GIT - Mastication & Salivation

Zydus Medical College and Hospital

Good Morning

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Mastication/chewing

- Process by which the food placed in mouth is cut and grounded and smaller pieces.

- Involves –

➢ Movement of jaws
➢ Action of teeth
➢ Co-ordinated movements of tongue and muscles of oral cavity
➢ Massetor, temporalis, buccinators, pterygoids

- Voluntary act

- **Chewing reflex-**

➢ **Mouth opened to place food –**

stretching of jaw muscles – contraction- closes the mouth

➢ **Food stimulates buccal receptors –**

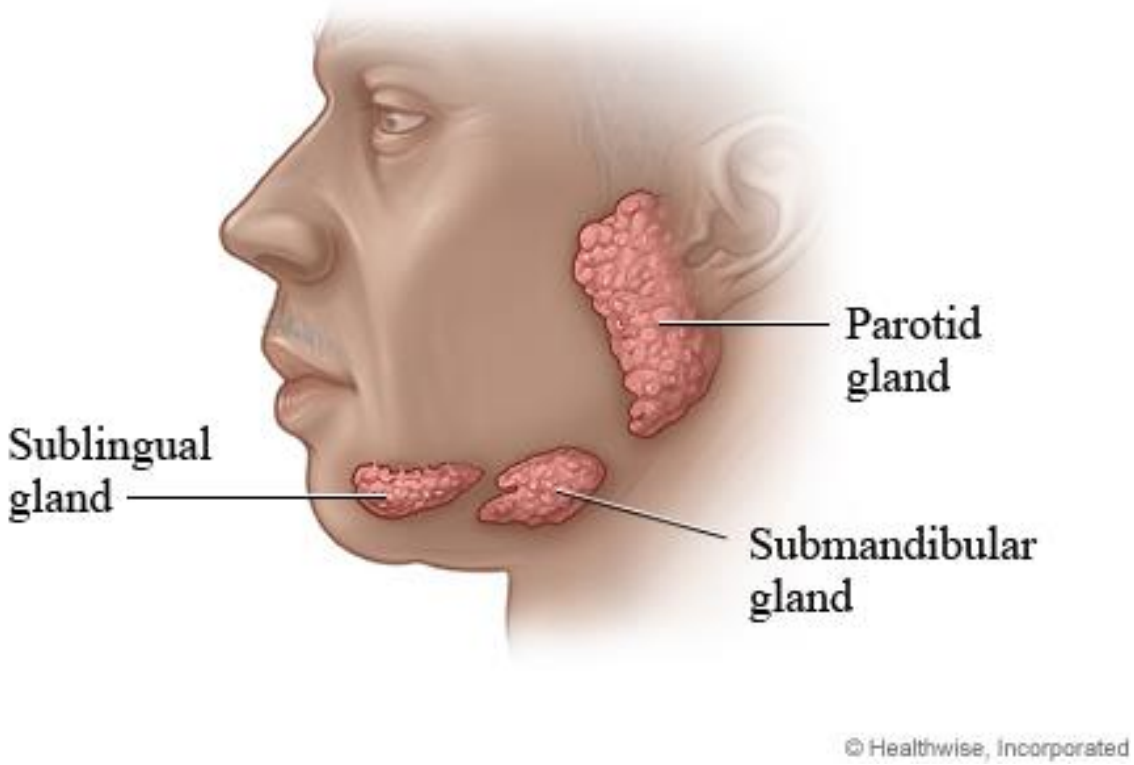
reflex inhibition of muscles of mastication

stimulation of digastric & lateral pterygoid causing mouth to open

Functions of mastication –

1. Breaking of food - increased surface area for enzymes to act
2. Undigestive Cellulose in fruits & veg broken
3. Mixing with saliva - digestion by salivary amylase & lipase
4. Swallowing becomes easier
5. Stimulation of taste buds & olfactory receptors.

