

- **Planes**
 - Midsagittal plane – vertical plane; divides body into equal left and right
 - Parasagittal plane – vertical plane: divides body into unequal left and right
 - Frontal/coronal plane – vertical plane: divides body into equal and unequal front and back
 - Transverse plane – horizontal plane; divides body into equal and unequal top and bottom
 - Oblique – angular plane, divides body at an angle

LECTURE 2 - THE CELL OUTCOMES

Atoms, elements, molecules and compounds

- **Atom**
 - Smallest stable unit of matter
 - Take part in chemical reaction and are neutrally charged
 - Has energy or willing to work (potential energy) but no mass
 - Proton (+), electrons (-) and neutrons (0)
 - Nucleus = contains proton and neutrons, electrons orbit in layers (constant motion, provide chemical energy)
- **Element**
 - Element = single atom (1 atom of H = element of hydrogen)
 - Substance that CANNOT be broken down to a simpler substance
 - Contains carbon, hydrogen, oxygen and nitrogen
 - Contains trace elements for growth, development, psychological function (iodine, copper, zinc)
- **Molecule**
 - Molecule = 2+ atoms combined
 - H₂ hydrogen (2 hydrogen), H₂O (1 hydrogen : 1 oxygen ratio)
 - All compounds = molecules
- **Ions**
 - = positively or negatively charged atoms
- **Structure**
 - Octet rule – rule of 8
 - 2 for 1st shell – 8 electrons in all other shells
 - Completely empties or fills valency (outer) shell
 - Valence shell
 - Has the most potential energy
 - Chemically reactive electrons combine with atoms
 - Stability
 - Stable = full valence shell (chemically inert)
 - Unstable = incomplete valence shell (chemically reactive elements)
 - Chemical interactions
 - Transfer from one shell to another
 - Forms bonds and uses energy
 - Breaks bonds and release energy
 - Positive and negative atoms attracted to each other
 - Potential energy = store energy
 - Kinetic energy = movement
- **Bonds**
 - Ionic (electro covalent)
 - Electrons transfer between atoms
 - Ionic bond = complete transfer of electrons
 - Covalent
 - Valent electrons shared between atom

Connective tissue				
Types	Make-up		Function	Location
Loose connective tissue	Mostly ground substance Fibroblasts, adipocytes		Binds underlying organs to skin and each other, provide padding and support network for other tissues <u>Most common type</u>	
Dense connective tissue	Collagen fibers		Provides structural support	
Reticular tissue	Reticular fibers produced by fibroblasts		Form fine network that can support small structures like blood and lymphatic vessels	
Adipose tissue	Adipocytes (fat storing), surrounding fibroblasts, and ECM		Insulates and conserves body heat, cushion internal organs, energy reserve	
Specialised connective tissue				
Types	Subtype	Make-up	Function	Location
Cartilage (made up of chondrocytes) – (support, attachments, cushion bone)	Hyaline	Mostly ground substances		Covers the end of moveable joints,. Nose and respiratory passages
	Fibrous Cartilage	ECM = mostly collagen fibers, little ground substance	Resist compression and limit bone to bone contact, tough shock absorbers	Knee joint, pubic symphysis and intervertebral discs
	Elastic cartilage	ECM = mostly elastic fibers	Tolerate distortion and return to original shape	Ear, epiglottis
Bone tissue	Compact and spongy bone types	Osteocytes, osteoblasts and osteoclasts	Support + protect tissues + organs Provide attachment point for muscles Store calcium + fat Produce RBCs	
Blood	Plasma proteins		Blood clotting, transport of substances	Cardiovascular system
	Erythrocytes (RBCs)		Bind to and transport oxygen through body	
	Leukocytes (WBCs)		Immunity	
	Platelets		Major role in blood clotting	

Lymph	Fluid from blood plasma, reticular fibres, leukocytes, cell debris		Lymphatic system
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Membranes

Types	Subtypes	Make-up	Function	Location
Serous membranes	Parietal layer (outer)	Mesothelium (thin layer of squamous epithelium, layer of connective tissue and basement membrane)	Reduces friction created when organs move in membranes	Line pericardial, peritoneal and pleural body cavities
	Visceral layer (inner)			
Synovial membranes				
Mucous membranes (not a true membrane)		Epithelium and basement membrane Goblet cells (produce and secrete mucus)	Primary function = protection	Line all body passages as components of walls of hollow organs (respiratory, mouth, nasal cavity, digestive tract, reproductive tracts)
Cutaneous membranes			Protects structures deep to it	Skin – largest organ of the body

