Marieb's Human Anatomy and Physiology

Ninth Edition

Marieb ◆ Hoehn

Chapter 7
The Axial and Appendicular Skeleton
Lecture 14

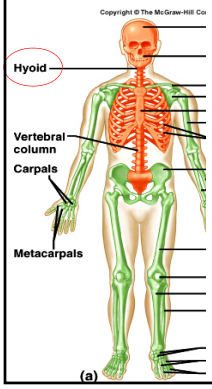
1

Lecture Overview

- Axial Skeleton
  - Hyoid bone
  - Bones of the orbit
  - Paranasal sinuses
  - Infantile skull
  - Vertebral column
    - Curves
    - Intervertebral disks
  - Ribs

2

The Axial Skeleton – Hyoid Bone



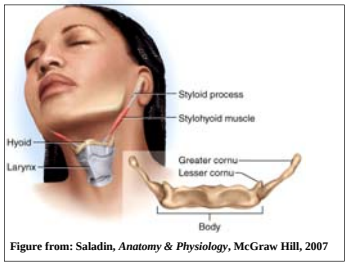


Figure from: Saladin, *Anatomy & Physiology*, McGraw Hill, 2007

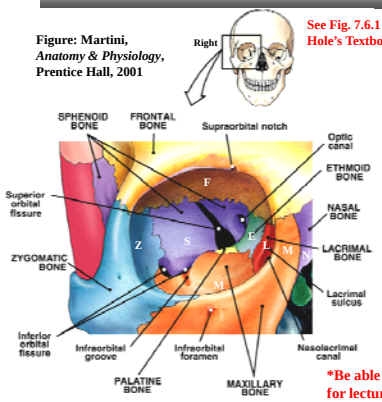
Suspended from the styloid processes of the temporal bones by ligaments and muscles

The hyoid bone supports the larynx and is the site of attachment for the muscles of the larynx, pharynx, and tongue

3

Axial Skeleton – the Orbit

Figure: Martini, *Anatomy & Physiology*, Prentice Hall, 2001



See Fig. 7.6.1 in Martini and Fig. 7.20 in Hole's Textbook

Optic canal – Optic nerve; opthalmic artery

Superior orbital fissure – Oculomotor nerve, trochlear nerve, opthalmic branch of trigeminal nerve, abducens nerve; opthalmic vein

Inferior orbital fissure – Maxillary branch of trigeminal nerve

Infraorbital groove – Infraorbital nerve, maxillary branch of trigeminal nerve, infraorbital artery

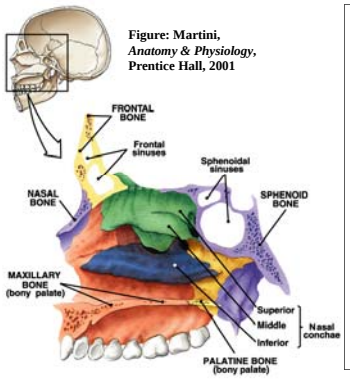
Lacrimal sulcus – Lacrimal sac and tearduct

***Be able to label a diagram of the orbit for lecture exam**

4

Nasal Cavities and Sinuses

Figure: Martini, *Anatomy & Physiology*, Prentice Hall, 2001



Paranasal sinuses are air-filled, mucous membrane-lined chambers connected to the nasal cavity.

Superior wall of nasal cavities is formed by frontal, ethmoid, and sphenoid bones

Lateral wall of nasal cavities formed by maxillary and lacrimal bones and the conchae

Functions of conchae are to create swirls, turbulence, and eddies that:

- **direct particles against mucus**
- **slow air movement so it can be warmed and humidified**
- **direct air to superior nasal cavity to olfactory receptors**

5

Axial Skeleton - Sinuses

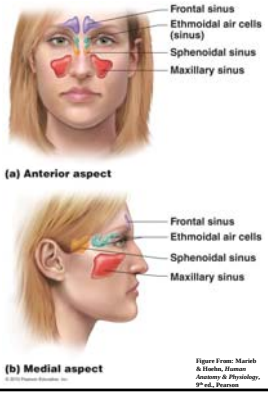


Figure From: Marieb & Hoehn, *Human Anatomy & Physiology*, 9th ed., Pearson

Sinuses are lined with mucus membranes.

