

Date:

## NUTRITION IN ANIMALS

### HOLOZOIC:

- intake of food through the mouth — **Ingestion**  
(opening towards anterior end)
- breakdown of complex food into simple nutrients using enzymes — **Digestion**
- movement of molecule nutrients from digestive system into the blood — **Absorption**
- pathways followed by nutrients (simple ones) to their destination within the body — **Assimilation**
- removal of undigested food materials — **Egestion**  
(using an opening towards Anus (posterior end))

### HUMAN DIGESTION (DIGESTIVE TRACK / ELEMENTARY CANAL / GUT)

1. **Mouth**: → for intake of food
  2. **Buccal Cavity**: → presence of jaws (lined by jaws)  
bony structures that provide sockets for ) 2 in number (upper jaw: lower jaw)  
teeth → chewing/tearing/cutting food material) Mechanical / Physical  
(fixed) (limited movement)
- \* chewing is done to increase the surface area of food for the enzyme digestion).
- presence of salivary glands  
produce saliva (mucus + salivary amylase) (enzyme) (acting at neutral pH 7)
  - ↳ lubricates food
  - ↳ start digestion of starch / digestion starch is converted into maltose
- Chemical Digestion starts

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### 3. Pharynx :

- acting as a common passage for food and inspired air  
(moves to trachea)
- presence of glottis covered by epiglottis

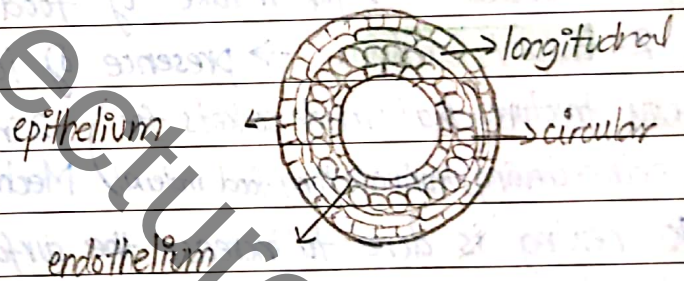
### 4. Oesophagus :

- long tube like structure through which the food moves
- after crossing the chest part it opens to the abdomen  
thoracic / chest cavity

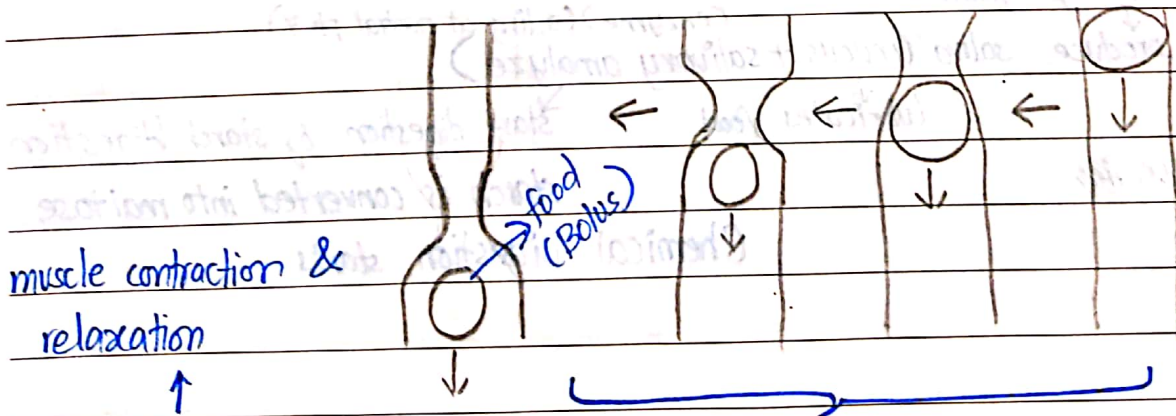
#### → muscular tube

- because the oesophagus wall comprising of two types of muscles smooth
- circular and longitudinal (act opposite to each other) (for the protection)  
ropes                      straws                      antagonists

- \* contraction → shortening
- relaxation → normal size
- no two consecutive contraction



- the tube squeezes behind the food and expand in front



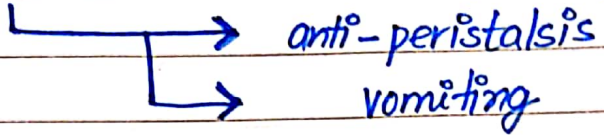
muscle contraction & relaxation  
↑

peristalsis : rhythmic movements of oesophagus walls to move food in forward direction. it activates with the presence of food.

