Structural Organisation in Animals

A group of similar cells along with intercellular substance performing specific function is known as TISSUE.
When 2 or more organs perform a common function by the physical or chemical interaction, they together form organ system.

Animal Tissue

Epithelial Tissue

It has a free surface which faces body fluid or outside environment, hence forms covering or internal lining. Cells are compactly packed with little intercellular space.

Simple

- Single layer.
- Lining for body cavities.
- Ducts & tubes.

Cuboidal

Cube like cells perform secretion & absorption. Eg- ducts of glands, tubular part of nephron.

Columnar

Tall,slender cells with nuclei at base help in secretion & absorption. Eg. Lining of stomach, intestine.

Squamous

Flattened cells with irregular boundaries form diffusion boundaries. Eg- wall of blood vessels, air sac of lungs.

Compound

- 2 or more layers of cell
- Protective function in skin.
- Cover dry surface of skin,
- Moist surface of buccal cavity,Pharynx, inner lining of salivary glands & pancreatic ducts.

Glandular epithelium

May be UNICELLULAR-isolated glandular cell(eg-goblet cell) OR MULTICELLULAR-cluster of cells (eg-salivary gland).

May be EXOCRINE-have duct(eg-mucus, saliva ear wax, oil, milk) OR ENDOCRINE-ductless(eg-thyroid).

Ciliated Epithelium

- May be cuboidal/columnar.
- Helps in transportation.
- Present inside hollow organs like bronchioles
- fallopian duct.

Junctions

Adhering junction

Keeps neighbouring cells together.

Connexis

With the help of 2 protein cylinders.

Tight junction

To stop substance to leak.

Gap junction

- For communication and transfer of ions.
- small molecules & sometime big molecules.

Connective tissue

(Most abundant in body)

All cells in them(except in blood) secrete fibres of structural protein collagen & elastin, the fibres give strength,stretchability & elasticity. Cells also secrete polysaccharide (modified) which accumulate between cells and form matrix(ground substance).

Loose Connective Tissue

Fibres loosely arranged in semi-fluid matrix.

Areolar

Beneath skin,contain fibroblast(secrete fibre), macrophages, mast cells. Support framework for epithelium.

Adipose

Beneath skin,stores fat.

Dense Connective Tissue

Fibres & fibroblasts are compactly packed.

Dense Irregular

Oriented differently, contain fibroblast & mostly collagen. Eg- skin.

Dense Regular

Collagen fibre present in rows between parallel bundles of fibres. Eg- Tendon (bone to muscle), Ligament (bone to bone).

Specialised Connective Tissue

CARTILAGE- Solid, pliable,resists compression. Chondrocyte cells present in self made cavity. Present on nose tip, ear pinna, b/w bones of vertebra, lips & hands of adults.
BONE-hard, non-pliable & rich in Calcium salts, collagen fibres. Osteocytes are present in lacunae. Bone marrow helps in production of RBC. Long bone have weight gaining function.
Blood : Fluid Connective Tissue

Muscular tissue

These fibres are composed of myofibrils they contract(for any stimulus) & relax in coordinated fashion

Cardiac Muscle

• Contractile tissue
• Cell junction fuse plasma membrane and make them stick together.
• Intercalated disc(communication junction) makes all cell to contract at single time.

Smooth Muscle

• Fusiform(taper at both ends
• Do not shows striations.
• Cell junction hold them together (involuntary).
• Wall of blood vessel, stomach, intestine contain these muscles.

Skeletal Muscle

Syncytium

• Attached to skeletal bone.
• Eg-Biceps(they are arranged in parallel fashion held by connective tissue).
• Striated/striped, voluntary.

Neural tissue

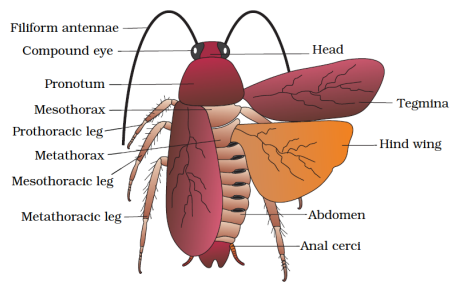
Unit of neural system are nervous which are excitable cells the neuroglial cells make up more than half the volume of neural tissue in our body which protection & support neurons. When it is stimulated, an electrical disturbance travels along its plasma membrane.

Our heart contain all four type of tissues. The complexity in organ and organ system displays discernible trend which is called as evolutionary trend.

cockroach

Introduction

• May be bright yellow/red/ green coloured in tropical regions.
• Size-1/4 inch to 3 inch (0.6-7.6cm) they have flat extension of upper body wall that concoels head.
• They are serious pests & vectors of several diseases.



