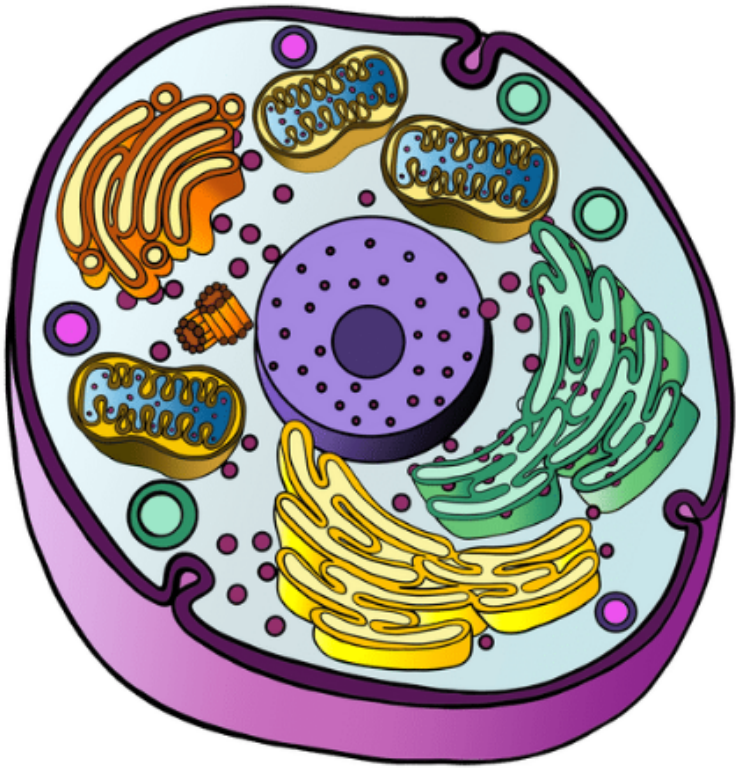
Objectives:

1. Understand the functions of the organelles of eukaryotic cells.
2. Make a comparison of the organelles of a eukaryotic cell to a city.
3. Model the process of protein synthesis within a fungi cell.
4. Understand how and why fungi can produce antibiotics.
5. Represent written text in a visual way.
6. Work with ambiguity in an open-ended activity.



Like animal and plant cells, fungi cells are known as **eukaryotic**. This type of cell contains a wide variety of organelles (like tiny organs) within each cell, that work together to carry out specific functions. Eukaryotic cells also have DNA that is wound into chromosomes, located in the nucleus. **Prokaryotes** (bacteria) generally have one chromosome, while eukaryotes (plants, animals, fungi, protists) can have hundreds of pairs of chromosomes. That's a lot of genetic material to keep track of! Each eukaryotic cell is like a tiny city working together, and each organelle has their role.

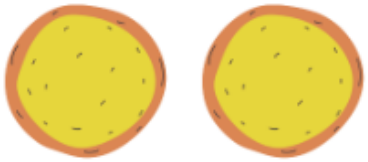
Table: Organelles of a fungal cell and their function.

Organelle	*Description*
Cell Wall	Acts as a protective barrier for the cell. It is made up of a polymer called chitin, which is also found in the shells of crustaceans and the exoskeleton of insects.
Mitochondria	Commonly known as the "powerhouse" of the cell, it's where the cell converts nutrients into usable energy.

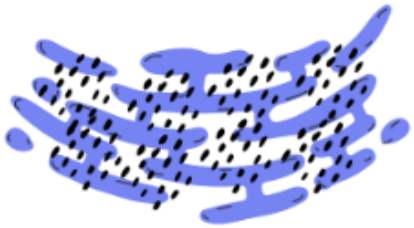
Cell Membrane	Controls the movements of substances in and out of the cell.
Nucleus	Contains the cell's DNA. Sends 'instructions' to the rest of the cell in the form of genetic material. These instructions are read by other organelles.
Cytoplasm	Fluid-filled region of cell that serves as a site for reactions to take place by the organelles.
Rough endoplasmic reticulum (RER)	The site where the synthesis of products occurs.
Golgi apparatus	Receives products from the RER and packages them up for transport to where they are needed.
Vesicles	Transport organelles that carry products to and from various organelles.
Lysosomes	Contain digestive enzymes for breaking down food and other material into smaller components.
Vacuole	Used as storage space, digestion of food, or even maintaining balance of water in the cell's cytoplasm.

1. Create an analogy: choose at least 5 of the organelles listed above. Think about their function and create an analogy for it. What would that organelle possibly be if the cell were a city?

2. In this activity, you will build a fungi cell and then model the synthesis of penicillin by the fungi.
   Cut out the various organelles in the fungi. Arrange the organelles onto the outline of the fungi cell. Some rules to follow:
   - The rough endoplasmic reticulum is usually located *directly next to* the nucleus.
   - The cell wall is the outermost layer of the cell.
   - The cell membrane is located underneath the cell wall.
   - The cytoplasm is not an organelle, but rather a solution acting as the site for organelles to function.
   - Freely place all other organelles within the cell.

