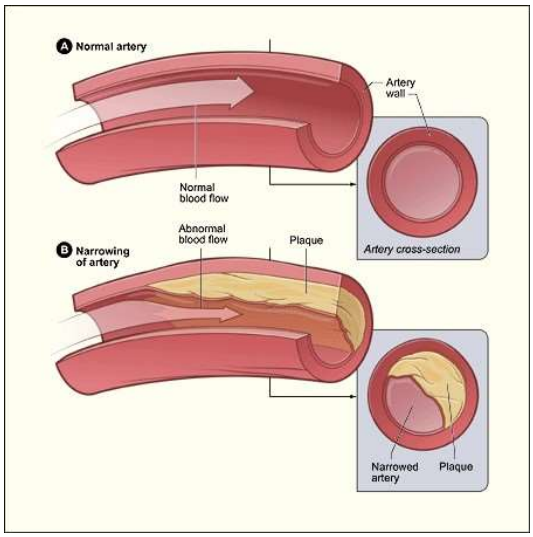
# 1.1.2 Adapting & Developing Mindbody Exercises for Older Adults
# Glossary of Terms

**Atherosclerosis**

Atherosclerosis is a condition where the inner walls of the arteries gradually become thicker and harder due to the build-up of fatty deposits (plaques) made of cholesterol, calcium, and other substances from the blood. Over time, these plaques narrow the arteries and reduce their flexibility, making it harder for blood to flow smoothly. If a plaque ruptures, it can cause a blood clot, which may lead to heart attack or stroke.

Atherosclerosis becomes more common with age - when blood vessels also naturally lose some of their elasticity. Other risk factors for atherosclerosis include:

- high blood pressure
- high cholesterol
- smoking
- diabetes
- obesity
- close relative with cardiovascular disease
- inflammatory diseases such as rheumatoid arthritis
- sedentary behaviour




1. Cross section of an artery without and with atherosclerosis

It is useful to understand that people diagnosed with atherosclerosis can tire easily and may need to avoid more demanding practices, including retention during pranayama. However, gentle, mindful movement and breathing can help support circulation and overall cardiovascular health.

**Baroreceptors**

Baroreceptors are specialised sensory nerve endings found mainly in the walls of the carotid arteries (in the neck) and the aorta. Their role is to constantly monitor blood pressure by detecting the stretch of the arterial walls. When blood pressure rises or falls, baroreceptors send signals to the brain, which then adjusts heart rate, blood vessel tone and blood pressure to keep circulation stable.

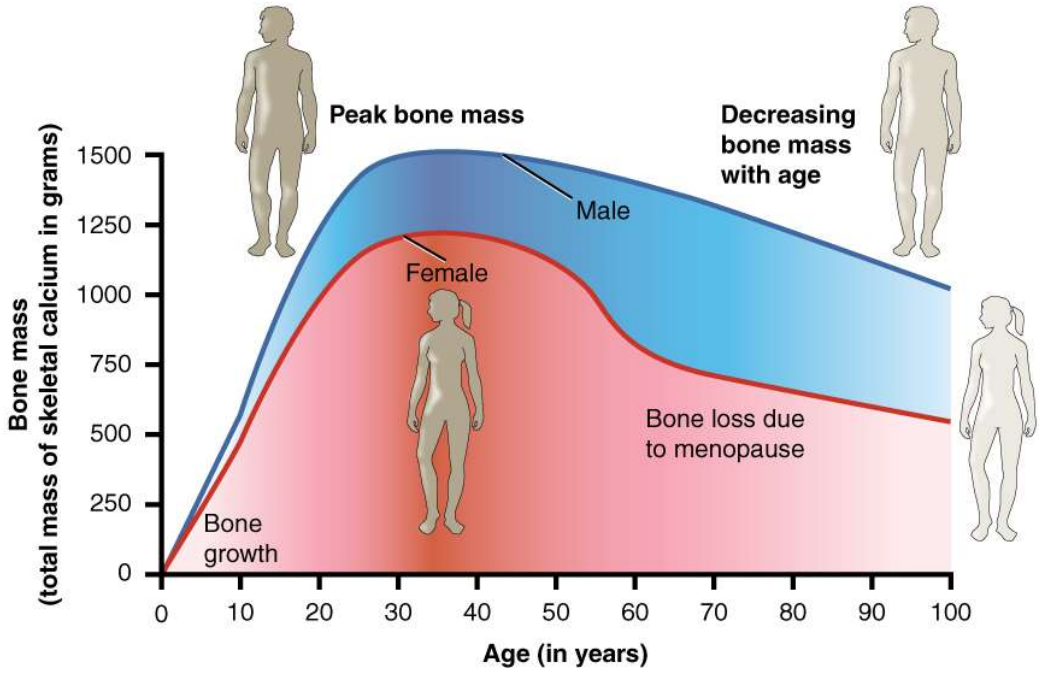
Baroreceptors tend to become less sensitive as we get older. This makes it harder for the body to quickly adjust blood pressure when changing positions, such as when moving from lying down to standing up, for example. Consequently, older adults may experience dizziness, light-headedness or fainting (see *orthostatic hypotension*).