Inflammation of these membranes is called sinusitis.

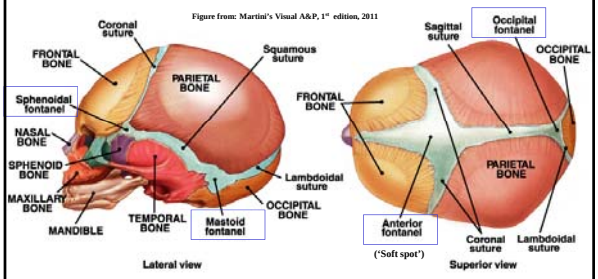
Know the locations of the sinuses

6

Infantile Skull

Fontanels – fibrous membranes in the fetal/infant skull to allow 1) movement of the skull bones and 2) brain growth.

Figure from: Martini's Visual A&P, 1st edition, 2011



Anterior fontanel (soft spot) is largest and last to close (by about two years of age). Other fontanels disappear or begin to close within one to three months after birth.

7

Axial Skeleton - Vertebral Column

- **cervical vertebrae (7)**
- **thoracic vertebrae (12)**
- **lumbar vertebrae (5)**
- **sacrum**
- **coccyx**

Primary curves are present at birth. These are also called 'accommodation' curves since they accommodate the organs of the thorax and pelvis.

Secondary curves do not develop until several months after birth as infants begin to hold their head up and stand. These are also called compensation curves because they shift the weight of the trunk over the lower limbs.

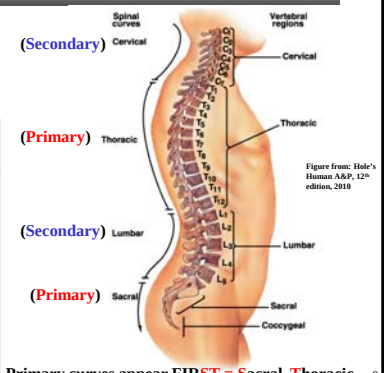


Figure from: Hole's Human A&P, 12th edition, 2010

Primary curves appear FIRST = Sacral, Thoracic

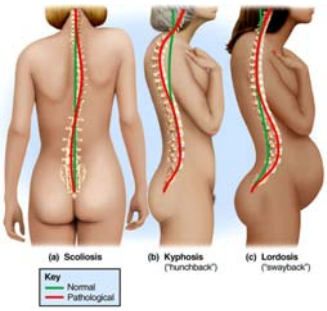
8

Spinal Curvature of Newborn Infant

Figure from: Saladin, *Anatomy & Physiology*, McGraw Hill, 2007

9

Abnormal Curvature of the Spine



Scoliosis (a) – abnormal lateral curve

Kyphosis (b) – exaggerated thoracic curve

Lordosis (c) – exaggerated lumbar curve

Figure from: Saladin, *Anatomy & Physiology*, McGraw Hill, 2007

10

Intervertebral Discs

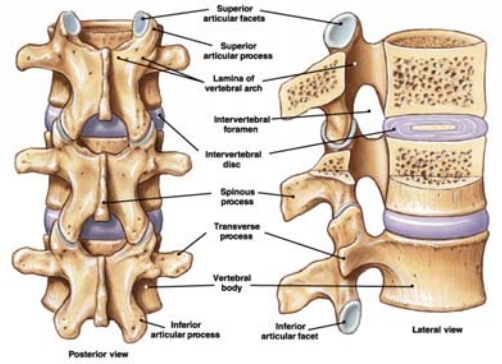


Figure from: Hole's Human A&P, 12th edition, 2010

11

Intervertebral Discs

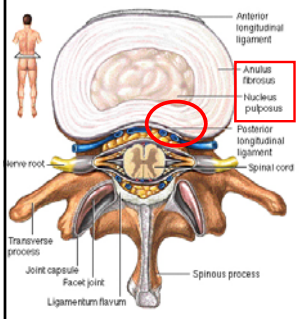


Figure: © 1998 A.D.A.M. Software, Inc.

