ANP1106 MIDTERM 1 REVIEW

Topic 1: Anatomical Terms

- Anterior (toward the front)
- Posterior (toward the back)
- Lateral (away from the midline)
- Medial (toward the midline

Regional Terms: 2 fundamental divisions

1. Axial part = head, neck and trunk
2. Appendicular part = appendages or limbs attached to axis

Body Planes and Sections: 3 common body planes – 2 vertical, 1 horizontal

1. Sagittal plane: vertical line that divides right and left parts – does not need to be through the midline parasagittal = not equal halves
2. Frontal plane: vertical plane that divides anterior and posteriorly (coronal plane)
3. Transverse/horizontal plane: from right to left dividing the body into superior and inferior parts (cross section) – oblique section = not parallel with ground\

Body Cavities:

1. Dorsal body cavity: cranial cavity (enclosed by skull – brain) and vertebral cavity (enclosed by vertebrae – spinal cord) – continuous and well protected
2. Ventral body cavity: separated by the diaphragm
    - Thoracic cavity: 2 lateral pleural cavities and central pericardial cavity
    - Abdominopelvic cavity: superior abdominal cavity and inferior pelvic cavity

Abdominopelvic quadrants: used surgically – intersect at belly button right upper quadrant, left upper quadrant, right lower quadrant and left lower quadrant

Nine abdominopelvic regions: used by anatomists Right hypochondriac, epigastric, left hypochondriac, right lumbar, umbilical, left lumbar, right iliac, hypogastric, left iliac (3X3 square)

Topic 2: Integumentary System

Structure of Skin: 2 layers

1. Epidermis: epithelial layer – thick, keratinized stratified squamous epithelium
    a. Keratinocytes: produce keratin (hard and water proof qualities) fibrous protein
    b. Melanocytes: produce melanin (dark pigment; imparts color to skin and hair)- shield from UV rays; deepest layer of epidermis branching processes for cell to cell melanin transfer
    c. Dendritic cells: Langerhans cells (star shaped) – migrate to epidermis from bone marrow; macrophages activate immune system and ingest foreign substances
    d. Tactile cells: Merkel cells – at epidermis and dermis boundary associated with a disk-like sensory nerve ending (sensory receptor for touch)
2. Dermis: connective tissue

Four major epidermal layers- thin skin:

1. Stratum corneum: 20-30 layers of dead cells – flat membranous sacs filled with keratin
2. Stratum granulosum: 5 layers of flattened cells
3. Stratum spinosum: several layers of keratinocytes – thick bundles of intermediate filaments made of pre-keratin
4. Stratum basale: deepest epidermal layer – one row of actively mitotic stem cells

Thick skin: double layer of skin – found on feet, palms of hands and fingertips stratum lucidum: clear layer – 2-3 rows of clear, flat dead keratinocytes only found in thick skin (beneath corneum)

Layers of Dermis:

1. Papillary layer: 20%
    a. Interwoven mat of areolar CT fibers interspersed with blood vessels
    b. Dermal papillae: wavy boundary between dermis and epidermis: contains capillaries/nerve endings for touch allows blood vessels/sensor nerves to

be as close as possible to epidermis and helps the two layers stay together (creates friction)

c. Dermal papillae overlie dermal ridges (palms of hands/soles of feet) friction ridges also known as finger prints

2. Reticular layer: 80%

a. Dense irregular CT (thick bundles of collagen fibers parallel to skin surface) \

b. Collagen fibers give strength and resiliency/maintain skins hydration: bundles in a particular fashion, in between matrix filled space, bundles around the body, up and down around the limbs during surgery cut with reticular layer

c. Elastic fibers provide stretch-recoil abilities

- Blister: once epidermis and dermis are separated, fluid builds up pulling the epidermis farther away. This causes a white color (pink color from dermis is further away)
- Striae: skin is stretched dramatically, extra pull in dermis pulls (ex. Putting on weight fast, pregnancy, extensive workout)
- Flexure lines: tend to fold skin, a lot of movement of the skin anchored more firmly