Muscle tissue

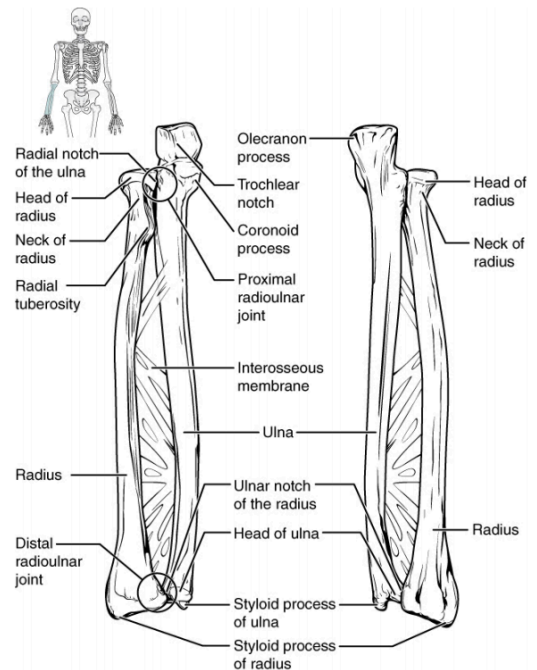
Types	Make-up	Function	Location
Smooth muscle	Main component = myocyte	Common ability = turn chemical energy (ATP) into mechanical energy movement Contraction	
Skeletal muscle			
Cardiac muscle			

Nervous tissue

Types	Subtype	Make-up	Function	Location
Neurons		Ground substance	Sending and receiving messages	Brain, spinal cord, nerves
Neuroglial cells		Contains unique proteoglycans, very few protein fibers	Support neuron activities	

- Osteocytes (mature bone cells) sit in chambers (lacunae) and connect to each other via canaliculi
- Form rings called lamellae around a central blood vessel canal (haversian)
- Haversian only found in compact bone
- Haversian are linked by volkman canals
- Osteon = lamellae and canal
- **Spongy bone – Histology**
 - Not weight-bearing like compact bone
 - Provide a protective structure for bone marrow tissue
 - Struts or ribs of bones called trabeculae, covered with endosteum and usually not arranged into osteons
 - Trabeculae – composed of concentric lamellae between which lacunae are found containing osteocytes – communicate with each other through canaliculi
 - No central or perforating canals supplying blood to trabeculae (obtain their blood supply from vessels in bone marrow)
- **Bone formation**
 - Ossification (osteogenesis) = process of bone formation
 - Bones form in 4 situations
 - During embryological and foetal development
 - When bones grow before adulthood
 - When bones remodel
 - When fractures heal
 - All bones start as hyaline cartilage
 - 2 types of bone formation
 - Intramembranous
 - Flat bones e.g. skull
 - Connective tissue replaced by bone
 - Endochondral
 - Hyaline cartilage converts to bone (chondrocytes become osteoblasts)
 - All other bones (except clavicle)
- **Bone growth**
 - Epiphyseal (growth) plate is cartilage that continues to divide pushing the epiphysis away from the diaphysis, resulting in longitudinal growth.
- **Bone remodelling**
 - Essential for bones to retain normal size and strength as body grows (resorption by osteoclasts and deposition by osteoblasts)
 - Triggered by exercise, injury, dietary changes, age, sedentary lifestyle)
 - New bone grows thicker compared to old bone
 - Gravity and muscle pull effects on skeleton determine here osteoblasts deposit new bone so skeleton remains as strong and healthy as possible
- **Factors affecting bone growth and remodelling**
 - Parathyroid hormone – determines if bone is resorbed, under homeostatic control
 - Thyroid hormone – stimulates osteoblasts
 - Growth hormone
 - Testosterone and estrogen
 - Testosterone = increases appositional growth (thicker bones)
 - Estrogen = increases longitudinal growth and inhibits osteoclasts
 - Growth spurts (increase mitosis of epiphyseal plate and closure of epiphyseal plate)
 - Vitamin A = stimulates osteoblasts
 - Vitamin C = collagen synthesis
 - Vitamin D – builds bone by absorbing calcium from food
 - K and B12 -for other bone proteins

- Shape and articulating surface – important to hip joint
- Ligaments – important for IV and ankle joints (stability)
 - Prohibit movement in undesirable directions
 - Limit range of normal movements
 - Hold/protect important structures in place
- Muscles – important for shoulder, muscle tone provides stabilising force
- Tendons – cross joints, provide stability when muscles contract
- Bursae and tendon sheaths – stabilising forces in high stress regions
 - Bursae – sac filled with synovial fluid between tendons, muscles and bone to minimize friction of moving parts
 - Tendon sheaths – long bursa surrounds and protects tendons as they slide across joint during movement

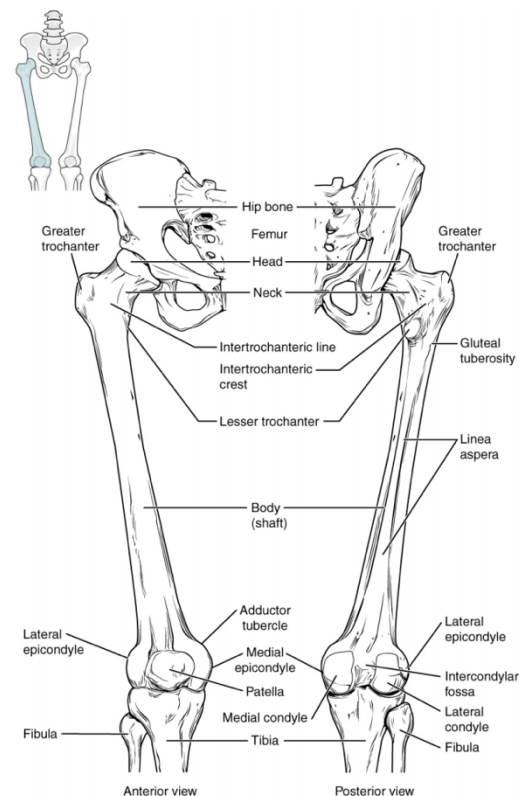


Elbow joint – very stable hinge joint, 2 articulations, 3 ligaments supporting capsule

