

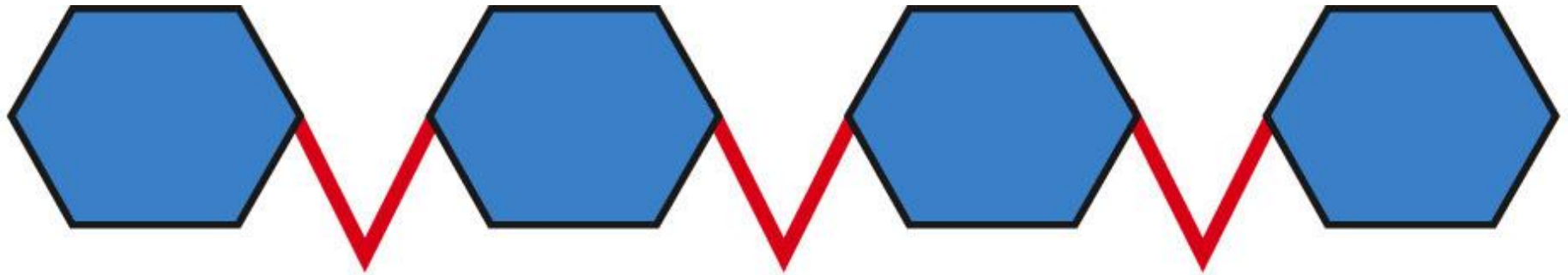
# ESU009– Complex carbohydrates as functional foods

## Lecture 19

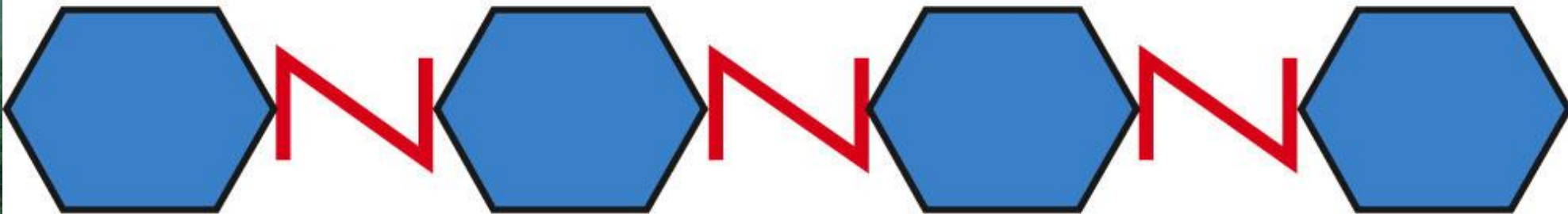


# The Complex Carbohydrates

- Dietary fibers provide structure in plants, are very diverse, and cannot be broken down by human enzymes.
  - Soluble fibers are viscous and can be digested by intestinal bacteria (this property is also known as fermentability). These fibers are found in fruits and vegetables.
  - Insoluble fibers are nonviscous and are not digested by intestinal bacteria. These fibers are found in grains and vegetables.



Starch



Cellulose



# The Complex Carbohydrates

- Fiber Sources
  - Dietary fibers are found in plant foods.
  - Functional fibers are health-benefiting fibers that are added to foods or supplements.
  - Total fiber considers both dietary and functional fibers.
- Resistant starches escape digestion and are found in legumes, raw potatoes and unripe bananas.
- Phytic acid or phytate has a close association with fiber and binds some minerals.

# Digestion and Absorption of Carbohydrates

- Carbohydrate Digestion
- In the mouth, the salivary enzyme amylase begins to hydrolyze starch into short polysaccharides and maltose.
- In the stomach, acid continues to hydrolyze starch while fiber delays gastric emptying and provides a feeling of fullness (satiety).

# Digestion and Absorption of Carbohydrates

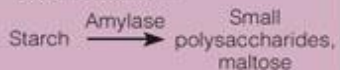
- Carbohydrate Digestion

- In the small intestine, pancreatic amylase among other enzymes (maltase, sucrase, and lactase) hydrolyzes starches to disaccharides and monosaccharides.
- In the large intestine, fibers remain and attract water, soften stools and ferment.

