Salivary glands:-

They are exocrine glands in the mouth that produce saliva, which has digestive, lubricating & protective functions. There are 2 groups of the salivary glands; the major salivary glands include the parotid, submandibular(submaxillary) & sublingual glands; and the minor salivary glands include labial, buccal, molar, lingual & palatine glands. Two of the major glands (parotid ' & submandibular) are located outside the oral cavity, while the minor salivary glands are chiefly in the submucosa of the different parts, of the wall of the oral cavity. The major glands secrete only in response to certain stimuli; mechanical, chemical or olfactory. The minor salivary glands seem to secrete continuously.

The major salivary glands are surrounded by capsule of C.T rich in collagen fibres. The capsule is well developed in parotid, of average thickness in submandibular & very thin in sublingual. From the capsule septa (trabeculae) of C.T penetrate the gland, dividing it into lobes & lobules. Vessels & nerves enter the gland at the hilum & gradually branches into the lobules. A rich vascular & nervous plexus surrounds the secretory & ductal components of each lobule. The alveoli(acini) are surrounded by basal lamina continuous with that of the ducts. Myoepithelial cells lie between the basal lamina & the epithelial cells of alveoli & also of the intercalated ducts. Myoepithelial cells surrounding the secretory portion are well developed & branched (called basket cells), whereas those associated with intercalated ducts are spindle-shaped & lie parallel to the length of the duct. Serous alveoli(acini):- consist of pyramid-shaped cells arranged around a small lumen. The serous cells exhibit characteristics of polarized protein-secreting cells. Their apical cytoplasm is crowded with secretory granules. Serous cells have spherical nucleus & the surrounding basal
cytoplasm contains numerous profiles of rough endoplasmic reticulum (stains deeply basophilic). Adjacent secretory cells are joined together by junctional complexes. These junctional complexes may be located well below the apical margin, in which case **intercellular secretory canaliculi** are formed. These canaliculi increase the area available for the discharge of serous secretions. The luminal (apical) surface of the serous cells bears many short microvilli. Deep to the junctional complexes, the lateral margins show folds that interdigitate with those of adjoining cells—»cell boundaries are indistinct.

**Mucous alveoli(acini):** are larger than the serous acini. Mucous cells are usually cuboidal to the columnar in shape. Their nuclei are flattened & pressed against the base of the cell. They exhibit the characteristics of mucus-secreting cells, containing glycoprotein (mucins) important for the moistening & lubricating functions of saliva. They are pale in staining. The mucous acini have larger & more apparent lumen. Mucous cells are most often organized as tubules. The cell boundaries are quite distinct.

**Mixed alveoli(acini):** are typically mucous alveoli surrounded or capped by one or more groups of the serous cells, forming a crescent-shaped **serous demilune**.

The parotid gland is purely serous gland. The submandibular gland is a mixed type, being composed predominantly of serous acini. The sublingual gland is also a mixed gland but predominantly mucous, most of the secretory acini are mucous & mixed.

**Salivary gland ducts:** the secretory acini empty into the **intercalated ducts**, lined by simple cuboidal epithelium. Several of these short ducts join to form **striated ducts**, lined by simple columnar epithelium, characterized by **basal striations** (radial striations) that extend from the bases of the cells to the level of the nuclei. When viewed in the electron microscope, the striations are seen to consist of infoldings of the
basal plasma membrane with numerous elongated mitochondria that are aligned parallel to the infolded membranes; this structure is characteristic of ion-transporting cells. Intercalated & striated ducts are also called intralobular ducts because of their location within the lobule.

The striated ducts of each lobule converge & drain into ducts located in the C.T septae separating the lobules, where they become interlobular or excretory ducts. These drain into the main duct of each gland, which empties into the oral cavity.

Saliva: - is a hypotonic solution produced at a rate of about 1 litre/day. It lubricates, moistens & cleanses the oral cavity by means of its water or glycoprotein (mucus) content. It acts as a solvent for substances that stimulate the taste buds. It initiates digestion of carbohydrates by the action of salivary amylase (produced mainly 'by the serous acini) and digestion of triglycerides by lipase. It controls bacterial flora by the action of lysozyme, lactoferrin & IgA, as well as by its cleansing action. The salivary enzyme lysozyme secreted by the serous cells that form the demilunes in submandibular and sublingual glands, hydrolyzes the cell walls of certain bacteria & inhibits their growth in the oral cavity. Lactoferrin secreted by acinar & intercalated duct cells, binds iron, a nutrient necessary for bacterial growth & inhibits their growth. The immunoglobulins in saliva, primarily the IgA produced by the plasma cells in the C.T -of the glands, forms a complex with a secretory component synthesized by the serous acinar, intercalated & striated duct cells. The IgA-secretory piece complex released into the saliva is resistant to enzymatic digestion & constitutes an immuno-logic defense mechanism against pathogens in the oral cavity.

Human saliva consists of secretions from the parotid glands 25%, the submandibular gland 70% & the sublingual 5%.
Parasympathetic stimulation (e.g. smell & taste of food) provokes a copious watery secretion with little organic content. Sympathetic stimulation (e.g. fear & stress) produces small amounts of viscous saliva, rich in organic material.

