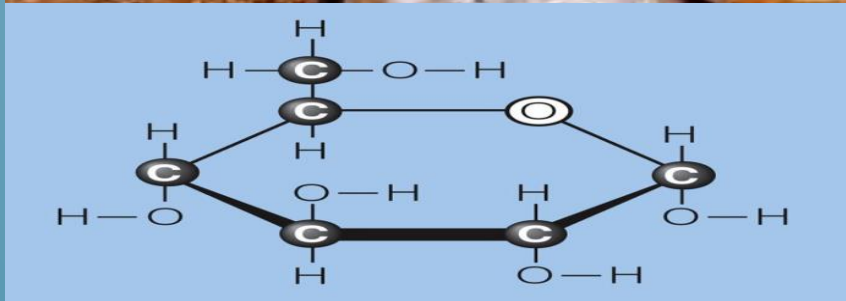




# Biochemistry – Year 2

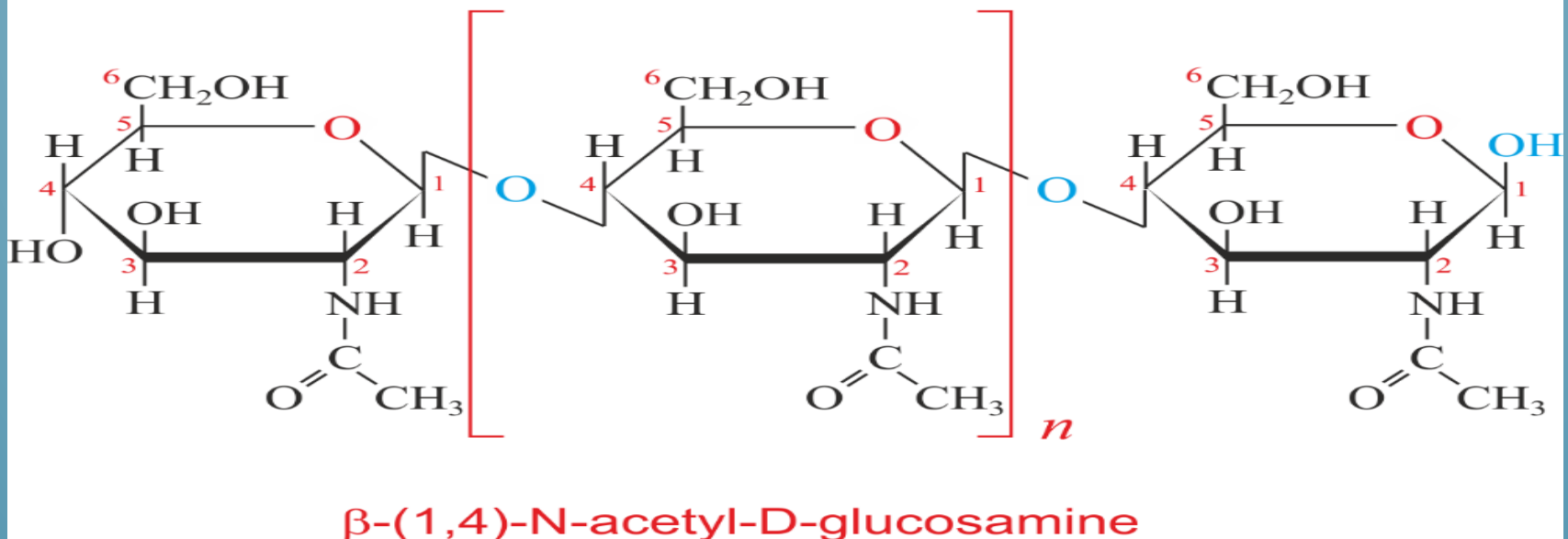


**Lecture 4**  
**By**  
**Assistance teacher**  
**Wisal Althamiry**  
**Department of Basic**  
**sciences**  
**College of Dentistry**  
**University of Basrah**