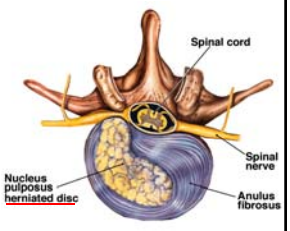


Figure: Martini, *Anatomy & Physiology*, Prentice Hall, 2001

12

Axial Skeleton - Thoracic Cage

- **Ribs**
- **Sternum**
- **Thoracic vertebrae**
- **Costal cartilages**

- **Supports shoulder girdle**
- **Protects viscera**
- **Role in breathing**

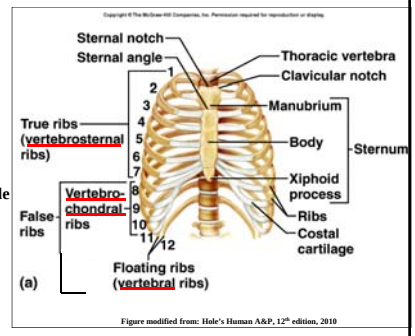


Figure modified from: Hole's Human A&P, 12th edition, 2010

13

Lecture Overview

- Appendicular Skeleton
  - Review of pectoral girdle
  - Shoulder joint; dislocations
  - Review of bones of upper limb and hand
  - Review of the pectoral girdle
    - Divisions of the pelvis
    - Male-female pelvic differences
  - Comparison of the pectoral and pelvic girdles
  - Review of bones of the leg and foot
  - Arches of the foot

14

Review of Upper Limb

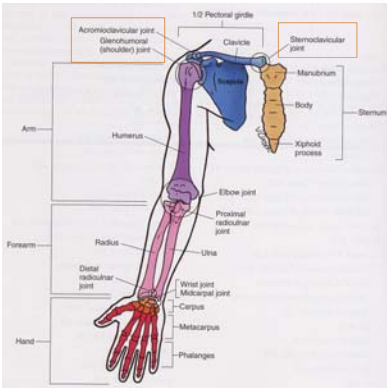


Figure from: Moore & Agur, *Essential Clinical Anatomy*, Lippincott, Williams & Wilkins, 2002

15

Review of Scapula

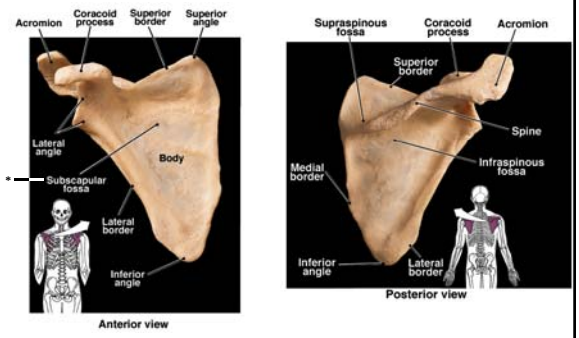
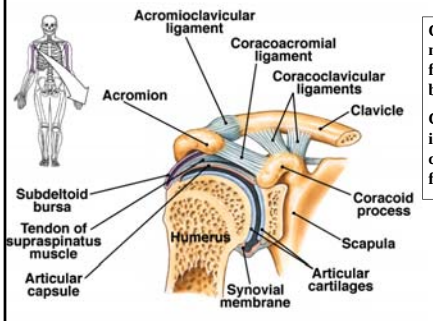


Figure: Martini, *Fundamentals of Anatomy & Physiology*, Prentice Hall, 2004

16

Joints of the Pectoral Girdle



Clavicle is one of the most frequently fractured bones in the body.

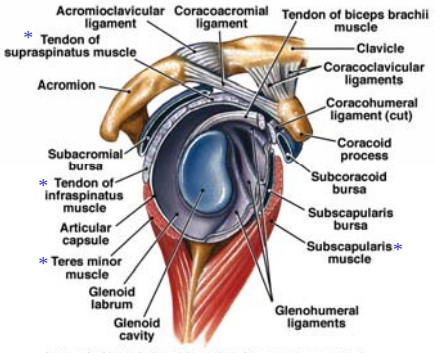
Clavicular midregion is the weakest point of clavicle and most frequent fracture site.

