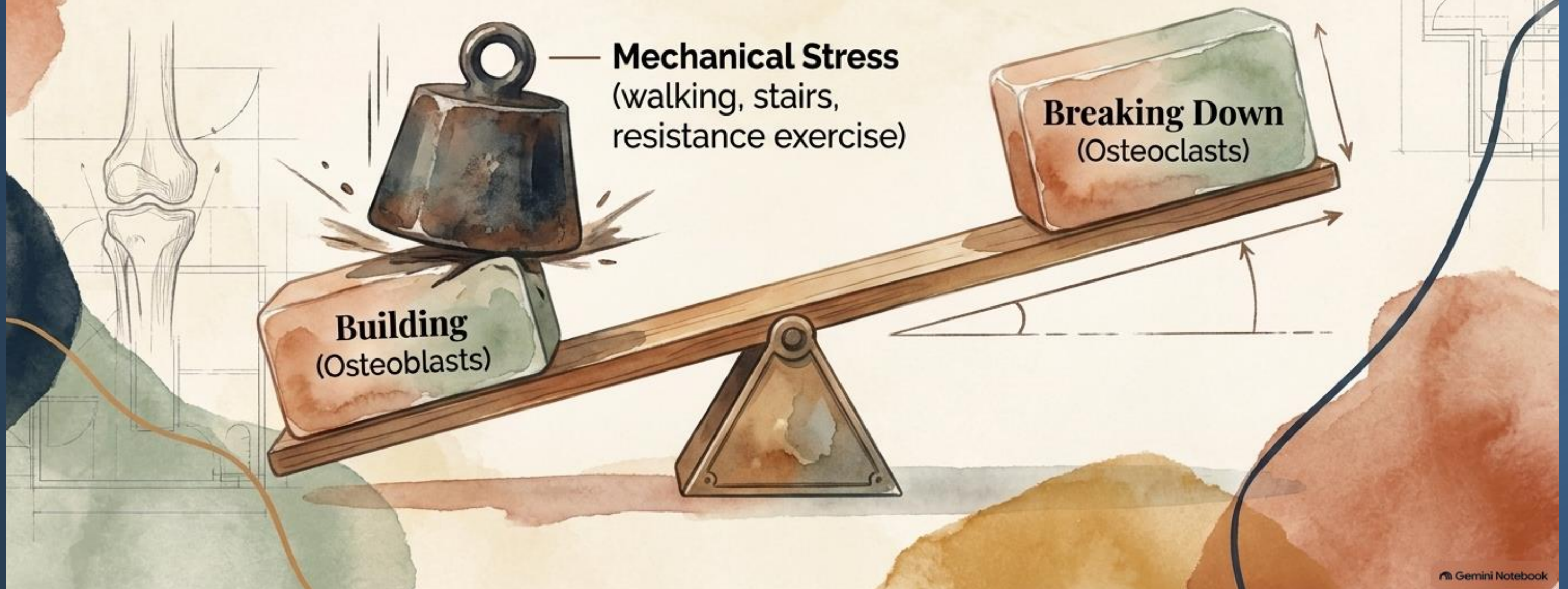


**D.** Genetics — there is not much we can change.

**Facilitator Prompt:** Commit to your best prediction before we discuss.

# The Answer: B — Bones Respond to Load

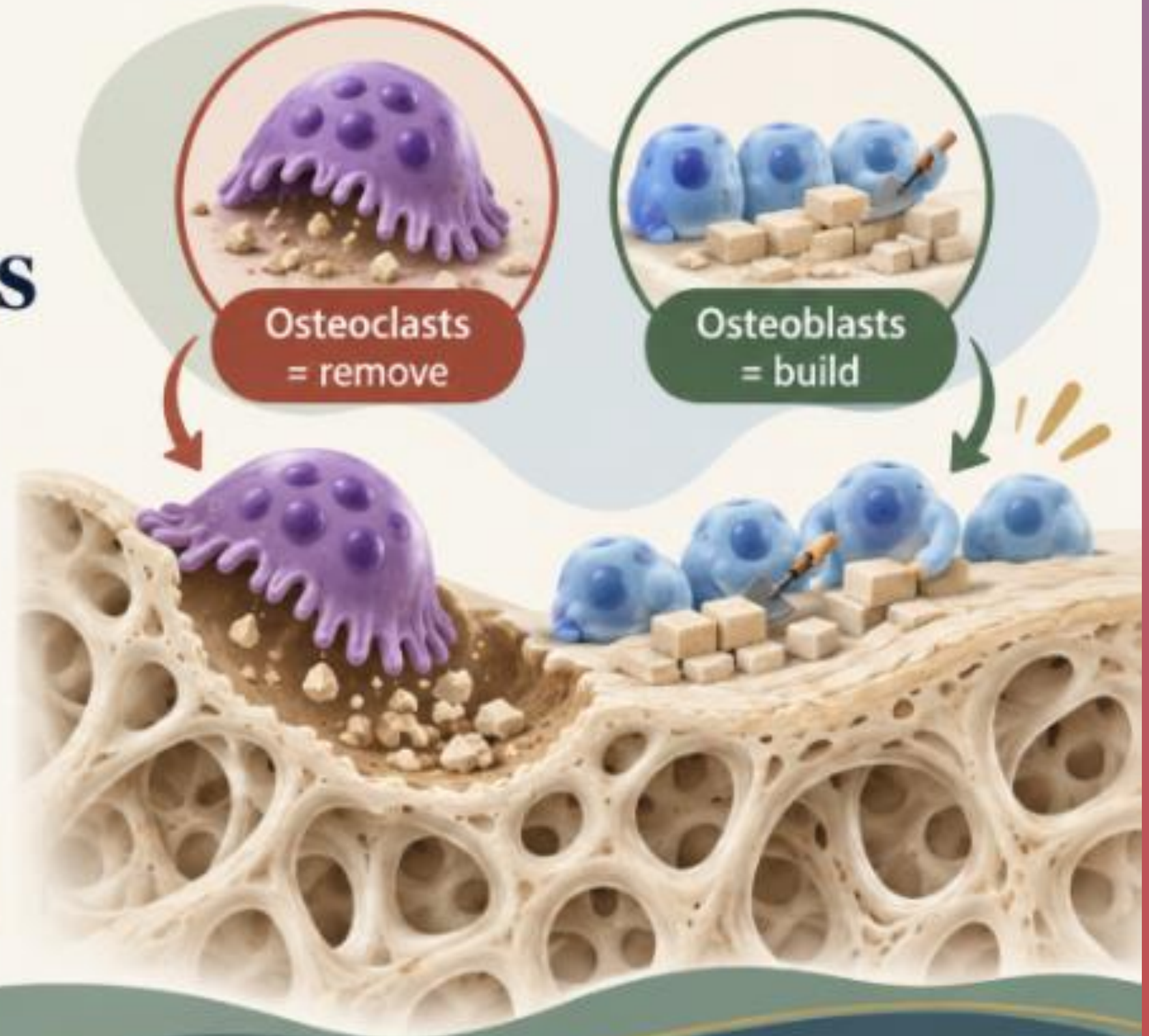
Bones are living tissue, continually remodeling. With age, the balance can shift toward breaking down. Our skeleton responds to how we use it.