## 4. Chitin

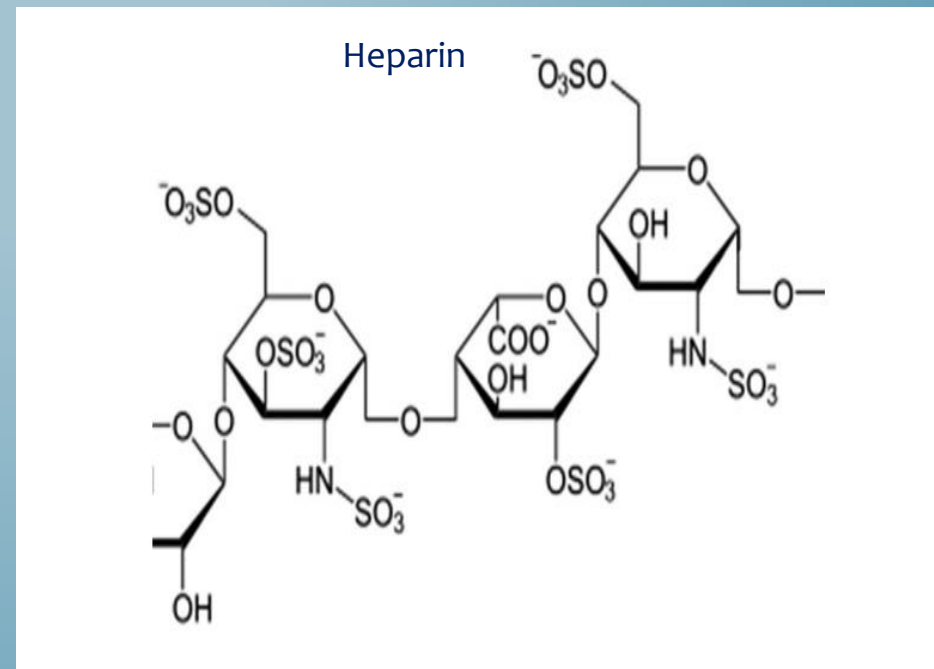
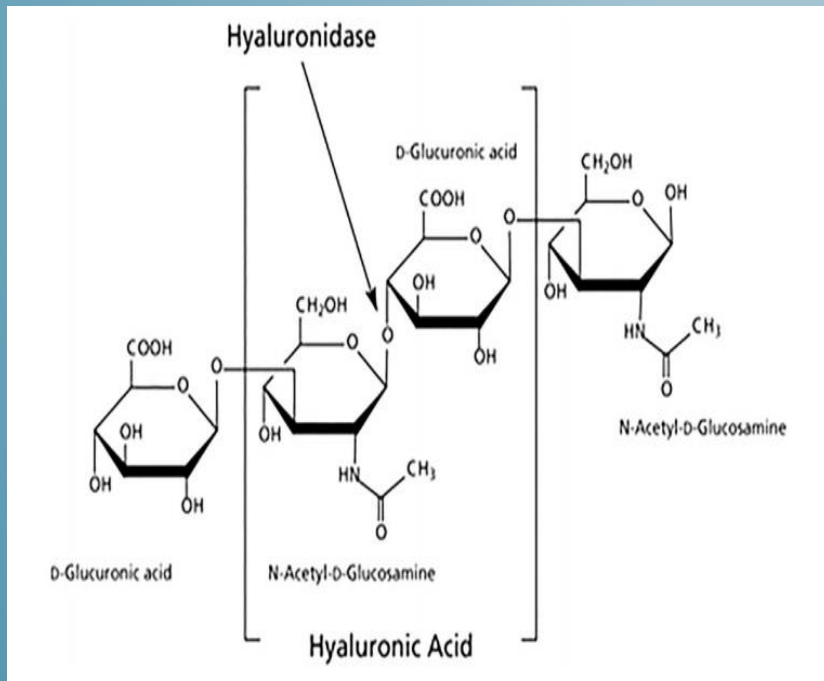
It is an important structural polysaccharides of invertebrates. It is found , for example in the exoskeletons of insects. Structurally , chitin consists of N-acetyl -D- glucosamine units joined by  $\beta$  (1  $\longrightarrow$  4) glycosidic linkages.

Chitin



## 5. Mucopolysaccharide (Glycosaminoglycan)

- a. They are usually composed of **amino sugar** and **uronic acid** units such as Hyaluronic acid , Heparin .
- b. They may be attached to a Protein molecule to form a **proteoglycan**.



# Glycoproteins and proteoglycans:

## proteoglycans:

- a. They are proteins that contain covalently glycosaminoglycans. The protein are called “core proteins”.
- b. The unbranched carbohydrate chains may form up to 95% of its weight.

