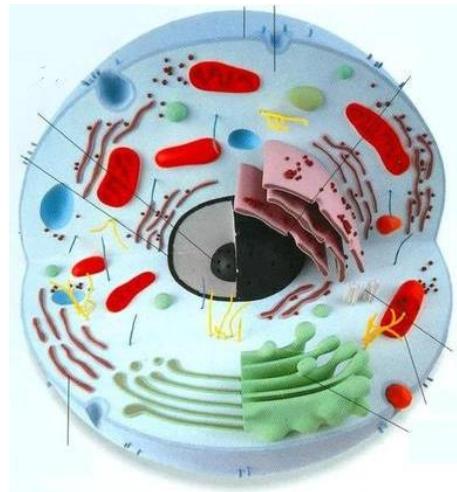
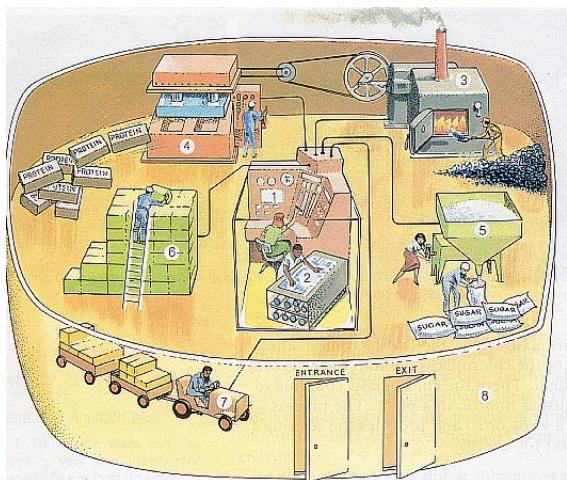


How is a Cell Like a Factory? (An Introduction to Cell Organelles)



Have you ever been inside a factory? Whether they make toys, cell phones, or t-shirts, most factories are set up the same way, and work in pretty similar patterns.

Let's start with the building. Of course a factory has walls, to separate the inside from the outside. It also has interior walls to divide it into different areas, or rooms. Don't forget that it also needs doors and windows, so people and materials can come in and out!

Inside the factory, there are different departments, where workers perform many different jobs. You have the administrative offices, where all the big decisions are made, and where all the orders come from. You have the factory floor, where workers assemble the product. Then you have the packaging department, which handles the finished product and gets it ready for shipping.

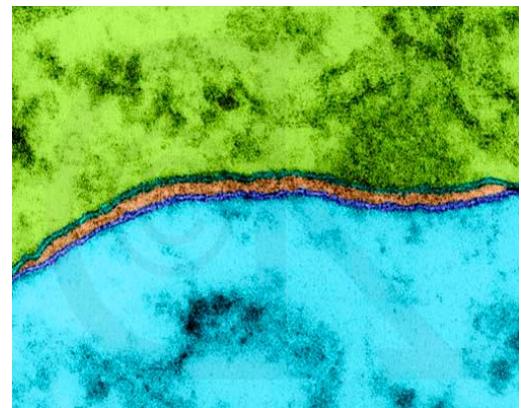
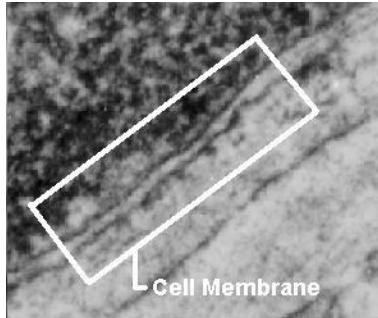
Don't forget the backup crews! Factories require a lot of energy. They often have their own power plant, to keep things running smoothly. And you also need a clean-up crew to get rid of all the trash.

Cells are similar to factories. To stay alive and function properly, cells have many different parts (called organelles) that work together as a system, to keep the cell healthy. Let's take a look at some different cell parts, and how they would be compared to a factory.

The Cell Membrane (Factory Walls)

In a factory, there are walls to keep things in – or out. Of course there are doors, to bring in necessary materials, and also to take out waste.