## STARCH

### Mouth and salivary glands

The salivary glands secrete saliva into the mouth to moisten the food. The salivary enzyme amylase begins digestion:

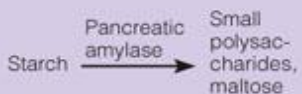


### Stomach

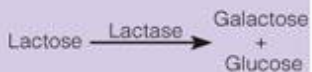
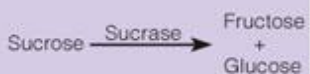
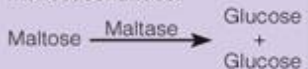
Stomach acid inactivates salivary enzymes, halting starch digestion.

### Small intestine and pancreas

The pancreas produces an amylase that is released through the pancreatic duct into the small intestine:



Then disaccharidase enzymes on the surface of the small intestinal cells hydrolyze the disaccharides into monosaccharides:



Intestinal cells absorb these monosaccharides.

## FIBER

### Mouth

The mechanical action of the mouth crushes and tears fiber in food and mixes it with saliva to moisten it for swallowing.

### Stomach

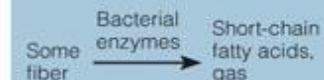
Fiber is not digested, and it delays gastric emptying.

### Small intestine

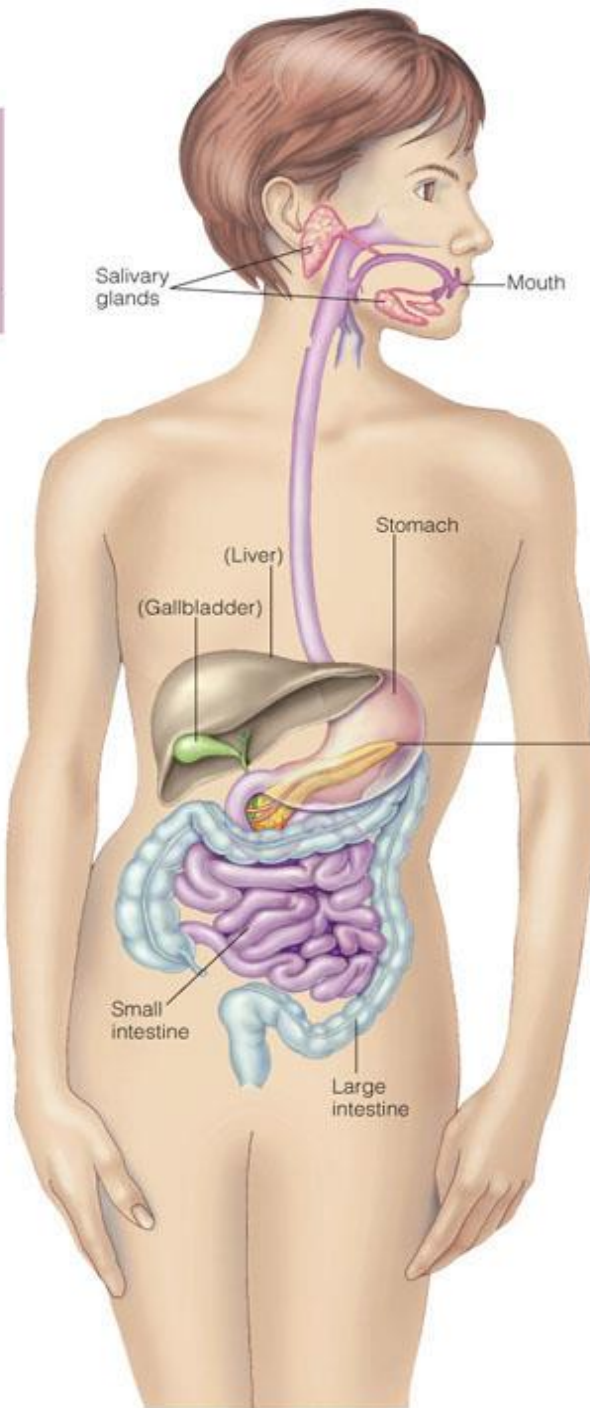
Fiber is not digested, and it delays absorption of other nutrients.

### Large intestine

Most fiber passes intact through the digestive tract to the large intestine. Here, bacterial enzymes digest fiber:



Fiber holds water; regulates bowel activity; and binds substances such as bile, cholesterol, and some minerals, carrying them out of the body.

