

eLearning

by  **Dr. M.G.R.** EDUCATIONAL AND RESEARCH INSTITUTE



# Dr. M.G.R

## EDUCATIONAL AND RESEARCH INSTITUTE

(Deemed to be University with Graded Autonomy Status)

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Maduravoyal, Chennai - 600 095, Tamilnadu, INDIA

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**DIGESTION AND  
ABSORPTION  
OF CARBOHYDRATES**

**CARBOHYDRATES  
SOURCE FROM  
DIET**

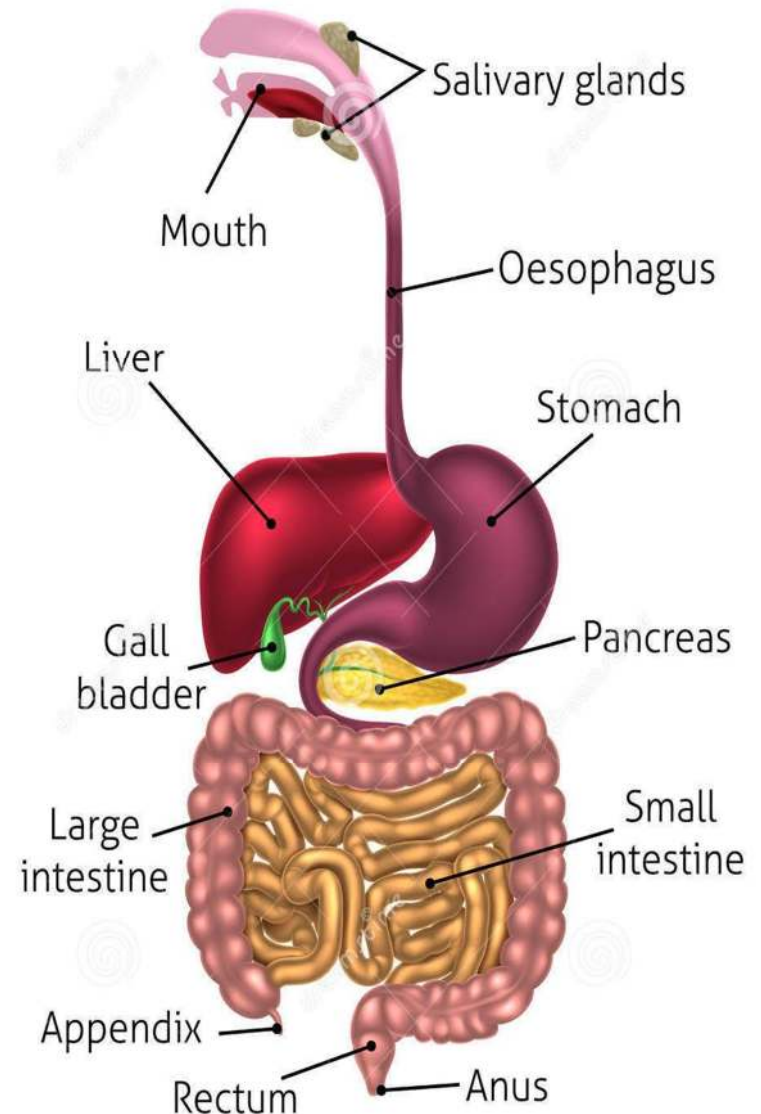
**POLYSACCHARIDES  
STARCH  
GLYCOGEN**

**DISACCHARIDES  
LACTOSE  
MALTOSE  
SUCROSE**

**MONOSACCHARIDES  
GLUCOSE  
FRUCTOSE  
PENTOSE**

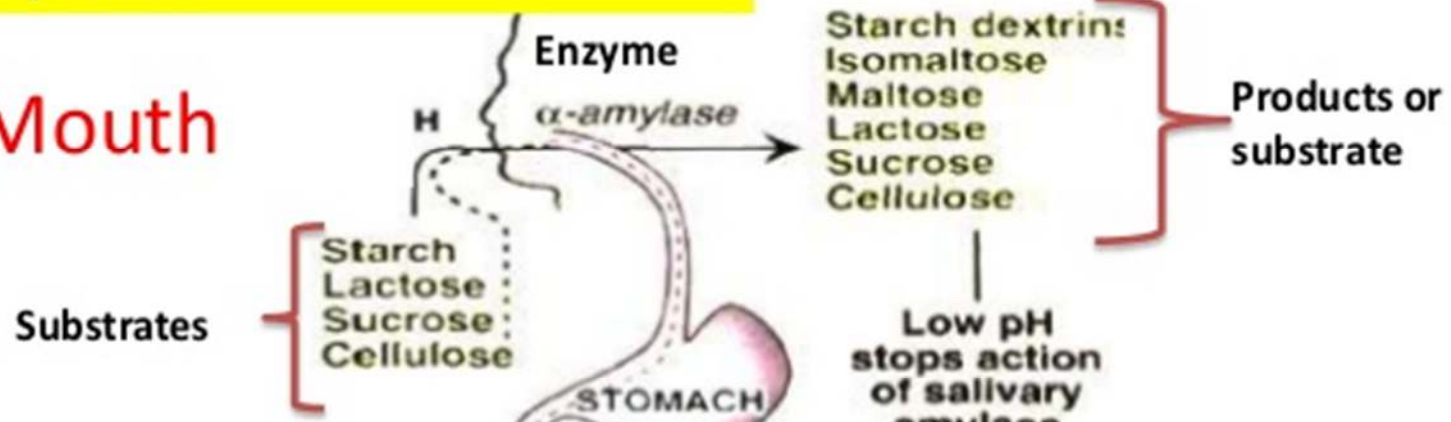
# DIGESTION

- The digestion of carbohydrates occurs briefly in **mouth** and largely in the **intestine**.
- The polysaccharides get hydrated during heating which is essential for their efficient digestion.
- The hydrolysis of **glycosidic bonds** is carried out by a group of enzymes called **glycosidases**.