Hypodermis: superficial fascia, subcutaneous tissue subcutaneous tissue just deep to the skin

- Composed of adipose, blood vessels and areolar CT
- Anchors skin to underlying structures with ability to slide, shock absorber & insulation and stores fat

Pigments Contributing to Skin Color

1. Melanin: made in the skin several different forms that gives different color – skin color dependent on type, relative amount and keratinocyte retention of the pigment

a. Too much sun exposure can cause melanin cells to become cancerous and skin can become “leathery” changes chemicals in skin causing it to be less resilient/ages the skin faster.

b. Skin darkens in the sun because it stimulates the production of melanin natural protection for UV radiation

2. Carotene: yellow- orange pigment found in plant products (ex. Carrots) – deposits in keratinocytes (esp stratum corneum) and hypodermis

a. Carotene can imbed itself in the superficial layers of the skin

3. Hemoglobin: from capillary circulation and gives skin a pinkish hue – fair skinned people (hue from RBC)

a. Cyanosis: bluish discoloration in the skin due to low oxygen

Accessory Structure of Skin

1. Hair and Hair follicles:

a. Functions: sense insects, guard head physical trauma, heat loss and sun protection, shield eyes, filter particles from inhaled air

b. Hard keratin: more durable doesn’t flake

c. Hair shaft: shape determine if hair is straight or curly

c.i. Medulla: large cells partially separated by air spaces – absent in fine hairs

c.ii. Cortex: several layers of flattened keratinocytes (pigment here)

c.iii. Cuticle: single layer of overlapping cells – prevents tangling

c.iv. Split ends: oldest part of hair, damaged causes it to fragment.

c.v. Gray or white hair: air space accumulates between cells and pigment production slows down.

d. Hair structure:

d.i. shaft: part that projects from skin - has 3 layers indicated on previous slide

d.ii. root: part embedded in skin (contained within hair follicle)

d.iii. bulb: expanded deep end of follicle - has papilla & root hair plexus - growth occurs here

d.iv. follicle: outer CT root sheath & inner epithelial root sheath; hair matrix

d.v. arrector pili muscle: 1/follicle; contract to pull hair up & dimple skin (goose bump)

d.vi. sebaceous gland: holocrine gland that secretes sebum (oily - lubrication & waterproofing; bactericidal) – protect and prevent tangling

e. Hair thinning and baldness

e.i. Vellus hair= finer/thinner hair

e.ii. Terminal hair= scalps and eye brows

e.iii. Testosterone: important influence in hair growth (male and females- not as much)

e.iv. Nutrition is very important- protein deficient hair will thin out

e.v. Hirsutism= hair growth where you don't expect it (excessive androgens) ex. Cushing's syndrome

e.vi. Average rate of hair growth 2.5mm/week

e.vii. Active phase: then detatched, reboots itself (resting phase)

e.viii. Head hair has longer active phase (6-10 years)

e.ix. Alopecia= natural hair loss/thinning that occurs with age (hair follicles slowing down)

e.x. Male pattern baldness= genetic condition- excessive, unnatural, early balding in males- speeds up active/resting phase in hair follicle (does not remain in active phase long enough for hair to show)

2. Nails

a. Scale-like modification of epidermis – protective, useful tool lots of hard keratin cells

b. Nail fold protects your nail from chipping or breaking – 2 lateral and 1 proximal

c. Nail matrix= wear nail is growing

a. Lunula= thicker area of epidermal cells covering nail matrix for protection

3. Sweat glands

a. Distributed over skin surface except nipples & parts of external genitalia- >2.5 million/person

b. Sweat: hypotonic filtrate of the blood that passes through secretory cells of the sweat glands and released by exocytosis

b.i. Merocrine: more common; esp. palms, soles, forehead - simple coiled tubular glands with pore at surface