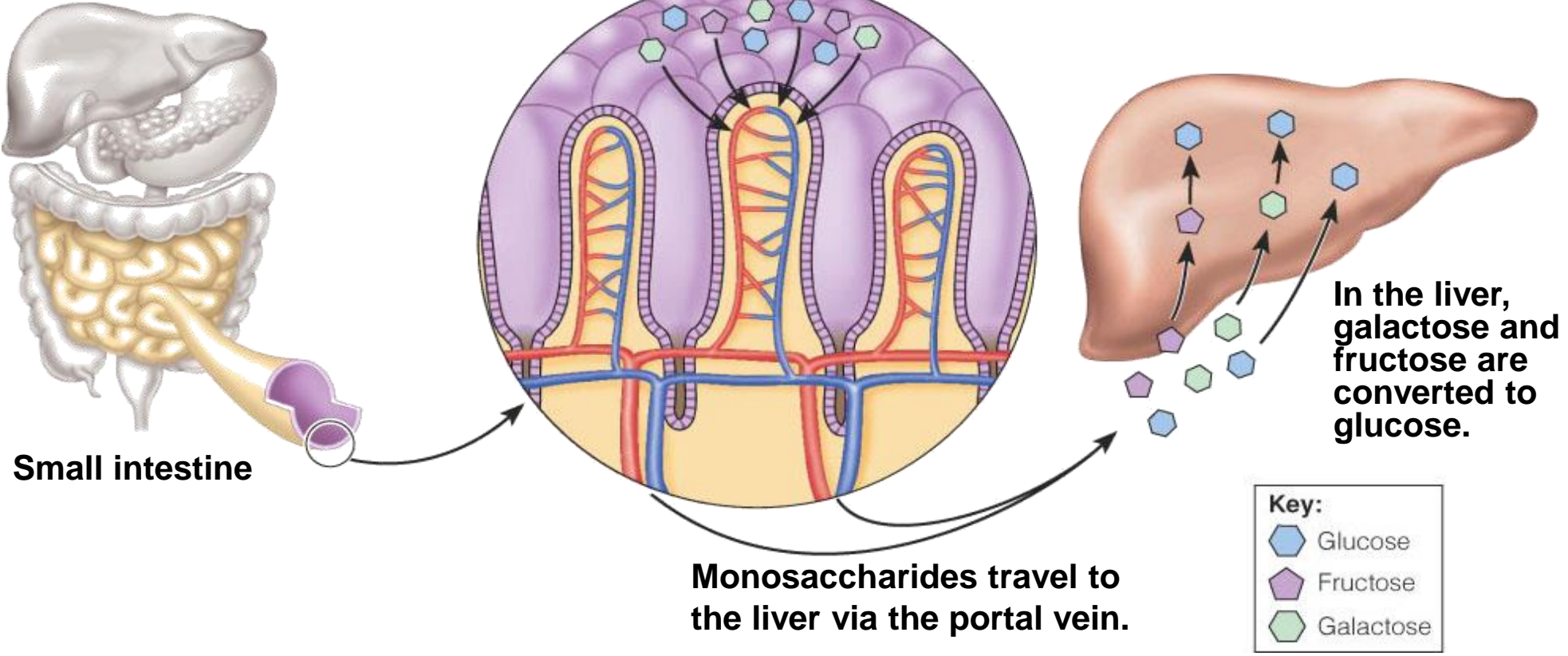


# Digestion and Absorption of Carbohydrates

- Carbohydrate Absorption
  - Primarily takes place in the small intestine
  - Glucose and galactose are absorbed by active transport.
  - Fructose is absorbed by facilitated diffusion.






**Monosaccharides, the end products of carbohydrate digestion, enter the capillaries of the intestinal villi.**



**Small intestine**

**Monosaccharides travel to the liver via the portal vein.**

**In the liver, galactose and fructose are converted to glucose.**

Key:	
	Glucose
	Fructose
	Galactose

# Digestion and Absorption of Carbohydrates

- Lactose Intolerance
  - Symptoms include bloating, abdominal discomfort, and diarrhea.
  - Causes include lactase deficiency due to a natural decrease that occurs with aging or damaged intestinal villi.

# Digestion and Absorption of Carbohydrates

- Lactose Intolerance - Dietary Changes
  - Increase consumption of milk products gradually.
  - Mix dairy with other foods.
  - Spread dairy intake throughout the day.
  - Use of acidophilus milk, yogurt, and kefir (fermented products)
  - Use of enzymes
  - Individualization of diets
  - Must be careful that vitamin and mineral deficiencies do not develop

# Thank you

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