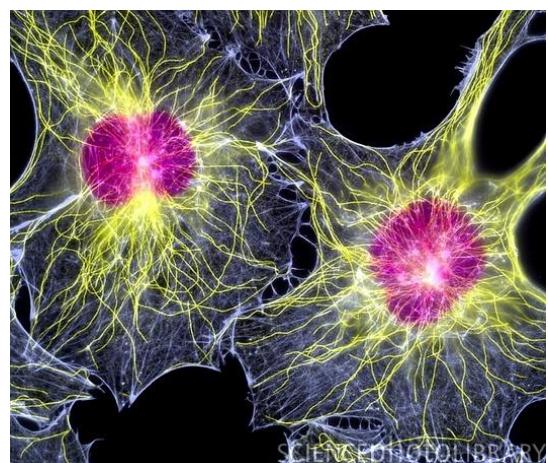
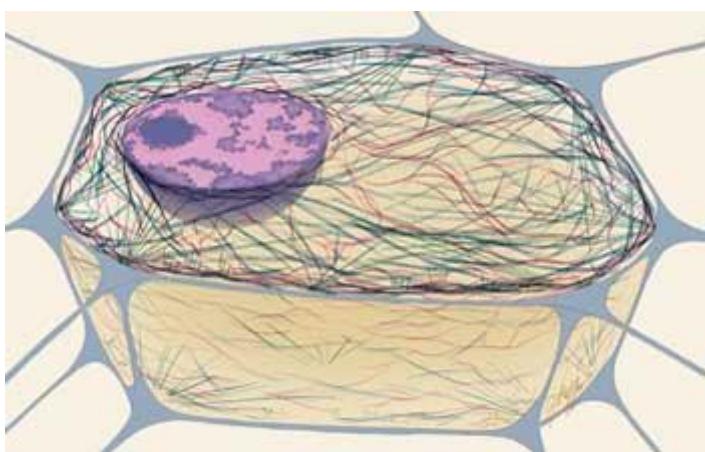
All cells have a **cell membrane**. This is a thin covering around the cell. It **holds all of the parts of the cell inside, and keeps unneeded materials outside**. The cell membrane has **openings** in it, to allow the cell **to bring in nutrients, food, and water, and to get rid of waste**.



The Cytoskeleton (Factory Beams)

In a factory, the interior is supported by walls made of beams (pieces of wood). These beams provide support so that the structure doesn't collapse.

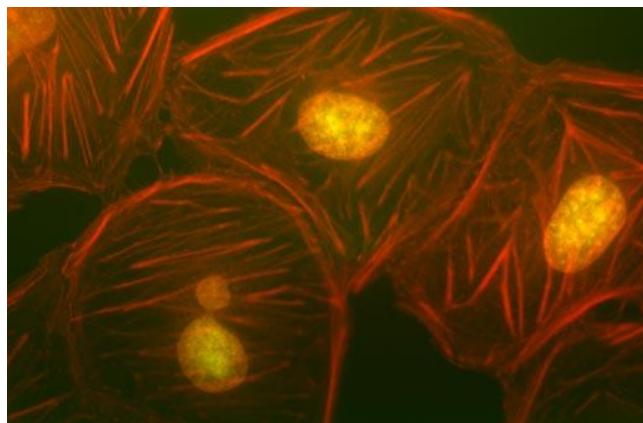
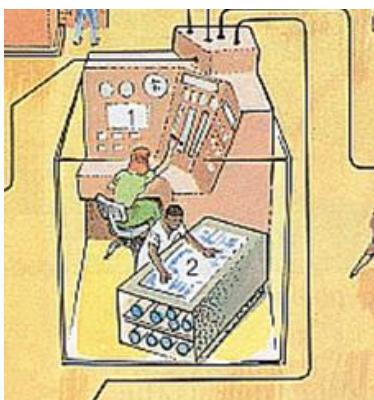
In a cell, the **cytoskeleton** provides structure to the cell (just like a skeleton provides structure to our body). The cytoskeleton is made of very thin pieces, called filaments, that extend from one end of the cell to the other. **It helps to give the cell shape and support**.