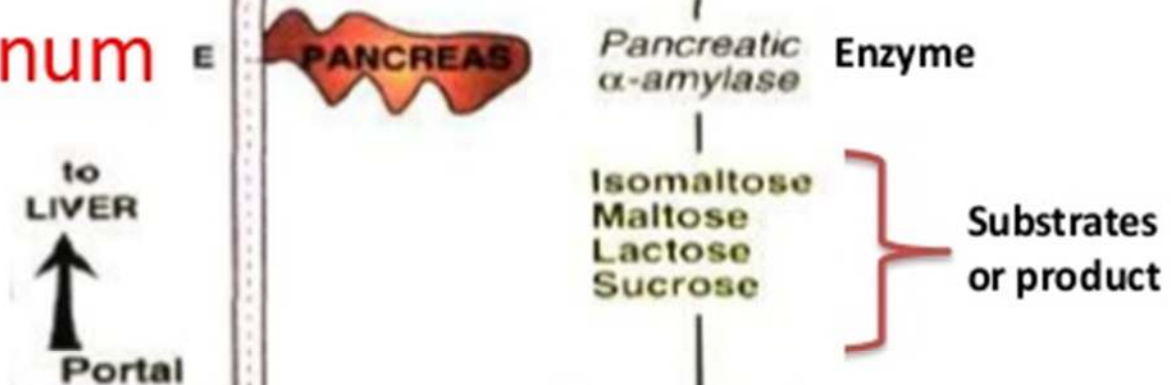


# 1.1.Digestion

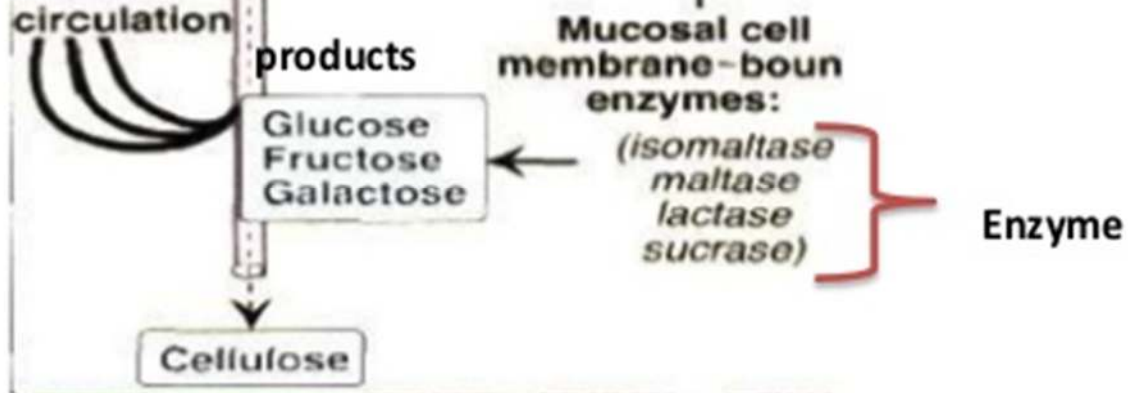
## 1- Mouth



## 2- Duodenum



## 3- Ileum



# DIGESTION IN THE MOUTH

- Carbohydrates are the only nutrients for which the digestion begins in the mouth to a significant extent.
- During the process of mastication, salivary  **$\alpha$ -amylase** (ptyalin) acts on starch randomly and cleaves  **$\alpha$ -1,4-glycosidic bonds.**