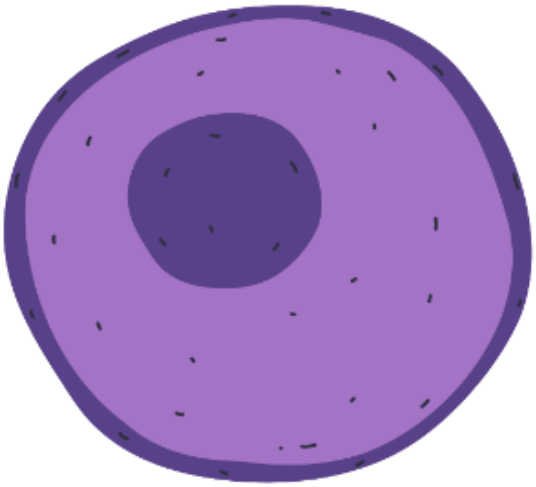


Lysosomes



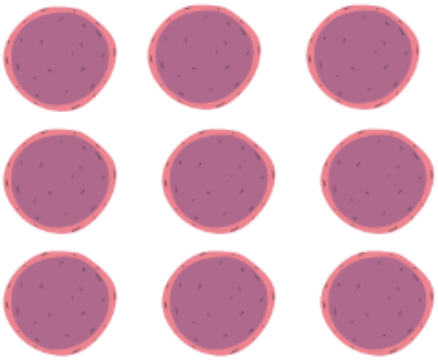
Rough endoplasmic reticulum

Golgi apparatus

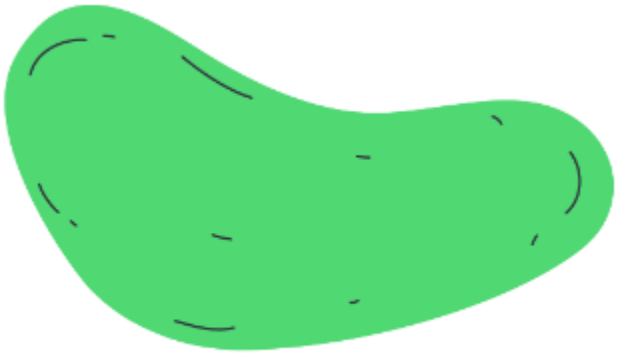


Nucleus

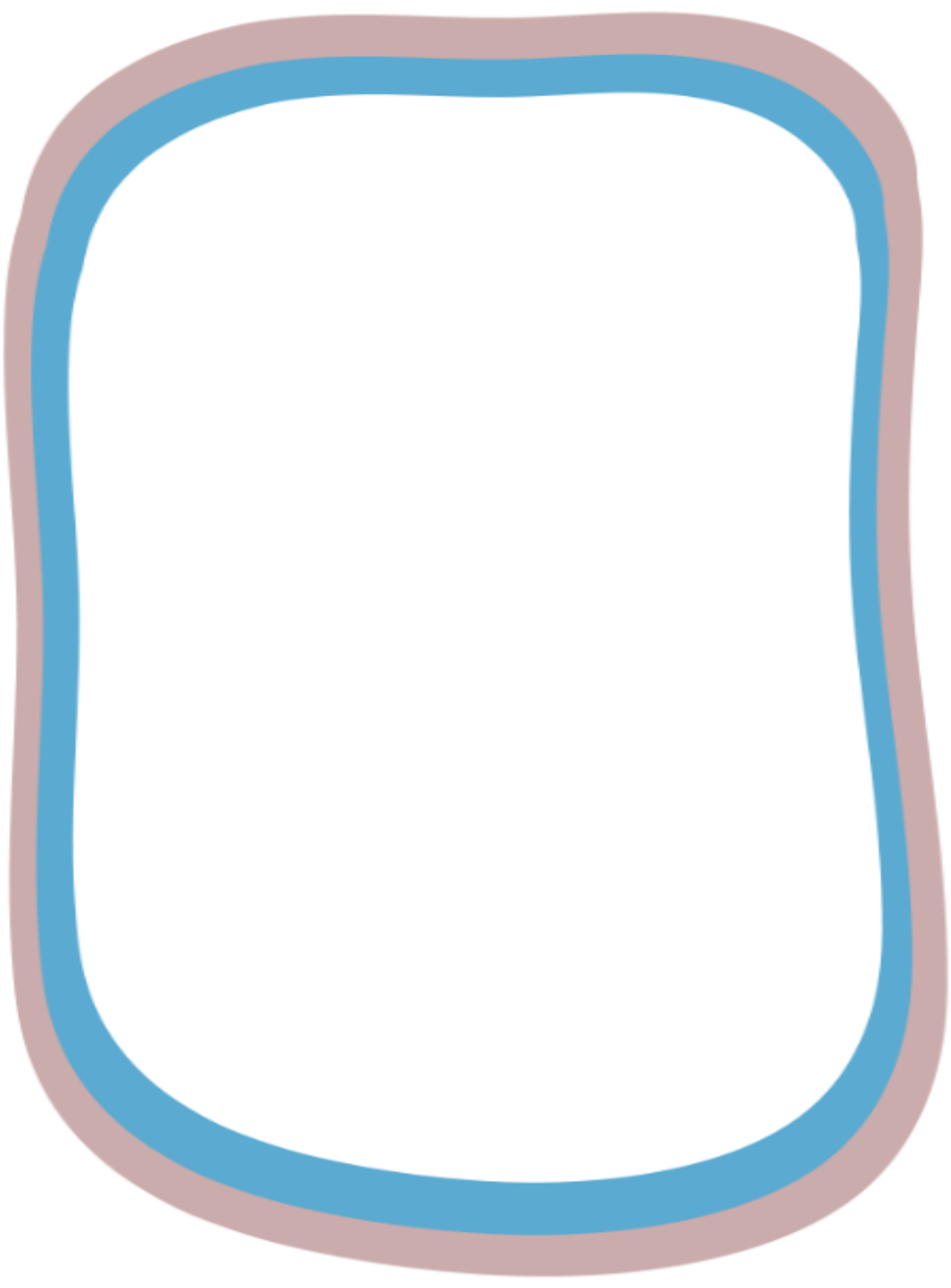
Mitochondria



Vesicles



Vacuole



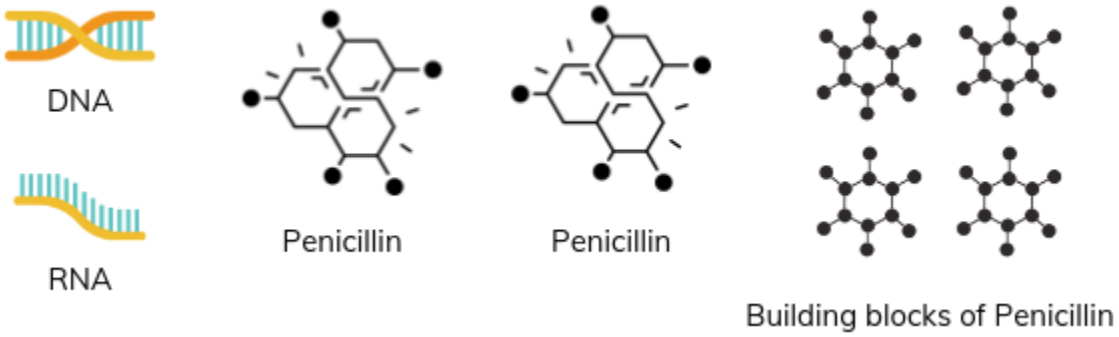
Ever had an ear infection when you were younger? You might have taken an **antibiotic** for it! Antibiotics are a group of chemical compounds that fight bacterial infections. They are used widely in medicine to treat patients, as well as on livestock to prevent sickness in animals. Did you know that fungi produce many powerful antibiotics? Penicillin, a common antibiotic, is produced by a fungus known as *Penicillium chrysogenum* and has become one of the most important medical drugs in history. Discovered by scientist Alexander Fleming in 1929, penicillin works by blocking the growth

of the cell wall, which causes the bacterial cells to be unprotected. This stops their reproduction and growth.

Tetracycline is another common antibiotic and is often prescribed to treat bacteria growth that causes facial acne. It is also produced by a fungi, known as *Streptomyces rimosus*. This chemical compound works by blocking the process of protein synthesis in bacteria, which halts their growth. Penicillin and Tetracycline are products that are made by the cells of the fungi through the process of protein synthesis. But fungi don't create these for the benefit of humans! Through **natural selection**, many fungi have evolved to produce antibiotics as a defense mechanism. This limits competition for resources in the environments where both decomposers live, and gives the fungi an edge in order to grow and reproduce.

3. **Activity:** Model a fungi cell producing penicillin.

Cut out the remaining pieces for your fungal cell.



A. Double-stranded **DNA** contains the genetic information that codes for the production of penicillin.
B. DNA sends the instructions out of the nucleus in the form of a single-stranded **RNA** molecule.
C. RNA goes to the RER, where there are several ribosomes (the black dots) receiving the instructions.
D. The ribosomes read the instructions and produce the **building blocks for penicillin**.
E. Vesicles then pick up these initial parts and transport them to the golgi apparatus.
F. The golgi apparatus processes them into completed **Penicillin**, to be transported outside of the cell.
G. Vesicles transport the finished penicillin from the golgi apparatus to the plasma membrane where it will move through a channel and leave the cell. (Remember they are needed outside of the fungi if they are going to kill bacteria in the surrounding soil!).

Using the steps and cut-outs above, model the process of producing penicillin. This could be in the form of a narrated video, series of images, or annotated poster.