b.ii. Apocrine: axillary & anogenital areas; larger; ducts empty into hair follicles - same as sweat but + fatty substances & some proteins - odourless until decomposed by skin bacteria BO

b.iii. Function unknown but activated by sympathetic nerve fibers during pain and stress and sexual foreplay

b.iv. Ceruminous - secrete wax (cerumen) in external ear canal

b.v. Mammary - secrete milk

Major Functions of the Skin

1. PROTECTION: 3 types of barriers

a. chemical: secretions, melanin – slightly acidic – antibacterial properties

b. physical: barrier to trauma & bacterial invasion; also waterproofing

c. biological: Langerhans cells of epidermis & macrophages in dermis

d. Not impermeable to: gases, fat-soluble vitamins & steroids, plant oleoresins, organic solvents, salts of heavy metals, penetration enhancers for drug administration

2. BODY TEMPERATURE: sweating (0.5-12 L fluid/day) – vasoconstriction

3. CUTANEOUS SENSATION: temperature, texture, moisture, pain/pressure – important to give us information of our surroundings

4. METABOLIC: : activation of vitamin D, activation of steroid hormone (corticoid hormone)
5. BLOOD RESEVOIR: redirection of blood to needed areas ex. Exercise
6. EXCRETION: ammonia, urea, uric acid and sweat

Burns: caused from heat, electricity, radiation and chemicals

- Concerns: fluid loss (related to shock) loose protective layer and infections
- First degree: only epidermis
- Second degree: epidermis and upper dermis
- Third degree: entire thickness of skin (epidermis and all of dermis)
    - little to no chance of repair (no basal layer to regenerate repair) skin grafts: rejection is major concern
- Rule of nine: how much fluid needs to be replace in accordance with the size of the burn

Topic 3: Bony Tissue

1. Bone reacts to amount of force applied by increasing both the density & amount of roughening on bone or decreasing density when force is reduced or eliminated (eg: paralysis) (deposition vs resorption) -Deposition: calcium phosphates into bone/resorption: pulls calcium phosphate salts into blood stream
2. Bone stores calcium – resorbed & transferred to bloodstream when needed

Functions of bone:

- ✓ SUPPORT: holds up body, allows standing upright, physical support.
- ✓ PROTECTION: skull and ribcage protects lungs, brain and heart
- ✓ MOVEMENT: joints, allows body to move
- ✓ MINERAL STORAGE: calcium phosphate salts
- ✓ BLOOD CELL FORMATION: bone marrow (hematic poetic tissue)
- ✓ FAT STORAGE: adipose tissue in shafts of long bones

- ✓ HORMONE PRODUCTION: osteoblasts, osteocalcin (hormone: influence on insulin, blood glucose levels (metabolic functions))

Cartilage:

- features between dense CT and bone tough but flexible and gives shape – ossification with aging
- avascular, devoid of nerve fibers – thin can survive without a blood supply (doesn't allow for proper repairs resulting in scar tissue)
- ground substance contains lots of the GAGs (glucose amino glycan – polypeptide chains and sugars: allows to hold water (spongy, shock absorbing)) chondroitin sulfate & hyaluronic acid - also Chondronectin, (adhesive protein)
- Collagen fibers (can have some elastic fibers)
- Up to 80% H_2O
- Perichondrium: outer connective tissue surrounding cartilage
- Chondroblasts: immature cartilage cells - actively form cartilage
- Chondrocytes: mature cartilage cells maintain cartilage
- Lacunae: localized clusters of chondrocytes in cartilage