- The products formed include  **$\alpha$ -limit dextrins**, (containing about 8 glucose units with one or more  $\alpha$ -1,6-glycosidic bonds) **maltotriose** and **maltose.**

CARBOHYDRATES

Salivary amylase  
(ptyalin)



CLEAVAGE OF  $\alpha$ -1,4- GLYCOSIDIC BONDS



$\alpha$ -limit dextrins, maltotriose & maltose.

# Carbohydrates not digested in the stomach

ENZYME SALIVARY AMYLASE IS INACTIVATED



high acidity( low pH)

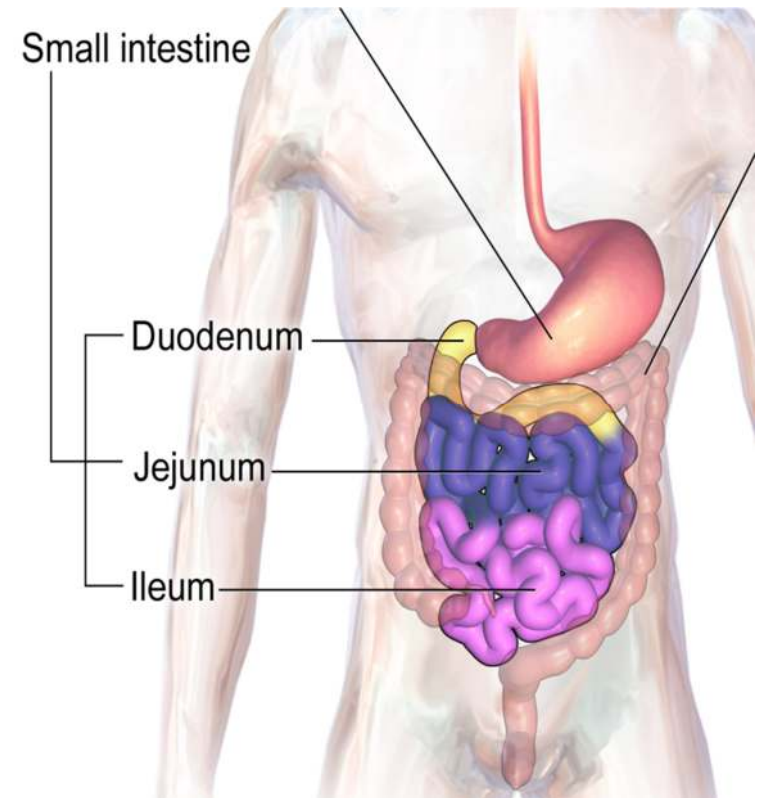


the ongoing degradation of starch is stopped.



