

FEDERAL

UNIT 16

BONE

- * Epiphysis → Terminal broad part of bone
- * diaphysis or shaft → middle part along the length of the bone which contains a central cavity (lumen) filled by yellow bone marrow.
- * Periosteum: outer connective tissue around the bone
- * endosteum: ~~endosteum~~ inner covering
- * Compact bone: peripheral part of bone
- * Spongy bone: inner bone mass
Most of the spongy bone is present in epiphysis
- * Red bone marrow: found in spaces of spongy bone

CARTILAGE

- * Perichondrium: The cartilage matrix is covered by a dense layer of collagen fibres called perichondrium → or external covering of cartilage is perichondrium
- * Lacunae: ~~lacunae~~ Lacunae are small cavities distributed in the matrix which contain cartilage cells
- * Hyaline Cartilage:
 - Found: → at the end of long bones
 - In the nose
 - At larynx and trachea
- * Fibrocartilage:
 - Found in: → intervertebral discs
 - in knee
- * Elastic cartilage:
 - Found in: → ear flaps
 - epiglottis

- * Atlas → The first cervical vertebra
- * Axis → Second cervical vertebra
- * Sacrum → Sacral vertebrae are five fused vertebrae forming the sacrum. The sacrum articulates with the iliac bones of the hip bone to form the back of the pelvis
- * Pelvic vertebrae → Sacral and coccygeal vertebrae are together called pelvic vertebrae
- * chest cavity → semi-vacuum chamber

PECTORAL GIRDLE

- A pair of clavicles
- A pair of scapula

Clavicles → collar bones

Scapula → shoulder blades

- * Humerus : A long bone, the end of which has a spherical head, which fits into the glenoid cavity

* Radius → towards the thumb

* Ulna → towards the little finger

* Ulna is slightly bigger than radius

* Pubic Symphysis: The two halves of the pelvic girdle are joined at the pubic symphysis

* Acetabulum: Cavity of pelvic girdle

* Femur or thighbone fits into acetabulum

* Patella or knee cap is embedded in a long tendon which runs over the knee joint

* Tibia → shin bone

PECTORAL GIRDLE

* Arthrology → The scientific study of the structure and function of joints

* Synovial Joints: The joint capsule of synovial joints is composed of an outer layer of ligaments and an inner lining of synovial membrane, which secretes synovial fluid

* Arthroplasty: Joint replacement is called arthroplasty

- ✧ Osteoporosis → hormonal or hereditary
- ✧ Osteomalacia and rickets → due to nutritional deficiency

✧ Each intervertebral disc consist of:

1. Annulus fibrosis (outer)
2. Nucleus pulposis (inner)

✧ ~~Q~~ Nucleus pulposis: An inner semifluid which gives the disc its elasticity and compressibility

✧ Anulus fibrosis: strong outer ring of fibrocartilage, which holds together successive vertebrae

✧ Intervertebral discs act as shock absorbers

✧ The herniated disc or slipped disc usually involves rupture of annulus fibrosis followed by the protrusion of the spongy nucleus pulposis

✧ Gouty arthritis: Gouty arthritis results from a metabolic disorder in which an abnormal amount of uric acid is retained in the blood and sodium urate crystals are deposited in the joints. The most common joint affected is the joint of the big toe

* Complicated Fracture → A fracture that damages the adjacent organs

* Myology → The study of muscles

* Cardiac Muscles:

Adjacent cardiac cells join together to form branching fibres by specialized cell-to-cell attachments called intercalated discs, which have gap like junctions that allow action potentials to pass from cell to cell.

* In certain regions of the sarcomere, actin and myosin filaments overlap. Transverse sections in these regions indicate that six actin filaments surround each myosin filament.

A Band → Myosin And actin filaments together

I Band → Actin filaments alone

* The centre of the A band is lighter than the other regions in a relaxed sarcomere as there is no overlap b/w the actin and myosin in this region. It is called the H-Zone.