Figure: Martini, *Fundamentals of Anatomy & Physiology*, Prentice Hall, 2004

Anterior view, frontal section; right shoulder

17

Lateral View of Pectoral Girdle

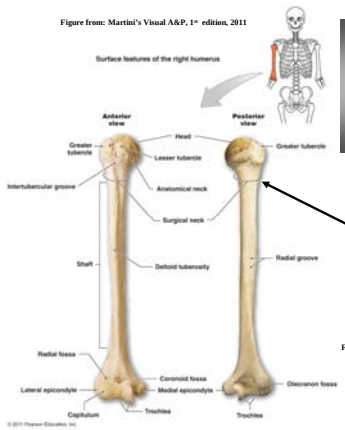


* = Part of Rotator Cuff (SITS)

Lateral view of shoulder joint, humerus removed

18

Figure from: Martini's Visual A&P, 1st edition, 2011



Review of the Bones of the Upper Arm

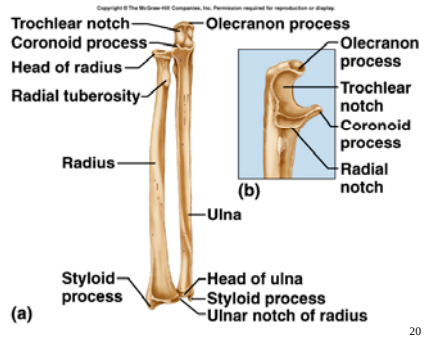
Typical site of fractures

Figure from: Hole's Human A&P, 12th edition, 2010

19

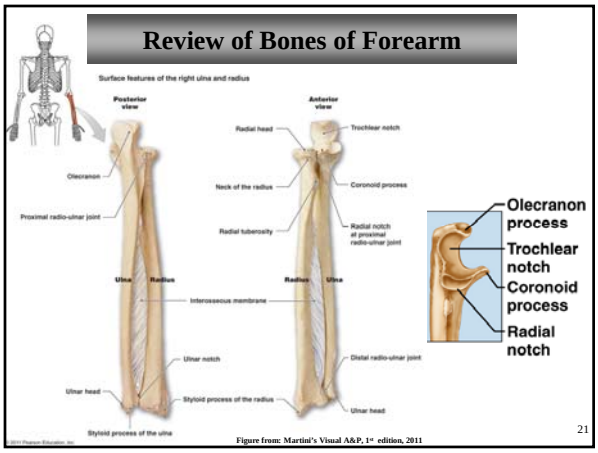
Review of Bones of Forearm

- **lateral forearm bone**
- **head**
- **radial tuberosity**
- **styloid process**



20

Review of Bones of Forearm



21

Figure from: Martini's Visual A&P, 1st edition, 2011

Bones of the Elbow Joint

Figures: © 1998 A.D.A.M. Software, Inc.

Lateral view, right arm

Medial view, right arm

22

Colles' Fracture

A Colles' fracture, a break in the distal portion of the radius, is typically the result of reaching out to cushion a fall.

- One of the most common types of fractures.
- Involves the radius, but may involve a fracture of the ulna as well.
- Treatment is reduction followed by splinting.

Figure from: Tortora and Grabowski, *Principles of Anatomy & Physiology*, Wiley Press, 2003

23

Review of the Bones of the Wrist and Hand

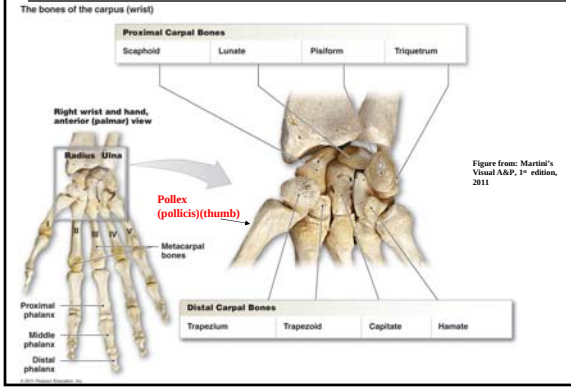


Figure from: Martini's Visual A&P, 1st edition, 2011

24

Review of the Pelvic Girdle

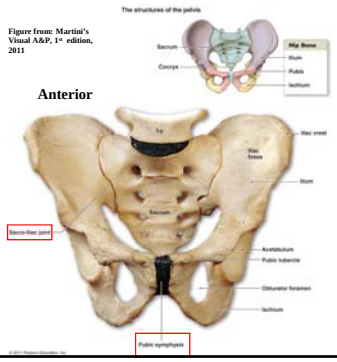
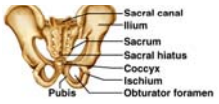