### c. Function :

1. Are found in every tissue of the body (as the ground or packing substance ) , Mainly in the extra cellular matrix (ECM) where they are bound to bone , collagen and elastin.
2. They are negatively charged so they binds cations such as  $\text{Na}^+$  and  $\text{K}^+$  and thus attract water to ECM.

## Glycoproteins:

- a. They are proteins to which oligosaccharides are attached to it. The oligosaccharides are usually branched.
- b. They contain more proteins than carbohydrates.
- c. **Function:**
  - 1. Structural molecules such as collagen.
  - 2. Act as receptors on cell membrane for hormones and in cell recognition.
  - 3. Act as transport molecule such as Transferrin.
  - 4. Immunoglobulin are glycoproteins
  - 5. Some have a role in blood clotting such as fibrinogen.
  - 6. Act as hormones such as Thyroid stimulating hormone (TSH) and HCG.



# Carbohydrate Digestion

## Ready-to-absorb carbohydrates:

Which do not need digestion and are absorbed as such, e.g., monosaccharides: glucose, mannose, galactose, fructose and pentoses.

## Digestible carbohydrates:

starch, glycogen, maltose, sucrose, and lactose (oligosaccharides and polysaccharides).

## Non-digestible carbohydrates:

Which are called dietary fibers.

These include cellulose, gums and pectins.

They are very important for stools excretion and are anticancer and intestinal bacteria feed on it to release certain vitamins.

# 1. Carbohydrate Digestion in the mouth :

- . In the mouth, salivary amylase is produced by the salivary glands.
- .Its optimum pH is 6.7 - 6.8 and is activated by chloride ions.
- .It is a  $\alpha$ -glycosidase specific for hydrolysis of  $\alpha$ -1,4 glucosidic linkage present in cooked starch and glycogen producing dextrins and maltose .
- .Salivary amylase cannot digest  $\beta$ -1,4-glucosidic linkage in cellulose.

## **2. Carbohydrate digestion in the Stomach:**

Salivary amylase continues to act on starch, glycogen or dextrans for 2 - 3 minutes only in the stomach (acidic pH 1 - 2).

## **3. Carbohydrate digestion in the Small Intestine:**

In the small intestine, there are two juices that digest carbohydrates:

### **A. The pancreatic juice:**

This juice contains pancreatic amylase, an  $\alpha$ -glycosidase. It has an optimum pH 7.1 and is also activated by chloride ion.



It acts exactly as salivary amylase, digesting cooked and uncooked starch, glycogen and starch . dextrins which escaped digestion by salivary amylase in the mouth producing maltose, maltotriose (three  $\alpha$ -glucose residues linked by  $\alpha$ -1,4 bonds) and a mixture of branched oligosaccharides ( $\alpha$ -limited dextrins) , non-branched oligosaccharides and some glucose.

### **B. Intestinal mucosal brush border enzymes:**

**The final digestion of carbohydrates occurs in the small intestine by the action of the following disaccharidases:**

Lactase hydrolyzes lactose into glucose and galactose.

surcease hydrolyzes sucrose into glucose and fructose.

maltase hydrolyzes malctose into 2 glucose .

# Dietary fibers

1. The  $\beta$ -1,4 glucosidic linkage of Cellulose is not hydrolyzed by human digestive enzymes.
2. Hemicellulose, gums, pectins and pentosans are also indigestible.
3. Cellulose and other dietary fibers passes as it is in stools, increasing bulk of intestinal contents by adsorbing water and stimulates peristaltic movements to reduces stool transit time and prevents constipation.
4. They bind and dilute bile acids.
5. The more soluble fibers found in legumes and fruit, e.g., gums and pectins, lower blood cholesterol, possibly by binding bile acids and dietary cholesterol.

# Carbohydrate Absorption

## Site of absorption:

Mainly the upper part of small intestine, i.e., jejunum. Very small amount is absorbed in the stomach or large intestine.

In the form of hexoses (glucose, fructose, mannose and galactose) and as pentose sugars (ribose) and brought via the blood to the liver.

- **Glucose** and **galactose** are absorbed by **active transport**.
- **Fructose** is absorbed by **facilitated diffusion**.

# Recap

- ✓ Define carbohydrate
- ✓ Biological importance
- ✓ classification
- ✓ Some reactions of monosaccharides
- ✓ Glycoproteins and proteoglycans

thanks