**Pharynx:-**

It is the posterior continuation of the oral cavity where the respiratory & alimentary passages fuse & cross. It extends from the level of the base of the skull to the level of the cricoid cartilage where it becomes continuous with the oesophagus. It is simple transport tube through which ingested food is transmitted without undergoing significant metabolic change. It has 3 parts:- 1. Upper part - Nasopharynx 2. Middle part - Oropharynx 3. Lower part - Laryngeal pharynx

The wall of the pharynx is composed of the following layers:(starting from inside)

1. **Mucous membrane** ——► epithelium
   ——► Lamina propria, It is lined in its upper part by pseudostratified columnar ciliated epithelium with goblet cells (respiratory epithelium). The lower two parts are lined by stratified squamous non-keratinized epithelium continuous with that of the oesophagus.

   The lamina propria consists of C.T. containing many lymphocytes. In its upper part there is definite lymph nodules (pharyngeal tonsil), in the middle part there is also lymph nodules (palatine tonsils). Numerous mucous & mixed glands are present.

2. **The muscular layer:**- consists of striated muscles (constrictors of the pharynx).

3. **The outer fibrous layer (adventitia):**- consists of dense C.T. continuous with surrounding structures.

   It may also contain glands (oesophageal & Brunner's gland) & lymphoid tissue.
3. The muscularis externa:- this usually consists of an inner circular & an outer longitudinal layer of smooth m. A plexus of nerve fibers associated with numerous ganglion cells are situated chiefly between the circular & longitudinal layers. This plexus is called Auerbach's plexus or Myenteric nerve plexus. The contractions of the muscularis, generated and coordinated by nerve plexuses, propel and mix the food in the digestive tract. These plexuses are composed mainly of nerve cell aggregates (multipolar visceral neurons) that form small parasympathetic ganglia.

At the sphincters the circular layer is greatly increased. Localized thickenings of muscle in the bowel wall act as valves & are called sphincters. Sphincter contraction occludes the lumen & thus prevents the passage of the luminal contents.

**The pyloric sphincter:-** is the most important sphincter & is located at the junction between the stomach & duodenum. By contracting, it delays stomach emptying, hereby permitting continued food break down in the stomach.

**The oesophagogastric sphincter(cardiac sphincter):-** is located between the lower oesophagus & proximal stomach. It prevents reflux of gastric contents into oesophagus.

**The ileocaecal valve:-** is situated between the terminal ileum & caecum. It delays discharge of ileal contents into the caecum.

**The internal anal sphincter:-** is located at the upper end of the anal canal. It retains fecal waste material in the rectum until controlled defecation.

**The pharyngoesophageal sphincter:-** is a physiological sphincter (no significant increase in the number of circular muscle fibers).

4. The serosa or adventitia:- consists of loose C.T. rich in blood & lymph vessels, covered in those portions of the tube that are suspended by mesentery with simple squamous epith(mesothelium). In other parts, the adventitia consists only of loose C.T.
Major salivary glands. About 90% of saliva is produced by three bilateral pairs of salivary glands: the parotid, submandibular, and sublingual glands. Locations and relative sizes of these glands are shown here diagrammatically. These glands plus microscopic salivary glands throughout the oral mucosa produce 0.75 to 1.50 L of saliva daily.
Epithelial components of a submandibular gland lobule. The secretory portions are composed of pyramidal serous (light blue) and mucous (light brown) cells. Serous cells are typical protein—secreting cells, with rounded nuclei, accumulation of rough ER in the basal third, and an apex filled with protein—rich secretory granules. The nuclei of mucous cells, flattened with condensed chromatin, are located near the bases of the cells. The short intercalated ducts are lined with cuboidal epithelium. The striated ducts are composed of columnar cells with characteristics of ion—transporting cells: basal membrane invaginations with mitochondrial accumulations. Myoepithelial cells are shown in the serous acini.
**Striated ducts.** (a): This light micrograph of a striated duct (SD) shows very faint pink striations in the basal half of the columnar cells. The striations are produced by mitochondria located in the folds of the lateral cell membrane. X200. H&E. (b): SEM indicates that the apical ends of the cells are joined together near the small lumen (L), with interdigitating folds of cell membrane best developed at the basal end (B). X4000. (c): This SEM shows the bases (B) of several such cells with the basal lamina removed, revealing the extensive interlocking of folded membrane between neighboring cells. Mitochondria between the folds supply energy for membrane ion pumps and ion uptake from saliva is rapid and efficient. X4000
Submandibular gland and sublingual gland. (a): Submandibular gland is a mixed serous and mucous gland (serous cells predominate) and shows well—stained cells in serous acini (A) and in serous demilunes (S) and pale—staining mucous cells (M) grouped as tubules in this tubuloacinar gland. Small intralobular ducts (ID) drain each lobule, but these are not composed of columnar cells with well—developed striations. X340. H&E. (b): Sublingual gland is a mixed but largely mucous gland with a tubuloacinar arrangement of poorly stained mucous cells (M). Small intralobular ducts (ID) are seen in connective tissue, as well as small fascicles of lingual striated muscle (SM). X140. H&E.