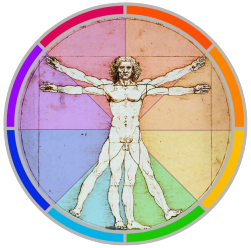
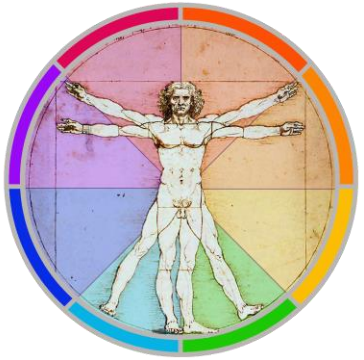
HUBS191 Lecture Material

This pre-lecture material is to help you prepare for the lecture and to assist your note-taking within the lecture, it is NOT a substitute for the lecture !



Please note that although every effort is made to ensure this pre-lecture material corresponds to the live-lecture there may be differences / additions.

Human Body Systems (HUBS) 191



The structure of the skeleton

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ŌTĀKOU WHAKAIHU WAKA

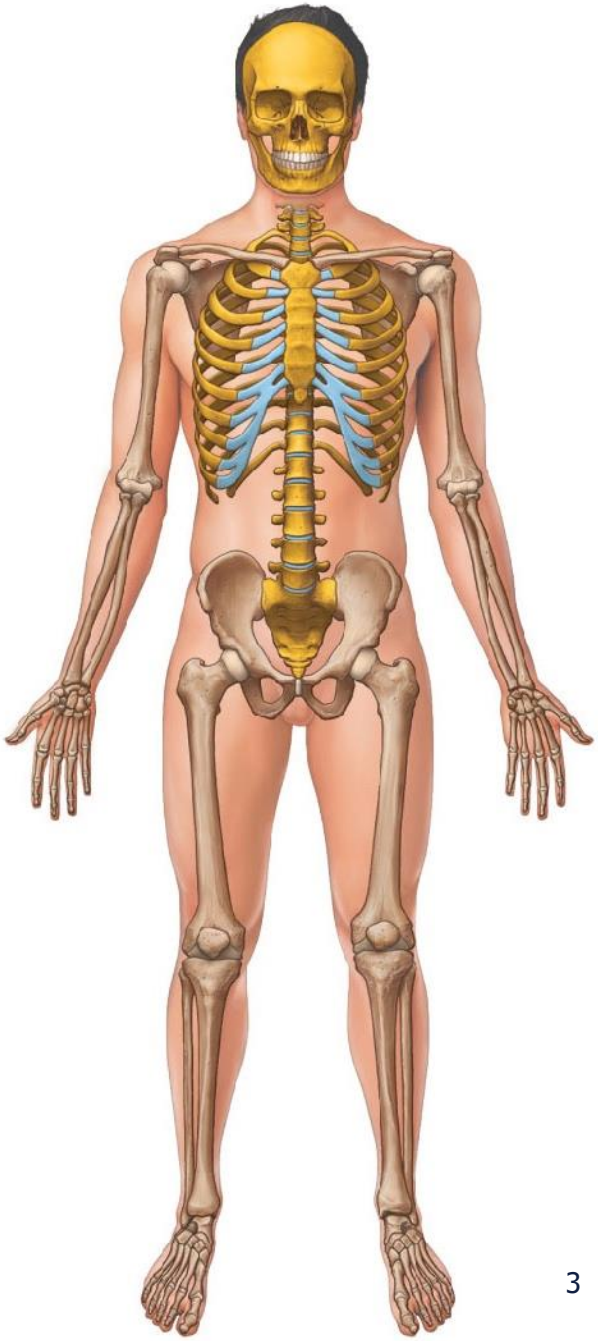
Objectives

By the end of this lecture you should be able to:

- describe the functions of the skeletal system
- describe the gross structure of bones and explain how they reflect their functions
- describe the different classes of bone in the human skeleton and explain how their shape relates to function
- Identify the major bones of the skeleton, and understand why/how some are sexually dimorphic

Functions of the skeleton

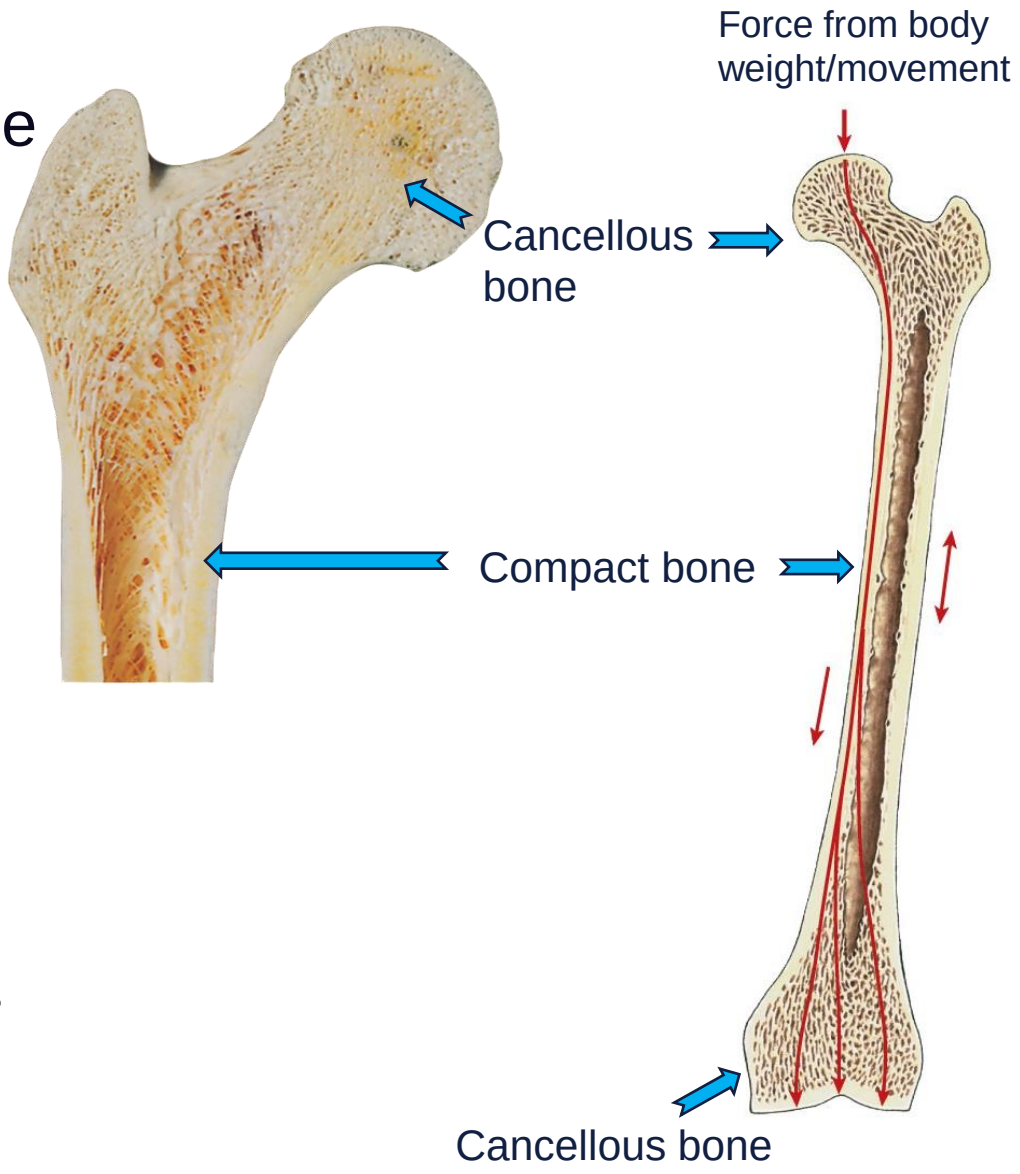
- Support
- Movement
  - Bones are levers!
- Protection
  - Major organs
- Storage
  - Minerals
- Red Blood Cell Formation
  - In marrow



Martini et al, *Visual Anatomy & Physiology (3rd Edition)*, 2018: pp 283

The Structure of Bones

- There are 2 types of bone tissue (same material, different structure):
- Compact Bone
  - Strong
  - Good at transmitting force in one direction
- Cancellous (aka trabecular) bone
  - Light, spongy bone
  - Shock-absorbing
  - Resists & channels forces that come from multiple directions