# DIGESTION IN THE SMALL INTESTINE

- The acidic dietary contents of the stomach, on reaching small intestine, are neutralized by bicarbonate produced by pancreas.
- Continuation of the digestion process.





**STARCH**

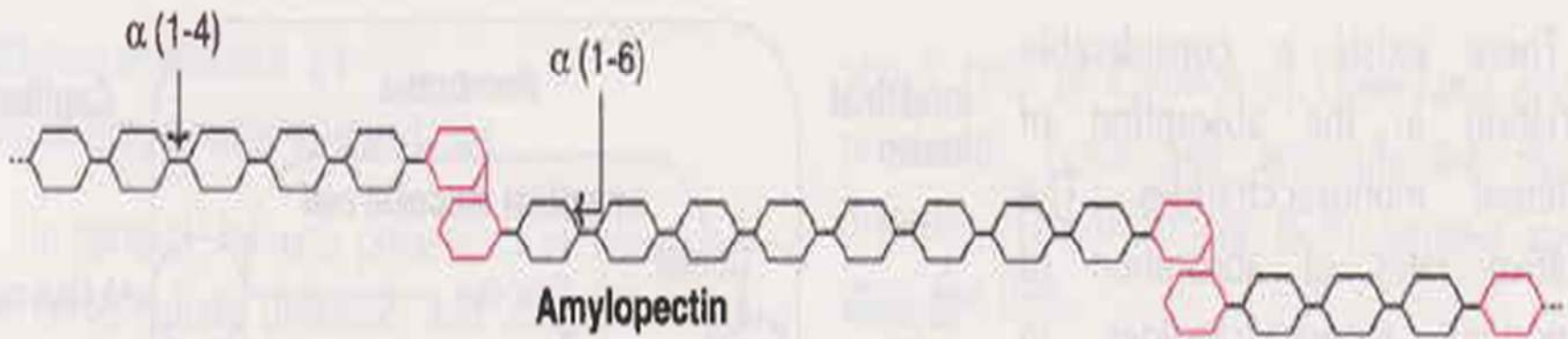
**pancreatic  $\alpha$ -amylase**



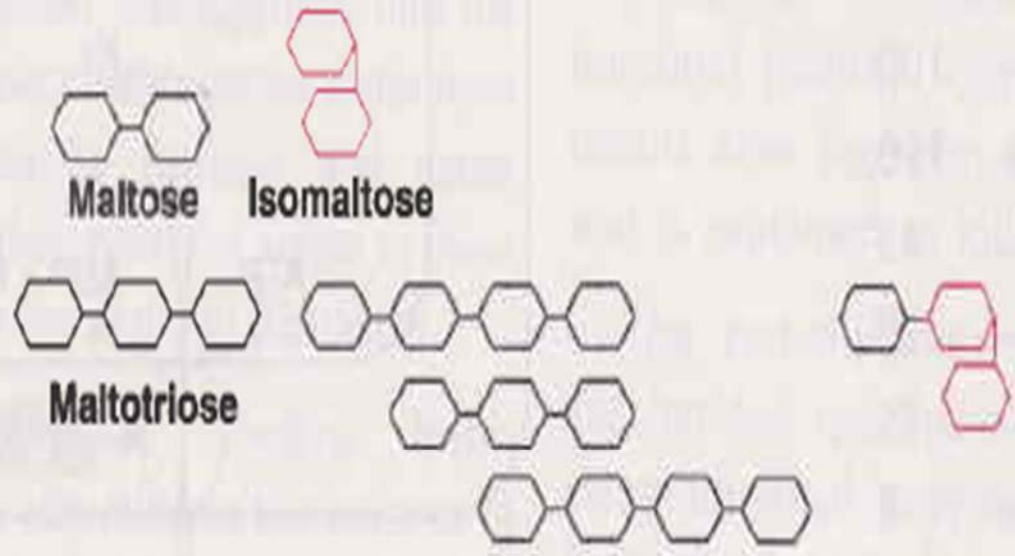
**specifically acts on  $\alpha$ -1,4-glycosidic bonds**  
( not on  $\alpha$ ,-1,6-bonds)