**Bone Density**

**Bone** density is defined as the level mineral content, mainly calcium and phosphorus, within a given section of bone. Simply put, it indicates how strong and resilient the bones are.

As Mindbody teachers, it's useful to appreciate that higher bone density means bones are better able to tolerate load, compression and impact, while lower bone density means bones are more fragile and at greater risk of fractures.

With age, bone density decreases, as shown in the chart below.




2. Changes to bone density with age

**Cartilage**

Cartilage is a smooth, flexible connective tissue found in joints as well as the nose, ears, and between the ribs and sternum. It is made up of specialised cells called chondrocytes, which sit within a gel-like matrix primarily made up of 80% water, plus collagen fibres, various proteins and hyaluronic acid. This allows cartilage to cushion joints, reduce friction during movement and act as a shock absorber.

As production of the component parts of the matrix slow down and chondrocytes become less active, cartilage tends to become thinner, less hydrated and less resilient. As a result, with age, joints may feel stiffer or more painful, and movement more restricted.

**Collagen**

Collagen is a structural protein that forms the main framework of the body's connective tissues, including skin, muscles, tendons, ligaments, cartilage, and bones. It provides strength, elasticity, and support, helping tissues stay firm yet flexible. Collagen fibres are produced by cells called fibroblasts and are made up of tightly packed protein strands that give tissues their resilience and integrity.

As we age, the body produces less collagen, and the fibres that remain become thinner, stiffer, and more fragmented. This leads to reduced elasticity and strength in skin, joints and muscles, contributing to wrinkles, joint stiffness, slower recovery times and reduced flexibility.

**Elastin**

Elastin is a key protein in connective tissue that gives skin, lungs and blood vessels etc their elasticity. It works alongside collagen, forming a flexible network of fibres that allows tissues to move, expand, and recoil without damage.

As we age, the body produces less elastin and existing fibres become less flexible and more brittle. Sun exposure, oxidative stress, and reduced cellular repair further break down elastin, leading to stiffer tissues, less supple skin, and reduced elasticity in muscles, joints, and blood vessels.

**Fascia**

Fascia is a continuous web of connective tissue that surrounds, supports, and links all structures in the body. It is made primarily of collagen and elastin fibres suspended in a hydrated gel-like matrix. This makes it strong and flexible. Healthy fascia helps transmit force efficiently through the body, supports posture, and allows smooth, coordinated movement.