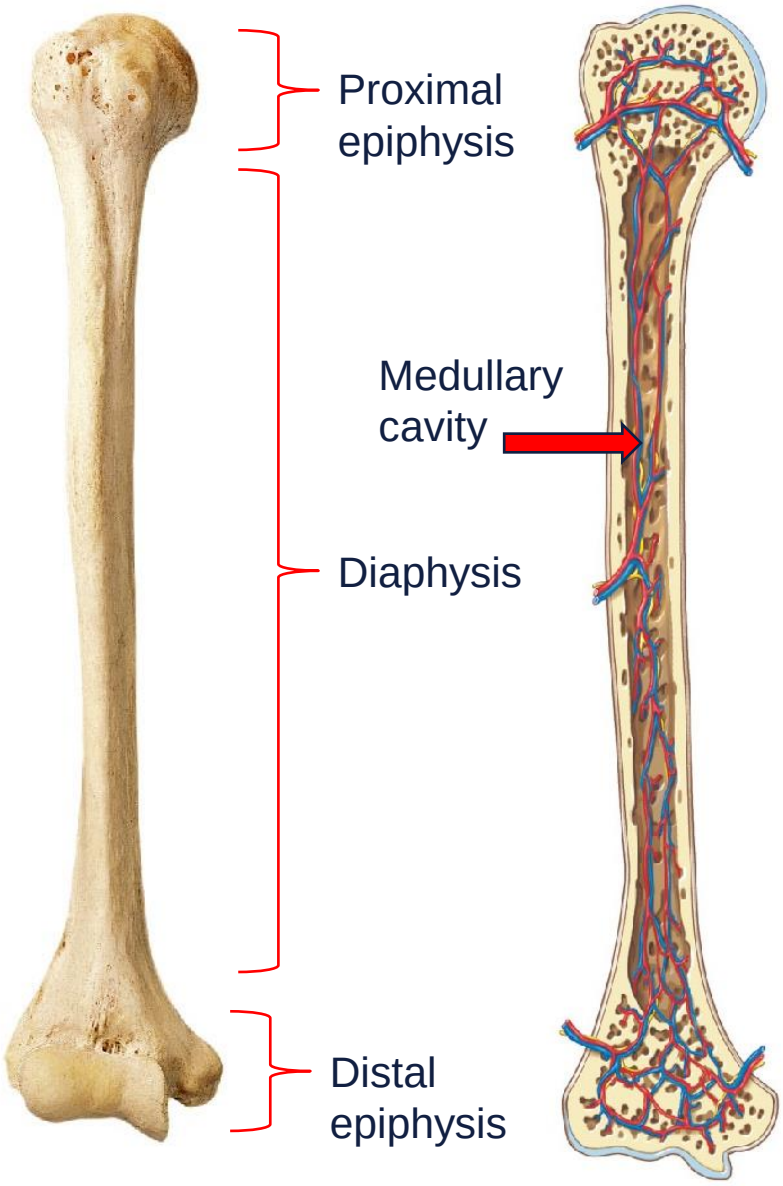


Martini et al, *Visual Anatomy & Physiology (3rd Edition)*, 2018: pp 256

Bone Classes

1. Long Bones

- Longer than they are wide
- Composed of wider epiphyses and a longer, narrower diaphysis
- Act as levers for movement
- Thicker compact bone in diaphysis
- Mostly limb bones

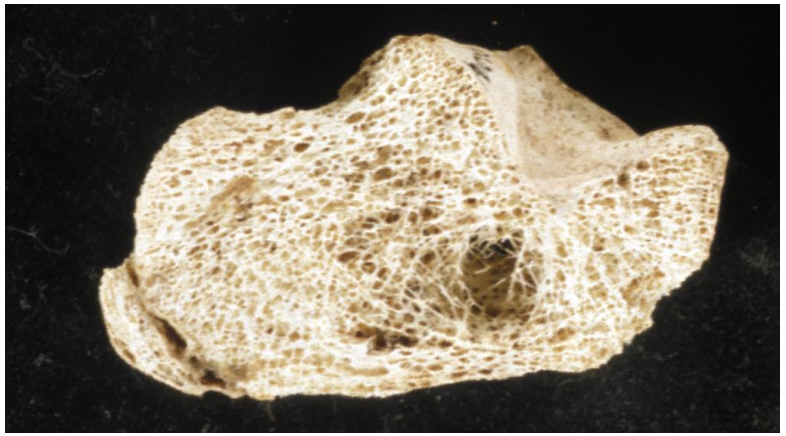


Martini et al, *Visual Anatomy & Physiology (3rd Edition)*, 2018: pp 256

Bone Classes

2. Short Bones

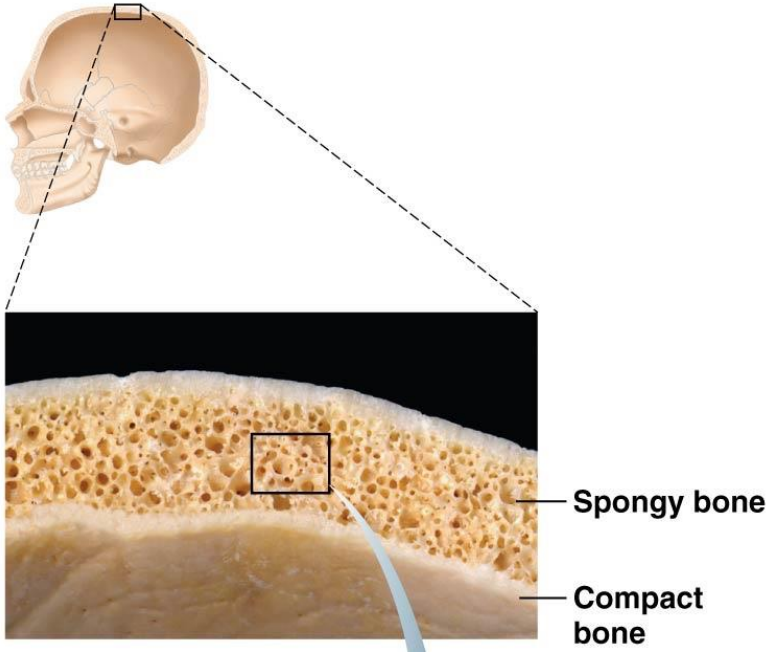
- Close to equal width and length
- Mostly cancellous bone
- Weight bearing (from multiple directions)
- E.g. Carpals and tarsals

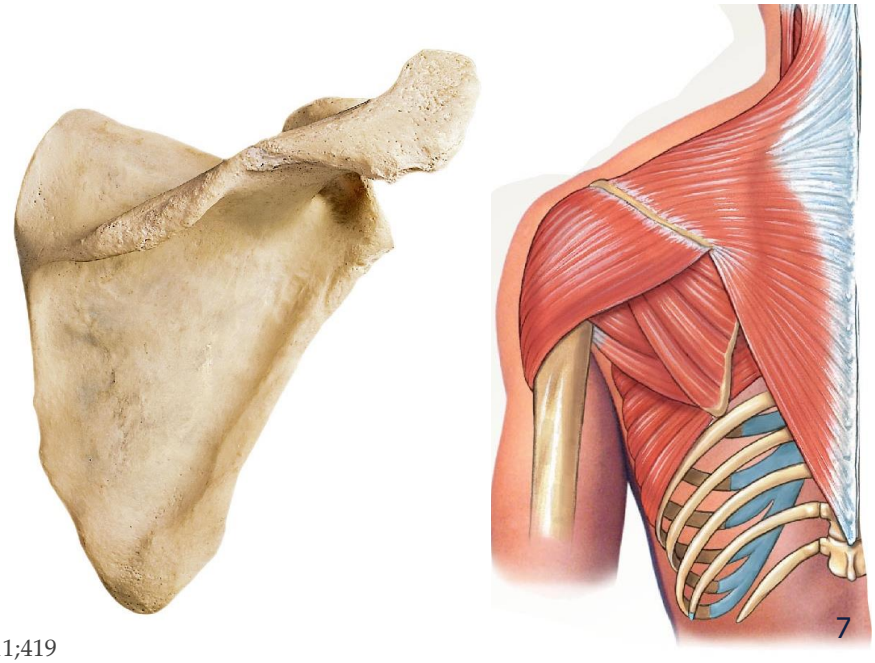


Bone Classes

3. Flat bones

- Function usually for muscle attachment (e.g. scapula)
- Also protection (e.g. skull, sternum)
- Thin plates of compact bone (some cancellous too)





Martini et al, *Visual Anatomy & Physiology (3rd Edition)*, 2018: pp 311;419

Bone Classes

4. Irregular bones

- Doesn't seem to fit into any other category?
  - Probably an irregular bone!
- Various shapes and functions