Figure from: Martini's Visual A&P, 1st edition, 2011

Anterior



Posterior

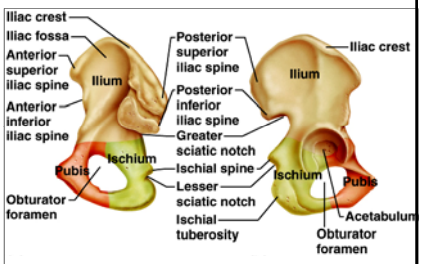
Figure from: Hole's Human A&P, 12th edition, 2010

25

Review of the Bones of the Pelvis

- hip (coxae) bones
- ilium
  - iliac crest
  - iliac spines
  - greater sciatic notch
- ischium
  - ischial spines
  - lesser sciatic notch
  - ischial tuberosity
- pubis

- obturator foramen
- acetabulum
  - ilium
  - ischium
  - pubis

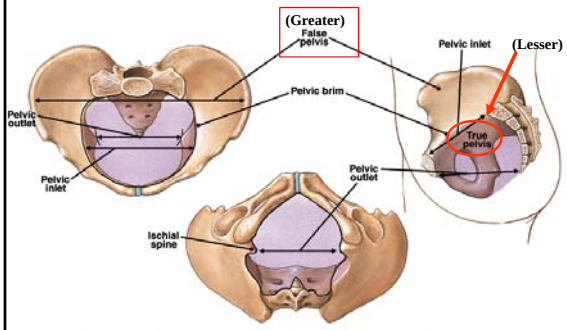


(Medial view, right coxa) – (Lateral view, right coxa)

Figure from: Hole's Human A&P, 12th edition, 2010

26

Review of the Divisions of the Pelvis



Pelvic brim = (sacral promontory, sacral ala, arcuate line, pectineal line, pubic crest) x 2

Figure from: Martini's Visual A&P, 1st edition, 2011

27

Male-Female Pelvic Differences

Figure from: Martini's Visual A&P, 1st edition, 2011

Male Female

1. Iliac bones are more flared in the female; hips are broader
2. Pubic angle is greater in the female pelvis
3. Greater distance between the ischial spines in the female pelvis
4. Broader, flatter pelvis in females; wider, more circular pelvic inlet
5. Less projection of sacrum and coccyx into the pelvic outlet in the female pelvis

28

Comparison of Pectoral and Pelvic Girdles

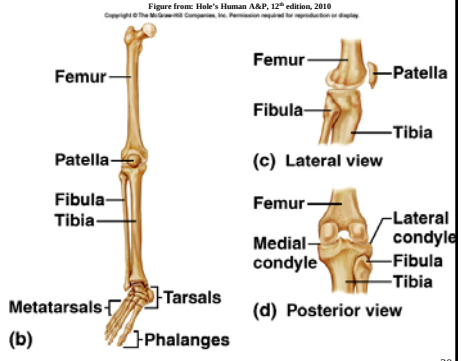
	Pectoral Girdle (Clavicle, Scapula)	Pelvic Girdle (Ossa coxae, sacrum, coccyx)
Articulation with vertebral column	None	Direct (sacroiliac joint)
Joint sockets for limbs	Shallow – maximize movement	Deep – maximize strength
Overall characteristic	Maximum movement, reduced strength	Maximum strength, reduced movement

