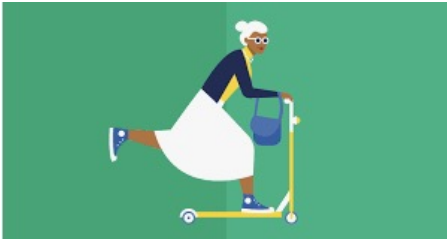


Our Ageing Bodies

A very brief outline of some of the physiological changes that occur with age

Lena Gan
24th February 2022

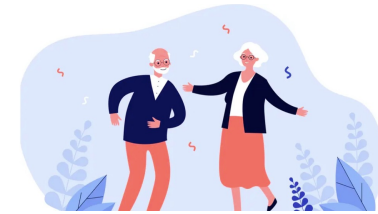


1

Ageing: we're all doing it!

What are some of the changes that occur?
Some are visible and others are not:

- > posture
- > gait
- > skin texture
- > hair colour
- > dexterity
- > ailments...



<https://www.hartmandirect.co.uk/information-centre/what-changes-happen-when-we-age/>

2

Age, age, age...

Biological, psychological, social, emotional...
Age of consent, retirement, driving...

Genetic factors vs lifestyle factors
As little as 20% vs ...

<https://immunityageing.biomedcentral.com/articles/10.1186/s12979-016-0066-z>



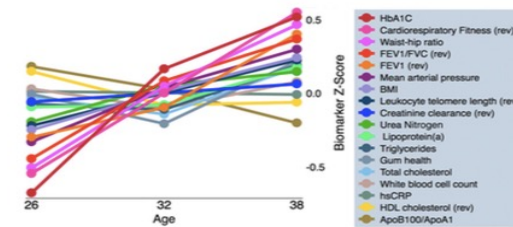
3

Chronological vs physiological age

Billions of our cells die each day as a normal part of maintaining health and avoiding disease

Quantification of biological ageing in young adults 2015 – Belsky et al

Healthy adults exhibit biological ageing of multiple organ systems over 12 years of follow-up



4

Blue zones

Okinawa (Jp) | Sardinia (It) | Ikaria (Gr) | Loma Linda (Cal) | Nicoya (CR)

From 6-10x more centenarians

Lessons from the Blue Zones:

1. Move naturally
2. Purpose in life
3. Belonging
4. Minimise stress
5. 80% rule re food
6. Plant focused diet
7. Alcohol in moderation
8. Loved ones first
9. Right tribe

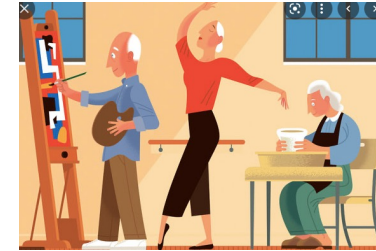


Buettner, D. & Kemp, S. (2016). Blue Zones: Lessons from the World's Longest Lived
<https://journals.sagepub.com/doi/pdf/10.1177/1559827616637066>

5

Creativity and walking

Stanford researchers found that walking boosts creative inspiration. They examined creativity levels of people while they walked versus while they sat. A person's creative output **increased** by an average of **60% when walking**.



<https://news.stanford.edu/2014/04/24/walking-creativity-042414/>
Westmead Children's Hospital Labyrinth <https://youtu.be/5MXXOXADkuJ8>

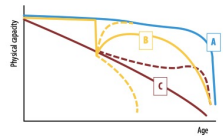
6

Functional ability & intrinsic capacity

Intrinsic capacity = total of physical + mental capacities

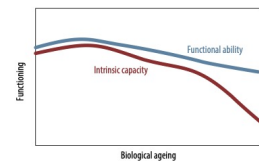
Functional ability = interaction b/w individual + environment

Fig. 2.2. Three hypothetical trajectories of physical capacity



— A. Optimal trajectory, intrinsic capacity remains high until the end of life.
— B. Interrupted trajectory, an event causes a decrease in capacity with some recovery.
— C. Declining trajectory, capacity declines steadily until death.
The dashed lines represent alternative trajectories.

Fig. 2.3. Trajectories of functional ability and intrinsic capacity



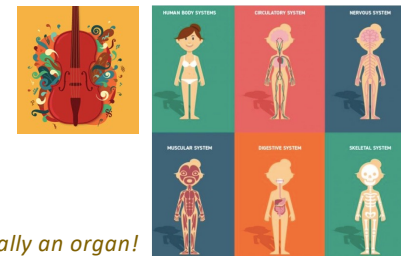
NB: Importance of supportive environments!

7

The body*

A system or rather multiple systems – all interconnected!

It works together like an orchestra OR a car!