**resultant products**  
**disaccharides and oligosaccharide**



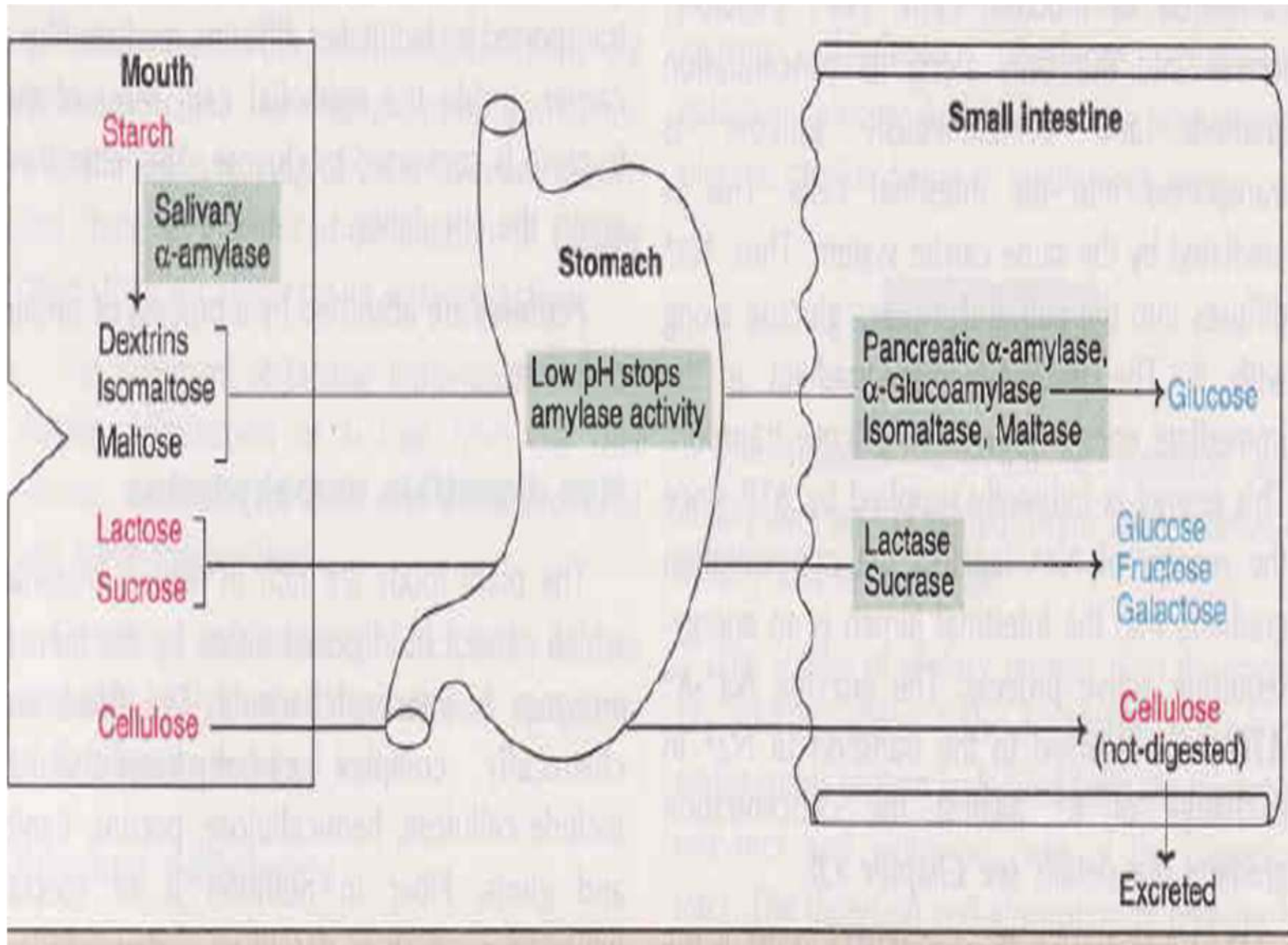
$\alpha$ -Amylase



Oligosaccharides

- The final digestion of di- and oligosaccharides to monosaccharides primarily occurs at the **mucosal lining of the upper jejunum.**
- This is carried out by
- **Oligosaccharidases (e.g. glucoamylase acting on amylose) and**
- **Disaccharidases (e.g. maltase, sucrase, lactase).**
- The enzyme **sucrase** is capable of hydrolysing a large quantity of table sugar (sucrose.)
- **Lactase** will hydrolyse milk sugar lactose.