Saliva - Salivary glands



Saliva

- 1500 ml/day amount & pH 6 - 7.4
- Composition - 99% water and 1% solids

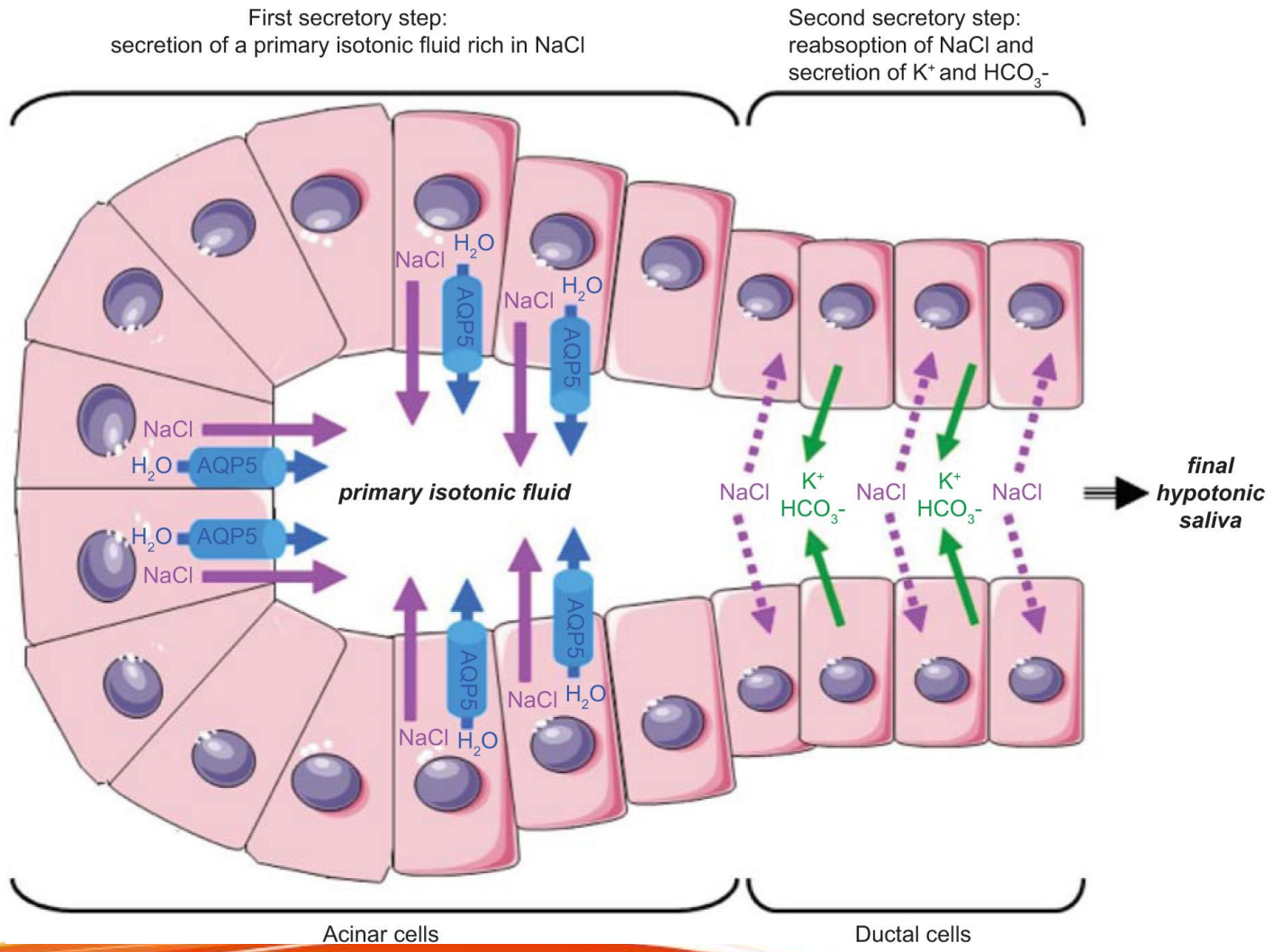
Organic substances	Inorganic substances
salivary α-amylase(ptyalin) lingual lipase kallikerin lysozyme, lactoferrin urea, uric acid, cholesterol and mucin (small amounts) IgA Proline rich proteins	Na^+ Cl^- K^+ HCO_3^- Ca^{++},PO_4^{3-}, Br^- (in traces)

Saliva -Mechanism of formation

Aldosterone increases reabsorption of Na+ and Cl^-

Addison,s disease - Aldosterone deficiency - High Na^+/Cl^- in saliva

Hyperaldosteronism - Almost zero Na+/Cl- and excess K+ in saliva



Saliva - Phases of salivary secretion

1. **Cephalic phase** - due to sight/smell of food

2. **Buccal phase** - due to stimulation of buccal receptors

3. **Oesophageal phase** - stimulation of salivary glands due to passage of food in oesophagus

4.**Gastric phase** - Presence of food (specially irritant food) in stomach e.g. vomiting

5.**Intestinal phase** - Caused by irritant food in intestine.