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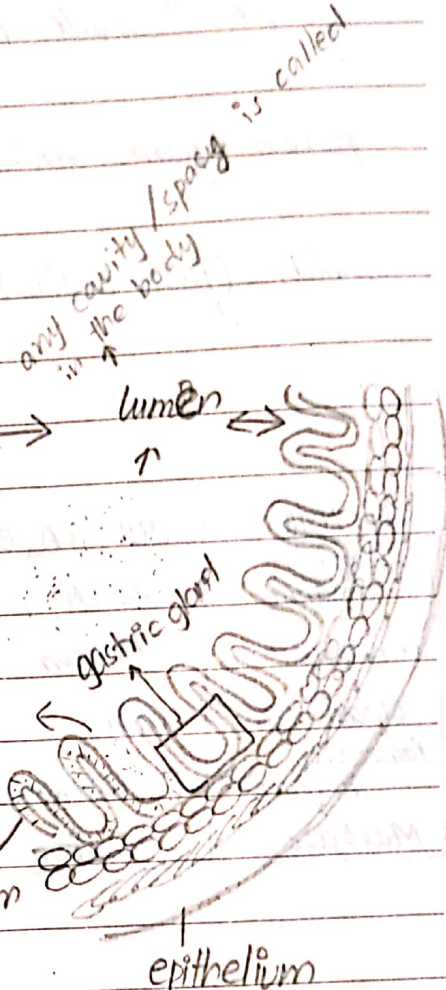
→ when oesophagus wall gets irritated it moves against their normal pattern. (Acidity, food poisoning)



### 5. Stomach

(Acidic Conditions)

- expanded muscular bag like structure
- the folds of endothelium provide us with increased surface area and glands.
- glands ⇒ Gastric glands



produces gastric juice

↓

mucus + dilute HCl + protease (inactive pepsinogen)

↓

(for the sake of protection from protease)

(gives an acidic condition pH-2-3) to activate protease (pepsinogen → pepsin)

- gastric glands activate with presence of food in accordance with protein content (more acidity → more protein content)
- protein is converted into polypeptides by pepsin (incomplete, partially digested)

FOOD → maltose + polypeptides + fat (at the level of stomach)

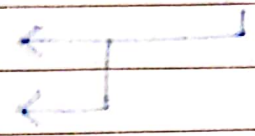
→ the food material leaving the stomach is called Chyme.  
Kind of a liquid as compared to the bolus that enters

Date: \_\_\_\_\_

glycogen is made from glucose

protein from amino acids

lipids (fats & oils) from fatty acids & glycerol



ENZYME	SUBSTRATE	WHERE PRODUCED	END-PRODUCTS
salivary amylase	starch	salivary glands	Maltose
Protease	Protein	Stomach + Pancreas	Amino Acids
Lipase	Lipids	Pancreas	Fatty acids + glycerol
pancreatic amylase	starch	<del>Stomach</del> Pancreas	Maltose
Maltase	Maltose	Small Intestine	Glucose

Date:

## 6. Pancreas

→ whitish leaf like part of body acting as an endocrine part

producing hormones: insulin  
glucagon

• insulin: ↓ blood glucose to normal limits (more insulin)

• glucagon: ↑ blood glucose to normal limits (less glucagon)

• they are antagonistic

→ also acts as exocrine part which produces pancreatic juices

enzymes for digestion

	↓	↓	↓
	Pancreatic amylase	Pancreatic lipase (dig. of lipids)	Pancreatic protease (trypsin)

→ pancreatic juice moves down to the duodenum through the pancreatic duct

→ is an accessory organ

## 7. Liver

→ accessory organ

→ involved in detoxification (conversion of harmful, poisonous chemicals)

→ converts toxic chemicals into smaller molecules to make them not poisonous.

→ contains gall bladder that temporarily contains bile (no enzyme liquid)  
↓  
produced by liver

→ moves down to the duodenum through the bile and pancreatic duct

• bile doesn't contain any enzyme.