Martini *et al*, *Visual Anatomy & Physiology*, 3rd Edn, 2018, p.304

Not long
Not round/square shaped
Not just cancellous bone
Not flat
Often have foramina (holes)

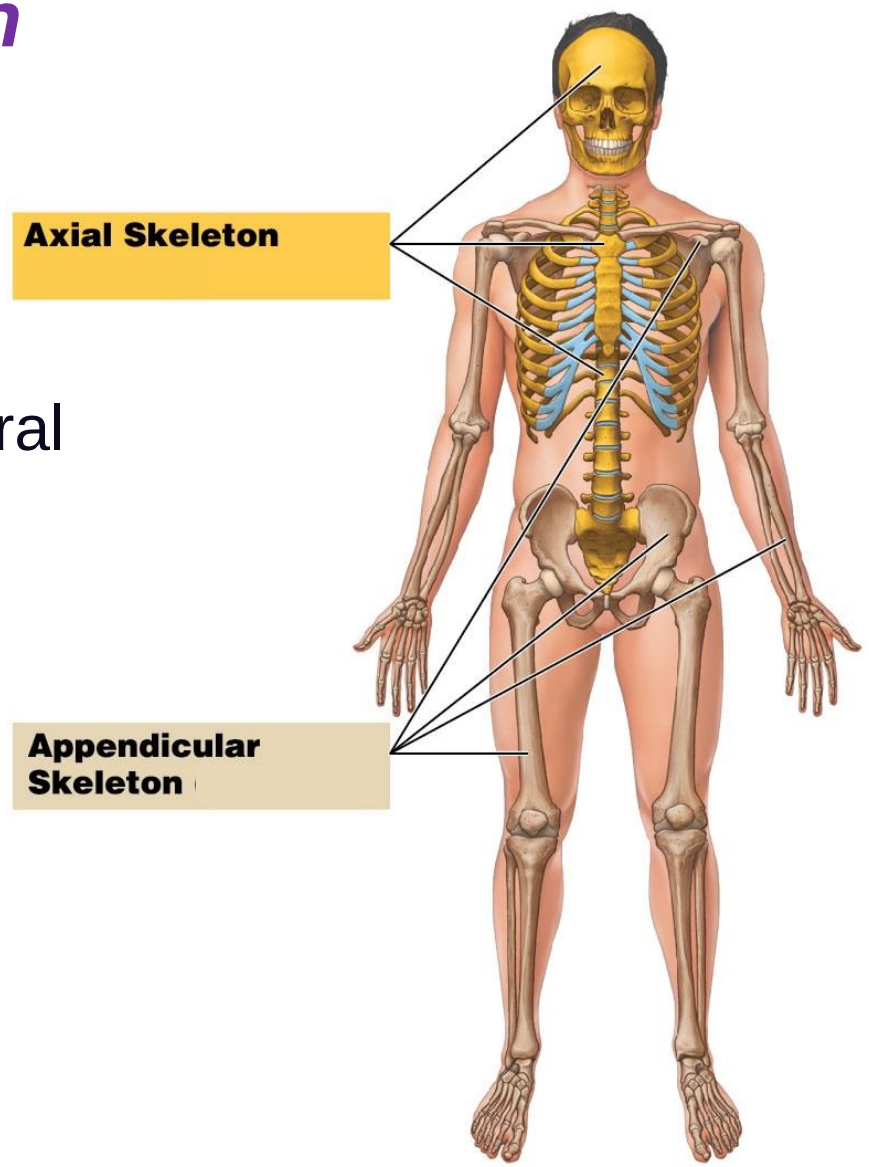
Divisions of the skeleton

Axial skeleton:

- Bones of the core
  - Skull, sternum, ribs, vertebral column, sacrum, coccyx.
- Protection of vital organs

Appendicular skeleton:

- Bones of the limbs
- Most important for movement

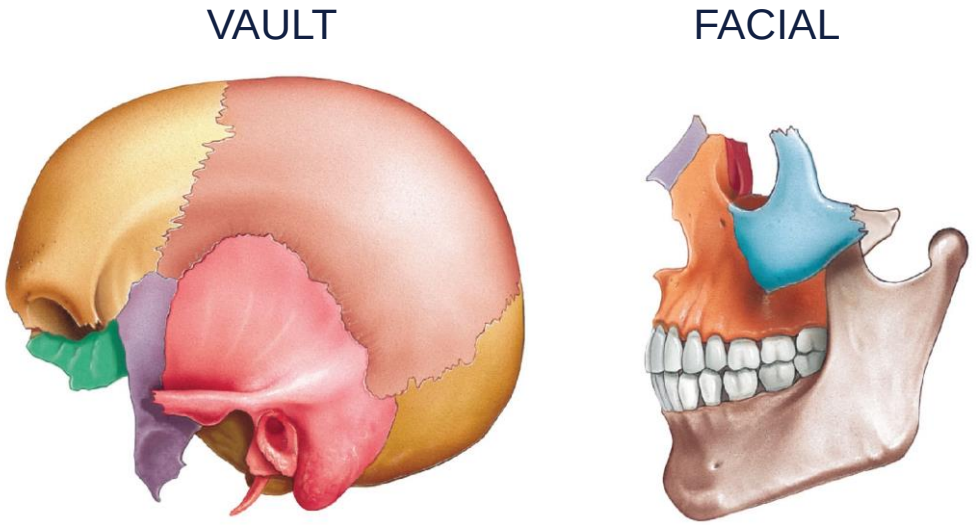


Martini *et al*, *Visual Anatomy & Physiology*, 3rd Edn, 2018, p.253

Axial skeleton

The Skull

- Cranium (vault)
  - Encloses the brain
  - Muscle attachments
- Facial bones
  - Protect & support sensory organs
- Join at sutures (immovable)