Saliva - Control of salivary secretion

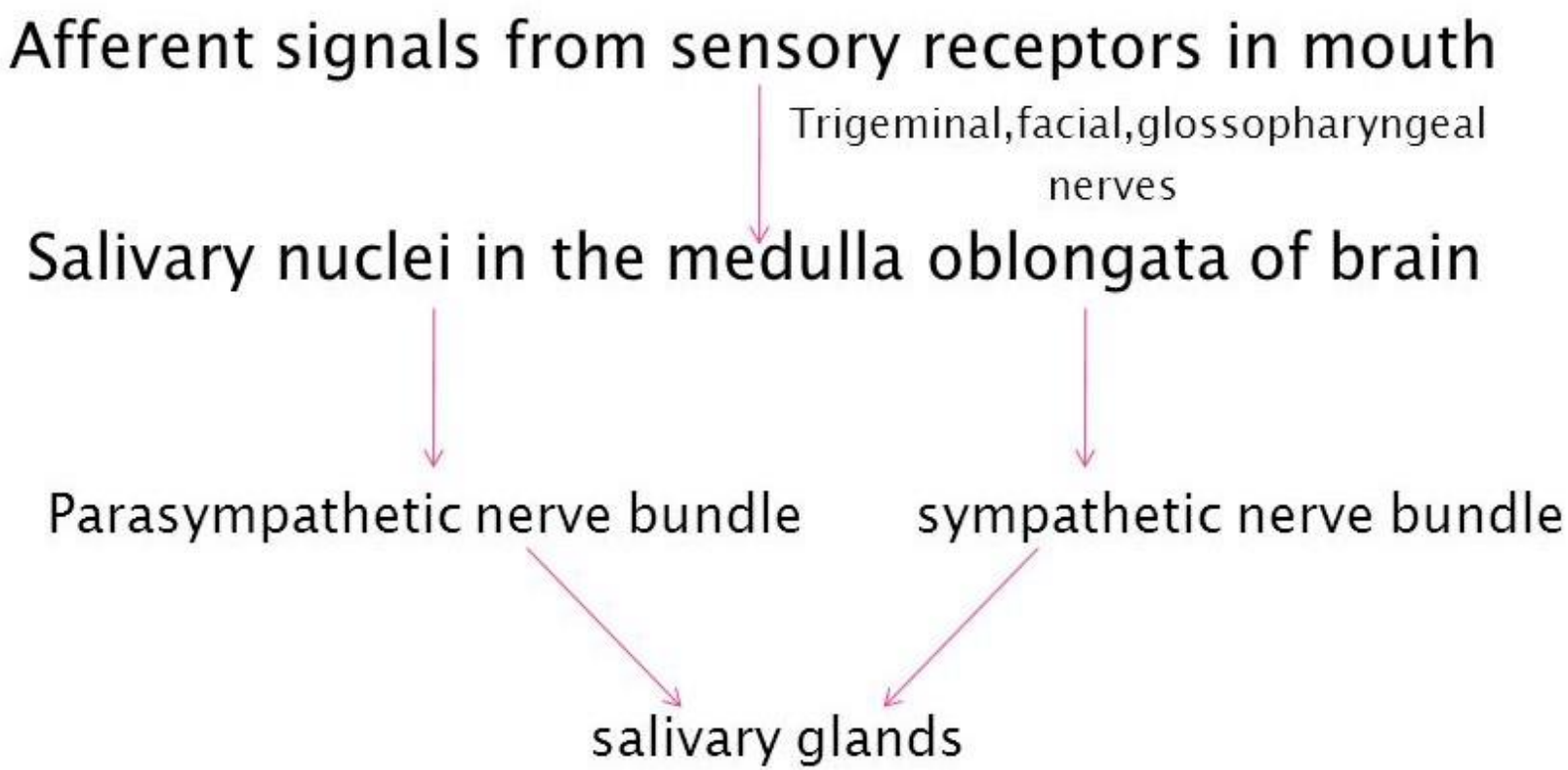
Sensory Receptors

1.Mechanoreceptors

2.Chemoreceptors/ Taste buds -

Ant. 2/3 of tongue- VII

Post 1/3 of tongue - IX



- Entirely controlled by ANS
- Unique Feature- increased by both **sympathetic** and parasympathetic system