# Osteoblasts: The Bone Builders

- Build new bone tissue
- Help mineralize bone with calcium and other minerals
- Work alongside osteoclasts during bone remodeling

**Osteoclasts** remove old bone.  
**Osteoblasts** build new bone.



# How Load Helps Osteoblasts



Movement creates mechanical stress on bone.



Bone cells sense that stress.



Signals tell osteoblasts where strength is needed.



Osteoblasts help build and mineralize new bone.



Movement  
/load



Stress  
signal



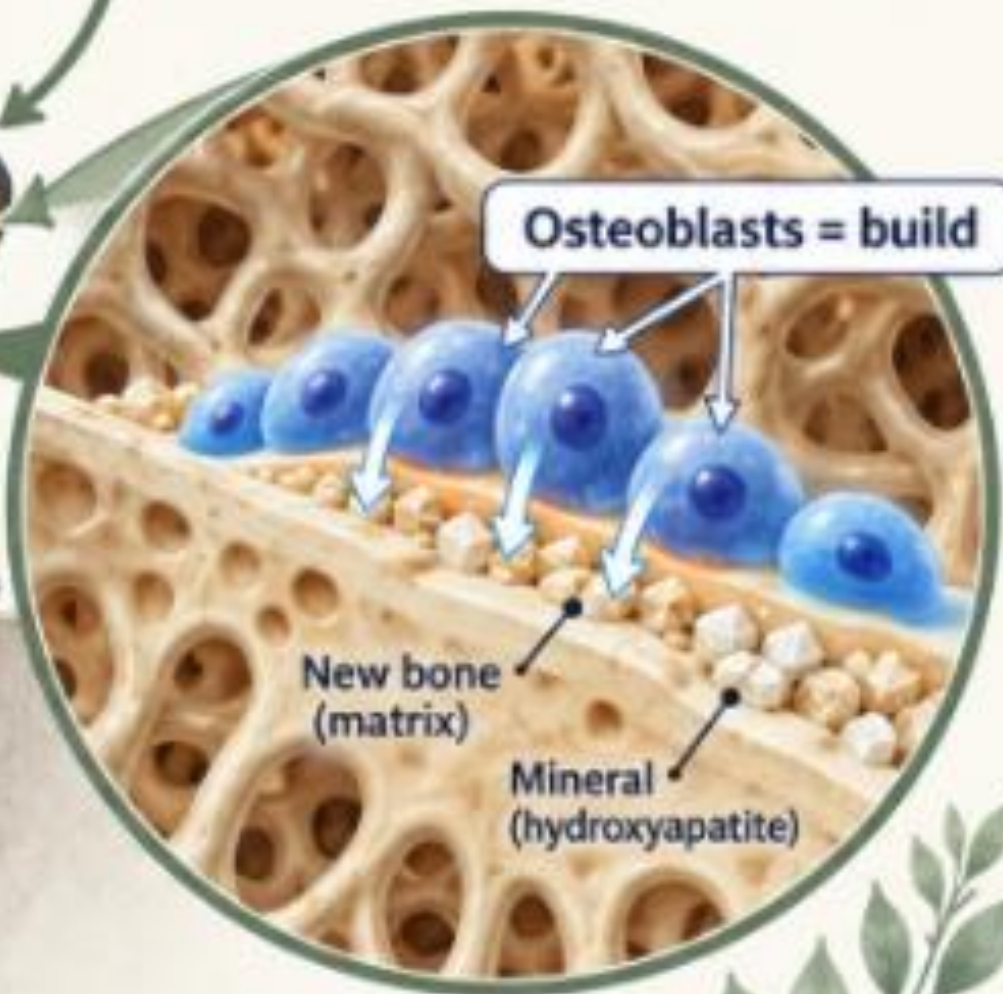
Osteoblast  
activity



Stronger  
bone



Load tells bone:  
build strength here.