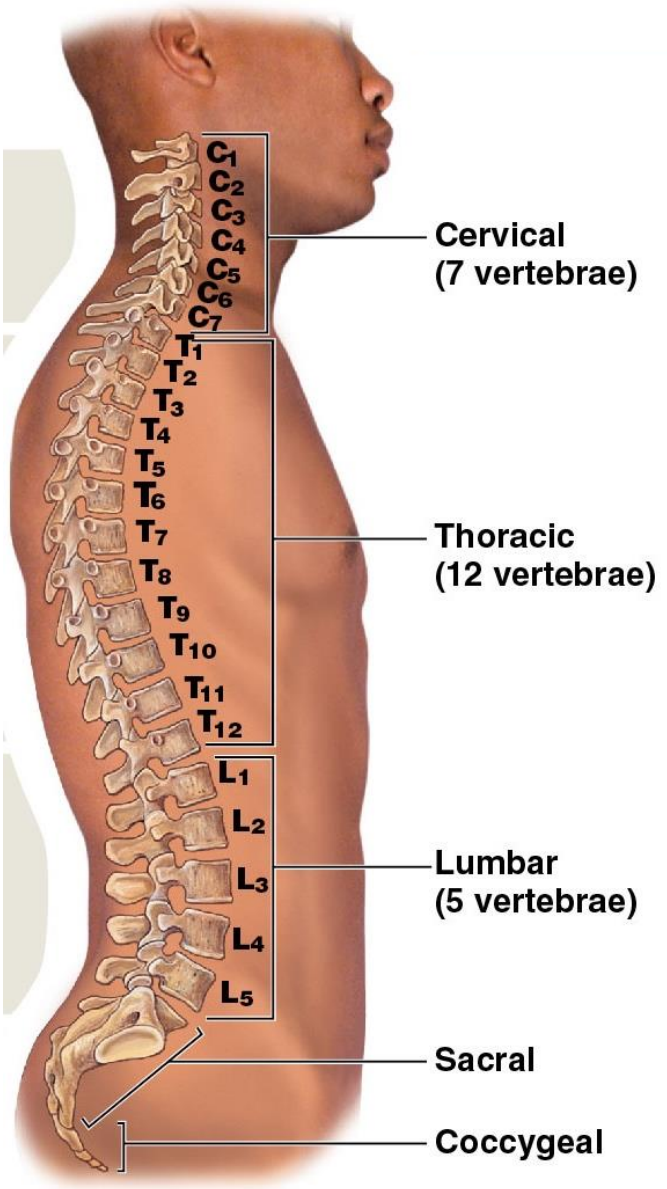


Martini *et al*, *Visual Anatomy & Physiology*, 3rd Edn, 2018, p.284-5

Axial skeleton

The Vertebral column

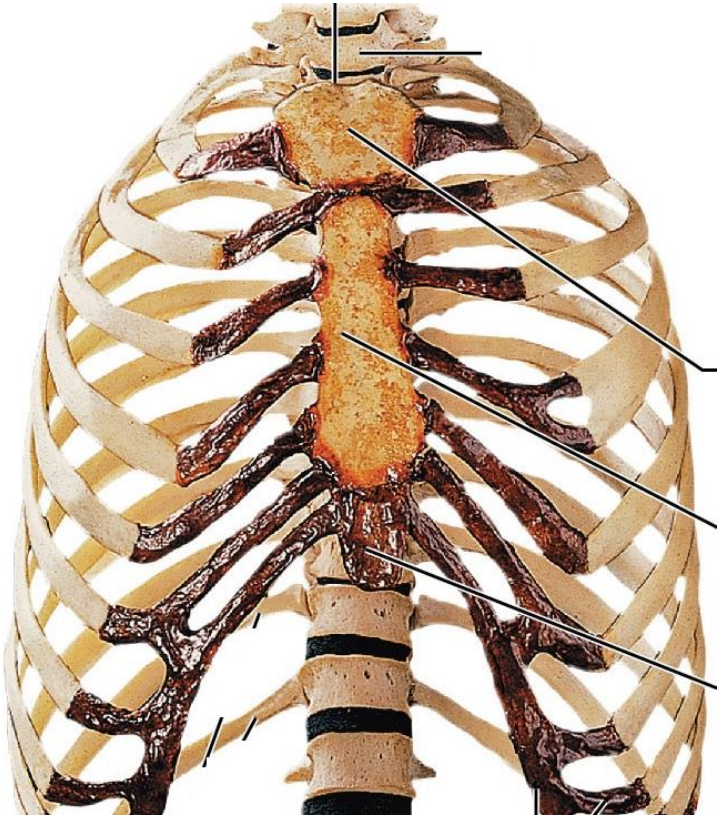
- Keeps the trunk upright
  - Lots of muscle/ligament attachments
- Supports head
- Divisions
  - Cervical (7)
  - Thoracic (12)
  - Lumbar (5)
  - Sacrum and coccyx



Martini *et al*, *Visual Anatomy & Physiology*, 3rd Edn, 2018, p.300

Axial skeleton

- Rib cage (thoracic cage)
  - Ribs
  - Sternum

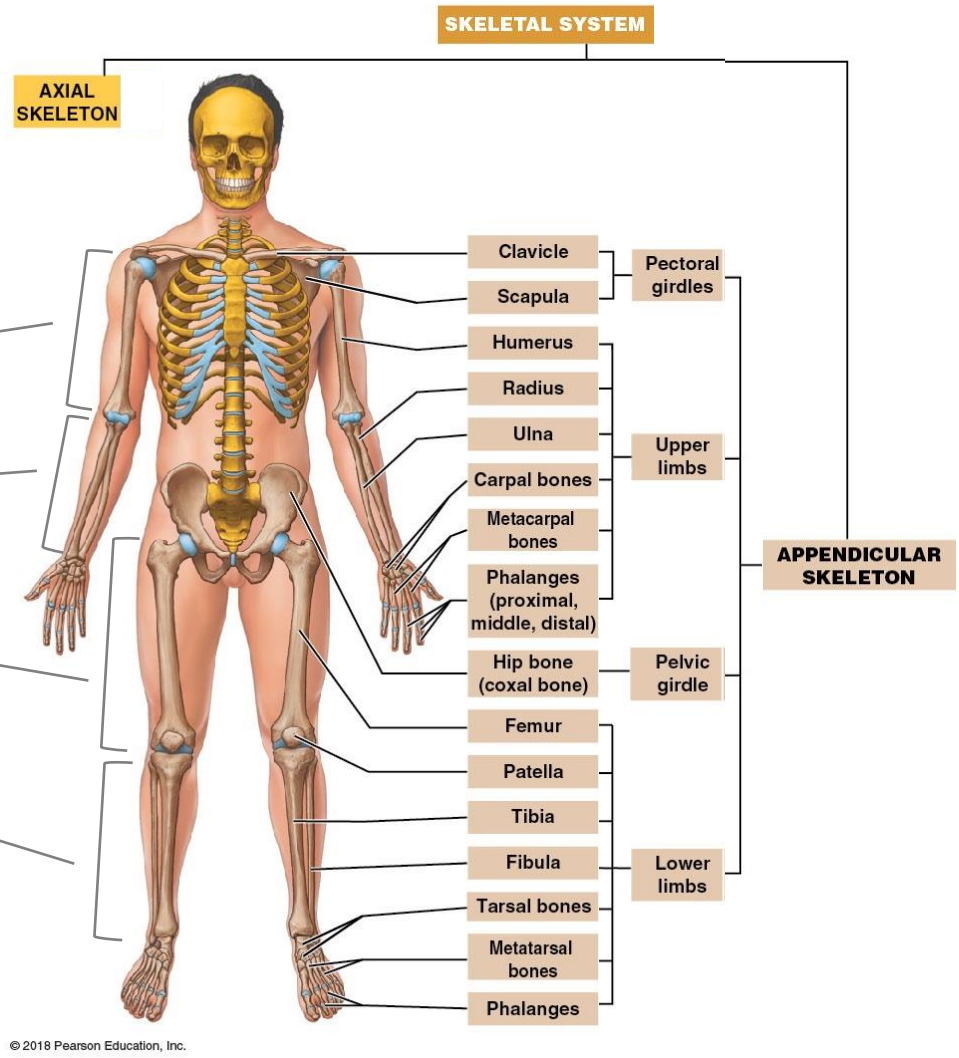


Posterior articulation with thoracic vertebrae

Martini *et al, Visual Anatomy & Physiology*, 3rd Edn, 2018, p.306-7

Appendicular skeleton

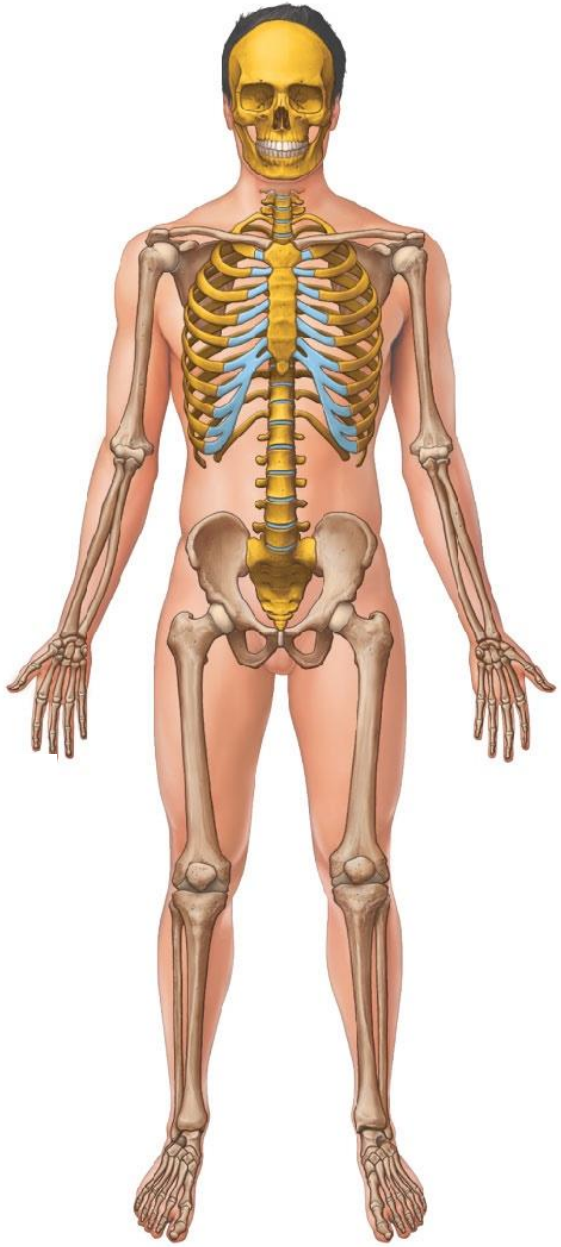
- Limbs
- Regions
  - Arm
  - Forearm
  - Thigh
  - Leg