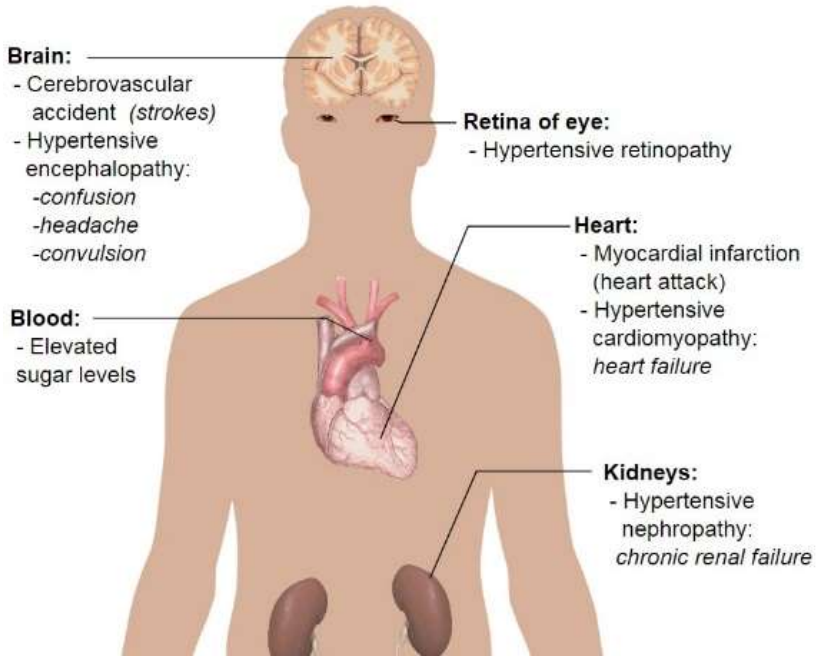
Fascia tends to become thicker, less elastic, and more dehydrated with age, reducing its ability to glide and stretch. This can lead to stiffness, restricted movement and discomfort, especially if the body is inactive for long periods.

**Hypertension**

Hypertension, or high blood pressure, occurs when the force of blood against the artery walls remains consistently higher than normal. The arteries are lined with smooth muscle and elastic tissue that allow them to expand and contract as blood moves through.  Blood pressure depends on how much blood the heart pumps and how easily it can flow through the arteries.

With age, artery walls gradually lose elasticity and become stiffer due to changes in collagen and elastin. This makes it harder for the arteries to expand and recoil, so the heart must work harder to move blood around the body.

Over time, this can increase the risk of heart disease and stroke as well as other complications.

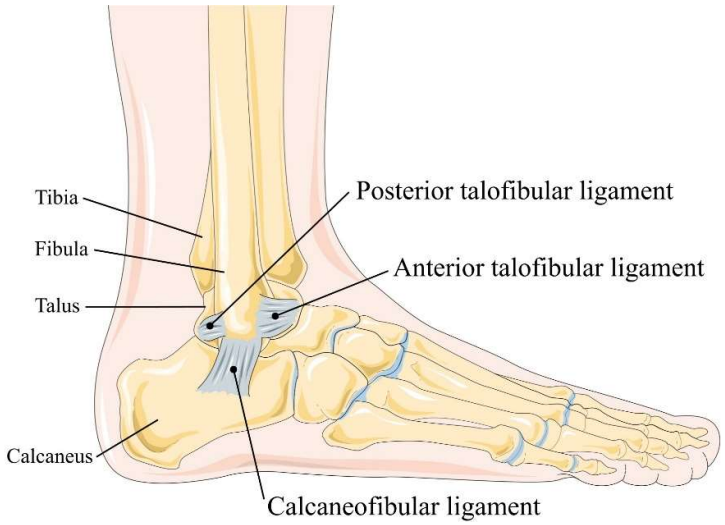



3. Complications of Chronic Hypertension

**Ligament**

Ligaments are strong bands of dense connective tissue that connect bones to other bones across joints, helping to stabilise and guide movement. They are made primarily of collagen fibres, with small amounts of elastin, giving them strength but limited flexibility.

Ligaments do not have a rich blood supply, which means they are slow to heal when damaged.




4. Ankle ligaments

As we age, ligaments tend to become less elastic and more rigid because collagen fibres thicken and elastin content decreases. This can lead to reduced joint flexibility, a greater risk of strain or injury, and a feeling of stiffness in movement.

**Orthostatic Hypotension (Postural Hypotension)**

Orthostatic (or Postural) Hypotension is defined as an abnormal drop in blood pressure that occurs when a person stands up from sitting or lying down. More specifically, it refers to a decrease of at least 20 mmHg in systolic blood pressure or 10 mmHg in diastolic pressure within three minutes of standing.

This sudden drop in blood pressure reduces blood flow to the brain, causing symptoms such as light-headedness, dizziness or fainting.