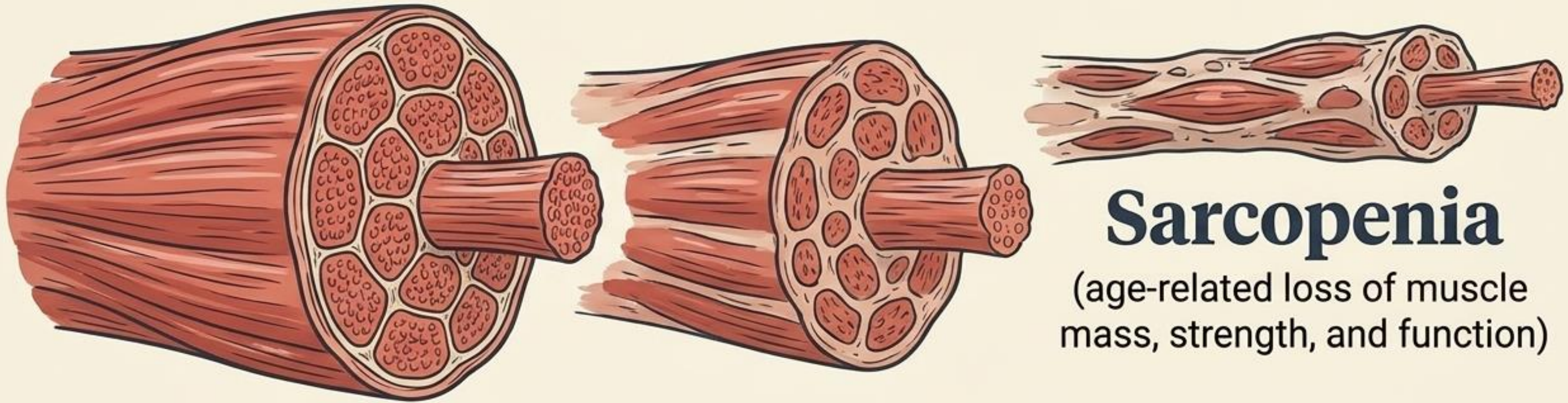


# What Happens to Bone With Age?

- When bone loss begins to outpace bone formation, bone density may decrease
- This can increase risk for osteopenia, osteoporosis, and fractures
- Bone health is affected by age, hormones, genetics, nutrition, medications, health conditions, and physical activity



# Muscle Changes With Age



## Sarcopenia

(age-related loss of muscle mass, strength, and function)

Sarcopenia can affect walking, balance, grip strength, stairs, getting out of a chair, endurance, and recovery after illness.

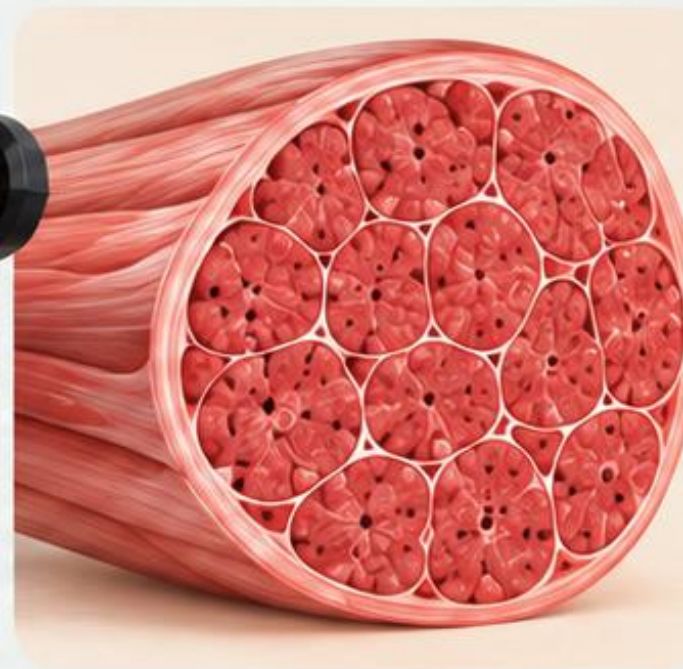
**The concern is not appearance — it is function.**

# Sarcopenia: What Happens to Muscle?

- Age-related loss of muscle mass, strength, and function.
- Often begins in midlife and accelerates after age 60.
- Less muscle can make everyday tasks harder.
- Effects can be slowed with movement, strength training, protein, and medical guidance.

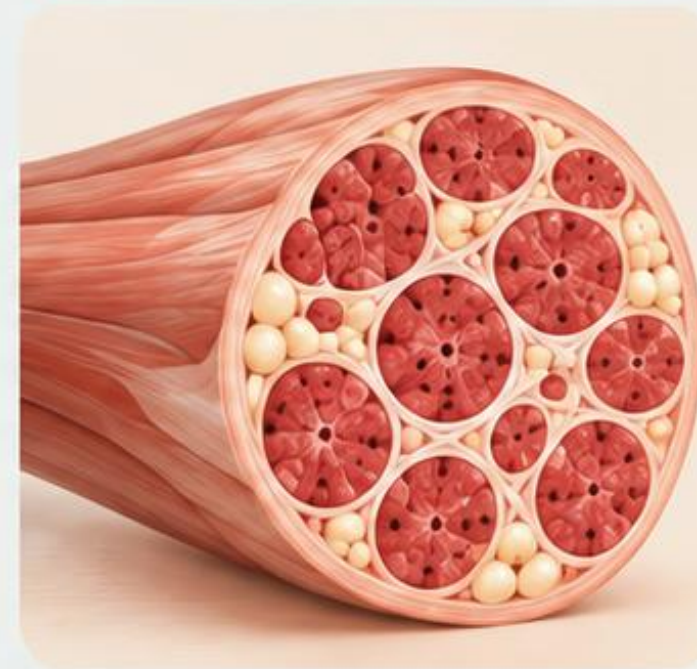


Younger Muscle



Larger, more numerous  
muscle fibers

Muscle with Sarcopenia



Smaller and fewer  
muscle fibers, more fat  
and connective tissue



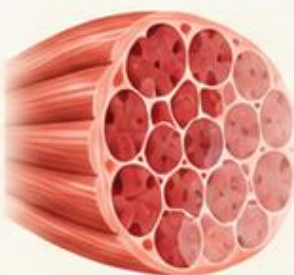
# Why Does Sarcopenia Happen?

Muscle loss happens when the body breaks down muscle faster than it rebuilds it.