Martini *et al*, *Visual Anatomy & Physiology*, 3rd Edn, 2018, p.309

Limb structure

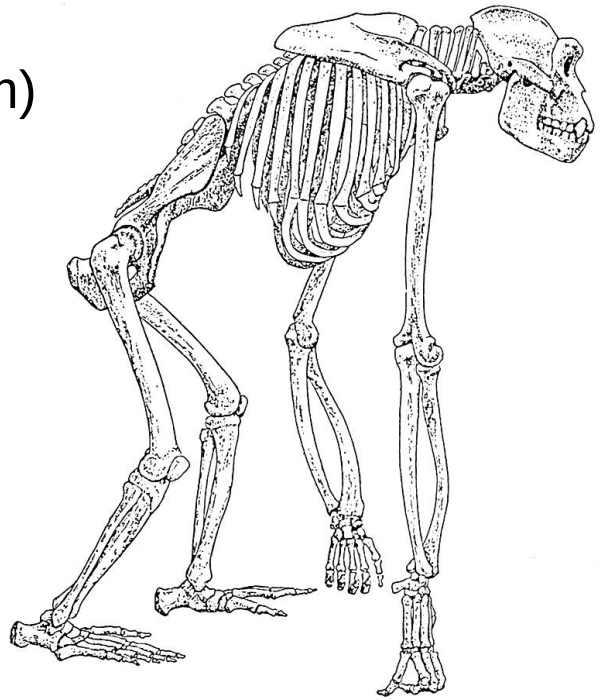
- Single proximal long bone
  - Humerus/Femur
- Two distal long bones
  - Ulna and Radius/ Tibia and Fibula
    - Ulna and radius more mobile
- Hands and feet

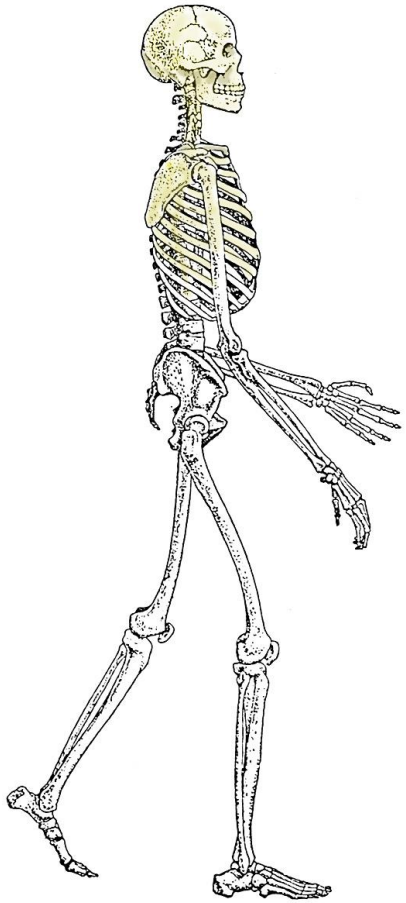


Martini *et al*, *Visual Anatomy & Physiology*, 3rd Edn, 2018, p.253

Why is the human skeleton this shape?

- FORM related to FUNCTION
- We walk on 2 limbs (Bipedalism) vs. other apes on 4 limbs (Quadrapedalism)
- Human lower limb needs STABILTY + MOVEMENT





Hands free!

- Not involved in locomotion

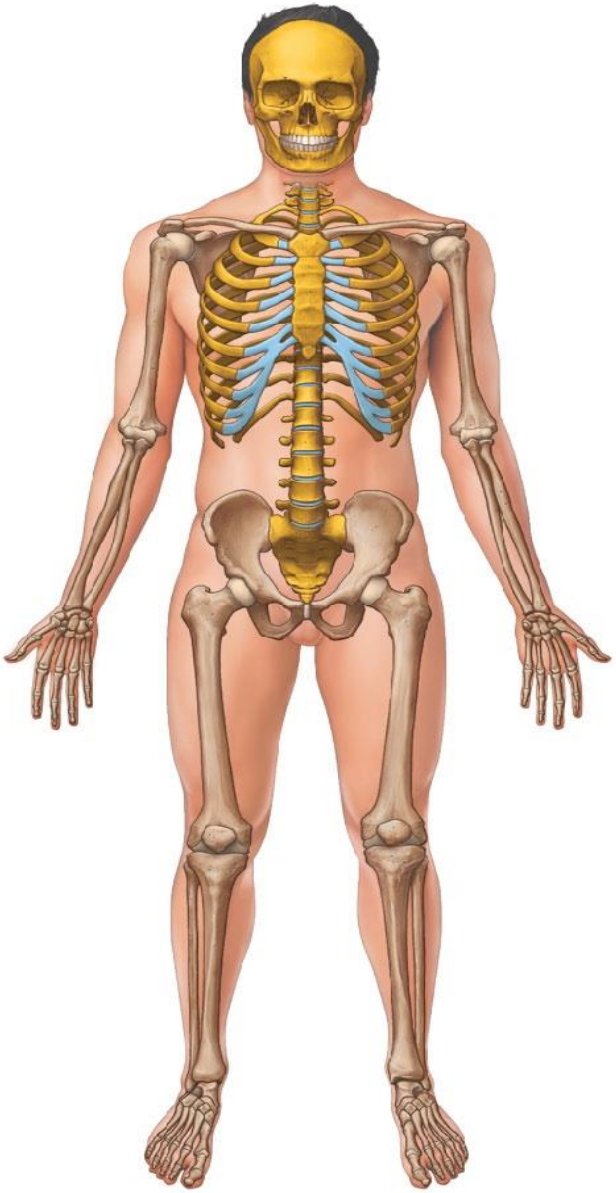
- Lack of stability

- Adapted for manipulation of environment/precision

Humerus and femur

- Humerus - shorter, lighter
- Deeper articulation for prox. femur than prox. humerus
- Stability vs. movement

Anatomy Resource Collection, University of Otago, 201



Martini *et al*, *Visual Anatomy & Physiology*, 3rd Edn, 2018, p.288

Mobile forearms and wrists…

- Pronation and supination of radius and ulna
- Shape of distal articulation for wrist mobility

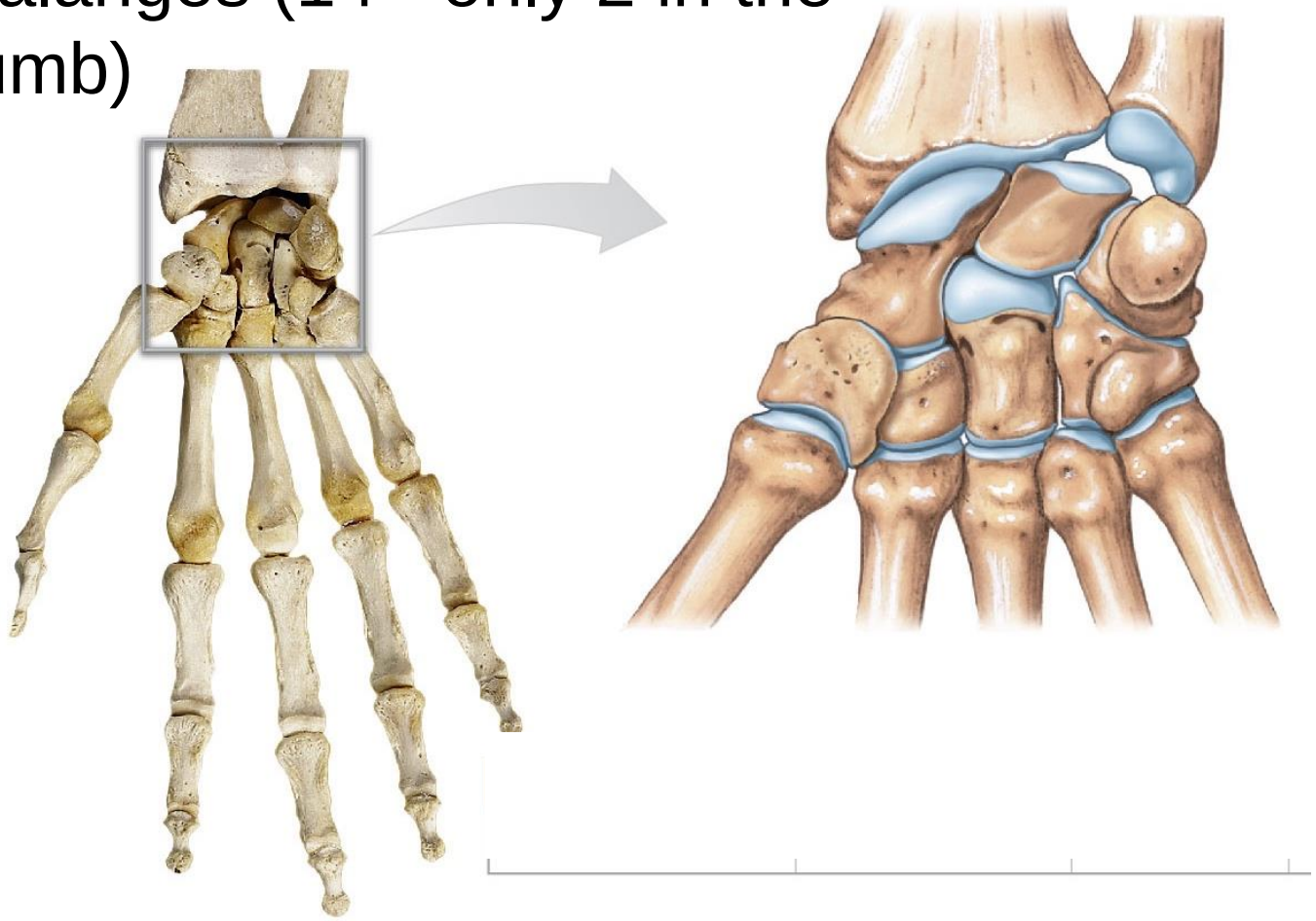
Martini *et al*, *Visual Anatomy & Physiology*, 3rd Edn, 2018, p.288