Types of cartilage:

a. Hyaline cartilage: most abundant – firm supports and pliable (lots of collagen); appears glassy blue-white; chondrocytes = 1-10% of volume
   I. Location: embryonic skeleton, ends of long bones (epiphyseal plates in growing children), costal cartilages of ribs, cartilages of nose, trachea, larynx
   II. Function: supports & reinforces; resilient cushioning & resists compressive stress

b. Elastic cartilage: like hyaline but more elastic fibers
   I. Location: external ear, epiglottis (needs to be bendy)
   II. Function: maintains shape while giving lots of flexibility

c. Fibrocartilage: rows of chondrocytes alternating with rows of thick collagen fibers; structural intermediate between hyaline cartilage & dense regular CT - Almost as strong as bone yet more resilient – lots of fibers

I. Location: intervertebral discs, pubic symphysis, discs of knee joints (where hyaline cartilage meets a ligament or a tendon)

II. Function: tensile strength with ability to absorb compressive shock

BONE:

- Calcium salts give hardness & strength for support/protection of softer tissues; cavities for fat storage & synthesis of blood cells
- osteoblasts: least differentiated cell
- osteocytes: maintaining bone as a tissue
- osteoclasts: reabsorb/digest bone cell into blood

Calcified tissue:

- Compact bone: dense, outer layer
- Spongy bone: trabeculae - interwoven projection of bones absorbs shock in many different directions (red/yellow marrow found in spongy bone)
- Outer layer is strongest/sturdiest
- Inner layer: osteoblasts and osteoclasts
- Linings:
  - Periosteum: outer fibrous layer and inner osteogenic layer (outside layer of bone)
  - Endosteum: covers trabeculae of spongy bone and lines canals of compact bone

Classification of bones:

- Lots of variations in shape and size of bones – fulfils a particular need classified by shape not size
- Structure the same for all bone shape: compact bone provides the external surface and spongy bone provides the inner bone

1. Long bone: much longer than wide – a shaft and 2 ends mostly compact with hallow center (spongy bone near joint ends) Ex. Femur – movement and strength
2. Short bone: roughly cube-shaped – primarily spongy bone and thin outer layer of compact bone Ex. Wrist, ankle and sesamoid bones
3. Flat bone: thin, flattened and sometimes curved Ex. Skull bones, ribs and breast bone
4. Irregular: leftovers – complicated shapes: primarily spongy bone and thin covering layer of compact bone Ex. Vertebrae and hip bones

Long Bones:

A. Diaphysis: tubular shaft of the long bone = long axis of bone
    a. collar of compact bone surrounding marrow cavity (medullary cavity)
    b. in adults, medullary cavity contains fat (yellow marrow or yellow bone marrow cavity)
B. EPIPHYSES: (sing. = epiphysis)
    a. extremities of a long bone; expanded for articulation with other bones
    b. compact bone forms thin outer layer; interior filled with spongy bone
    c. thin layer of hyaline cartilage at end of epiphyses for protection, shock absorption and to avoid friction between bones
C. EPIPHYSEAL LINE
    a. between diaphysis & each epiphysis; remnant of epiphyseal plate
    b. used to be cartilage as a child (epiphyseal plate) as growth occurs it turns to bone
D. MEMBRANES
    a. Covers outer & inner surfaces of long bones – periosteum and endosteum

Microscopic Compact Bone Structure:

- Osteon: structural unit of compact bone - elongated cylinder oriented parallel to the long axis of bone group of hallow tubes of bone matrix

- Veins, artery, nerve fibers and lymphatic vessels in central canal.
- Collagen fibers perpendicular allow for extensive, twisting force to occur without breaking.
- Lamellae bone: layers of bones

- Central (Haversian) canal: runs through the center of each osteon containing small blood vessels and nerve fibers serve osteon cells
- Perforating (Volkmanns) canal: perpendicular to long axis of bone – connect the nerve and blood supply from the medullary cavity to the central cavities
- Lacunae: small space, cavity, or depression in bone/cartilage occupied by cells
- CANALICULI: small canals that connect the lacunae with each other; also connected to central canal of Haversian system
- INTERSTITIAL LAMELLAE: fill the gaps between forming osteons or are leftovers of osteons that were partially destroyed by bone remodeling
- CIRCUMFERENTIAL LAMELLAE: sheets of bone located just deep to periosteum; extend around entire circumference of shaft