* Each myosin molecule consist of six polypeptides which are arranged in such a way that each myosin molecule possesses a tail and two globular heads

* Thick myofilaments → 16nm in diameter
→ composed only of myosin

* Thin filaments → 7-8 nm in diameter
→ composed chiefly of actin

* Tropomyosin:

→ Two strands of tropomyosin spiral about the actin core and help stiffen it.

→ In a relaxed muscle fibre, they ~~block~~ block myosin binding sites on actin so that the myosin heads cannot bind to the thin filaments

* Troponin:

Troponin is a three-polypeptide complex
i.e. TnI, TnC and TnT

1. TnI → Inhibitory subunit that binds to actin
2. TnT → binds to tropomyosin and helps position it on actin
3. TnC → Binds calcium ions

* Muscle contraction is initiated by nerve impulse arriving at the neuromuscular junction.

* Ligaments: connective tissue that joins bone to bone

* Tetany:
→ caused by low calcium level in blood

NERVOUS COORDINATION

- * If plants are grown without light, they become extremely long and fail to form chlorophyll. They are said to be etiolated.
- * Diurnal Rythms → Day time acitivity
- * ~~Di~~ Circadian → 24-hours
- * Circannual → 365 days
- * The detection of vibrations of the ground by terrestrial vertebrates is probably achieved by receptors in the joints.
- * Nissl's Granules: A group of ribosomes associated with rough E.R. and golgi apparatus present in cell body of neuron
- * The neural cell membrane is virtually impermeable to all ions but is slightly permeable to K^+ .
- * Cerebrospinal fluid → similar in composition to blood plasma
- * Parasympathetic System: A few cranial nerves including the vagus nerve together with the nerves from bottom portion of spinal cord, form the parasympathetic nervous system.

CHEMICAL COORDINATION

* HYPOTHALAMUS

It is believed that oxytocin and ADH are produced in hypothalamus and travel down the nerves to the posterior lobe of pituitary to be stored

* Pituitary Gland → Also known as hypophysis cerebri

* Somatotrophin Hormone:

Somatotrophin Releasing Factor (SRF) is secreted from hypothalamus throughout life

In Growth Age → promote growth

When Growth has Ceased → promote protein synthesis throughout body

* Excess melanocyte stimulating Hormone is secreted in Addison's Disease

* A lack of ADH causes diabetes insipidus, characterized by production of large quantities of dilute urine and great thirst

* The process of metamorphosis is brought about by T_3 and T_4 .

* Graves' disease can lead to cardiac failure if prolonged

CORTICAL HORMONES

The adrenal cortex is active at all times but especially so following shock or stress and infection.

Cortical ~~to~~ Hormones include cortisol, corticosterone and aldosterone

1. Cortisol :

→ a glucocorticoid

→ brings about an increase in blood glucose level mainly by its production from protein and by antagonizing the action of insulin

2. Corticosterone:

→ both a glucocorticoid and mineral cortecoid

→ Increases blood glucose levels

→ Regulates mineral ion balance

3. Aldosterone

→ mineral cortecoid

→ conserve level of Na^+ in body by preventing their loss from kidney tubules

→ Addison's Disease: Destruction of adrenal cortex

→ Cushing's disease: Excess production of cortical hormone

* Androgens:

- produced by adrenal gland
- cause development of secondary male characteristics
- secreted in small amounts

* Progesterone suppresses ovulation. That's why it is a major constituent of birth control pill.

RESPIRATION

* Vestibules → The anterior parts of nasal cavities near the nostrils are called vestibules which contain a network of hairs.

