Name: _____ Period: _____ Date: _____

The Cell in Action: ER, Golgi, and Lysosomes:

1. Scenario 1: Counterattack!

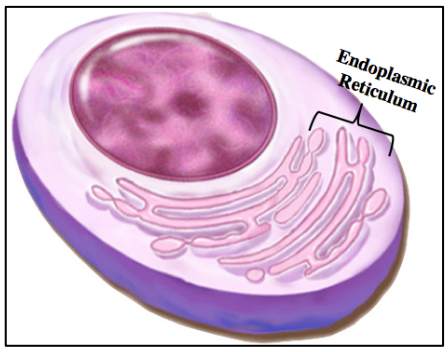


Figure 1: A White blood cell fills up with endoplasmic reticulum as it produces antibodies

When you fight off a virus, your immune system produces *antibodies*. Antibodies are virus-killing proteins that are made in white blood cells and released into the blood.

As white blood cells produce antibodies, their appearance changes. Their cytoplasm becomes filled with **endoplasmic reticulum (ER).** There's also a lot of **Golgi Apparatus.**

What's going on?

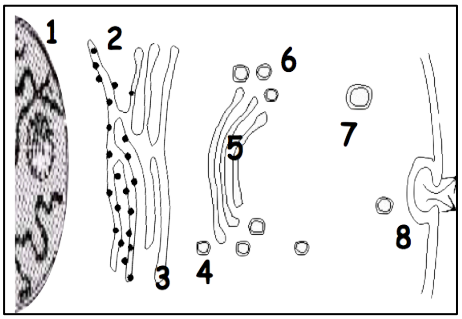


Figure 2: Nucleus, ER, Golgi, Membrane

The **ER** is a vast internal network of channels separated from the rest of the cytoplasm by membrane . The **Golgi** is similar, except for that instead of channels, the Golgi forms a series of flattened, elongated sacs, also bound by membranes.

In the diagram to the left, the **nucleus** is shown at 1. The endoplasmic reticulum is at 2 and 3. The Golgi is at 5.

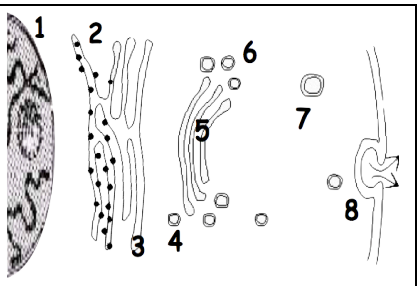
The left side of the ER is covered by many **ribosomes**, which are shown as dots in this illustration. Ribosomes are the cell's *protein factories:* they'll make any protein that they're told to make, based on instructions they receive from the nucleus. ER with ribosomes is called ***Rough ER***. ER without ribosomes is smooth ER, and we'll discuss it more below.

Antibodies, like all proteins that will be exported out of the cell, are made at the rough ER (2). As the antibody is made, it gets put into the channels of the ER. It then moves to the Smooth ER (3). In the same way that bubbles can form from a soap film, the smooth ER will bud off a bubble of membrane, also known as a vesicle (4). A **vesicle** is the name we give to any small, membrane bound sac that's transporting substances from one area of the cell to another.

This vesicle, containing the antibody, will merge with the **Golgi Apparatus** (5). The Golgi has enzymes that modify the antibody, getting the antibody into the exact form it will need to be in to bind with and destroy the virus. When the Golgi is done, it buds off another vesicle (6). This vesicle will fuse with the **cell membrane** (8). As it does, the antibody will be dumped into the cell's exterior. In this case, that means the bloodstream. The antibody will now float in the blood and, hopefully, bind with the virus, helping to destroy it.

2. Understanding Cell Processes and Structures: Based on the reading on the opposite side, create a key for the diagram below and to the right. Note that we're deliberately skipping numbers 3 and 7.

Number	Name	Based on the reading above, a quick summary of its function
1		
2		
4		
5		
6		
8		

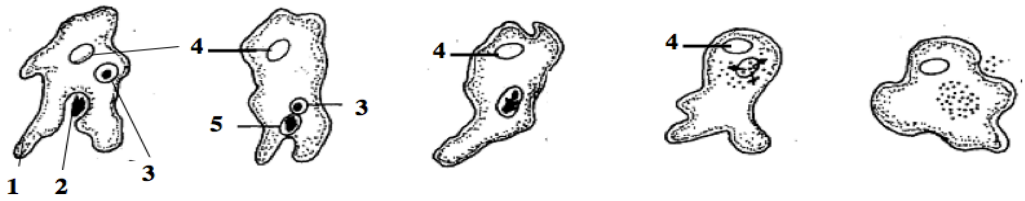


3. Checking Understanding: Put your answers in column on the right

1. ER stands for _____ _____	_____ _____
2. The _____ ER is covered with ribosomes.	_____
3. _____ are the cell's protein factories	_____
4. The instructions for making proteins can be found in the cell's _____	_____
5. The part that modifies, packages, and sorts proteins is the _____	_____
6. The part the controls what enters and leaves the cell is the _____	_____
7. The _____ is the cell's overall control center.	_____

4. Scenario 2: Intracellular digestion

Intracellular digestion is digestion that happens inside the cell. Consider an Amoeba, a single celled predator. In this series of diagrams, an amoeba is shown engulfing (swallowing) and digesting prey.