…vs. stability of legs

- No pronation/supination.
- Ankle joint = stable.
- Tibia very robust (weight-bearing)

Hand

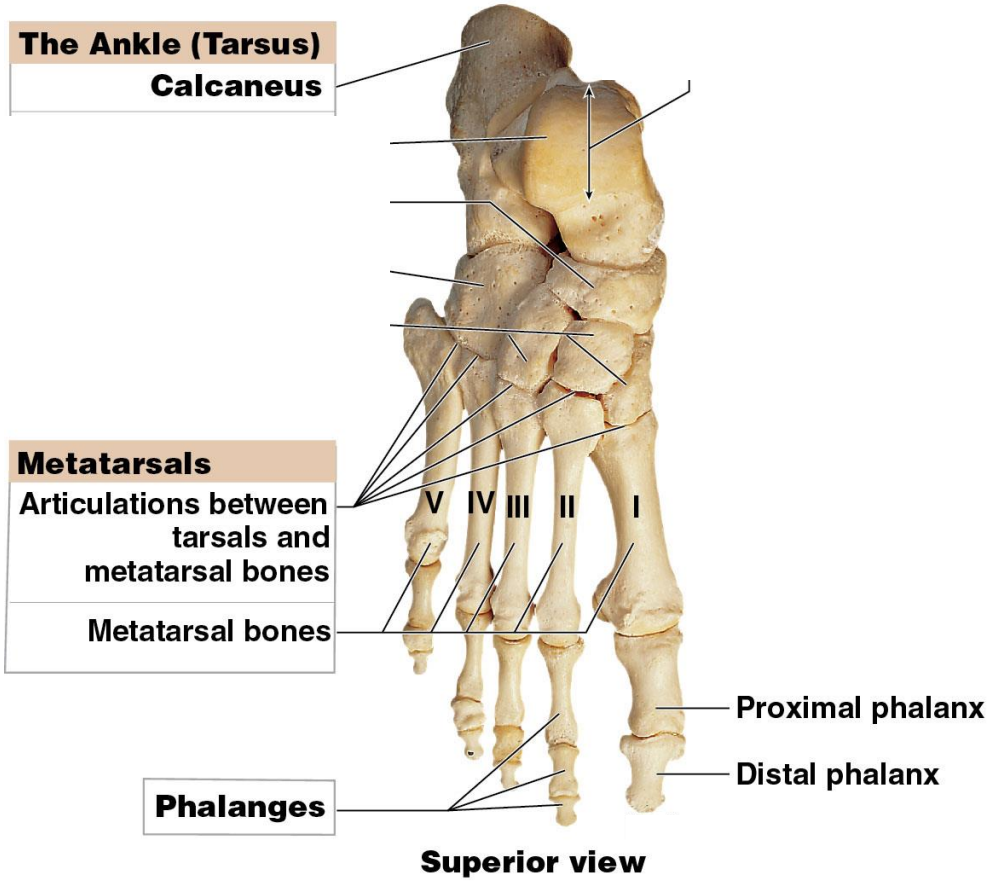
- Carpals (8)
- Metacarpals (5)
- Phalanges (14 - only 2 in the thumb)

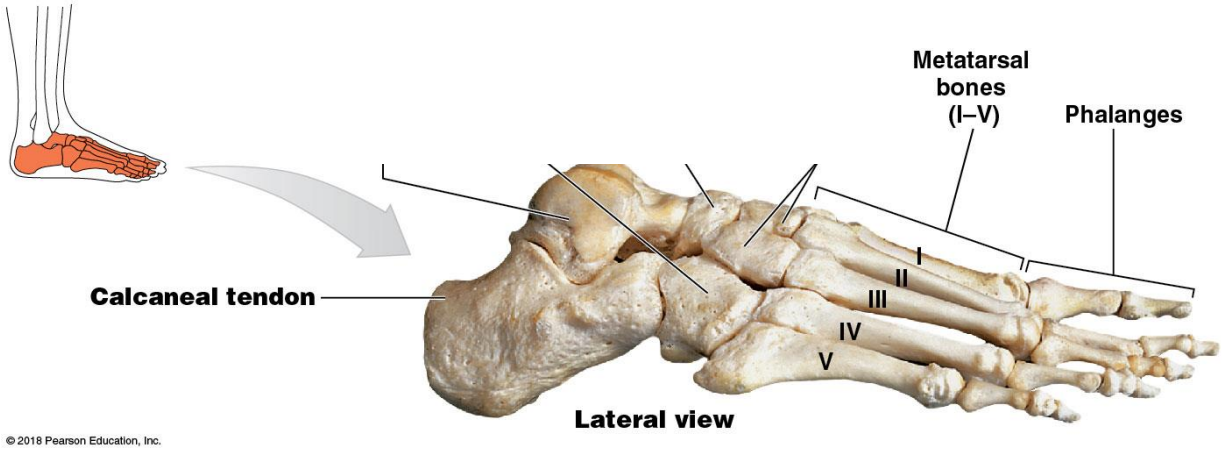


Martini *et al*, *Visual Anatomy & Physiology*, 3rd Edn, 2018, p.288

Foot

- Tarsals (7)
- Metatarsals (5)
- Phalanges (14)



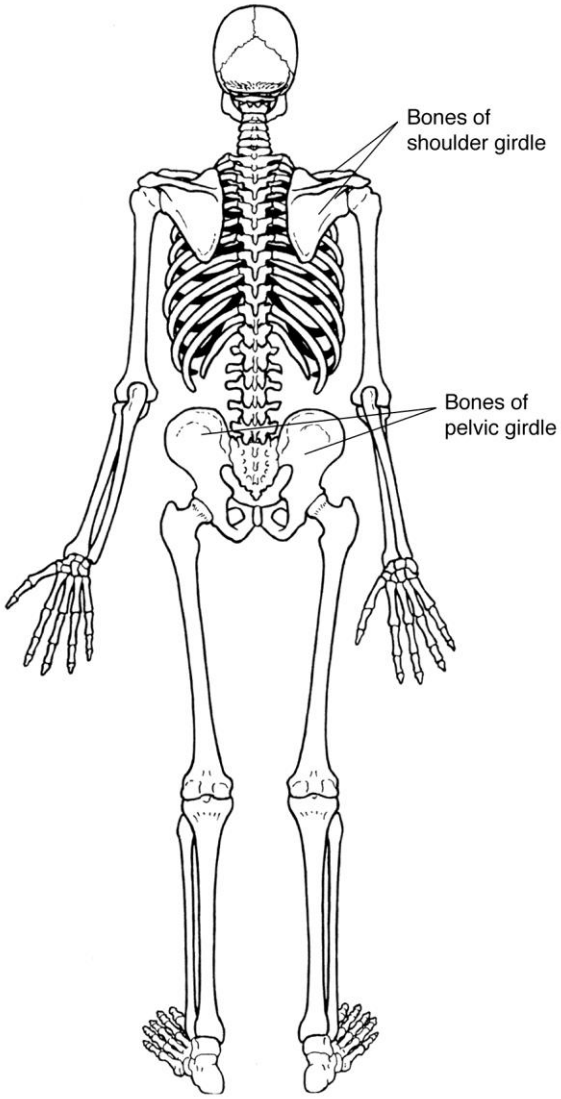


Martini *et al*, *Visual Anatomy & Physiology*, 3rd Edn, 2018, p.288

How do the limbs attach to the axial skeleton?

