SNC1L

GRADE 9 SCIENCE

INTRODUCTION & UNIT 1
BIOLOGY

Course Description

Welcome to Grade 9 Science, SNC1L

The course is divided into four units of five lessons each. This package contains the introduction to SNC1L and the first unit of the course, life-sustaining processes in simple and complex organisms. The other three units will be forwarded to you when you have successfully completed and submitted all of the key questions from Unit 1.

This is an introductory course in science that will allow you to learn about the basic concepts involved in biology, chemistry, physics and scientific inquiry. Each of these topics explore a range of topics including life-sustaining processes in simple and complex organisms, properties of common materials, electrical circuits and science in daily life. The course is designed to help you develop your mathematical and scientific process skills and to continue developing your skills in reading, writing and oral language through practical and relevant science activities. You will be asked to design and conduct investigations related to the 4 topics of study allowing you to put your practical problem solving abilities to use and to apply your knowledge of science to everyday situations.

This course will provide you with considerable knowledge in science and prepare you for the next level of study and success in everyday life. If you wish to continue study science this course prepares you for the Grade 11 Workplace Preparation course, SNC 3E.

Materials

There are four lesson books in this course, one for each unit of study. Although you do not require a textbook to complete this course, you may find the following 2 textbooks helpful if you require more clarification for science concepts mentioned throughout the lessons. Both books are currently used in Ontario Schools.

- Bob Ritter, et al., *Science 9* (Toronto: Nelson Canada, 1995).
- Elgin Wolfe, et al., *Sciencepower 9* (Toronto: McGraw-Hill Ryerson, 1999).

These textbooks should be available in public libraries. Another great resource would be the following web pages if you have access to the internet

- http://biology.about.com/
- http://chemistry.about.com/
- http://www.sciencemadesimple.com/static.html
- http://www.thinkquest.org/library/websitena.html?28032
- http://www.cellsalive.com/

If you do not have a computer at home, free internet access is available in public libraries. There are many different resources that will be of great help to you, as you work through the course, you will become aware of reference materials that you may want to use.

As you work through each unit and lesson you may find it helpful to have extra paper for rough work, a ruler, calculator, pencil, eraser and pen on hand as you complete your work.

Practical Investigations

Practical investigations are an essential part of learning science. You will be asked to do several practical investigations throughout the course to help you to better understand the scientific concepts being presented. Some of the materials you will need to complete these investigations can be found in your home, from a hardware store, grocery store, or even your local dollar store has several items that you may require. You will find a list of required materials at the beginning of each unit.

When writing a report for your practical investigation, use the following headings:

- Hypothesis
- Materials
- Safety Precautions
- Procedure
- Observations
- Analysis/Evaluation
- Conclusion

Expectations

The first page of each unit will list overall curriculum expectations. More specific expectations will be listed at the beginning of each lesson. Each of the specific expectations are listed under the heading “What You Will Learn” because they directly relate to what we expect you will learn after completing each lesson. Each of the specific expectations will be evaluated using the key questions.

Coursework and Evaluation

In each lesson, there are support and key questions. You will be evaluated on your answers to the key questions in each lesson and on the final test.

Important Symbols

Support Questions

These questions will help you to understand the ideas and to master the skills in the course. The support questions will be indicated using the pencil icon, showed to you here on the left side of the page. They will help you to improve the way you communicate your ideas. The support questions will prepare you for answering the key questions.

Write your answers to the support questions in your notebook. Please DO NOT submit these questions to be marked. You can check your answers against the suggested answers given at the end of each unit.

Key Questions

The key questions evaluate your achievement of the expectations for the lesson. The key questions will be indicated using the key icon, showed to you here on the left side of the page. Your answers will show how well you have understood the ideas and mastered the skills and also how well you communicate your ideas.

You must try all the key questions and complete most of them successfully in order to pass each unit. Save your answers to the key questions until you have finished all the lessons in the unit. Remember to label your work with the unit, lesson, and key question numbers.