# Overview of carbohydrate digestion

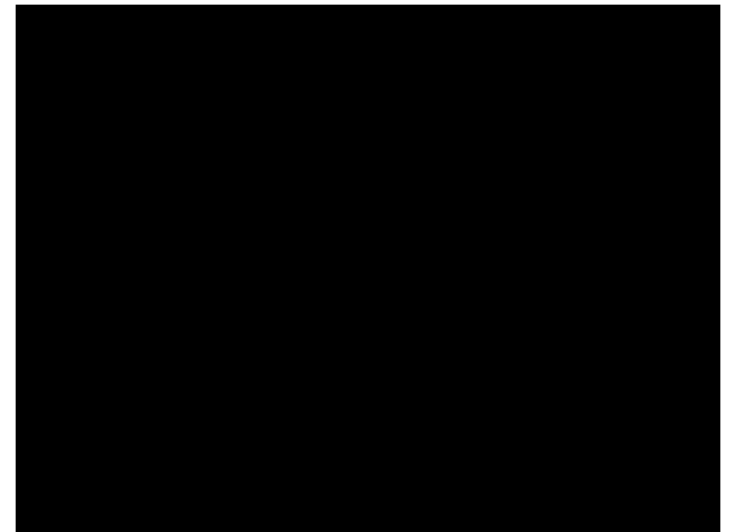
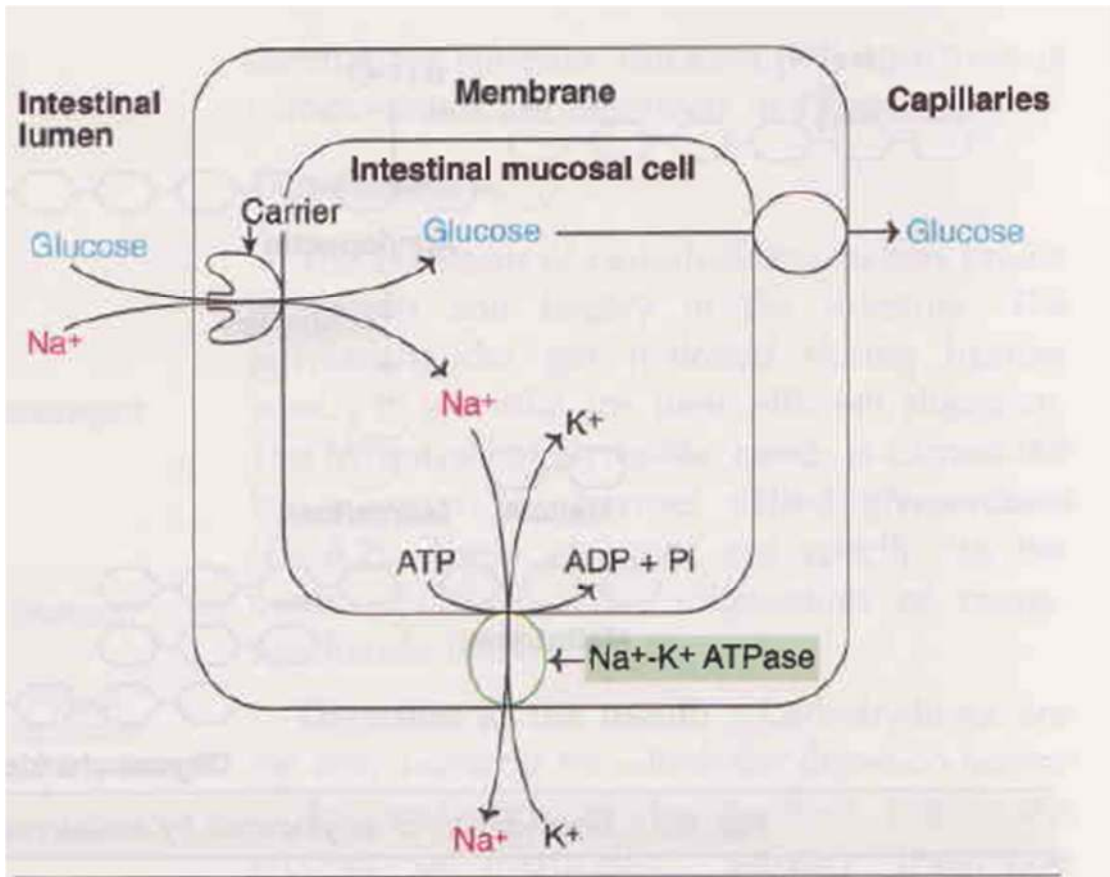