A **B** **C** **D** **E**

The process begins at "A". The amoeba extends part of its membrane to surround its **prey** (2). The extension is called a **pseudopod** ("false foot), and is shown at 1. In this same diagram, you can also see two other organelles. Number 3 is a **lysosome**. The lysosome contains digestive enzymes which would be harmful to the cell if they were floating in the cytoplasm (because they would digest the cell). Number 4 is the cell's **nucleus**.

In "B" you can see what happens when the pseudopods completely surround the prey. At this point, the prey is enclosed in a **food vacuole** (5). In "C," the lysosome fuses with the food vacuole. The enzymes in the lysosome attack the prey, breaking it down to simple monomers.

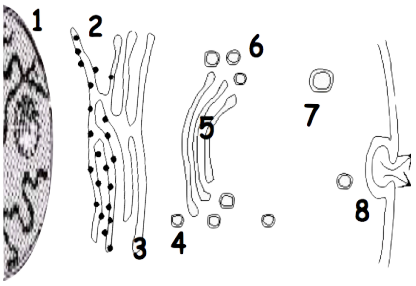
In "D", those monomers are released into the cytoplasm, where the cell can use them for food or energy. In "E" the lysosome has been inactivated. The food molecules are in the cytoplasm, and molecules or particles that can't be digested are released from the cell.

5. Understanding Cell Processes and Structures: Based on the reading above, create a key for the diagram above.

Number	Name	Based on the reading above, a quick summary of its function
1		
2		food for the amoeba
3		
4		
5		

6. Application: The enzymes in lysosomes are dangerous, and can't be directly exposed to the cytoplasm. In the diagram below, 7 represents a lysosome. Explain what has to happen for an enzyme to get placed inside a lysosome. Note that the membrane (8) is not involved in this process.

First, the instructions…



Next,

After that, the smooth ER will

Following that, a vesicle will

At the Golgi,

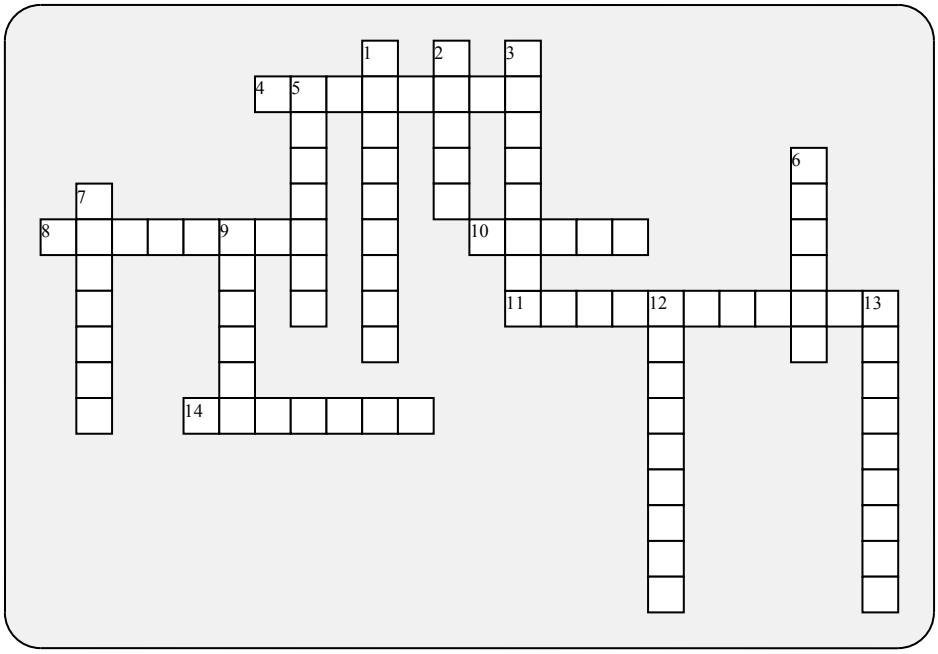
Finally.

7: Amazing idea

Think about your hand. When you were an early embryo, just a few centimeters long, you had no distinct fingers, just a paddle of bone, surrounded by muscle, surrounded by skin. At a certain point in development, a chemical signal went out to the cells that were in between the cells that now make up your fingers. That signal instructed the cells to destroy themselves by opening up their lysosomes, having the enzymes in the lysosomes devour the cytoplasm and the rest of the cell. What was left became your hand.