Morphology

• 34-53 mm long wings (beyond abdomen tip in male).
• Body of cockroach = head + thorax(prothorax,mesothorax, metathorax)+ abdomen.
• The exoskeleton has hardened plates called sclerites (dorsal ->tergite, ventral-> sternite) that are joined by articular membrane (Arthrodial membrane).
• Triangular head lies anteriorly at right angle to body axis(longitudinal). Head- 6 segments, thorax- 3 segments, abdomen-10 segments.
• Mobility in all direction due to flexible neck.
• Head capsule bear compound eye.
•Antennae (help in monitoring env.) arise from membranous sockets lying in front of eye.
• Mouth parts = labrum(upper lip) + labium(lower lip) + pair of mandible & maxilla + hypopharynx(tongue).
• The head is connected to thorax by short extension of prothorax known as neck/pronotum.
• Each thoracic segment bear a pair of walking legs. First pair of wings(tegmina/forewings)-> mesothoracic (opaque & dark coloured to cover hind wings), second pair of wings (hindwings)-> metathoracic (for flight/transparent).

Segments in abdomen & respective organs

IN FEMALE-7th boat shaped sterna, (7th, 8th,9th sterna) forms brood/genital pouch which contains gonopore, spermathecal pore & collateral glands.

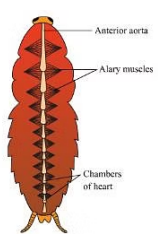
IN MALE-(9^{th}, 10^{th} terga + 9^{th} sterna) forms genital pouch/ chamber contains dorsal anus, ventral male genital pore, gonapophysis. In male anal style are present.

IN BOTH- 10^{th} segment bears anal cerci (filamentous structure).

ANATOMY OF COCKROACH

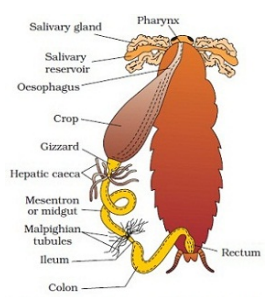
Blood vascular system

•Open type, blood vessels (poorly developed) open into Haemocoel.
• Blood is haemolymph (plasma+haemocytes).
•Heart lies at mid dorsal line of thorax & abdomen. It is differentiated into funnel shaped chambers with ostia on either side. Blood is entered through ostia and pumped anteriorly to sinuses again.



Digestive system

• Alimentary canal (foregut+midgut+hindgut)
• Mouth(salivary gland)->tubular part ->crop(food) proventriculus(secrete gastric juice,outer lined by circular muscle & inner 6 high chitinous plate called teeth which grind food). ->6,8 blind tubules (hepatic ceaceae)->100-150 yellow coloured malphigian tubule(help in removal of excretory waste from haemolymph). ->hindgut(broader than midgut)->anus.



Respiratory system

• Trachea that open through 10 pairs of small holes called spiracles.
• Present on lateral side of body.
• Tracheoles(subdivisions) carry oxygen from air to all parts.
•The opening of spiracles is regulated by the sphincters
• Exchange of gases takes place by diffusion.

NERVOUS SYSTEM

• Series of fused segmentally arranged ganglia joined by paired longitudinal connective on the ventral side.

• 3 ganglia in thorax & 6 ganglia in abdomen.

• Head holds a bit of nervous system and rest is situated on ventral(belly) side of body.

• If head is cut off a cockroach it will be alive for 1 week.

• Brain is represented by supra-oesophageal ganglion which supplies nerves to antennae & compound eyes.

• SENSE ORGANS-antennae,eyes,maxillary palps, labial palps and cerci.

• Compound eyes are located on dorsal surface. Each eye consist of 2000 omantidia (hexagonal) because of which Cockroach can see several images of an object. This vision is MOSAIC vision(more sensitivity,less Resolution) {nocturnal vision}

EXCRETION

• Performed by malphigian tubules, each tubule is lined by glandular and ciliated cells.

• They convert N_2 waste into uric acid.

• The fat body,nephrocytes & urecose glands also help in excretion.

REPRODUCTION SYSTEM

FEMALE REPRODUCTIVE SYSTEM

• Ovaries lie laterally in 2^{nd}-6^{th} abdomen.

• 1 ovary = 8 ovarian tubules/ovarioles containing a chain of developing ova.

• Oviduct from each ovary unite to form median oviduct/vagina which opens into genital chamber.

• Sperms are transferred through spermatophores. Their fertilised eggs are encased in capsules called oothecae(dark reddish to blackish brown capsule -3/8" (8mm) long).

• They are dropped or glued at a surface near a food source.

• Female produces 9-10 ootheceae, containing 14-16 eggs each.

• Development is through nymphal stage which is known as paurametabolus.

• Nymph grows by moulting 13 times to reach the adult form.

• Next to last stage have wing pods but only adult cockroach have wings.

MALE REPRODUCTIVE SYSTEM

• One testis lying on each lateral side in 4^{th} - 6^{th} abdominal segments.

• Vas deferens from each testis open into ejaculatory duct through seminal vesicle which furthers opens into male gonopore situated ventral to anus.

• Mushroom gland is present in between 6^{th}-7^{th} abdomen segment which function as an accessory reproductive gland.

• External genitalia are represented by male gonapophysis or phallomere(chitinous asymmetric structure surrounding male gonopore).

• Sperms are glued in seminal vesicle & formed into bundles called spermatophores, which are discharged during copulation.

There is no economic use of cockroach. They are pests because spoil food & contaminate it with their smelly excreta and by this they can transmit a variety of bacterial diseases.