The Nucleus (Administrative Office)

The administrative office of a factory is where all of the most important files are kept. This includes all the blueprints for the items the factory produces, as well as instructions for all of the different departments and jobs in the factory. Without the administrative office, nobody would know what to do!

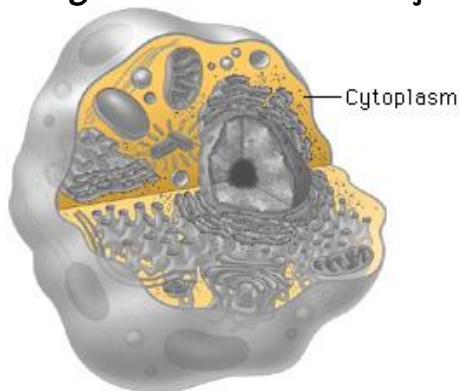
The **nucleus** is the “**brain**” of the cell. This is where the **DNA is stored**. DNA is like a blueprint – a set of instructions for building and maintaining the organism. You get your DNA from your parents...and they got it from their parents...and so on. The nucleus **controls everything that happens in the cell**.



The Cytoplasm (Factory Floor)

The factory floor is where the work gets done. This is where you find most of the materials needed to complete the work being done.

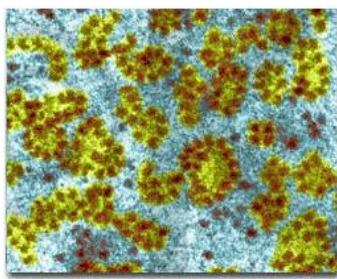
In cells, the **cytoplasm** is also where a lot of the work happens. The cytoplasm is a jellylike substance that **fills the cell** (like water filling a balloon). It is made mostly of water, salts, proteins, and other materials the cell needs. The cytoplasm **holds all of the cell organelles in place**, and these organelles are doing a bunch of different jobs for the cell.



Ribosomes (Workers)

Each factory has many different workers doing many different jobs. These workers do not do anything they want. Instead, they just follow the instructions from the administrative office (i.e. the cell nucleus). Some of them work together on an assembly line. Others move around the factory floor and work on their own.

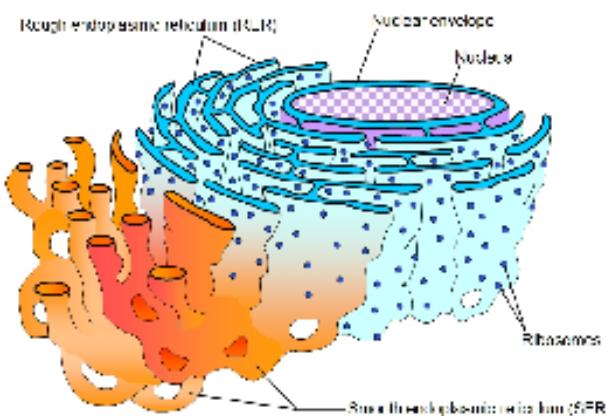
In cells, **ribosomes** create **proteins**. Proteins play a vital role in keeping cells healthy. There are many different types of proteins needed by the cell. Different ribosomes manufacture different proteins. Some ribosomes are attached to the endoplasmic reticulum (see below), while other ribosomes float loose in the cytoplasm.



The Endoplasmic Reticulum (Assembly Line).

In a factory, a lot of the work is set up in rows called assembly lines. Workers sit or stand along the line, and each worker does his or her part and then moves the work along.