29

Review of Bones of Lower Limb

- Femur
- Patella
- Tibia
- Fibula
- Tarsals
- Metatarsals
- Phalanges

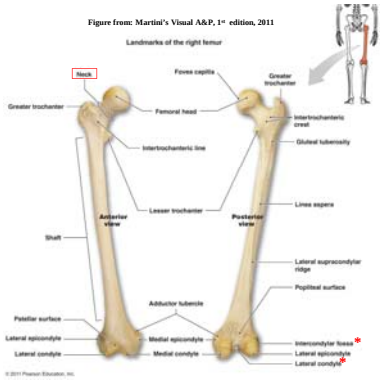
Figure from: Hole's Human A&P, 12th edition, 2010



30

Femur

Figure from: Martini's Visual A&P, 1st edition, 2011



31

Bones of Lower Leg: Tibia, Fibula

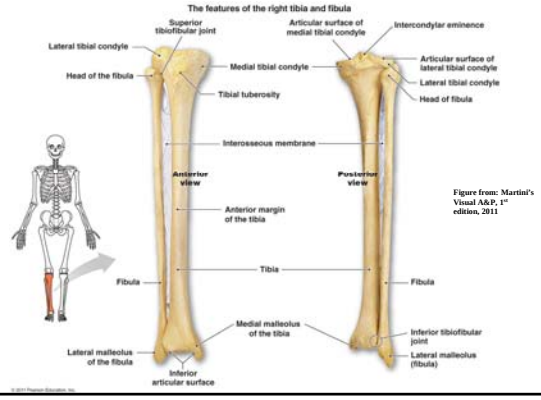


Figure from: Martini's Visual A&P, 1st edition, 2011

32

Potts' Fracture

Fracture of distal end of the fibula with significant damage to the distal tibial articulation.

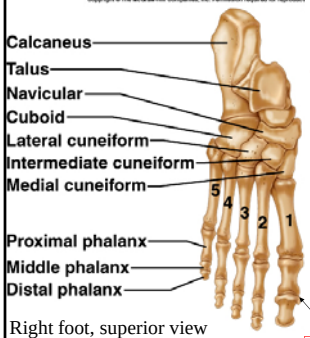
Usually caused by forcible eversion of the foot.

Figure from: Tortora and Grabowski, *Principles of Anatomy & Physiology*, Wiley Press, 2003

33

Bones of the Foot

Figure from: Hole's Human A&P, 12th edition, 2010



Right foot, superior view

Tall Californian

Navy

Medical Interns Like Cuban cigars

(Medial to lateral)

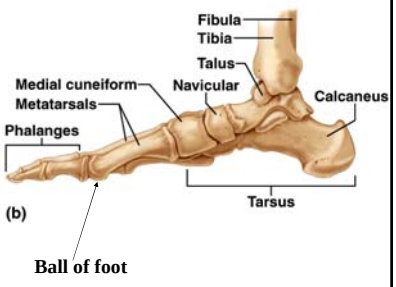
Don't like this mnemonic?...

Hallux (hallucis) = great toe

34

Appendicular Skeleton – Ankle and Foot

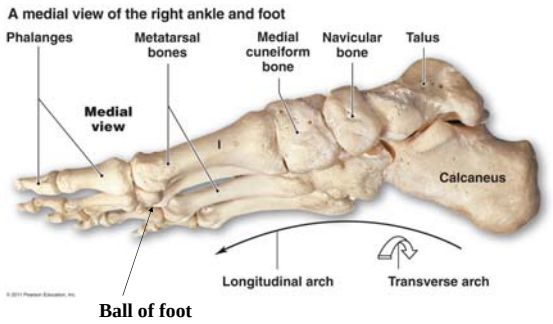
- **Tarsals (14)**
  - calcaneus
  - talus
  - navicular
  - cuboid
  - lateral cuneiform
  - intermediate cuneiform
  - medial cuneiform
- **Metatarsals (10)**
- **Phalanges (28)**
  - proximal
  - middle
  - distal



Ball of foot

35

Ankle and Foot



Ball of foot

Figure from: Martini's Visual A&P, 1st edition, 2011

36

Arches of the Foot

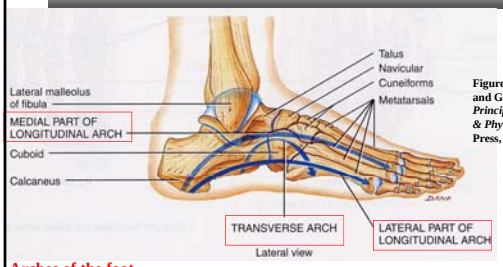


Figure from: Tortora and Grabowski, *Principles of Anatomy & Physiology*, Wiley Press, 2003