* Pharynx:

conventionally divided into three sections

1. Nasopharynx
2. Oropharynx
3. Laryngopharynx

* glottis → opening of the larynx is called glottis

* ~~Free~~ Bronchi ⇒

→ Trachea divides to form two smaller tubes called primary bronchi

→ The primary bronchi divide into secondary bronchi within each lung

→ Two secondary bronchi in left lung

Three " " " in right lung

→ Secondary bronchi gives rise to tertiary bronchi

* Mediastinum:

The right and left lung are separated medially by heart and mediastinum, which is the area b.w the lungs

RESPIRATION

- * Hilum → triangular shaped depression of both the lungs where the blood vessels and airways pass into the lungs.
- * Emotions acting through the limbic system of the brain can also affect the respiratory centre.
- * All known respiratory pigments contain a coloured non-protein portion.
- * Haemoglobin → contains four globin protein chains.
- * Myoglobin → consist of one polypeptide chain. This chain is associated with an iron containing ring structure
→ can bind with one molecule of oxygen
→ Myoglobin release oxygen when partial pressure of oxygen is below 20 mmHg.
- * In haemoglobin each molecule possess four iron containing haem groups while in myoglobin only one haem group is present.
- * Haemoglobin release oxygen when partial pressure of O_2 is below 60 mmHg.

HOMEOSTASIS

* Nephrology → study of kidney

* Fibrous capsule → Fibrous capsule is a fibrous connective tissue layer enclosing each kidney

* Renal papillae → The tips of the pyramids called renal papillae are pointed towards centre of kidney

* As fluid travels up the ascending limb, sodium chloride is transported actively out of the limb into the surrounding area. This movement is controlled by aldosterone

* The risk of UTI is 50 times more common in women than men

* Nephrolithiasis → The condition of having stones in the kidney

REPRODUCTION

* PLANTS

DIPLOHAPLONTIC LIFE CYCLE

Plants have diplohaplontic life cycle with alternating diploid sporophyte and haploid gametophyte generations.

Isomorphic Generation:

If the two generations are vegetatively similar, such alternation of generation is referred to as isomorphic.

HETEROMORPHIC GENERATION:

If the two generations are dissimilar

* ANIMALS

* Ovoviviparous → In some mammals like duckbill platypus and spiny ant-eater internal fertilization leads to internal development of young one in a shelled egg and when development is completed, shelled egg is laid which hatches the offspring. This is called ovoviviparous condition.

REPRODUCTION

* MALE REPRODUCTIVE SYSTEM

* PLANTS

* Fluid secreted by Sertoli cells provides liquid medium, protection and nourishment to sperms while they are in tubules

* Between the seminiferous tubules are interstitial cells which secrete testosterone

* FEMALE REPRODUCTIVE SYSTEM

→ The pituitary gland on the onset of puberty, releases follicle stimulating hormone (FSH) which stimulates the development of several primary follicles. Only one of these follicles continue to grow with its primary oocytes while the rest break down by a degenerative process known as follicle atresia.

* Estrogen Hormone:

- stimulates endometrium and vascularizes it
- inhibits secretion of FSH

* During gestation period, pituitary gland produces luteotropic hormone (LTH). Placenta also secretes human placental lactogen. Both these hormones stimulate mammary development in preparation for lactation (Luteotropic Hormone → also known as prolactin)

DEVELOPMENT AND HEALTH

* Fetus → From the beginning of 3rd month of pregnancy, the human embryo is referred to as fetus

→ Within 10-45 min after birth, the uterus contracts and separate the placenta from the wall of the uterus and placenta then passes out through the vagina. This is called after birth

→ During delivery, average loss of blood is about 350cm^3

* *Neisseria gonorrhoeae* → a gram-positive bacteria

* Syphilis → spirochete

* Ⓟ

DEVELOPMENT AND AGING

- * Blastula → characterized by the presence of segmentation cavity or blastocoele.
- * Gerontology → The study of aging
- * Teratology → The branch of biology which deals with abnormal developments of body and causes for such developments
- * In microcephaly, the individuals are born with small skull

CHROMOSOMES AND DNA

* Number of Chromosomes in Different Organisms:

Penicillium = 1

Mosquito = 6

Corn = 20

Honeybee = 32

Frog = 26

Mouse = 40

Human = 46

Sugar Cane = 80

* Karyotype → The particular array of chromosomes that an individual possesses is called its karyotype. Karyotype show marked differences among species and sometimes even among individuals of the same species.