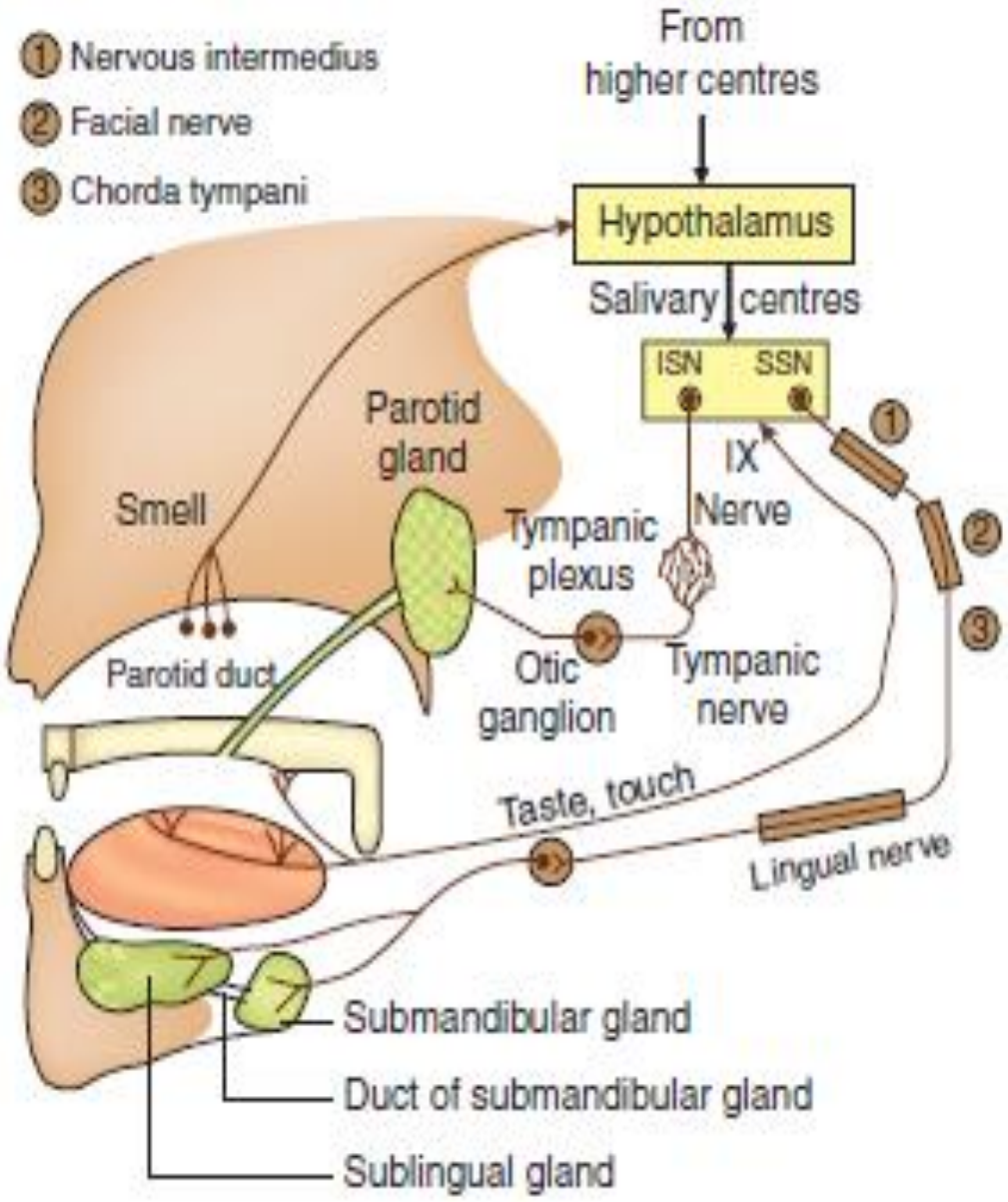


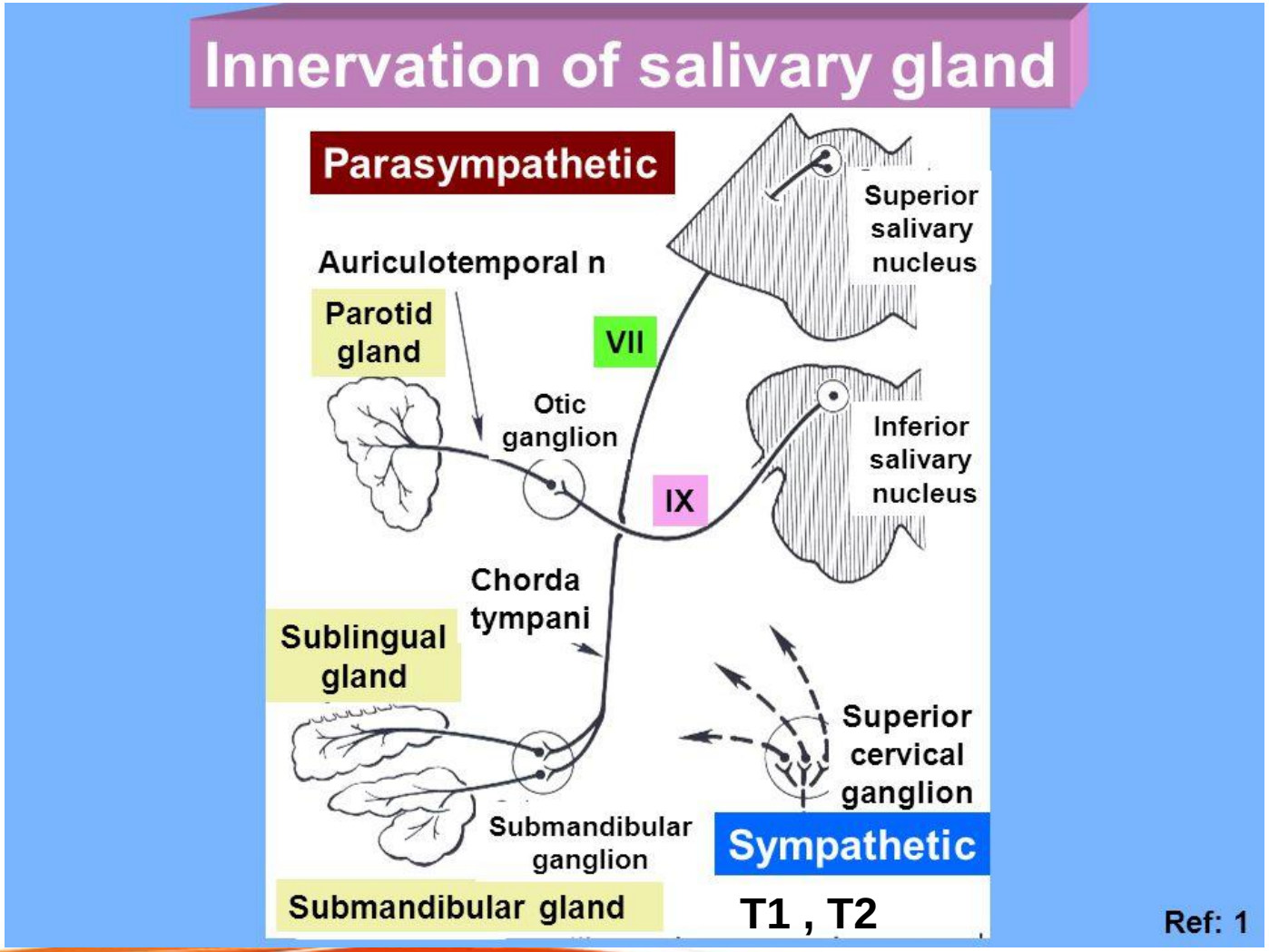
Fig. 7.2-4 Parasympathetic nerve supply to salivary glands.