Microscopic Spongy Bone Structure:

- Contains trabeculae, lamellarly arranged osteocytes and canaliculi (no osteons)
- Trabeculae arranged along lines of stress; helps bone to resist stress
- Trabeculae only a few cell layers thick
- nutrients diffuse through canaliculi from the marrow spaces between the trabeculae to reach the osteocytes

Bone Formation:

- osteogensis/ossification: includes formation of bony skeleton in embryos, growth of bones during childhood & adolescence & remodeling/repair of bones in adults

1. Intramembranous Ossification:
   a. bone develops from fibrous CT membrane containing mesenchymal cells
   b. cranial bones of the skull and the clavicles – these are flat bones

c. begins at about 8 weeks of embryonic development

2. Endochondral Ossification:

a. More complex because the hyaline cartilage must be broken down as ossification proceeds

b. bone development via the replacement of a hyaline cartilage model

c. Primary ossification: region where formation of long bone begins in the center of the hyaline cartilage shaft – blood vessels infiltrate the perichondrium covering the hyaline cartilage vascularized periosteum change in nutrition, underlying mesenchymal cells specialize into osteoblasts (now set for ossification)

d. Begins in second month od development

e. Secondary Ossification:

f. Bone collar forms around the diaphysis of the hyaline cartilage model: osteoblasts (new periosteum) secrete osteoid against diaphysis encasing it in a collar of bone

g. Cartilage in the center of the diaphysis calcifies and then develops cavities: chondrocytes within the shaft enlarge and signal surrounding cartilage to calcify chondrocytes die, matrix deteriorates, outer cartilage continues to grow elongating the bone

h. Periosteal bud (nutrient artery/vein, nerve fibers, RBM, osteoclasts) invades the internal cavities and spongy bone forms

i. Diaphysis elongates and medullary cavity forms: osteoclasts break down spongy bone and open up medullary cavity – cartilage calcifies, erodes and then is replaced by bony spicules

j. Epiphysis ossify: secondary ossification: cartilage in center of epiphysis calcifies and deteriorates opening up cavities that allow periosteal buds to enter (spongy bone in the interior is retained and no medullary cavity forms)

k. When secondary ossification is complete, hyaline cartilage remains:

k.i. on the epiphyseal surfaces as the articular cartilages

k.ii. at the junctions of diaphysis and epiphyses where it forms the epiphyseal plates - this is the area where long bones continue to grow

Mechanisms of Bone Growth:

During infancy & youth, long bones lengthen entirely by interstitial growth of the epiphyseal plates and all bones grow in thickness by appositional growth

Most bones stop growing during adolescence or in early adulthood - sohaftme facial bones (eg: nose & lower jaw) continue to grow (almost imperceptibly) throughout life

Long Bone Growth:

Mimics most events of endochondral ossification:

1. Cells divide quickly pushing the epiphysis away from the diaphysis
2. Cells enlarge and their lacunae erode and enlarge leaving large interconnected spaces surrounding cartilage matrix calcifies, chondrocytes die and deteriorate = calcification zone
3. Long slender spicules of calcified cartilage at junction (look like stalactites)
4. Spicules become part of ossification zone invaded by marrow elements, osteoclasts erode, then osteoblasts cover them with new bone spongy bone
    - As osteoclasts digest, medullary lengthens
    - Epiphyseal plate remains a constant thickness

As long bone lengthens, the shape of the ends must be altered (remodeling) ends are wider than shaft bone is destroyed by osteoclasts and laid down by osteoblasts on both the inner and outer surfaces of a growing long bone.

Longitudinal bone growth ends when epiphysis and diaphysis fuses (18-21 – only articular cartilage remains).