* The diffraction pattern of DNA suggested that DNA molecule had a shape of helix with a diameter of 2nm and a complete helical turn every 3.4nm.

* Primer → A sequence of about 10 RNA nucleotides complementary to the parent DNA template. The RNA nucleotides in the primer are then replaced by DNA nucleotides.

CHROMOSOMES AND DNA

* DNA Polymerase III → Can add nucleotides only to 3' end of DNA.

This means replication always proceeds 5' to 3' direction on a growing DNA strand.

* Primer → binds to 3' end of strand

* Alkaptonuria → A disorder in which a person produce urine containing homogentisic acid. This substance oxidizes rapidly when exposed to air, turning the urine black. In normal individuals, homogentisic acid is broken down into simpler substances. People with alkaptonuria lack the enzyme necessary to catalyze this breakdown.

* Sickle Cell Anemia → Sickle Cell Anemia is caused by a change in glutamic acid to valine at a single position in the protein.

* rRNA → During translation, rRNA provides the site where polypeptides are assembled.

* tRNA → tRNA transport the amino acids to the ribosomes for use in building the polypeptides and also position each amino acid ^{at} the correct place on elongating polypeptide chain.

→ Human cells contain about 45 different kinds of tRNA molecules

✦ TRANSCRIPTION

→ Only one of the two strands of DNA are transcribed. This strand is called template strand or antisense strand.

→ The opposite strand is called coding strand or the sense strand

→ The DNA strand open up to the place where enzyme is attached to the template strand forming transcription bubble

✦ The four nucleotides can be arranged in 4^3 or 64 different combinations of three (codons), more than enough to code for 20 amino acids.

TRANSLATION

✦ Particular tRNA molecules become attached to specific amino acids through the action of activating enzymes called aminoacyl-tRNA synthetase - one of which exist for each of the 20 common amino acids.

✦ Down's Syndrome → Also called Mongolism

TRANSCRIPTION

1. Promoter present at 5' end of DNA template strand (coding strand)
2. RNA polymerase binds to ~~the~~ promoter
3. DNA strand open
4. mRNA is formed complementary to antisense strand.

✧ Gene Pool: All the genes/alleles found in a breeding population at a given time are collectively called the gene pool

✧ Drosophila:

→ Male and female drosophila show sexual dimorphism.

Male : i) smaller in size with black rounded abdomen

ii) sex combs on front legs

Female : larger with pointed abdomen

→ Generation Time : Two weeks

→ Only 8 chromosomes in 4 homologous pairs

BASE PAIRS

- * Primer → 10 bases long in DNA Replication
- * Primer → 18-25 bases long in PCR (In MCQ select 20)
- * Poly-A tail → 30-500 Adenine Nucleotides
- * DNA/RNA Probe → 100-1000 base pairs
- * Okazaki Fragments → 150-200 base pairs
- * Promoter → 100-1000 base pairs
- * Cut Sites For Restriction Enzymes → 4 to 6 nucleotides

GENE LOCATIONS

1. Gene 'I' (Blood Group) → Chromosome 9
2. 'Se' (Secretor Gene) → Chromosome 19
3. ~~H substance~~
3. 'H' Gene → Chromosome 19
 - ↳ (H-substance is a precursor to A and B antigens)
4. Insulin Gene → Chromosome 11

* DIABETES MELLITUS

Type I: Juvenile Diabetes

→ Auto immune disorder

* So far more than 500 Restriction Endonucleases have been isolated out of which about 20 are frequently used in recombinant DNA technology

* Recombinant DNA also known as chimaeric DNA

* Cumulus Cell: Those cells that cling to an egg after ovulation occurs

* Plant cells are totipotent means each cell has the full genetic potential of the organism and, therefore a single cell would become a complete plant