Saliva - Control of salivary secretion

Effect of Parasympathetic- Cause secretion of large volume of **watey fluid high in electrolytes & low in proteins.**

Effect of sympathetic –

Vasoconstriction in salivary glands and secretion of very small amount of **viscid saliva rich in mucus and organic constituents**



Paralytic secretion

- Claude Bernard performed an experiment on dog
- After cutting chorda tympani nerve –
- scanty secretion of thin turbid saliva which increased to peak on 7th day and diminished in 3 weeks.
- He called it paralytic secretion
- Later on it was seen - increased secretion due to increased sensitivity of gland (denervation hypersensitivity)

Functions of saliva

- **Protective function-**

➢ Dilutes hot & irritant food

➢ Washes away food particles after end of meal - cleans oral cavity (Xerostomia - frequent dental caries)

➢ Destroys harmful bacteria - Lysozymes (bactericidal), Lactoferrin (bacteriostatic)

➢ Dilutes any HCl/bile that regurgitates into oesophagus and mouth

- **Role in mastication and deglutition**

➢ Lubricates food and buccal mucosa - helps in mastication and swallowing

Functions of saliva

- Helps in bolus formation - acts as glue

- **Digestive function**

- Starch $\xrightarrow{\text{salivary α-amylase(ptyalin) acts on 1-4 linkage}}$ Maltose

Initial starch digestion, short time of action as this action stopped by acidic pH of stomach when bolus reaches stomach.

- Initial triglyceride digestion - lingual lipase

Functions of saliva

- **Role in taste sensation- dissolved substance**
- **Role in speech** - lubricates oral cavity so facilitates movements of lip & tongue
- **Excretory function** - certain heavy metals, thiocyanate ions, alcohol and morphine.
- **Role in temperature regulation**

➢ During dehydration - salivary secretion reduced

➢ Panting mechanism-

In dogs saliva is evaporated to cause evaporative heat loss

- WRITE FUNCTIONS OF SALIVA
- WRITE PHASES OF SALIVARY SECRETION

Deglutition (Swallowing)

- Refers to passage of food from the **oral cavity** into the **stomach**
- Consists of 3 phases -

- **Oral phase (Voluntary)**
- **Pharyngeal phase (Reflex/Involuntary)**
- **Oesophageal phase (Reflex/Involuntary)**

Deglutition (Swallowing) contd.-

1. Oral phase

- Voluntary phase

- Bolus of food put over dorsum of tongue - tongue forces the bolus into oropharynx by pushing up against hard palate.

- Involuntary phase - swallowing reflex
- Components of swallowing reflex-

➢ *Receptors* - around opening of pharynx. Bolus moves from mouth to pharynx.

➢ *Afferent arc* – Receptor to deglutination center.Trigeminal(V), glossopharyngeal(IX),& vagus (X).