- Pectoral (shoulder) girdle
  - Clavicle
  - Scapula

- Pelvic girdle
  - Hip bones (2)
  - Sacrum (axial)



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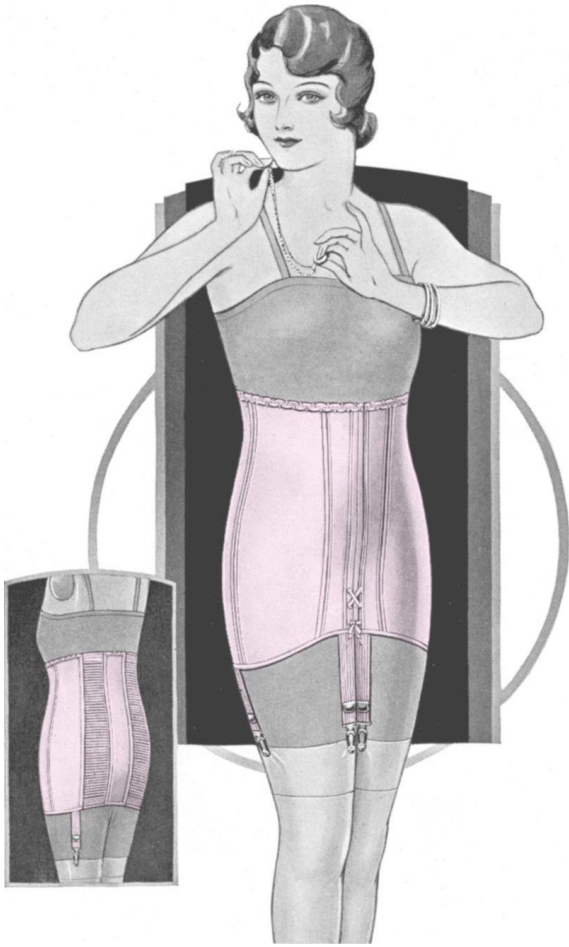
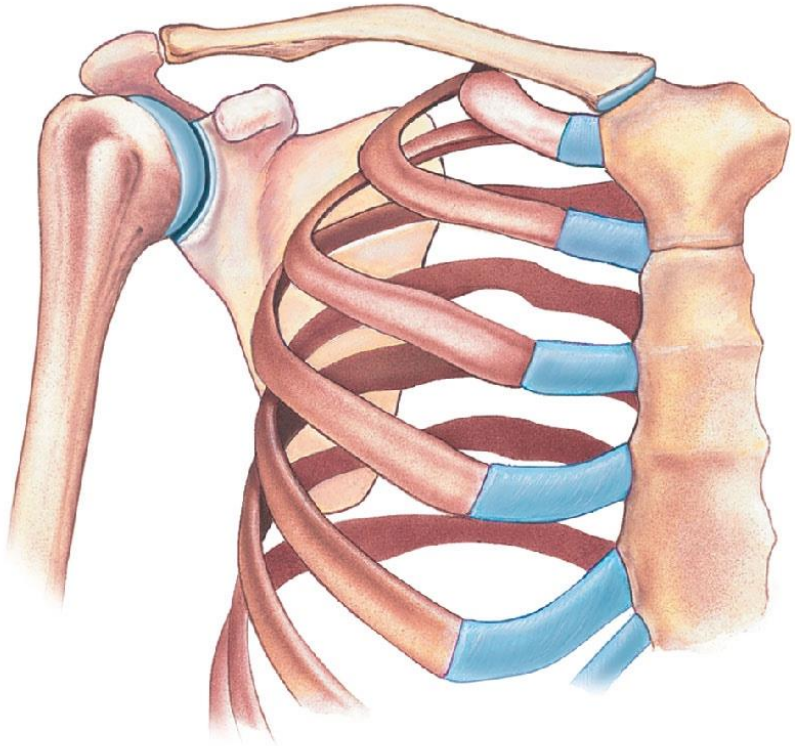


Marieb & Hoehn, *Human Anatomy & Physiology*, 10th Edn, 2018

Wikicommons: Girdle (CC BY 3.0)

The pectoral girdle

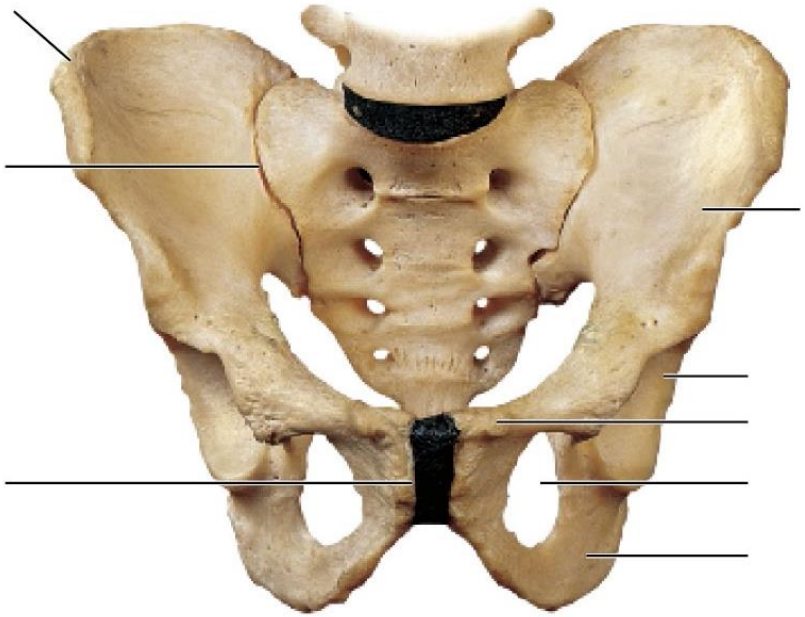
- Clavicle
  - Stabilising
- Scapula
  - Free-moving, muscle attachments



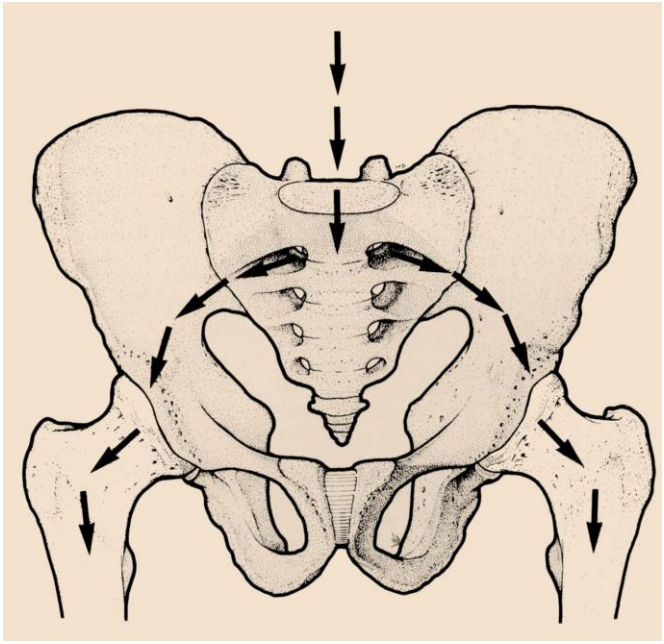
Martini *et al*, *Visual Anatomy & Physiology*, 3rd Edn, 2018, p.310

Pelvic girdle

- Hip bones (x2)
  - Os coxae
- Sacrum
  - Part of the axial skeleton
- Pelvic bones + sacrum = pelvis
- Lots of weight bearing