What You Must Do To Get a Credit

In order to be granted a credit in this course, you must

- ☑ Successfully complete the **Key Questions** for each unit and submit them for evaluation within the required time frame.
- ☑ Complete the **mid-term exam** after Unit 2.
- ☑ Complete and pass a **final examination**.

Important Symbols

Remember, questions with this symbol are **Key Questions** that give you an opportunity to show your understanding of the course content. Ensure that you complete these thoroughly as they will be evaluated!

Final Exams

Every Learn-at-Home credit course has a **midterm exam** and **final exam**. After you have successfully completed Unit 1 and 2 of your course, you will receive information about writing a **midterm exam**. After you have successfully completed Unit 3 & 4 of the course, you will be given information about writing a **final exam**. You must complete and pass both of these exams to successfully complete the course.

Your Final Mark

Your final mark will depend upon the following criteria:

• Each Unit has 5 lessons each worth 2% (10% per Unit x 4 Units)	40%	} Term
• Midterm Test	30%	
• Final Examination	30%	

Table of Contents

Unit 4: Science in Daily Life

Lesson 16: Scientific Method

Lesson 17: Scientific Skills and Tools

Lesson 18: A “Fair Test”

Lesson 19: Create Your Own Investigation

Lesson 20: Workplace Case Studies

Suggested Answers to Support Questions

SNC1L is based on the Ministry of Education curriculum policy document *The Ontario Curriculum, Grades 9 and 10, Science, 1999*.

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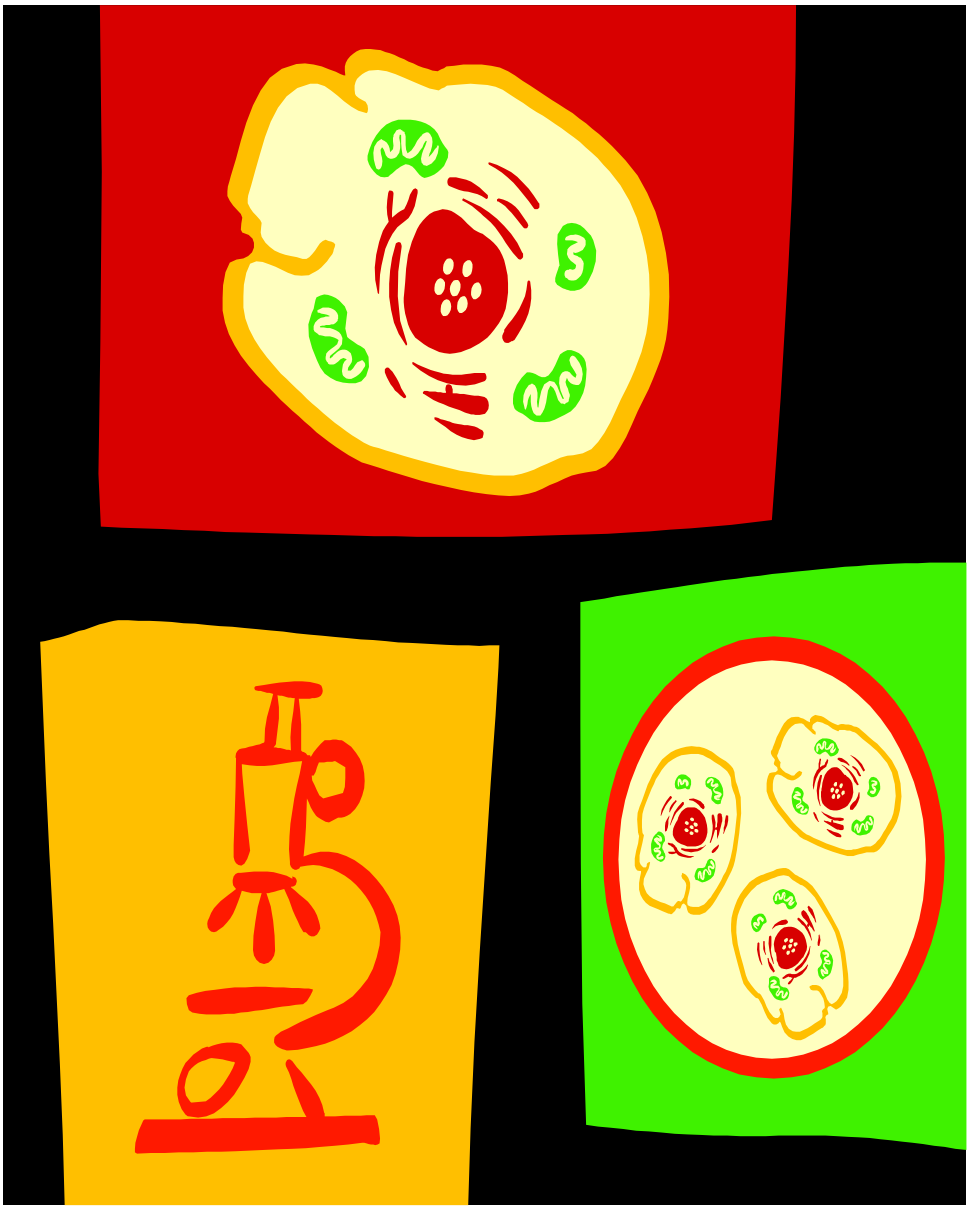
Unit 1