➢ *Deglutition centre* - Medulla - nucleus tractus solitarius (NTS)

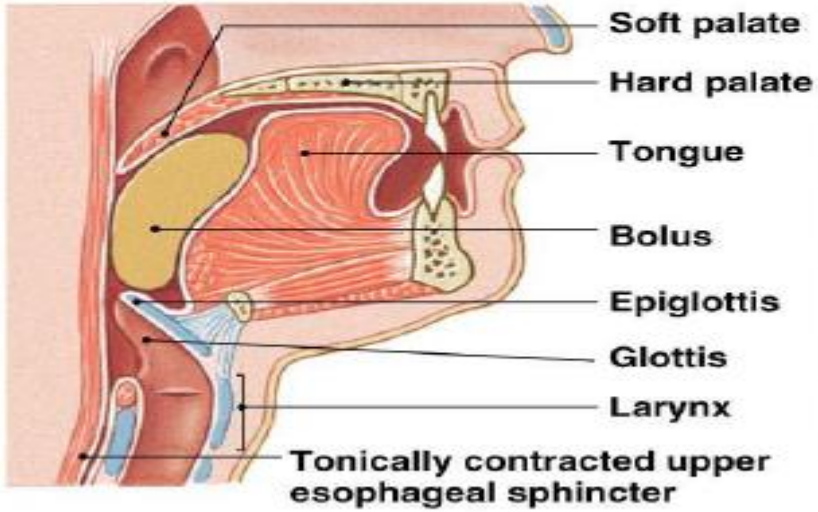
Lower Pons - nucleus ambiguus

➢ *Efferent arc* - V, IX, X, XII cranial nerves - pharyngeal musculature contraction

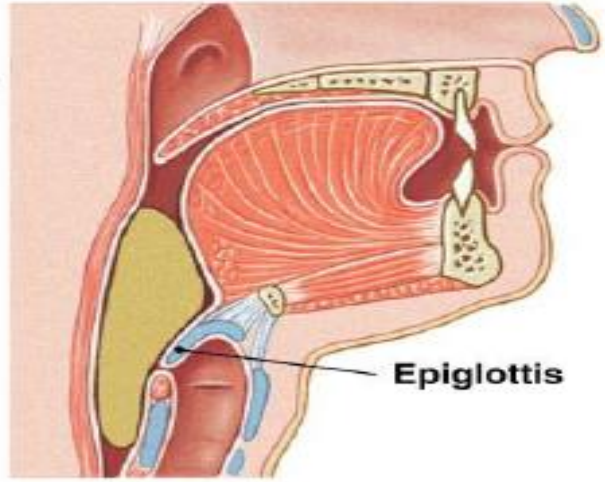
Events during pharyngeal phase –

- Oral cavity shut off by approximation of posterior pillar of the fauces
- Nasopharynx closed by upward movement of soft palate
- Palatopharyngeal folds pulled medially to make slit like opening
- Vocal cords approximated, larynx pulled upwards and anteriorly and epiglottis swings backwards to close larynx (*deglutition apnoea*)
- Upper oesophageal sphincter (UES) opens up and allows food to pass on to upper oesophagus by peristalsis.

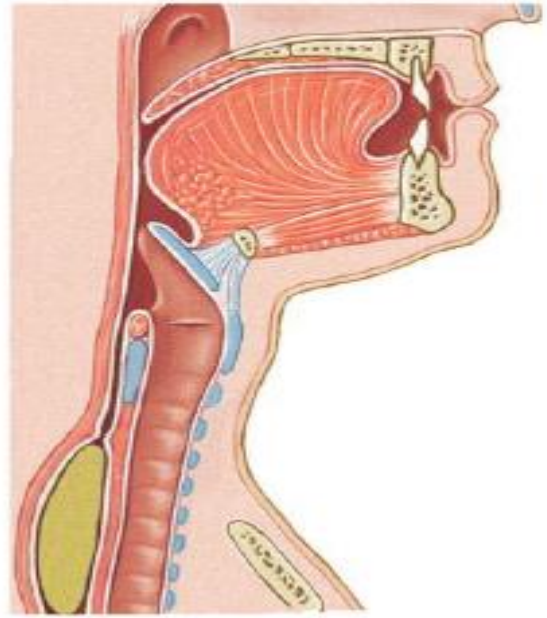
1. Tongue pushes bolus against soft palate and back of mouth, triggering swallowing reflex.