• bile is involved in emulsification of fats → & neutralizes the acid providing alkaline conditions required in intestine  
conversion of large fats into smaller parts known as fat globules

• so it is easier for lipase to digest

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- no gall bladder — no emulsification } because bile won't be able to reach pancreatic duct
- in case of removal because of stone
- fats will be digested but with much difficulty. } bile only helps.
- because of presence of pancreatic lipase.
- emulsification takes place in first part of duodenum

→ missing endocrine — diabetes  
mal function

## 8. Small Intestine

### i. Duodenum

- straight and short path
- on one hand receives pancreatic juice • bile (increasing pH)
- walls produce intestinal juice } carbo. digestion
  - maltase
  - lactase
- intestinal lipase } fat digestion
- enterokinase } protease digestion
- erypsin
- we have a pH of 8-9
- alkaline or basic pH
- 0-8 enzymes and chyme

### ii. Jejunum

- completion of digestion process from complex to simpler.

- ★ Pancreatic amylase → Starch → Maltose  $\xrightarrow{\text{maltase}}$  Glucose } carbohydrate digestion
- ★ Lactose  $\xrightarrow{\text{lactase}}$  Glucose } is complete
- Fat globules  $\xrightarrow{\text{P.lipase + G.lipase}}$  fatty acids and glycerol } fat digestion is complete
- Proteins (left)  $\xrightarrow{\text{trypsin}}$  polypeptides  $\xrightarrow[\text{enterokinase}]{\text{erypsin}}$  amino acids } protein digestion is complete

**!! DIGESTION IS COMPLETE !!**

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Date:

→ fats and glycerol do not get directly into blood because of their large size  
fluid of lacteal

→ F.A + glycerol → Lacteal (combine with fluid of lymph) →  
F.A and glycerol is converted into lymph + fat globules  
chyle

→ chyle is collected from all the lacteal

chyle → lymphatic duct → blood. (at the level of sub-clavian vein)  
the one that collects the ~~the~~ chyle from all lymphatic vessels.

→ if lymphatic vessels don't work: → extra water will get collected in cell and the part will swell

→ blood liquidity will lessen

colon is the first part of L.I that absorbs most of the remaining water

### 9. Large Intestine:

H<sub>2</sub>O + undigested waste materials (quite longer than duodenum)

→ presence of appendix on extreme left (toxic + fibre)

↳ it has a function in herbivores, it provides cellulase  
non-functional but is present

• food can get stuck and decompose producing toxic chemicals leading to appendicitis.

→ main function is absorption of water (digestive juices/drinking water)

→ some water is absorbed by fibres to make waste material soft and easy to pass ⇒ faeces

→ faeces <sup>ejected</sup> moves to rectum and is temporarily stored there

→ and the <sup>ejected</sup> moved through anus

• presence of muscular rings (voluntarily controlled by adults and involuntary in infants)

\* The process of removal of undigested waste material is called ~~the~~ Egestion.



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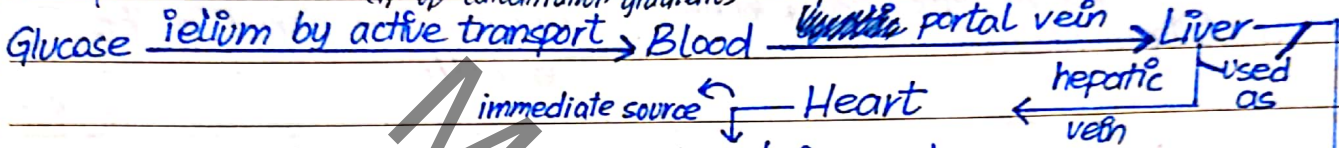
- infections at the level of large intestine give low absorption of water.
- as a result the waste becomes liquidy. Dehydration
- lack of fibre can give us Constipation  
less water in wastes at the first level of large intestine

### Assimilation

all pathways followed by absorbed nutrients

i. Glucose:

\* e.g. starvation periods  
(if up concentration gradient)

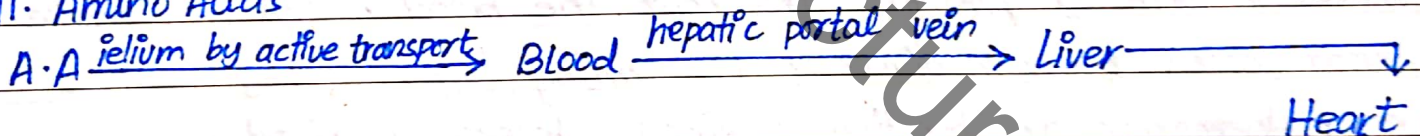


distributed to all body parts. it is used for cellular respiration / maintaining metabolic rate