Growth in Width:

- Growth in width = appositional growth
- Layers of bone are laid down on top of one another
    - Osteoblasts on periosteal side secrete bone matrix
    - Osteoclasts on the endosteal side remove bone matrix

- ✓ *Interstitial and appositional growth is an unequal process produces a thicker, stronger bone but prevents it from becoming too heavy*

Topic 4: Bones

- ✓ **206** bones in human skeleton - make up about 20% of body weight
- ✓ grouped into **axial** and **appendicular** skeletons
- ✓ **axial skeleton** = bones of skull, vertebral column, rib cage supports, protects the brain/spinal cord and organs
- ✓ **appendicular skeleton** = bones of upper & lower limbs + pectoral/pelvic girdles (attach limbs to axial skeleton)

SKULL

- ❖ most complex
- ❖ 2 sets of bones: **cranial** + **facial** = 22 bones
- ❖ most skull bones are flat bones; (except mandible); united by **sutures**
- ❖ facial bones form anterior part of skull & cranial bones form the rest
- ❖ skull has eye orbits & paranasal sinuses, houses organs of hearing, has 85 openings for nerves, blood vessels & spinal cord

A. Cranium vault and base
   a. vault: forms superior, lateral & posterior aspects of the skull + forehead
   b. base: inferior aspect of skull
   c. internally, 3 bony ridges divide the cranial base into 3 distinct areas: anterior (highest) fossa, middle fossa & posterior (lowest) fossa
   d. 8 cranial bones are the paired parietal & temporal bones & the unpaired frontal, occipital, sphenoid & ethmoid bones

I. Frontal bone: dome-shaped bone also forms the roof of the orbits & anterior cranial fossa articulates with paired parietal bones posteriorly – glabella: between orbits

II. Parietal Bones: paired – form superior and lateral aspects of the skull form bulk of cranial vault - four largest sutures occur where the parietal bones articulate with other cranial bones

III. Occipital Bone: single bone at base of skull; helps form posterior aspect of skull - also forms walls of the post cranial fossa

a. large hole at base = foramen magnum (passage for spinal cord)

b. occipital condyles on each side of foramen magnum = site of articulation with first cervical vertebra – nodding action (hypoglossal canal cranial nerve passes)

c. external occipital protuberance = projection at back of skull - more prominent in males

IV. Temporal Bone: paired; form inferior & lateral aspects of skull and parts of the cranial floor located just below the 2 parietal bones; have 3 very different areas or regions

a. Squamous region: flattened – zygomatic process to cheekbone - mandibular fossa receives condyle of mandible

b. Tympanic region**:** surrounds external acoustic meatus (ear canal)

c. Petrous region: is on internal aspect of temporal bone - contributes to cranial base; houses middle and inner ear cavities

c.i. mastoid process is attachment site for some neck muscles

c.ii. styloid process is attachment area for muscles of the tongue

V. Sphenoid Bone: complex bone; difficult to visualize; articulates with all other cranial bones - forms base of middle cranial fossa; contributes to base of anterior cranial fossa

a. Central body and 3 pairs of processes: greater wings, lesser wings and pterygoid processes.

b. Hypophyseal fossa – pituitary gland.

c. Optical canals – allows optic nerves to pass to the eyes

VI. Ethmoid Bone: approximates a cube that lies deep between orbits & nasal cavities

a. cribriform plate forms roof of nasal cavity & floor of anterior cranial fossa; tiny holes (olfactory foramina) transmit olfactory nerves

b. perpendicular plate projects inferiorly to contribute to nasal septum

c. crista galli projects superiorly to attach to dura mater of brain

d. lateral masses contain Ethmoid sinuses

B. Facial Bones:

a. Form framework of the face – cavities for sensory organs of sight, smell and taste – provides opening for food and air passage – secure the teeth

b. 14 bones of which mandible and vomer are unpaired

c. paired bones are: maxillae, zygomatic, nasal, lacrimal, palatine & inferior conchae