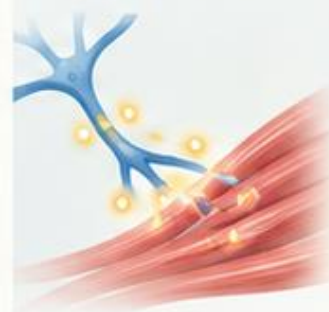
## Fewer muscle fibers

Fast-twitch fibers naturally decline with age, leading to fewer and smaller muscle fibers.



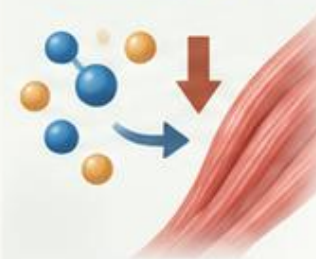
## Weaker nerve signals

Muscles receive less activation from the nervous system, so fewer muscle fibers are recruited.



## Lower protein synthesis

The body makes less protein to repair and grow muscle tissue, so breakdown outpaces rebuilding.



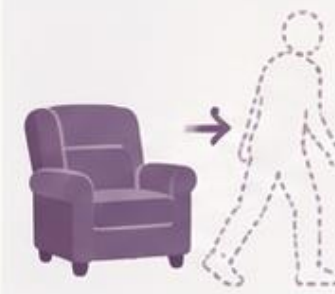
## Hormonal changes

Levels of testosterone, growth hormone, and IGF-1 decline, which reduces muscle building and repair.



## Less use over time

Inactivity accelerates the “use it or lose it” cycle, leading to faster muscle loss.



## How It Can Show Up in Daily Life



More difficulty with stairs



Harder to get up from a chair



Slower walking speed

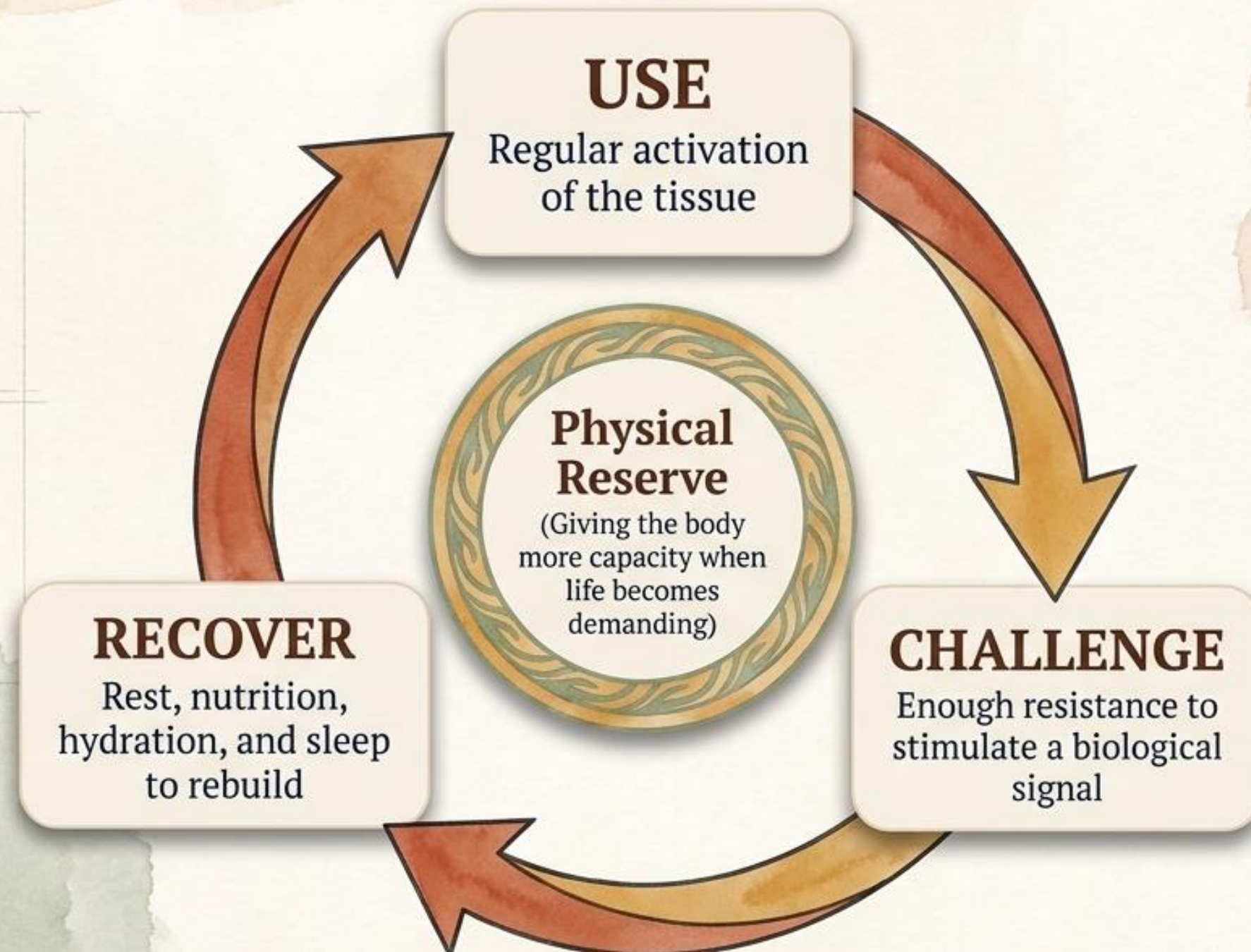


Harder to carry groceries



Increased risk of falls

# The Engine of Muscle Adaptation



Age-related loss  
of muscle mass  
(sarcopenia)  
affects grip,  
stairs, and  
balance.

The concern is  
function, not  
appearance.

Missing any  
one step in the  
cycle halts  
adaptation.

# Strength vs. Power



## Strength

**Definition:** How much total force can you produce?

**Real-World Application:**  
Carrying a heavy bag of groceries, getting out of a deep chair.



## Power

**Definition:** How quickly can you produce that force?

**Real-World Application:**  
Catching yourself when you stumble, stepping quickly onto a curb, reacting in real-time.

**Sometimes fast enough matters just as much as strong enough.**

# Strength Training Can Look Different

Strength training does not have to mean a gym.  
There are many ways to challenge a muscle.