<https://www.youtube.com/watch?v=Ae4MadKPiC0>
<https://www.youtube.com/watch?v=gEUU-A2wfSE>

**Includes the brain which is technically an organ!*

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Breathing

Crucial for homeostasis

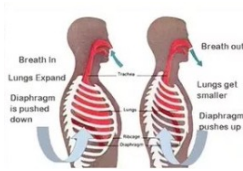
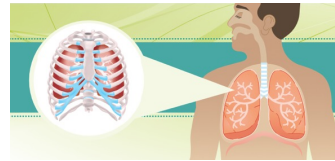
Oxygen rich blood for muscles & organs

Lung capacity declines due to bad posture, lack of exercise, reduced chest mobility, arthritic changes...

Vital capacity is a predictor of mortality

It's related to mobility of rib cage

<https://sequencewiz.org/2020/07/15/your-vital-lung-capacity-why-is-it-important-and-how-can-you-improve-it-with-yoga/>



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Skeletal system & bone density

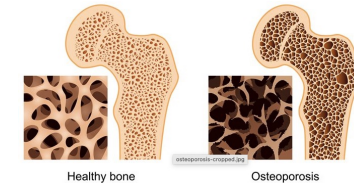
Bone tissue is constantly being recycled

With age there is a net loss > resorption outpaces formation.

Even short periods of inactivity result in loss of bone mass. Bones become thinner & weaker.

Intervertebral discs (30% of height) begin degeneration as early as 20s.

By 70yrs 60% of discs have severe degeneration = loss of flexibility of spinal column, reduction in height.



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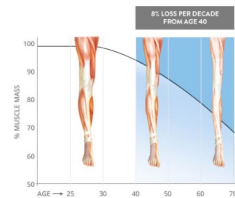
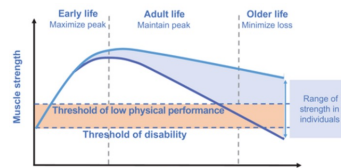
Muscle mass

Muscle mass 1-2% pa. from 50yrs = loss of strength & endurance

Lower body strength declines more rapidly (balance & falls)

Inactivity = muscle atrophy & faster decline

Reduced blood flow...



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Posture & flexibility

Flexibility = range of motion of a joint

Discs harden and lose flexibility

Cartilage, synovial fluid, ligaments, tendons
Muscle & bone mass

Inactivity is one of the main issues!

Sitting still for long periods is particularly deleterious!

DEVELOPMENT OF STOOPED STATURE WITH AGE



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Movement or gait

Gait is a complex task with "more than a 1,000 muscles synchronised to move over 200 bones around 100 moveable joints" (Prince et.al., 1997).

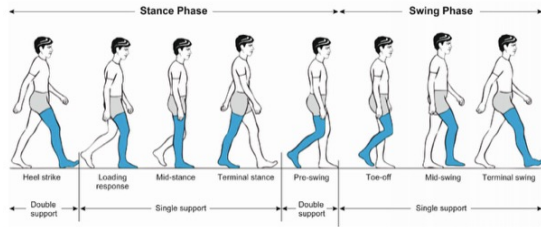


Fig. 1 Phases of the normal gait cycle

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Movement or gait

Some impairments that affect gait in older adults include:

Increase in muscle weakness; reduced range of joint movement; reduced visual; vestibular and proprioceptive acuity; reduced cognition and/or reduced ability to react when our COG moves outside our BOS.

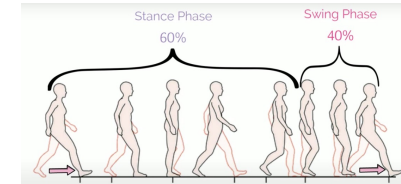
Jerome, G. J., Ko, S., Kauffman, D., Studenski, S. A., Ferrucci, L., and Simonsick, E. M. (2015).

Gait characteristics associated with walking speed decline in older adults:

Results from the Baltimore Longitudinal Study of Aging.

Archives Of Gerontology And Geriatrics, 60, 2, pages 239-242.

<https://www.physio-pedia.com/Gait>



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Reflexes

With age reflexes or reaction rates slow

Brains response time begins to decline slowly from 24yrs

This varies greatly from person to person!

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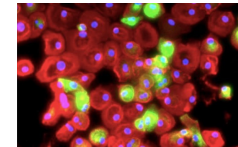
Immune & healing systems

Immune systems weakened with age

Also they're less responsive to vaccines

Recovery from injury, illness & infection is slower

Body produces fewer immune cells



Tips: Move often; eat well; don't smoke; sleep well; minimize stress

<https://www.webmd.com/healthy-aging/guide/seniors-boost-immunity#2>

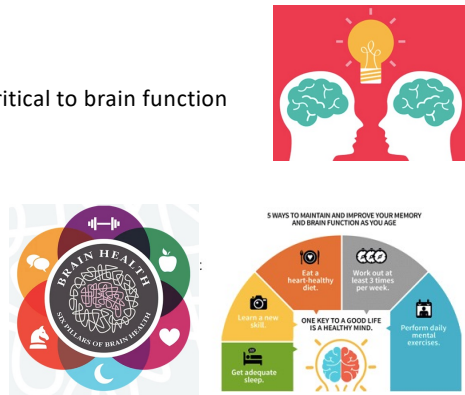
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Brain health

Blood flow & oxygen are critical to brain function

- > Don't sit still
- > Vitamin D*
- > Cholesterol
- > Diet (Mediterranean)
- > Social exercise

<https://healthybrains.org/pillars/>



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The senses

How many do we have? 5, 9, 10, 21, 24, 33...