1. Mandible: lower jaw bone - strongest & largest bone of the face - body is horizontal part & contains chin; left & right rami join body at mandibular angle
2. Maxillary bones: fused medially - alveolar margins hold teeth of upper jaw - palatine processes project posteriorly forming anterior 2/3 of hard palate
    a. Form upper jaw and central portion of the facial skeleton.
    b. All facial bones except the mandible articulate with the maxillae.
    c. Maxillae meet just above the nose to make the nasal spine.
    d. Incisive fossa: serves as passageway for blood vessels and nerves.
    e. Frontal processes: bridge of nose
3. Zygomatic bones: = cheekbones - articulate with zygomatic processes of maxilla and of temporal bones contribute to inferolateral margins of orbit
4. Nasal bones: 2 tiny, rectangular bones that fuse medially to form bridge of nose articulate with frontal bone superiorly & maxillary bones laterally
5. Lacrimal bones: 2 fingernail-shaped bones in anterior, medial portion of orbit – each has a depression (lacrimal fossa)
6. Palatine bones: 2 L-shaped bones/horizontal plates form part of hard palate - vertical plates - nasal cavity & orbit
7. Vomer: single thin bone forms nasal septum
8. Inferior nasal conchae: [superior and middle nasal conchae from ethmoid bone] - thin, curved bones - project medially largest of 3 pairs of conchae

Paranasal Sinuses: frontal, maxillary, sphenoid, and Ethmoid

- mucosa-lined, air-filled sinuses
- lighten skull and enhance resonance of voice; connect to nasal cavity so also help to warm & humidify incoming air

Hyoid:

- Only bone of the body that does not articulate with any other bone
- Supports tongue & gives attachment to muscles for swallowing & speech
- Horseshoe-shaped with a body + 2 pairs of horns

Orbits:

- Zygomatic
- Frontal
- Maxilla
- Ethmoid
- Lacrimal
- Sphenoid
- Palatine (orbital process)

Major Cranial Sutures:

- Bones of the adult skull are firmly united by sutures_
- Sutural bones**:** tiny irregular bones; can occur within cranial suture additional ossification centres that appeared rapidly during fetal development (lambdoid suture)
- 4 main sutures that connect the cranial bones_

  (1) Coronal suture: frontal bone & 2 parietal bones

  (2) Squamous suture: parietal bone & temporal bone

  (3) Lambdoid suture**:** occipital bone & 2 parietal bones

  (4) Sagittal suture: 2 parietal bones

Topic 5: The Skeleton

Vertebral Colum:

- 33 bones of which 24 remain separate (flexibility) and the remaining 9 fuse to form 2 composite bones (sacrum & coccyx) - 70 cm long 7 cervical 12 thoracic, 5 lumbar, 5 sacral, 3-4 coccyx

- 3 main functions: weight-bearing, anchor for muscles & ligaments, protection of spinal cord
- Curvatures: resilience and flexibility cervical and lumbar= concave, thoracic and sacral= convex

1. Ligaments:
    a. strap-like; support column of bones so stay upright
    b. major supporting ligaments are anterior & posterior longitudinal
    c. continuous bands down front & back of vertebral bodies from neck to sacrum
    d. broad anterior is strongly attached to bony vertebrae & the discs; prevents hyperextension of spine
    e. posterior is narrow, weaker & attached only to discs; prevents hyperflexion of spine
2. Intervertebral Discs:
    a. cushioning between bony vertebral bodies - shock absorbers - 25% length of vertebral column
    b. each is circular with nucleus pulposus in centre &annulus fibrosus around periphery
    c. nucleus pulposus is like a rubber ball »» elasticity & compressibility
    d. annulus fibrosus holds together successive vertebrae & resists tension in spine – woven strap (bind vertebrae) and withstand twisting
    e. Herniated disc: “slipped disc” – involves rupture of the anulus fibrosus followed by protrusion of the spongy nucleus pulposus through the annulus