- **Humero-ulnar**
 - Larger
 - Between trochlea of humerus and trochlear notch of ulna
- **Humero-radial joint**
 - Between capitulum of humerus and head of radius
- Radial ligament (lateral side)
- Ulnar ligament (medial side)
- Annular ligament – binds head of radius to neck of ulna, stabilises radial head

Knee joint (hinge) – largest diarthrotic joint

- **Articulations**
 - Tibiofemoral
 - Patellofemoral
- **Ligaments**
 - Anterior cruciate ligament / posterior cruciate ligament
 - Tighten on extension
 - Limit ext./flex. Within joint capsule
 - Medial collateral ligament (weak) and lateral collateral ligament (stronger)
 - Outside capsule
 - Limit adduction/abduction
 - Stabilise knee during extension by tightening
 - Patella
- **Menisci**
 - Deepen contour of tibial surface to increase femoral contact and spread load more evenly



LECTURE 9 – THE SPECIAL SENSES OUTCOMES

Olfactory system – anatomy and physiology

- **Olfactory receptors**
 - 400 smell genes
 - Detect 10,000 different odour molecules
 - Receptors in superior part of nasal cavity
 - Assesses environment in semi-intimate way
 - Involved in memory formation and recall
- **Anatomy**
 - Olfactory organs – either side of nasal septum in superior nasal cavity
 - Olfactory mucosa - 2 layers
 - Epithelium – receptor neurons, cilia embedded in mucus layer, support cells
 - Collective tissue – (lamina propria): contains olfactory glands which secrete mucus to absorb odorants

Gustatory system – anatomy and physiology

- **Gustation receptors**
 - 10,000 (mostly on tongue) – also in larynx and pharynx (replaced every 7-10 days by basal stem cells)
 - 5 types of taste receptors
 - Assesses environment in an intimate way (initiates protective reactions)
 - Triggers reflexes involved in digestion (stomach acid)
- **Papillae types**
 - Circumvallate
 - 10-11 present
 - Large round surrounded by deep epithelial folds
 - Each contains 200 taste buds
 - Fungiform
 - 200 presents
 - Mushroom shaped, scattered on top side of tongue
 - Each contains 5 taste buds
 - Filiform
 - Numerous
 - Rough, scattered on top side of tongue
 - Do not contain taste buds
 - Provides friction to help tongue move objects in mouth
 - Foliate
 - 4-5 present
 - Short vertical folds present on each side of tongue
 - Each contains 120 taste buds
- **Taste buds** – 50-100 epithelial cells (2 types)
 - Basal epithelial cells – stem cells that divide in 7-10 days
 - Gustatory epithelial cells with microvilli – gustatory hairs project into the taste pore, gustatory receptor cells
- **Taste – chemical process**
 - Chemicals dissolve in saliva → diffusion into taste pore → contact gustatory hairs
 - Chemicals activate receptors to produce depolarisation
 - Cranial nerves – take message to brain (dependant on region of tongue stimulated)
 - CN7 – facial
 - CN9 – glossopharyngeal
 - CN10 – vagus

Organ Tissue	Hormones		Target Tissue	Effects
Pineal Gland	Melatonin		Reticular formation of brain stem	Regulates and promotes sleep
Hypothalamus (released by Posterior Pituitary Gland aka PPG)	Antidiuretic hormone Oxytocin		Kidneys, Brain Uterus, Mammary Gland	Water reabsorption Milk let down reflex
Anterior Pituitary	(secreted) Thyroid stimulating hormone	REQ: Thyrotropin releasing hormone (TRH)	Thyroid Gland (produces)	Growth of thyroid gland & synthesis of thyroid gland.
	Adrenocorticotrophic hormone (ACTH)	Corticotropin releasing hormone (CRH)	Adrenal Cortex (produces)	Growth & development of adrenal, release of adrenal catecholamines.
	Prolactin	Prolactin releasing hormone (PRH)	Mammary Gland (produces)	Development of mammary gland & milk production.
	Luteinizing hormone (LH)	Gonadotropin releasing hormone (GnRH)	Gonads (produces)	Produces oestrogen/testosterone & ovulation
	Follicle stimulating hormone	Gonadotropin releasing hormone (GnRH)	Gonads (produces)	Testosterone & oestrogen production Maturation of ovarian follicles
	Growth hormone	Growth hormone releasing hormone (GRHR)	Liver, muscle tissue, bone cartilage & adipose tissue	Lipolysis Protein breakdown Production of insulin-like growth factor (which stimulates cell division & protein synthesis)