Resistance  
bands



Hand  
weights



Body-weight  
movement



Chair stands



Wall push-ups



Water  
exercise



Water  
exercise



Carrying  
groceries



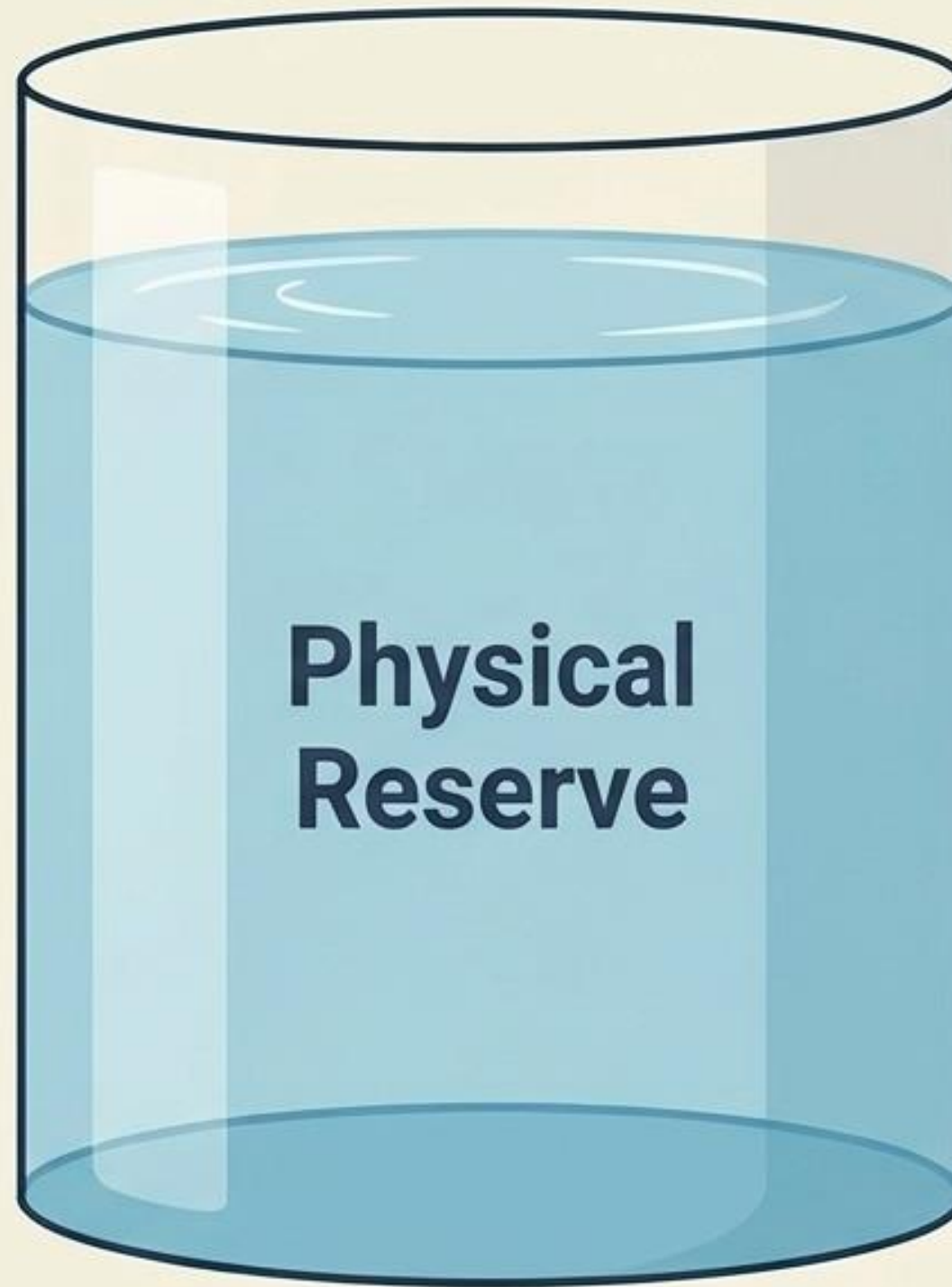
Gardening



Adaptive  
equipment

# Why Strength Matters

- Strong muscles
- support bones,
- joints, posture,
- balance, mobility,
- everyday tasks,
- and independence.



← Physical reserve gives the body more capacity when life becomes suddenly demanding (e.g., illness or a fall).



# Questions?

- Which ideas have we covered that feel most useful for your everyday life?



# 10-Minute Break



When we return: Balance, mobility, and fall prevention.

What do you think causes most falls in older adults?