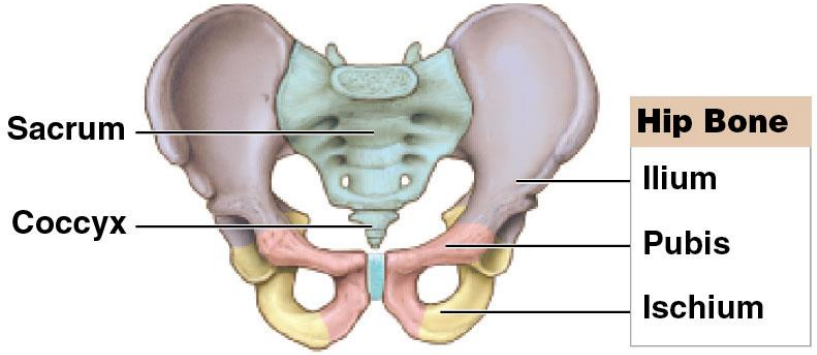


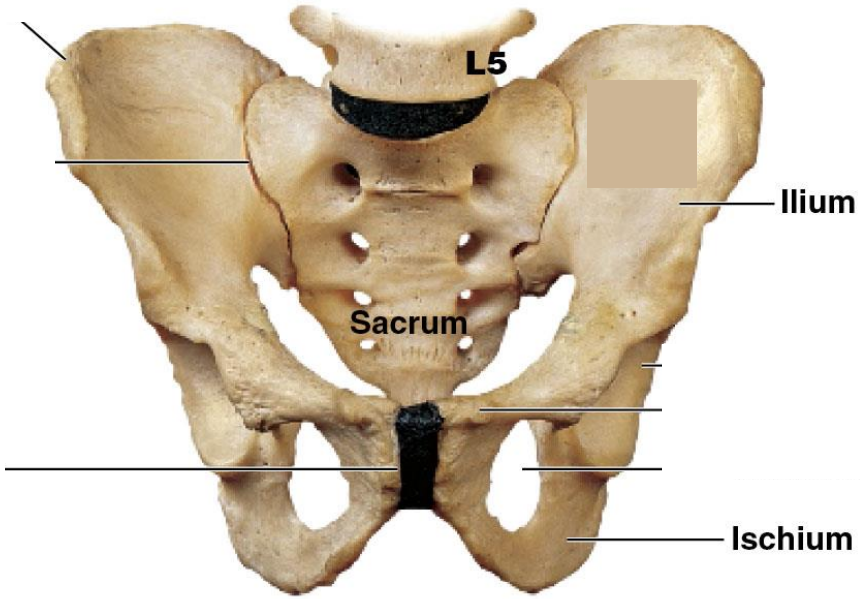
Marieb & Hoehn, *Human Anatomy & Physiology*, 10th Edn, 2018



Palastanga *et al*, *Anatomy and Human Movement*, 1992

Close up on the pelvis



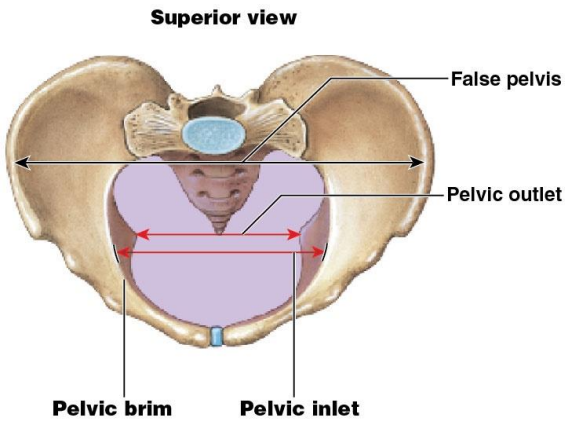


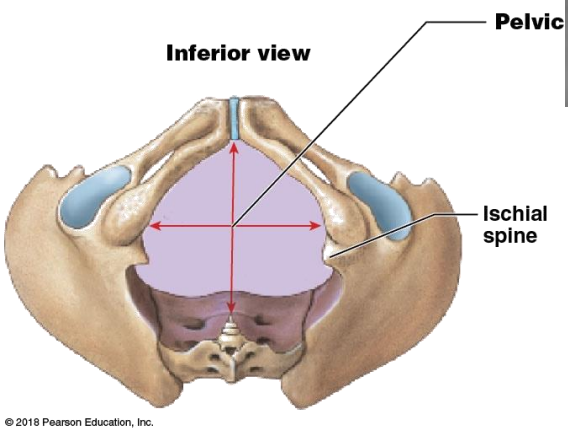
Anterior view

Martini *et al*, *Visual Anatomy & Physiology*, 3rd Edn, 2018, p.288

Differences between biological male and female pelvic anatomy

- WHY?
- Pelvic cavity of biological females more circular
- Pelvic outlet more open in biological females





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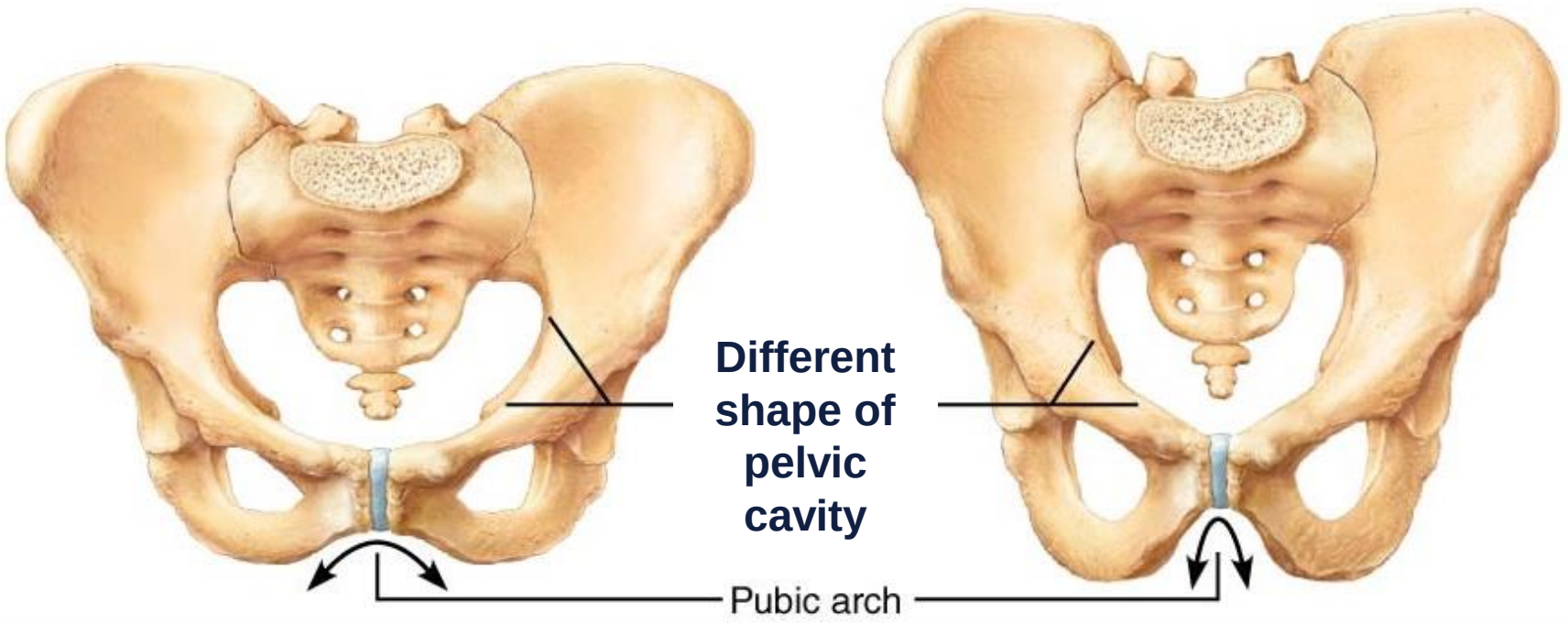
Maximising space



Biological Female

Biological Male

Subpubic angle

I need to revise this stuff…

- Check your Textbook (Martini et al. *Visual Anatomy*) chapter 7
- Check out this video from 2:40 – 3:45 for a summary of the types of bones

https://www.youtube.com/watch?v=rDGqkMHPDqE

Need some bones themed music for studying? Of course you do…

https://open.spotify.com/playlist/3SpOxM6kkQQ2o9aqPf5XBE?si=gw_7DoV6SK6eT5aadxlP9A

Test yourselves:

What class of bone is a rib?

A. Long

B. Short

C. Flat

D. Irregular

Why is cancellous bone good at shock absorbing?

A. Because it has a structure that is all aligned in one direction

B. Because it has a structure made of multi-directional struts

C. Because it is very dense

D. Because it contains lots of water

What is the pectoral girdle?

A. The bones that connect the upper limb to the axial skeleton

B. The bones that connect the lower limb to the axial skeleton

C. The humerus, scapula and clavicle

D. The femur and hip bones

Why do biologically male and female pelves have slightly different shapes?

A. Biological males are stronger and bigger so their pelvis is always bigger

B. Biological females do less physical activity

C. The biologically male pelvis is adapted for muscle development.

D. The biologically female pelvis is adapted for childbirth

HUBS191