2. Upper esophageal sphincter relaxes while epiglottis closes to keep swallowed material out of the airways.



3. Food moves downward into the esophagus, propelled by peristaltic waves and aided by gravity.



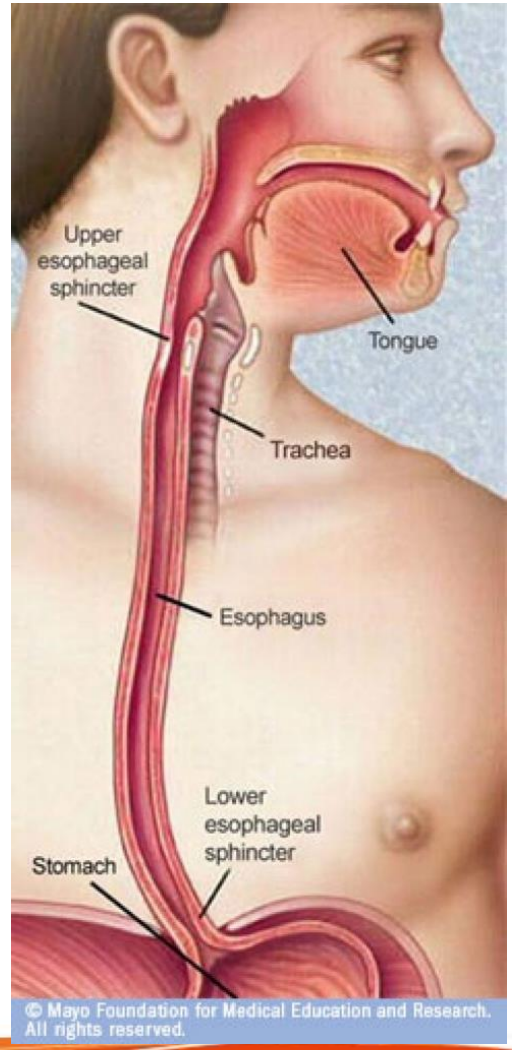
3. Oesophageal phase

- Food propelled from upper part of oesophagus to the stomach by oesophageal peristalsis (primary and secondary) aided by gravity
- *Upper oesophageal sphincter (UES)-*

➢ True sphincter formed by cricopharyngeal muscle
➢ Normally tonicaly contracted
➢ Prevents aerophagia
➢ Ach
➢ Opens during sollowing when a rapid peristaltic wave pass to oesophagus

- *Lower oesophageal / Cardiac sphincter (LES)*

➢ Called physiological sphincter, contractile
➢ Prevents regurgitation of gastric contents


Upper
esophageal
sphincter
Tongue
Trachea
Esophagus
Lower
esophageal
sphincter
Stomach
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- **Oesophageal peristalsis**

- Primary oesophageal peristalsis
- Primary oesophageal peristalsis is initiated by swallowing,
- Co-ordinated by vagal fibres emerging from swallowing centre.
- As soon as food bolus enters oesophagus from pharynx, **UES contracts to prevent regurgitation of food into mouth,** 8SEC
- primary oesophageal peristalsis begins which propel food downwards.
- **The LES (which normally remains tonically contracted) relaxes** as the peristaltic wave approaches sphincter and allows bolus of food to enter stomach without causing any resistance.

- Secondary oesophageal peristalsis

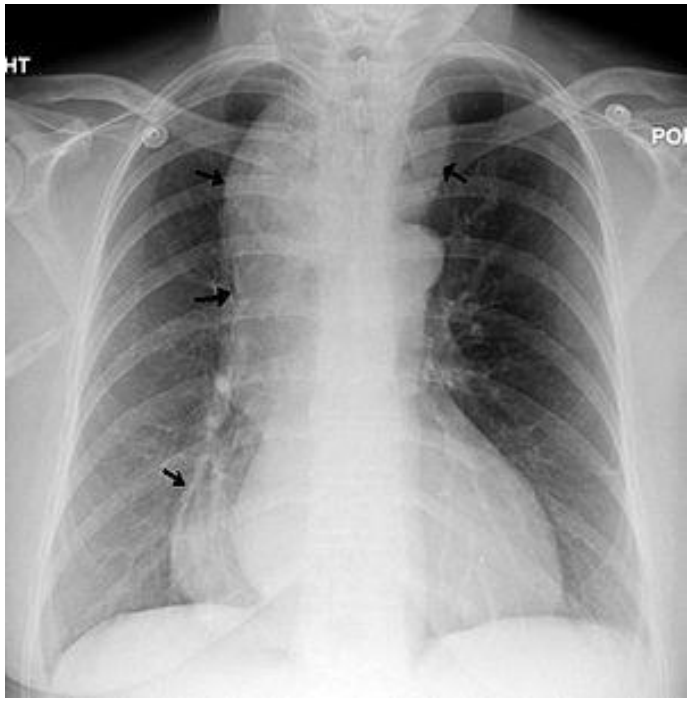
When primary oesophageal peristalsis is not able to push a bolus of solid food all the way down oesophagus, **food remaining in oesophagus stretches mechanical receptors Initiates another peristaltic wave called the secondary oesophageal peristalsis.**

Secondary oesophageal peristalsis is co-ordinated by the *intrinsic nervous system* of the oesophagus. This wave continue until allthe swallowed food removed from oesophagus