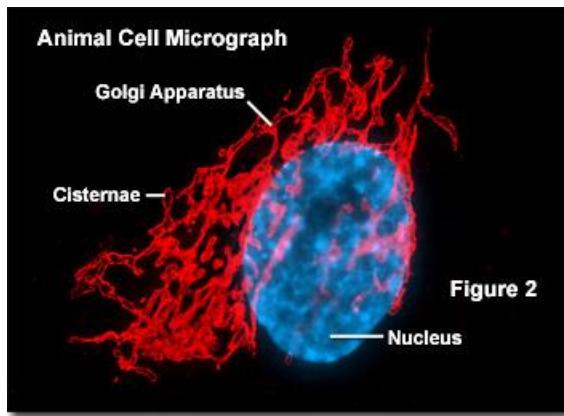
In cells, the **endoplasmic reticulum** is a series of pathways through the cell. It acts as a **transport system, work system, and support system**. It consists of thin membranes that fold in on themselves and create pathways through the cell. There are 2 types of endoplasmic reticulum (also called ER) – rough and smooth. **Rough ER has ribosomes attached**. As the ribosomes build proteins, they are moved along the pathways to the end of the endoplasmic reticulum. **Smooth ER does not have ribosomes attached** – it creates other materials (like steroids), and also helps regulate some cell materials.



Golgi Apparatus (Packaging Department)

What happens when a product comes off the assembly line? It's not quite done yet! It goes to the packaging department, where they inspect the final product, add all the fancy packaging and get it ready for shipping.

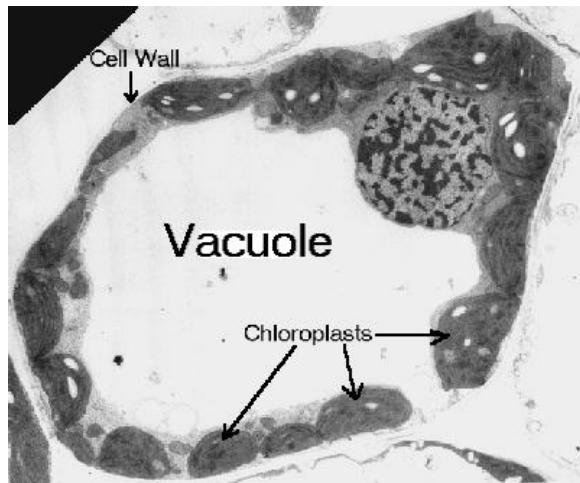
In cells, the **Golgi Apparatus** (also called **Golgi Bodies**) take the proteins that the ribosomes made, and **get them ready to use**. Sometimes they make improvements to the proteins, making them bigger and better. The Golgi Apparatus is the **last step in the protein production**.



Vacuoles (Storage Compartments)

In a factory, there are many materials that must be stored until they're ready to be used. Or, in case of trash, it gets stored until it's ready to be thrown in the dumpster outside.

Cells have storage compartments, too. They are called **vacuoles**. Vacuoles can **hold food and water** that the cell is not using yet. They also **hold waste materials** until the cell can get rid of them. Not all animal cells have vacuoles, and those that do usually have small ones. Plants are different because all plant cells have a very large vacuole called the central vacuole.



Lysosomes (Clean-up Crew)

No factory would be complete without a cleanup crew! These workers make sure the work area is neat by getting rid of used, waste materials.

Cells have a cleanup crew too! They are called **lysosomes** (which means “kill body”). The lysosomes contain powerful protein-digesting enzymes. They **break down waste material**. Without lysosomes, the cell would gather too much “junk” and wouldn’t function.

Mitochondria (Power Plant)

Factories have power generators to keep everything running smoothly. If the power goes out, the lights go off, the machines don’t function, and the work shuts down!

Mitochondria are the “**power plants**” inside cells. They have the very important role of **breaking down food to release the energy stored inside**. Without mitochondria, the cell would not have the energy it needed to function.



Chloroplasts (Solar Energy Converters)

Not **ALL** factories do this, but some factories are “going green” by using solar cells to produce their energy. The power plant can use the solar energy to keep the lights running.

Not **ALL** cells have **chloroplasts** – in fact, only **plants** and **some protists** do. This is because plants (and some protists) make their own food, using energy from the Sun. The chloroplasts are the organelles that are able to **capture energy from sunlight and use it to make food** in the form of sugar. This sugar is what the plant mitochondria will use to break apart to get energy.