8. Another application: Plant cells don't have lysosomes. Why?

ER, Golgi, Lysosomes Crossword



Across:

4 - A protein released into the blood to wipe out bacteria and viruses
8 - The cell's selective boundary. It controls what enters and leaves the cell.
10 - This apparatus or complex is a series of flattened sacs that modify and transport proteins
11 - This is the first name of a part that consists of a network of membrane-bound channels in the cytoplasm
14 - An organelle used for storage of food.

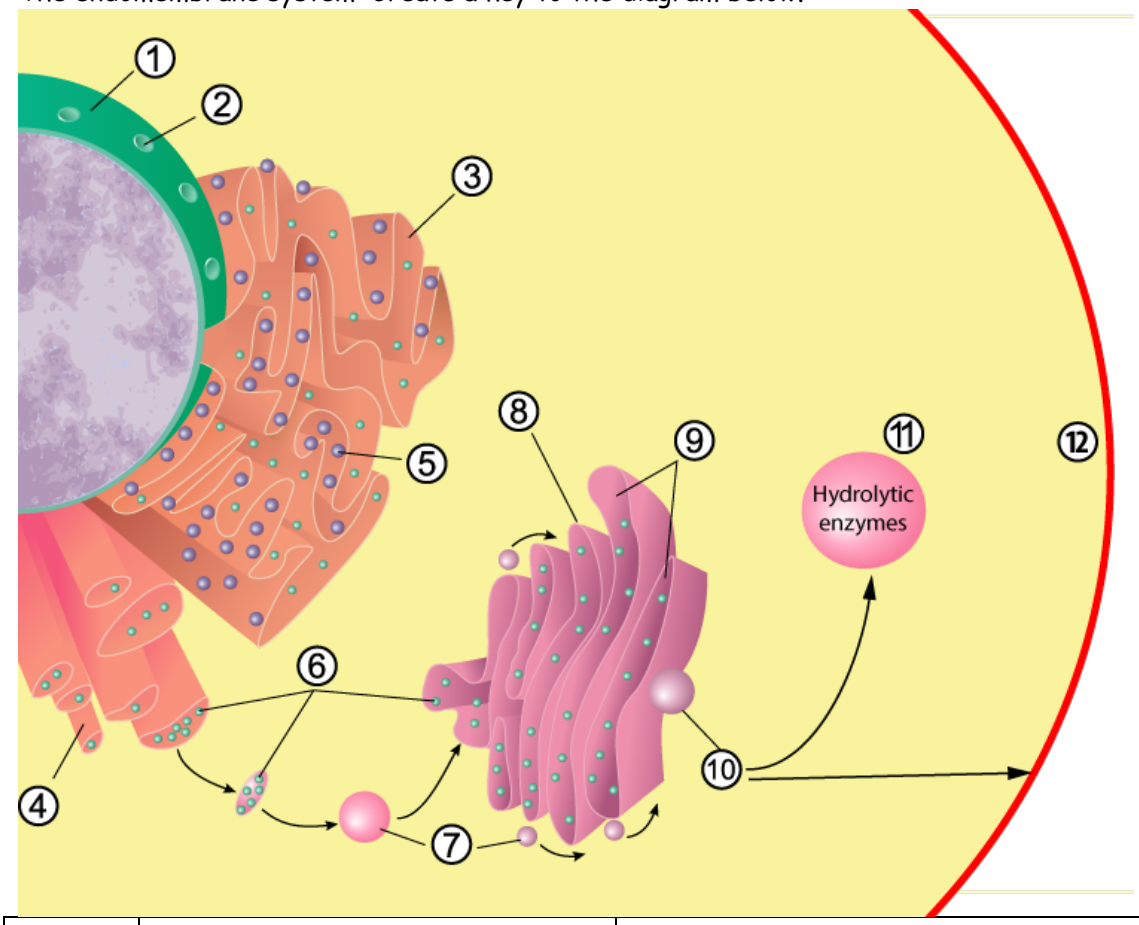
Down:

1 - The cell's protein factories
2 - This kind of ER is the one that's studded with ribosomes
3 - An organelle filled with enzymes that the cell uses for digesting food or recycling worn out parts.
5 - The cell's control center
6 - Protein catalysts that speed up reactions in cells. Often they're used in digestion.
7 - A small, membrane bound sac used to move materials from one part of the cell to another
9 - A single celled freshwater predator
12 - An extension of the membrane used for swallowing prey
13 - Any part of the cell in between the nucleus and the membrane is in the

Word bank on next page...but try not to use it!

Possible Answers:
Amoeba, Enzyme, Golgi, Rough, antibody, cytoplasm, endoplasmic, lysosome, membrane, nucleus, pseudopod, ribosomes, vacuole, vesicle

The endomembrane system: Create a key to the diagram below.



Number	Name	Function/Role
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		