<https://www.encyclopedia.org.uk/2016/06/20/multimodal-sensory-system/>
<https://www.nytimes.com/2016/06/20/health/multimodal-sensory-system.html>

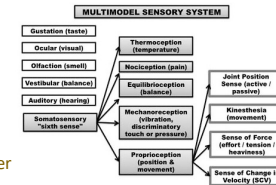
Here's a 24 item list to start with:

- Sight: light, colour |Hearing |Smell |Taste: sweet, salt, sour, bitter
- Touch | Pressure |Nociception (pain) |
- Mechanoreception: balance; proprioception; kinaesthesia

Thermoception: heat; cold

Interoceptors: blood pressure; blood oxygen; cerebrospinal fluid pH; **thirst**; hunger; lung inflation

Magnetoception | Time



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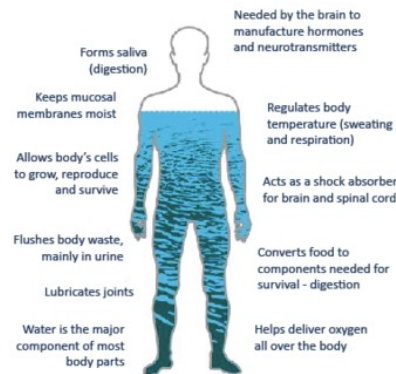
Thirst

Up to 60% of the human adult body is water.

- Brain and heart are composed of 73% water
- Lungs are about 83% water
- Skin contains 64% water
- Muscles and kidneys are 79% water
- Bones are 31% water.

(Mitchell, H. H. Journal of Biological Chemistry 158)

What Does Water do for You?



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Somatosensation

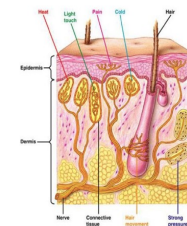
Somato means body,

Somatosensation = the total of all sensations we feel due to our sensory receptors!

<https://www.youtube.com/watch?v=imD0L6dAvJc>

Receptors

1. Chemoreceptors = chemical
2. Pain receptors = pain
3. Thermoreceptors = heat
4. Mechanoreceptors = pressure, location
5. Photoreceptors = light



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Vision

The eye contains over 70% of the sensory receptors of the body.

Short-sightedness; long-sightedness; astigmatism; presbyopia

Cataracts; macular degeneration; glaucoma; diabetic retinopathy

Vision Changes: the ageing eye:
<https://www.youtube.com/watch?v=EtC7danYGP>

How does my age affect my vision?
 Everyone's vision changes as they get older. Here are some conditions to keep an eye out for as you age.

Cataracts
 What it is: Tissues within the lens become cloudy.
 What it looks like: Cloudy vision and sensitivity to light.
 How it's treated: Prescription glasses or surgery.

Glaucoma
 What it is: Eye pressure that damages the optic nerve.
 What it looks like: Blurry vision or blind spots.
 How it's treated: Medications or surgery.

Presbyopia
 What it is: Lens loses its ability to change shape.
 What it looks like: Difficulty focusing on close objects.
 How it's treated: Readers, progressive lenses or surgery.

Age-related macular degeneration (AMD)
 What it is: The center of the retina deteriorates.
 What it looks like: Distortion in the center of your vision.
 How it's treated: Preventive dietary changes or medication.

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The senses: proprioception & equilibrioception

Proprioception = knowledge of the position of your joints in space

Loss of brain volume. Poor blood supply to the brain white matter; lesions leads to reduced proprioception with age

Equilibrioception = balance

We are most balanced if we keep our 'centre of mass' over our 'base of support'

The diagram shows three boxes at the top: 'Eyes (Visual input)', 'Ears (Vestibular input)', and 'Muscles & Joints (Proprioceptive input)'. Arrows from these boxes point to a central box labeled 'Brain'. Below the 'Brain' box is a box labeled 'Awareness of body position'. An arrow from the 'Brain' box points to a box at the bottom labeled 'Instructs eye and body muscles to move to coordinate balance'. Below the diagram is a photograph of four people (two men and two women) in a gym setting, performing various balance exercises like standing on one leg and using a stability ball.

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Keep moving, breathe deeply & drink water!

With thanks to: Louisa Remedios, Cathy Said & Cassandra Szoeko

The illustration shows a series of colorful silhouettes of people in various stages of movement. From left to right: a person walking, a person on a bicycle, a person running, a person walking with a shopping bag, and a person walking. The silhouettes are in shades of red, orange, yellow, green, blue, and purple, and they are reflected on a white surface below them.

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