# Absorption Of Monosaccharide

- The principal monosaccharides produced by the digestion of carbohydrates are
- **Glucose** (accounts for nearly 80% of the total monosaccharides)
- **fructose** and
- **galactose**.
- The absorption of sugars mostly takes place in the **duodenum** and **upper jejunum** of small intestine.

# Mechanism Of Carbohydrate Absorption

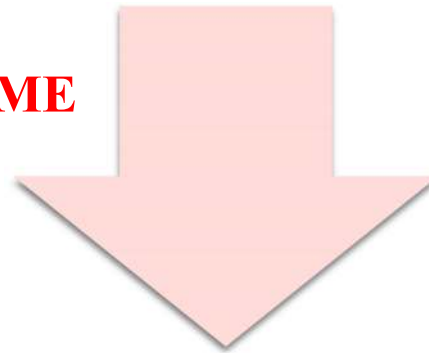
- Different sugars possess different mechanisms for their absorption.
- Glucose is transported into the intestinal mucosal cells by a
  - ❖ **carrier mediated** and
  - ❖ **energy requiring process**
- Glucose and  $\text{Na}^+$  share the same transport system (symport) which is referred to as sodium dependent glucose transporter.





Na<sup>+</sup> (intestinal lumen > mucosal cells)

**MEDIATED BY THE SAME  
CARRIER SYSTEM**



Na<sup>+</sup> diffuses into the cell and it drags glucose along with it  
(along concentration gradient )

- The intestinal  $\text{Na}^+$  gradient is the immediate energy source for glucose transport.
- This energy is **indirectly supplied by ATP** since the reentry of  $\text{Na}^+$  (against the concentration gradient) into the intestinal lumen is an energy requiring **active process.**
- The enzyme  **$\text{Na}^+$  -  $\text{K}^+$  ATPase** is involved in the transport of  $\text{Na}^+$  in exchange of  $\text{K}^+$  against the concentration gradient.

<b>LOCATION</b>	<b>DIGESTION OF CARBOHYDRATES</b>
<b>MOUTH</b>	<b>YES</b>
<b>STOMACH</b>	<b>NO</b>
<b>SMALL INTESTINE</b>	<b>YES</b>

# The Non - Digestible Carbohydrates

- The plant foods which are rich in fibrous material cannot be digested either by the human enzymes or intestinal bacteria.
- The fibers are chemically complex carbohydrates which include cellulose, hemicellulose, pectins, lignin and gums.

- Health implications
  - Stimulate GI motility
  - Promote a healthy microflora
  - Slow nutrient absorption
  - Increase intestinal gas

# **Abnormalities Of Carbohydrate Digestion**

# Lactose Intolerance

- **Defect** :- Enzyme **Lactase ( $\beta$ -galactosidase)**.
- **Treatment** :- Elimination of lactose from the diet (severe restriction of milk and dairy products) will solve the problem.
- Continued consumption of lactose by lactose intolerant individuals causes typical symptoms of
- **“Flatulence** –is characterized by increased intestinal **motility, cramps and irritation”**.







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