CHAP 1 CELLS

* Cell Theory → By Theodor, Schwann and Schleiden

* Abiogenesis → Living things arise from non-living things

↳ or informally, the origin of life

↳ The original evolution of life or living organisms from inorganic or inanimate substances

* Parenchymatous cells → store surplus food

* Plasma membrane

Basic unit → Unit membrane

* CELL WALL

• Middle Lamella

Major compound → Pectin

• Primary wall

→ outermost

→ cellulose, hemicellulose

• Secondary wall

→ for strength

→ cellulose, inorganic salts, silica, waxes, Lignin

* Ribosomes

→ non-membranous

CELLS CLASS 11
* Autophagosomes → Lysosomes which eat parts of their own cells are known as autophagosomes

* Secondary Lysosomes → The digestive vacuoles and autophagosomes are also known as secondary lysosomes

* Glyoxisome

→ help in metabolism of ~~the~~ oil

→ Play role in both catabolic and anabolic pathway

→ Break fatty acids to succinate

* Mitochondria

cristae → Lipoprotein membrane

* Leucoplast

1. Proteioplast → store protein

2. Lipoplast → store lipid

3. Amyloplast → store carbohydrate

* chromosomes

→ often deeply stained with 'basic' dyes

* Peptidoglycan / Murein

→ Polysaccharide chain bound covalently to shorter chains of amino acids

→ Entire cell wall is often regarded as a single huge molecule called sacculus

CHAPTER 9 → ANIMALIA

* PHYLUM PORIFERA

- * ostia: pores through which water enters the body
- * osculum: pore through which water leaves the body

* Intake of food: Sponges are sessile, therefore they depend upon the food coming to them along with water currents brought about by movement of flagella of choanocytes.

* Hermaphrodite

- * mostly protandrous → i.e. male sex cells develop first
- Fertilization occurs in mesenchyme

* PHYLUM COELENTRATA

* Reproduction: Both Asexual and sexual
Asexual → Budding

* Alternation of Generation:

- Both polyp and medusae are diploid
- Asexual and sexual generation alternate with one another

* Examples:

1. Aurelia (Jelly Fish)
2. Actinia (sea anemone)
3. Madrepora (corals)

ALJAMINA ← P 9379AH

CORALS : Corals are formed from the secretions produced by specialized polyps that are present in certain coelentrates. These polyps become covered by stony cups due to hardening of their secretions.

Living polyps are found on the surface layer of corals whereas underneath the mass are dead stony structures only and there are no polyps inside.

3. PHYLUM PLATYHELMINTHES

1. *Dugesia (Planaria)* - A free-living flatworm with a ciliated outer surface.

2. *Fasciola (Liverfluke)*:

- endoparasite in sheep and sometimes human beings.
- It complete its life cycle in two hosts; a snail and sheep (or man).
- It lives in bile duct of its hosts.

3. *Taenia (Tape worm)*

- Body is ribbon-like and divided into segments called proglottids which contain mainly sex organs.

4. PHYLUM NEMATODA

* vacuolated cells → Nematodes consist of a number of vacuolated cells filled with a protein-rich fluid which develops high hydrostatic pressure

* Sensory Organs → The sense organs are in the form of sensory papillae present on the lips at the anterior end

* Hook worm (*Ancylostoma duodenale*)
→ parasite of human small intestine

5. PHYLUM ANNELIDA

* prostomium → The mouth is overhung by lobed structure, the prostomium

* The skin is kept moist by mucous and coelomic fluid

* Muscles: Two Types

→ Circular Muscles

→ Longitudinal Muscles

6. PHYLUM ARTHROPODA

Chitin: → non-living, non-cellular and is secreted by

underlying epidermis.

→ made of polysaccharides

→ On outside of chitin, there is a waxy layer

The Tse-Tse fly transmits Trypanosoma

PHYLUM ANNELIDA

The skin is kept moist by a layer of mucus

and cilia

→ cilia + mucus

→ contractile muscles