**A. Weak muscles.**

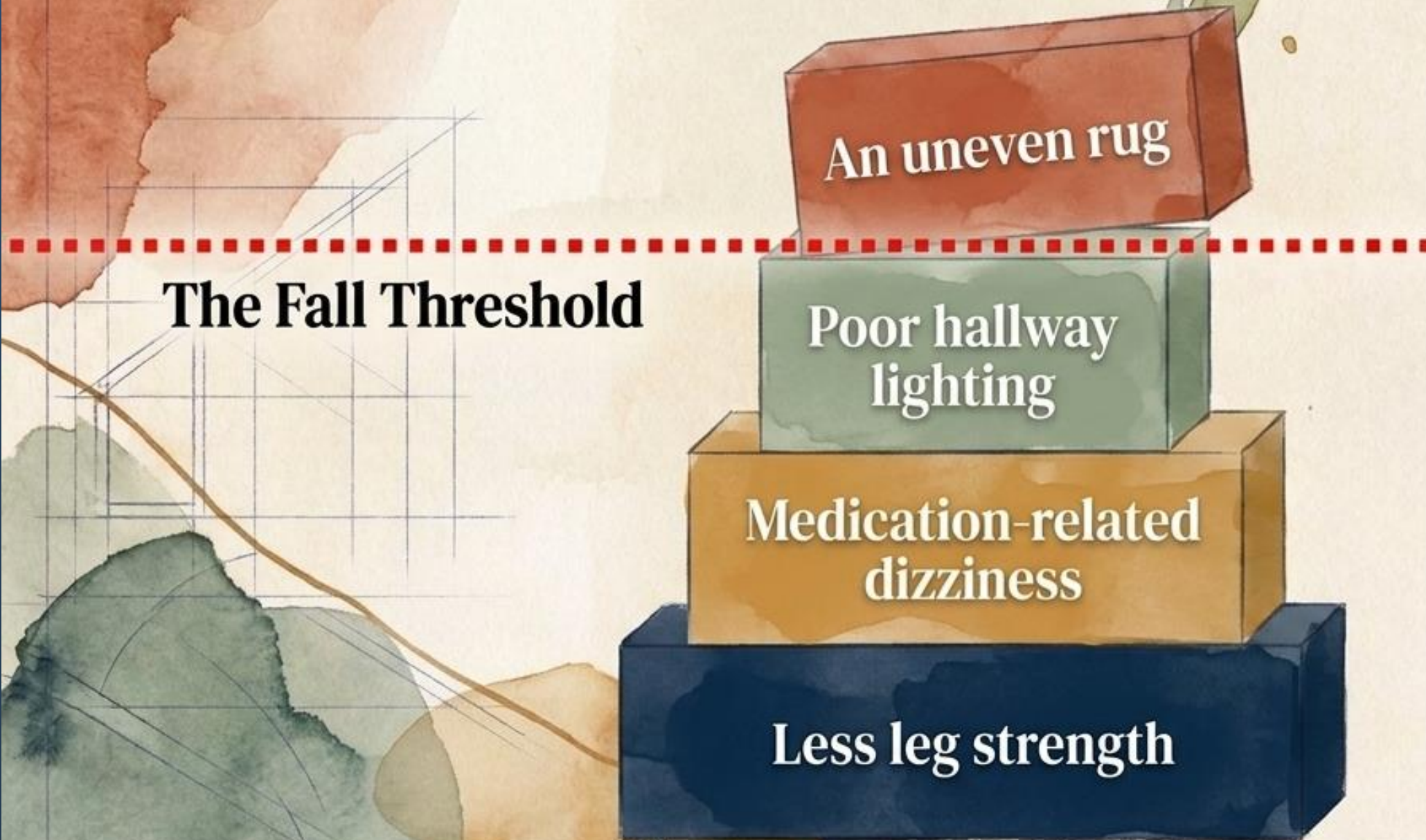
**B. Poor balance.**

**C. Hazards in the environment.**

**D. Usually a combination of several factors interacting at once.**

**Facilitator Prompt: What's your prediction?**

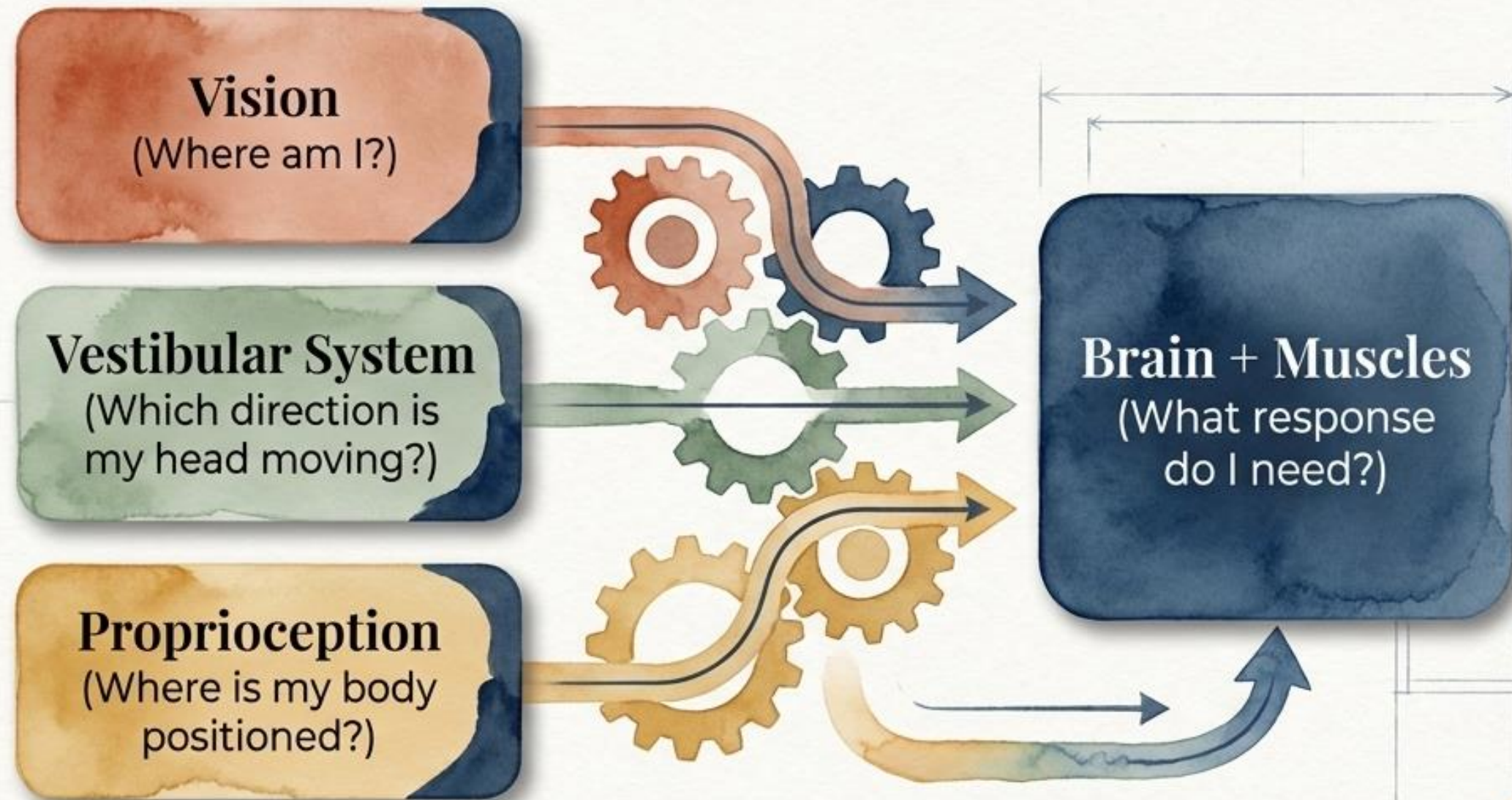
# The Answer: D — The Fall Threshold



Because falls are multifactorial, there are multiple places to intervene.

Changing the environment (removing the 'lighting' or 'rug' block) keeps you safely below the threshold, even if physical weakness remains.

# Balance is a Team Effort



Balance is a whole-body and whole-brain process. A small age-related change in several of these systems simultaneously can quickly add up.

# What Changes With Age?

- Several systems involved in balance may change
- Vision, inner-ear function, reaction time, muscle strength, joint flexibility, sensation in the feet, attention, and processing speed can all play a role
- A small change in several systems can add up



# Why Falls Happen

- **The person:** weakness, vision, balance, medications, health
- **The environment:** lighting, rugs, stairs, clutter, uneven surfaces