Orthostatic hypotension can result from a variety of causes. Common contributing factors include:

- Low blood volume - due to dehydration, blood loss, or insufficient fluid intake. Older adults are particularly at risk, especially if they take diuretics or avoid drinking fluids to reduce night-time urination.
- Age - with age, baroreceptors (pressure sensors in the arteries) become less responsive, slowing the body's ability to adjust blood pressure quickly when posture changes.
- Medications – certain drugs can lower blood pressure.

- Hot environments- heat causes vasodilation, further lowering blood pressure, especially after exertion or in warm studios.

Symptoms can include:

- Dizziness or light-headedness
- Syncope (fainting)
- Blurred or tunnel vision
- Weakness or fatigue
- 'Fuzzy head' or confusion
- Palpitations
- Nausea

**Osteoarthritis**

The most common form of arthritis, particularly in older adults, is osteoarthritis (OA). The World Health Organisation (2023) defines it as:

"A degenerative joint condition. It causes pain, swelling and stiffness, affecting a person's ability to move freely."

Osteoarthritis can occur in any joint but is most often found in weight-bearing joints such as the hips, knees, feet and lower spine, as well as in the hands.

In healthy joints, cartilage provides a smooth, cushioning surface that allows bones to glide easily against one another. With osteoarthritis, this cartilage gradually breaks down and becomes thinner. The underlying bone can thicken or develop small bony outgrowths (osteophytes), and inflammation of the surrounding tissues may occur.

Common symptoms of osteoarthritis include.

- Pain – often worse after activity or towards the end of the day.
- Stiffness – particularly after rest.
- Crepitus – a grating or crunchy sensation caused by friction between rough joint surfaces.

- Swelling – from joint thickening or an increase in synovial fluid.
- Reduced range of movement – due to structural changes and pain avoidance.

Several factors can increase the likelihood or severity of osteoarthritis:

- Ageing
- Joint overuse or injury
- Family history of osteoarthritis
- Obesity
- Muscle weakness
- Chronic inflammation

5. Arthritis in the index finger

Mindful movement can improve mobility, reduce stiffness and strengthen surrounding muscles.

**Osteoporosis**

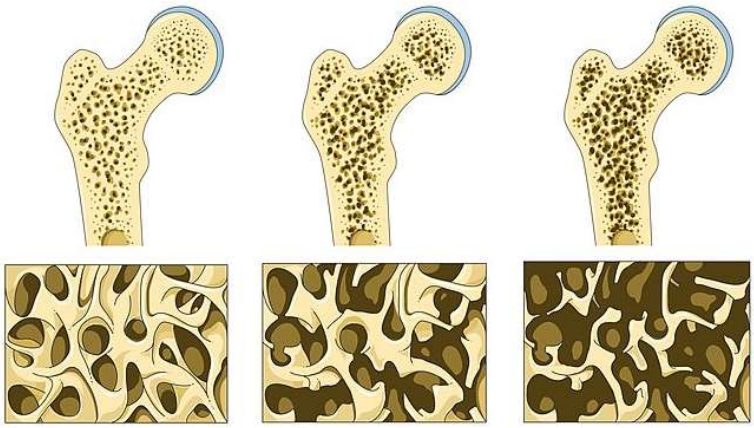
Under normal circumstances, the skeleton is a dynamic structure that continually remodels itself. Microdamage is constantly being repaired as new bone tissue replaces the old. At any given time, around 2–5% of the skeleton is undergoing this renewal process.

Remodelling depends on a delicate balance between two types of bone cells:

- Osteoclasts - which break down and reabsorb old or damaged bone, and
- Osteoblasts - which form new bone tissue.

When this system remains in balance, bone remains strong and resilient. However, if bone resorption exceeds bone formation, either because osteoclast activity increases or osteoblast activity decreases, the result is a gradual loss of bone mass. Over time, this can lead to osteopenia (milder bone loss) and, if the imbalance continues, to osteoporosis.

Osteoporosis is defined as a reduction in bone density and deterioration of bone tissue, typically measured as a bone mineral density score that deviates by -2.5 points or more from the young adult average.