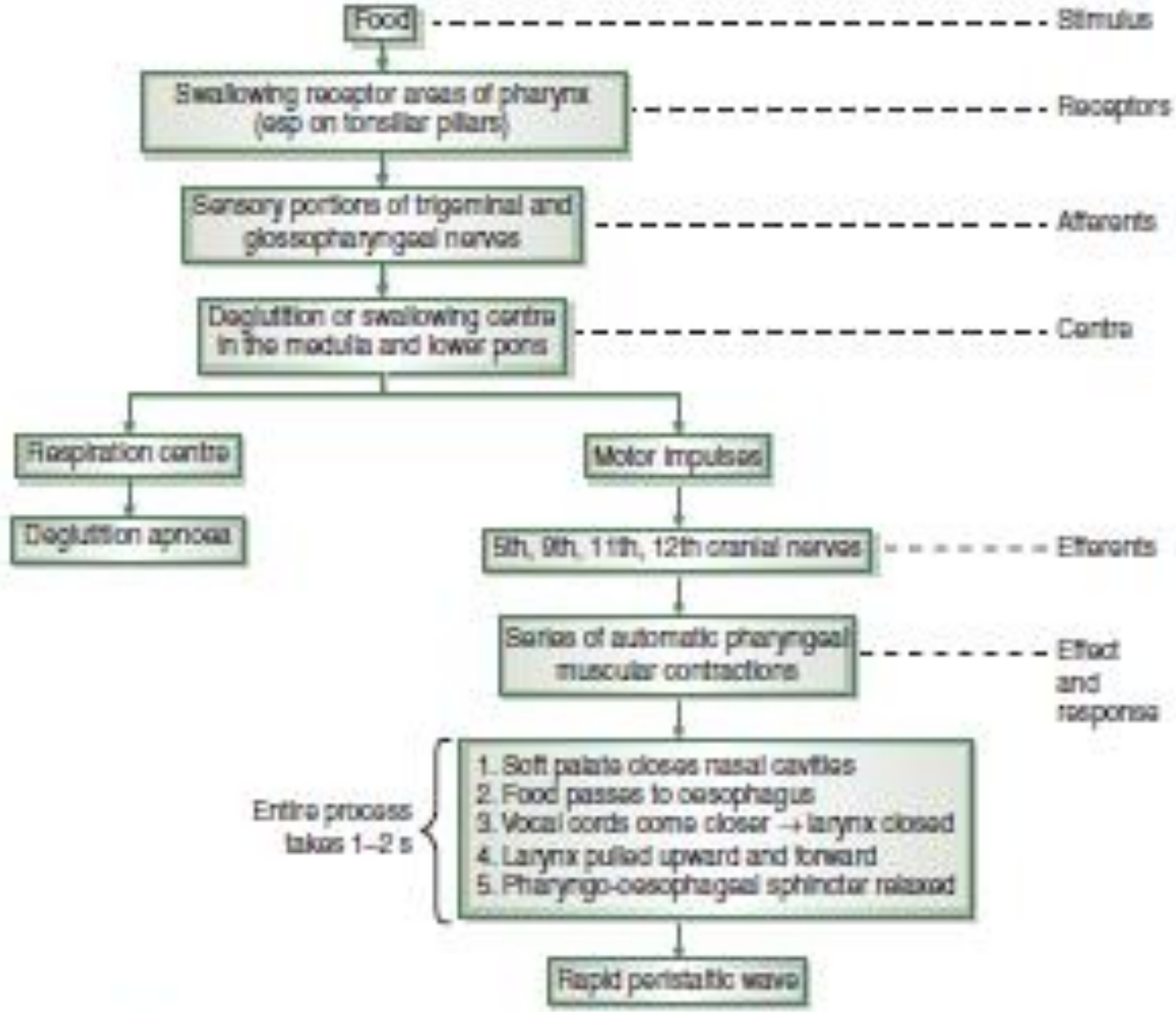
Disorders of swallowing –

- **Abolition of deglutition reflex** - IX or X nerve palsy, lesions in medulla (poliomyelitis, encephalitis)
- **Aerophagia** - low tone of UES
- **Dysphagia** - difficulty in swallowing - stroke, myesthenia gravis
- **Achalasia cardia**- neuromuscular disorder - LES fails to relax- no oesophagial peristalsis
- **Gastro-oesophageal reflux disease (GORD)** - LES incompetence – reflex gastric content into oesophagus. Heartburn

Achalasia cardia



Bird beak/ Rat tail appearance on barium swallow



7.2-6 Summary of swallowing reflex.

Summary

- Mastication
- Chewing reflex
- Function of mastication
- Saliva
- Formation of saliva
- Phases of salivary secretion
- Control of salivary secretion
- Function of saliva
- Phases of swallowing
- Disorders of sollowing

- WRITE MECHANISAM OF SOLLOWING. WRITE STAGES OF SOLLOWING.

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