- **The situation:** rushing, fatigue, illness, distraction, unfamiliar surroundings
- Most falls are multifactorial



## The Person

- Weakness
- Vision
- Balance
- Medications
- Health conditions



## The Environment

- Lighting
- Rugs
- Stairs
- Clutter
- Uneven surfaces



## The Situation

- Rushing
- Fatigue
- Illness
- Distraction
- Unfamiliar surroundings



**Most falls are multifactorial**



# Sometimes Change the Environment

- The solution is not always changing the person
- Helpful changes may include better lighting, handrails, grab bars, clear walkways, secure rugs, accessible storage, supportive footwear, and appropriate mobility devices
- Good design supports independence



# Mobility Is Bigger Than Walking

- Mobility includes standing, sitting, transfers, turning, reaching, carrying, climbing stairs, navigating uneven surfaces, and moving through community spaces.
- Mobility is participation.



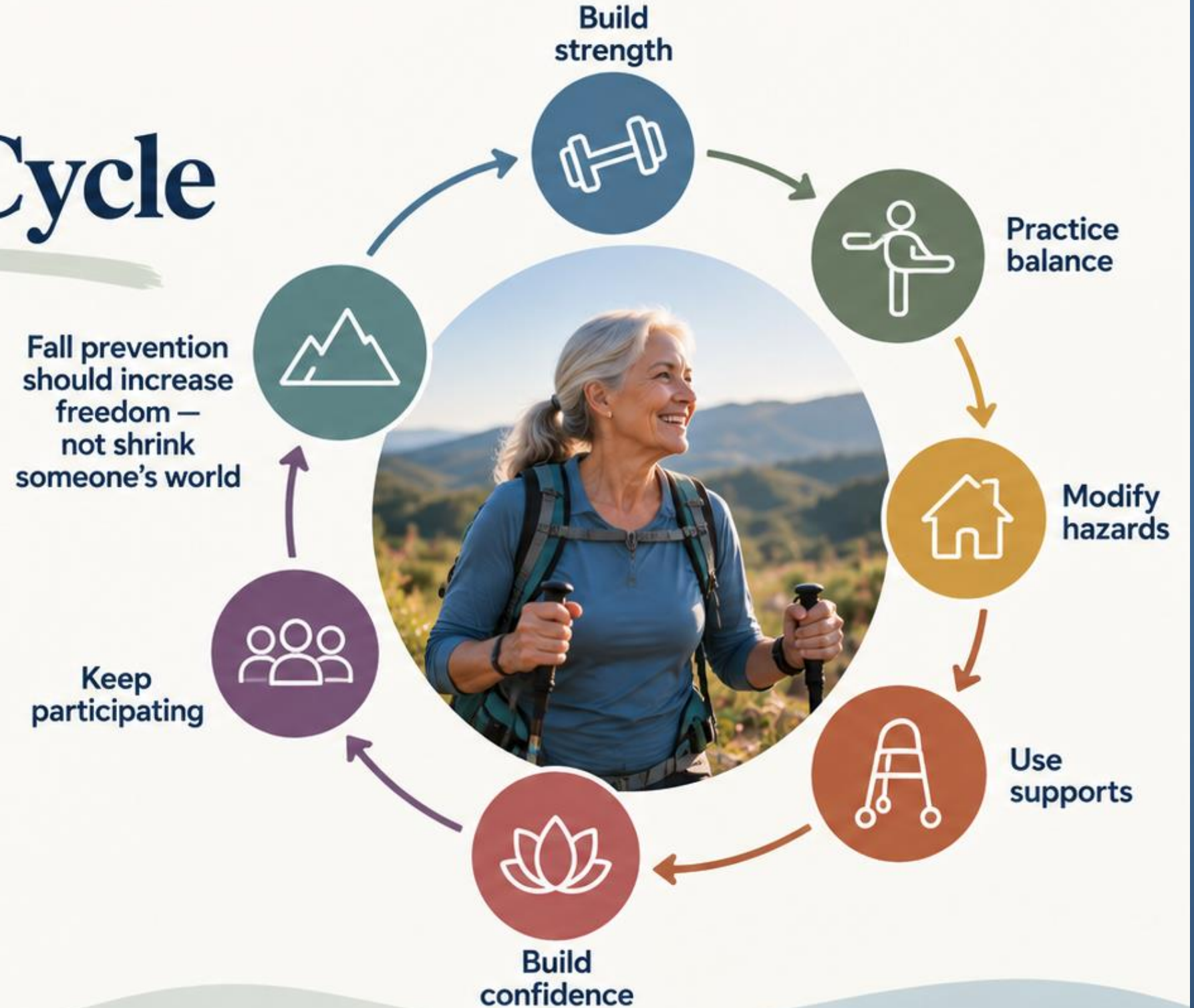
# The Fear-of-Falling Cycle



Fall prevention should increase your freedom—not shrink your world. The goal is not “never take a risk.”