6. Progressive changes to bone structure as a result of osteoporosis

There are several risk factors for osteoporosis, including:

- Ageing - bone density naturally declines with age as osteoblast activity slows.
- Hormonal changes - in women, reduced oestrogen after menopause accelerates bone resorption. In men, declining testosterone can have a similar, though slower, effect.
- Inactivity - weight-bearing and resistance-based movement stimulate osteoblasts and strengthen bone. Sedentary lifestyles accelerate bone loss.
- Poor nutrition - insufficient calcium, vitamin D, and protein intake reduce the body's ability to maintain bone structure.
- Smoking and alcohol - both interfere with calcium absorption and bone cell activity.
- Certain medications and conditions –long-term steroid use, thyroid disorders and digestive conditions that affect nutrient absorption can weaken bone.

Mindful, weight-bearing movement such as standing asana, controlled Pilates resistance work or balance-based functional movement can help maintain bone density. Awareness of alignment, breath, and gentle changes in load reduces the risk of injury while strengthening bones safely.

**Primary ageing**

Primary ageing refers to the natural changes that occur in the body over time as part of the normal ageing process. These changes are not caused by disease or lifestyle, but by the body's intrinsic biological processes.

These changes happen to everyone, though the rate and degree can vary between individuals.

Examples of primary ageing include:

- Reduced skin elasticity – as collagen production decreases.
- Slower reaction times.
- Decreased efficiency of the cardiovascular and respiratory systems, meaning recovery after exertion takes longer.
- Changes in balance and proprioception due to slower sensory feedback.

**Proprioception**

Proprioception is the body's ability to sense both its position in space and the way that it moves. As such, it is intimately linked to balance. Proprioception relies on specialised sensory receptors in the muscles, tendons, joints and inner ear that send positional information to the brain.

This internal awareness allows us to coordinate movement smoothly, maintain posture, and adjust balance automatically, for example, when walking on uneven ground, shifting weight in asana, or closing the eyes in relaxation without losing awareness of body alignment.

Proprioception declines as we get older with the sensory receptors and neural pathways becoming less responsive. This may lead to difficulties with balance, slower reaction times and greater risk of falls.

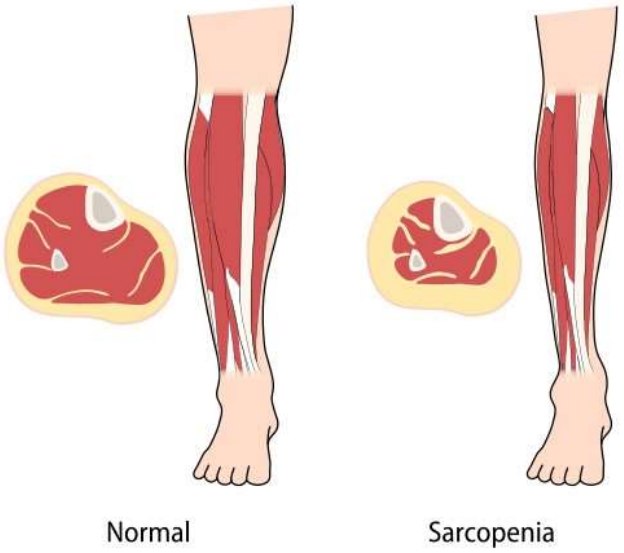
For Mindbody teachers, proprioception can be supported through practices that include:

- Slow, mindful movements
- Eyes-closed exercises to heighten internal awareness
- Gentle balance challenges
- Focused breath and body scanning to refine internal sensing.

**Sarcopenia**

Sarcopenia is the age-related loss of muscle mass, strength, and function. It develops gradually as muscle fibres shrink and reduce in number. This is the result of muscle protein breakdown outstripping repair. Contributing factors include reduced physical activity, hormonal changes and a decline in nerve signals that stimulate muscle contraction.

As sarcopenia progresses, it can lead to weaker muscles, slower movement, reduced balance and increased risk of falls. Regular strength-based, weight-bearing and balance exercises, combined with adequate nutrition and mindful movement, can slow its effects.