\* otherwise it diffuses

conversion of glucose into glycogen and stored in the liver cells.

ii. Amino Acids



\* building of protein molecules from amino acids

distributed to body cells for protein synthesis

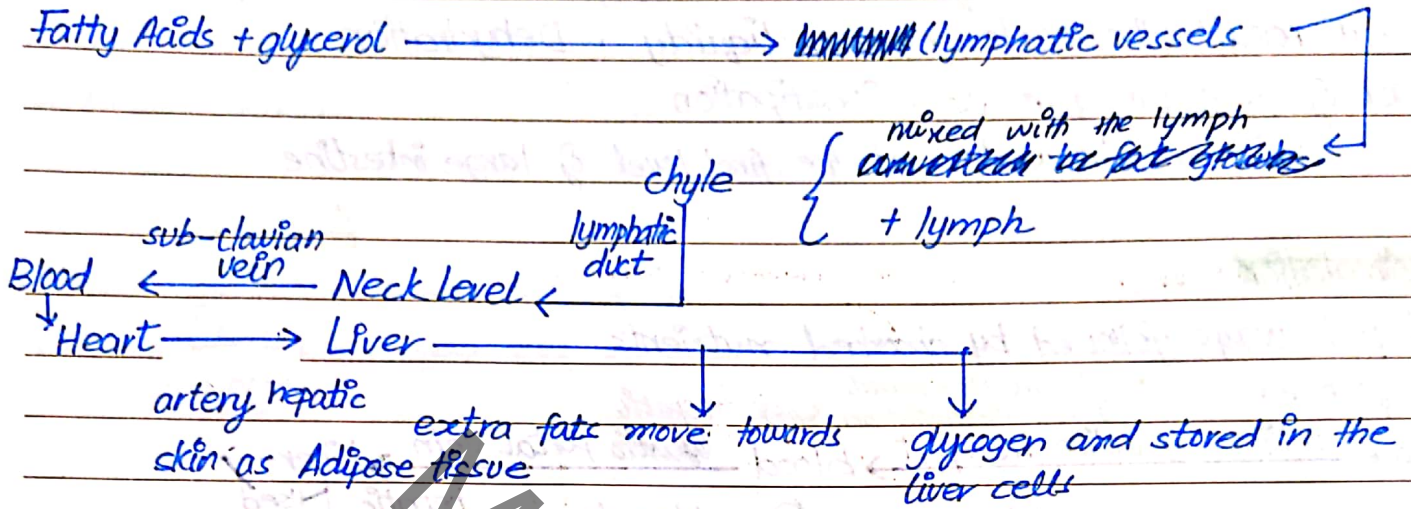
extra are degraded (deamination)

into Urea + Carbon Dioxide

moves to blood to heart to excretory organs (kidney) → converted to urine → excreted / moves to skin and converted to sweat

Date:

iii. Fats



- Adipose tissue • stores energy / energy reserve for prolonged starvation
- insulating layer, the body temperature  
so that the body temperature or the enzymes and metabolic activities will be deactivated
- it forms protective cushions. Ex: ovaries, heart, kidneys
- there is no immediate use of fats
- it moves in form of pure fats throughout the blood which can make the blood vessels less in diameter by forming layers, they can rupture: Haemorrhage (bursting of veins), increased blood pressure: blood is striving with walls, destroying the blood cells and forming blood clots  
mass of dead blood cells - clots  
↓  
beneficial at the level of vessel rupture

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## PHYSICAL DIGESTION:

### HUMAN TEETH:

i. Incisors

→ front teeth meant for cutting of food

ii. Canines

→ tearing of food

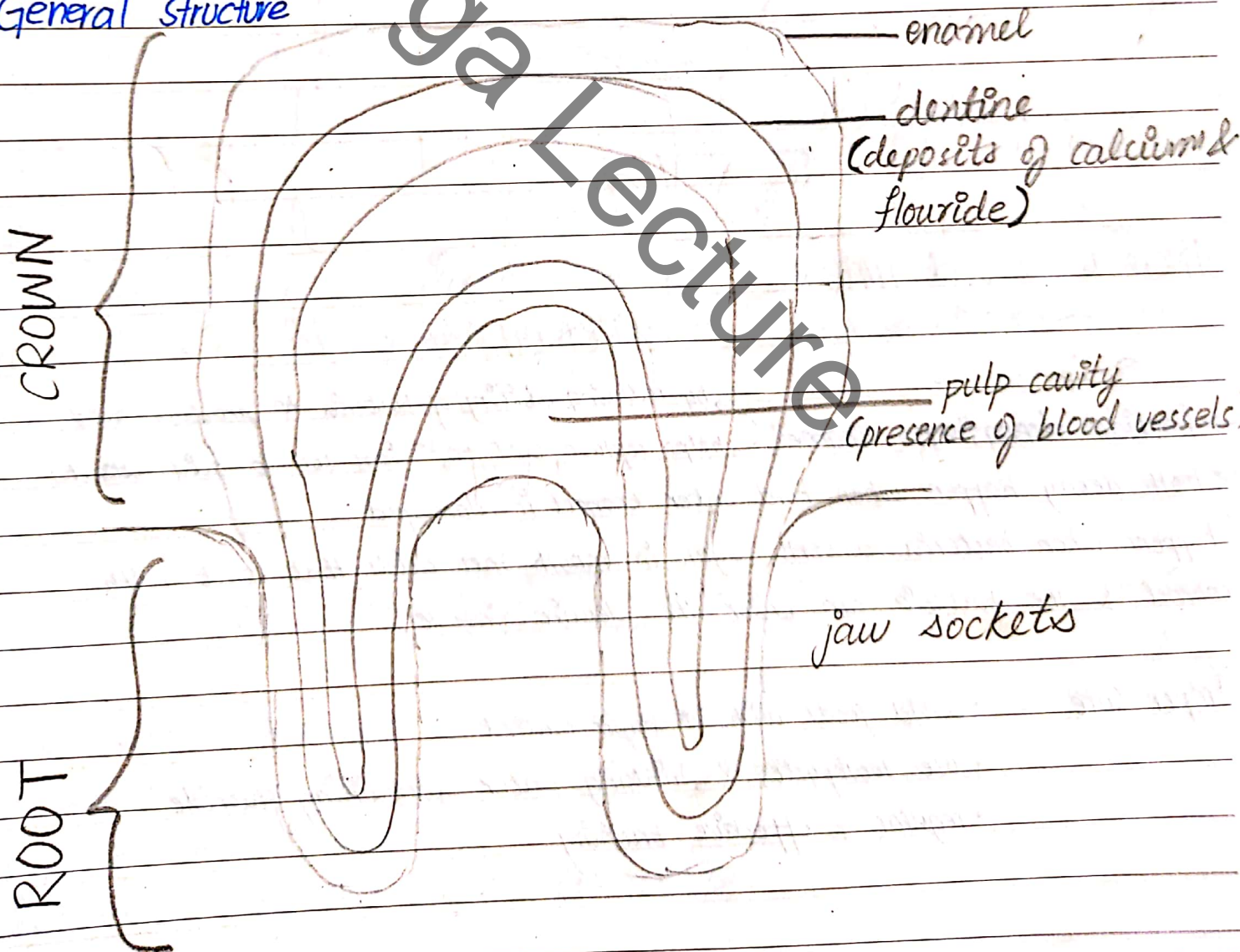
iii. Premolar

→ chewing of food

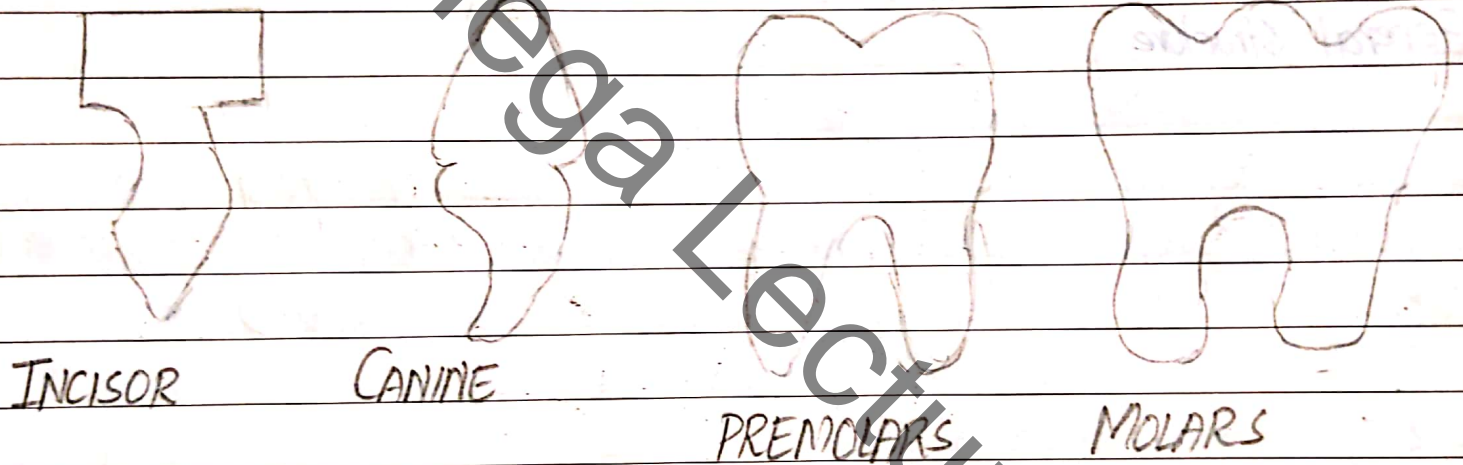
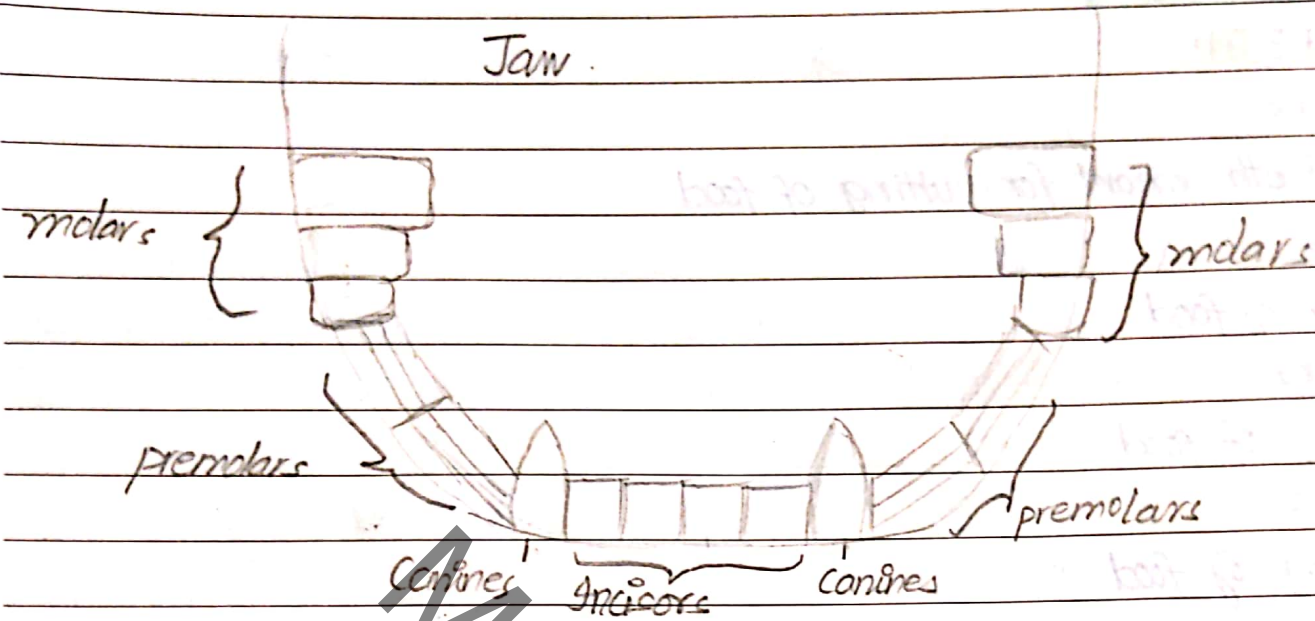
iv. Molars

→ grinding of food

### General structure



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- fluoride strengthens enamel by reducing ability of bacteria to produce acid
- fluoride helps replace  $\text{Ca}^{2+}$ ,  $\text{PO}_4^{3-}$  ions lost to acid attacks
- tooth decay happens when hard outer enamel is damaged
- ↳ happens when bacteria converts sugars in mouth into acids that react with enamel & the bacteria can enter the dentine inside

- Proper Care :-
- avoid foods with ↑ sugar content
  - use toothpaste & drinking water containing fluoride
  - regular & effective brushing