# Breaking the Cycle

- The goal is not “never take a risk”
- Build strength
- Practice balance
- Modify hazards
- Use supports
- Build confidence
- Keep participating
- Fall prevention should increase freedom — not shrink someone’s world



# Normal Aging vs. Something to Notice



## Common Changes

- Longer warm-up time
- Mild joint stiffness
- Slight reduction in speed
- Longer recovery time after activity



## Worth Discussing

- Repeated falls
- Sudden balance changes
- New unexplained weakness
- Persistent or severe pain
- Rapid mobility shifts

**Notice patterns. Ask questions. Seek support when something changes significantly.**



# Adapting Movement for Real Life

- What does “staying active” actually look like in a real human life?
- Healthy movement should fit the person — not the other way around



# Which person is getting the greatest benefit from physical activity?

A. Someone completing an intense workout they hate three times a week.

B. Someone walking, gardening, and doing resistance exercises they enjoy consistently.

C. Someone waiting until they are “in better shape” before beginning.

D. Someone avoiding movement because their body no longer moves the way it once did.

Facilitator Prompt: Choose before we discuss it.

# The Answer: B — Consistency Over Intensity (Build a Movement Menu)

## Aerobic

walking, cycling,  
swimming, dancing

## Strength

weights, bands, wall  
push-ups, chair stands

## Balance

tai chi, supported  
single-leg stands

## Mobility

stretching, yoga,  
range-of-motion

## Everyday Movement

gardening, cleaning, shopping, taking the  
stairs, walking the dog

Healthy movement  
fits the person—not  
the other way around.  
  
It all counts.

# Build a Movement Menu

- **Aerobic:** walking, cycling, swimming, dancing
- **Strength:** weights, bands, chair stands, body-weight movement
- **Balance:** tai chi, supported balance activities
- **Mobility:** stretching, yoga, range-of-motion activities
- **Everyday movement:** gardening, cleaning, shopping, stairs, walking the dog
- **It all counts**



Aerobic



Strength



Balance

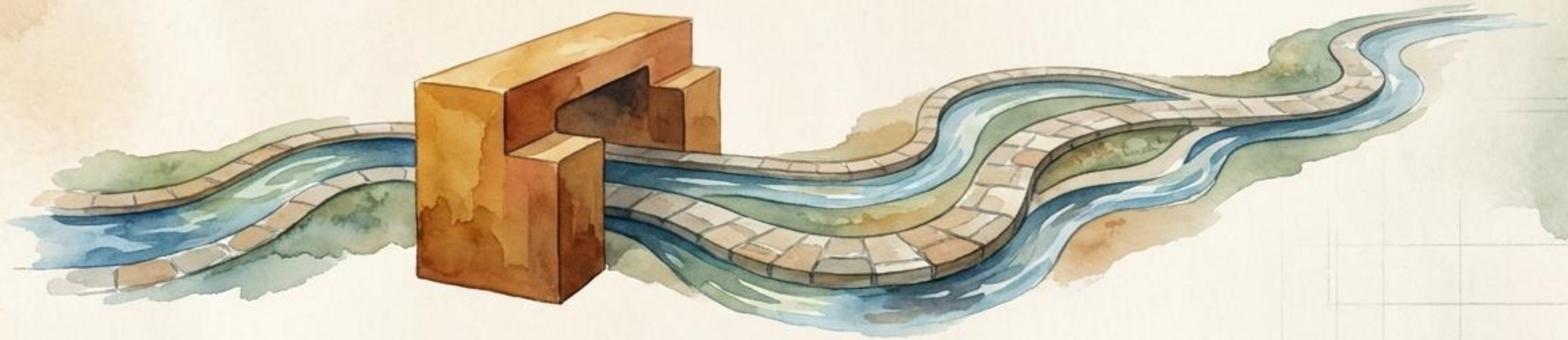


Mobility



Everyday movement

# Adapt, Don't Abandon



Using a cane, holding a railing, sitting during a task, or utilizing adaptive equipment does not mean you have “given up.”  
It means you are adapting to keep participating.

Instead of the myth “Use it or lose it,” try the reality:  
**Use** what you can. Support what needs support. **Adapt** what needs adapting.  
**Strengthen** what can be strengthened.

# The Big Takeaway

**1. Adaptability:** Aging changes how we move, but never eliminates our ability to adapt.

**2. Bones:** Respond directly to mechanical load.

**3. Muscles:** Respond directly to challenge and resistance.

**4. Balance:** A whole-brain skill that responds to practice.

**5. Recovery:** Rest is when the actual physical adaptation happens.

**6. Confidence:** Grows strictly through experience and participation.

**The goal is not to move like you did at 25—the goal is to keep moving in ways that support the life you want to live.**

# Action & Application

Select one specific habit or mindset shift to support your physical vitality this week.

*"One way I plan to challenge or adapt my movement this week is..."*

Try a new balance practice

Add resistance to a daily task

Modify a hazard at home

**Partner Activity:** Take 60 seconds to finish this sentence, then share your response with your partner.

# WEEK 4: The Immune System and Inflammation

- How immunity and inflammation evolve with age.
- The gut-brain-immune system connection
- Vaccines and immunity in older adulthood
- Nutrition, sleep, and stress as immune modulators
- Understanding chronic inflammation and what to do about it
- Effects of Long COVID in older adulthood.