7. Sarcopenia within the muscles of the lower leg.

**Secondary Ageing**

Secondary ageing refers to the changes that can occur in the body as a result of factors such as lifestyle, environment or disease. These are the things that are not an inevitable consequence of ageing.

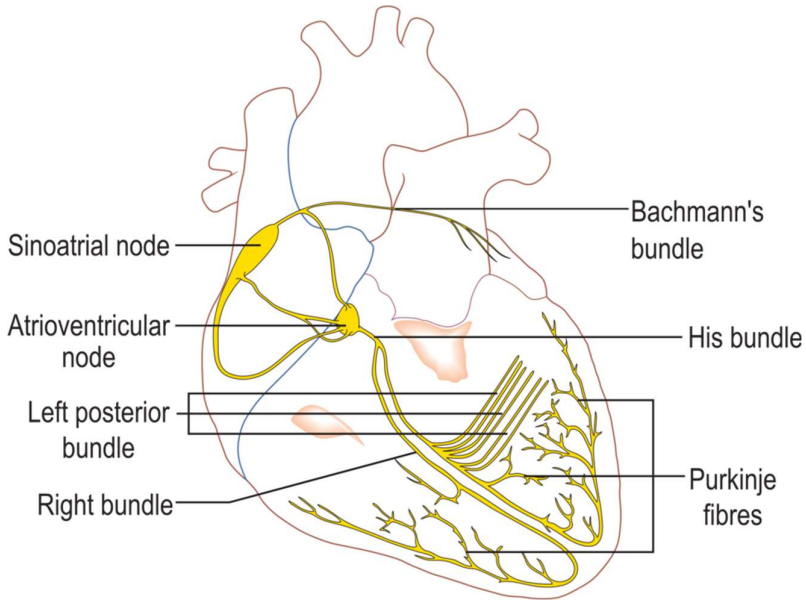
Examples of secondary ageing include:

- Loss of muscle strength and mobility due to physical inactivity.
- Arthritis.
- Hearing loss due to repeated exposure to loud noises.

**Sinoatrial Node**

The sinoatrial (SA) node, the heart's natural pacemaker, is a small cluster of specialised cardiac muscle cells located in the right atrium of the heart. These cells generate electrical impulses that set the rhythm of the heartbeat, causing the heart's chambers to contract in a coordinated way.

The SA node's activity is influenced by the autonomic nervous system, which adjusts heart rate in response to factors such as stress, relaxation and physical activity.




8. Sinoatrial node in context

As we age, the SA node tends to lose pacemaker cells and becomes less responsive to signals from the nervous system. This can lead to an increased risk of arrhythmias (irregular heartbeat) a reduction in maximum heart rate and a longer recovery time after activity.

For Mindbody teachers, this means encouraging paced, mindful exercise with gradual increases in intensity, allowing the heart time to adapt. Emphasising breath awareness, relaxation and gentle cardiovascular conditioning helps support overall cardiovascular health.

**Tendon**

Tendons are tough bands of fibrous connective tissue that attach muscles to bones. They are composed mainly of closely packed collagen fibres, arranged in parallel to give great tensile strength, with a small amount of elastin to allow slight stretch.

Tendons have a limited blood supply, so they repair and adapt slowly compared to muscles.

With age, tendons become stiffer and less flexible as collagen fibres lose some of their structure and elasticity declines. This can lead to reduced range of movement and a greater risk of strain or inflammation after sudden movements, or if range of movement is pushed too far.

Gradual warm-ups, mindful stretching and balanced strength work are recommended to support tendon health in older adults.

**Vascular Resistance**

Vascular resistance is the term used to describe the degree to which blood vessels resist the flow of blood. It is influenced by the diameter of the vessels, the smooth muscle tone in their walls and the viscosity (thickness) of the blood. When vessels constrict it is harder for blood to pass through, so resistance increases and blood pressure rises. When they relax and widen blood can flow more freely, so resistance decreases and blood pressure falls.

As we age, the artery walls become stiffer and less efficient. These changes lead to higher vascular resistance, making it harder for the heart to pump blood, which is a contributing factor in hypertension and reduced circulation.

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