

DIGESTION & MEMBRANE TRANSPORT

You eat a meal of pasta and meatballs in tomato sauce and drink a glass of sweet tea.

1. List the major biomolecules in each component of this meal.

Food	Biomolecules
Pasta	
Meatballs	
Tomato sauce	
Sweet tea	

2. Consider the contents of your stomach 1 hour after eating this meal. What, if anything, has been digested? What, if anything, has been absorbed?

Constituents of Food	What happens to ___ in the stomach ?	Digested or Absorbed?
Carbohydrates		
Proteins		
Fats		
Vitamins		
Sucrose		
water		

Refer to your textbook and notes to check yourself.

Digestion and absorption of carbohydrates, proteins, and fats are largely completed in the **small intestine**.

3. Outline the process of digestion and absorption of each type of biomolecule below:

	Digestive Enzyme(s)	Organ secreting the enzyme	Products of Digestion	Small Molecules absorbed into...
Carbohydrates				
Proteins				
Fats				

4. Draw a group of 3 intestinal epithelial cells. Label the apical membrane, basolateral membrane, and tight junctions. Indicate where **the intestinal lumen**, **capillaries**, and the **central lacteal** are relative to the 2 regions of the cell membrane.

5. Summarize the process of **glucose** and **monoglyceride** transport across the intestinal epithelial cell. Indicate the mechanism of membrane transport and the fluid compartment (blood or lymph) into which each is transported.

	Transport Mechanism across apical membrane	Transport Mechanism across basolateral membrane	Fluid compartment into which transported
glucose			
monoglycerides			

6. What is the relative intracellular v. extracellular glucose concentration across the apical membrane and across the basolateral membrane? Explain how the mechanism of glucose transport across the epithelial cell membrane is related to the local concentration gradient.

Teaching Tips for Peer Mentors

- Give students one page of this problem at a time. Individuals or groups should complete a page before moving on to the next page so that they have to work out their own answers instead of looking ahead.
- Question 1. Encourage students to use their notes, textbook, and other resources (smart phones, laptops) to find out what makes up each component of the meal.
- Question 2. In the “what happens?” column, some answers can be “nothing.” The stomach contains pepsin and HCl, so proteins are partially digested, but other biomolecules are not. In the “digested or absorbed” column, answers can be digested, absorbed, or neither. Refer students to their notes and to the appropriate section in the textbook.
- Question 3. Students should fill in the type of digestive enzyme (e.g. carbohydrase or protease), not the specific enzymes. The “products of digestion” are the monomers or subunits to which biomolecules are digested: monosaccharides, amino acids, fatty acids, monoglycerides, and diglycerides. “Small molecules absorbed into...” should indicate where the monomers go once they cross the intestinal epithelium – blood or lymph. Refer students to appropriate sections in their textbook. Students should draw in the table cell labeled “Diagram small molecule transport across the intestinal epithelial cell.” Refer students to appropriate sections in their textbook.
- Question 4 – drawing the intestinal epithelial cells – refer to the appropriate section in the textbook and to lecture notes for assistance on this.
- Question 5 – glucose and monoglyceride transport. “Fluid compartment into which transported” should be either blood or lymph, depending on the monomer. Refer students to relevant sections of their textbook, especially those discussing digestion, facilitated diffusion, and active transport.
- Question 6 – Students should be considering the 3 compartments they drew in Q4: intestinal lumen, inside the epithelial cell, and the capillaries or lymph vessel inside the villus. Remind them that the blood and lymph are always flowing and will therefore always have lower nutrient concentrations than inside the epithelial cell.

Notes to Faculty

Reference: This activity is modified from Unit 9, Gastrointestinal, Problem 1 in *Problem Solving in Physiology* by J.A. Michael and A.A. Rovick. 1999. Prentice Hall, Upper Saddle River, NJ.