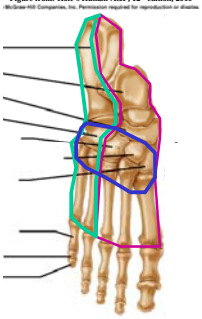
Arches of the foot
- **enable it to support the body weight**
- **ideally distribute body weight over hard and soft tissues**
- **provide leverage when walking**

Flatfoot – Height of medial longitudinal arch is decreased
Clawfoot – Medial longitudinal arch is abnormally elevated

37

Arches of Foot – Top View

Figure from: Hole's Human A&P, 12th edition, 2010



Longitudinal arch

Medial Arch (instep) – Calcaneus, talus, navicular, three cuneiforms, and medial three metatarsals

Lateral Arch – Calcaneus, cuboid, lateral two metatarsals

Transverse Arch – Cuboid, cuneiforms, bases of metatarsals

You should know the names and positions of each of the arches

38

Review

- The hyoid bone
  - Suspended from styloid processes of temporal bones
  - Supports larynx
  - Site of muscle attachments
  - Often fractured during manual strangulation
- The orbit includes seven bones of the skull
  - Frontal
  - Sphenoid
  - Ethmoid

  Cranial
  - Palatine
  - Zygomatic
  - Lacrimal
  - Maxilla

  Facial

39

Review

- The paranasal sinuses
  - air-filled chambers that connect with the nasal cavity
  - Formed by the frontal, sphenoid, ethmoid, and maxillary bones
  - Produce mucus and serve as resonating chambers
- The infantile skull
  - Contains soft spots
    - Fibrous CT membranes
    - Called fontanels
  - The anterior fontanel
    - Largest
    - Last to close (about 18-24 months after birth)

40

Review

- The vertebral column
  - Primary curves (accommodation)
    - Thoracic and sacral
    - Present at birth
  - Secondary curves (compensation)
    - Cervical and lumbar
    - Develop as head is held up and weight-bearing begins
  - Intervertebral disks
    - Shock absorbers between vertebral bones
    - Permit movement
    - Outer fibrocartilage – annulus fibrosus
    - Inner soft, pulpy core – nucleus pulposus

41

Review

- The thoracic cage
  - Protects the heart, lungs, thymus, and other structures in the thoracic cavity
  - Serves as an attachment point for muscles involved in respiration, positioning the vertebral column, and moving the pectoral girdle and upper limbs
- The thoracic cage consists of the
  - Thoracic vertebrae
  - The ribs
  - The sternum (breastbone)
- True, or vertebrosternal, ribs (7 pairs) are attached to the sternum by costal cartilages
- There are 5 pairs of false ribs
  - Ribs 8-10 are vertebrochondral ribs
  - Ribs 11 and 12 are floating, or vertebral, ribs

42

Review

- The pectoral girdle consists of the clavicle and scapula
  - Does not articulate with vertebral column
  - Designed for movement rather than strength
- The pelvic girdle consists of the paired hip bones, or coxae
  - Each coxa is formed by fusion of three bones:
    - Ilium
    - Ischium
    - Pubis
  - Articulates with vertebral column via the sacroiliac joint
  - Designed for strength rather than range of movement

43

Review

- The divisions of the pelvis include
  - True (lesser) pelvis
    - Encloses the pelvic cavity
    - Bony edge of the true pelvis is the pelvic brim and the enclosed space is called the pelvic inlet
  - False (greater) pelvis
    - Area above the pelvic brim
  - The pelvic outlet is bounded by the coccyx, ischial tuberosities, and the inferior border of the pubic symphysis

44

Review

- The arches of the foot
  - Function of arches
    - enable it to support the body weight
    - ideally distribute body weight over hard and soft tissues
    - provide leverage when walking
  - Longitudinal arches
    - Lateral
    - Medial (fallen arches; clawfoot)
  - Transverse arch

45