Biology: Staying Alive

Introduction

The world is full of living things. Throughout this Unit you will learn about the fascinating world of cells and cellular division, more commonly known as Reproduction. The cell and its extraordinary abilities have been a focus of human study for the last two centuries. Throughout this unit, you will retrace the scientific journey that led to an understanding of the cell as the basic unit of life. You will also observe the cycle responsible for cell growth and reproduction, and explore the asexual reproduction of organism.

Overall Expectations

After completing this unit, you will be able to

- Explain the systems and processes required by simple and complex organisms to sustain life;
- Investigate, through laboratory activities, the processes which simple and complex organisms use to sustain life;
- Analyse how personal health and safety in everyday life and in the workplace are protected through the proper use of equipment and safety practices.

Materials Required

In this unit, you will need the following material

- Pencil
- Ruler
- Scissors
- Whole flowers (at least 2, maximum 4)
- Coloured pencils
- Small paint brush
- Hand lens (magnifying glass)
- Tweezers
- Small knife
- Approximately 10 sheets of white paper
- Computer with internet access
- Piece of bread
- Piece of cheese
- 2 sandwich size Ziploc plastic bags
- Paper towel
- Poster board
- Coleus plant *(ask for help when looking for this type of plant, if you need an alternative plant, explain to the salesperson what it is you are trying to do and ask them to recommend an appropriate plant)*
- 3 small glass jars *(3 small baby food jars would be acceptable)*
- Potting soil *(**1** small bag)*
- 3 small plastic flower pot *(should be twice the size of the jars that were used previously)*
- Twist ties *(at least 3)*
- Popsicle sticks *(at least 3)*

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Lesson 1

Cells and Living Things

Introduction

The cell is the basic unit of life. All living things are composed of cells. All of the living organisms on Earth are divided in pieces called cells. There are smaller pieces such as **proteins** and **organelles**. There are also larger pieces called **systems** and **communities**. Cells are small compartments that hold all of the biological equipment necessary to keep an organism alive and successful on Earth.

What You Will Learn

After completing this lesson, you will be able to

Describe the basic life-sustaining processes of organisms, including single celled and complex organisms (e.g., ingestion of food, waste removal, gas exchange, material transport, response to environmental stimuli, reproduction) using appropriate scientific vocabulary

Relate structures involved in life-sustaining processes to their function (e.g., nucleus and reproduction, membranes and diffusion, components of respiratory system to gas exchange)

Outline how a complex organism functions through the basic interactions between organ systems (e.g., connection between respiratory and circulatory systems in animals, between roots and leaves in plants)

Communicate observations, interpretation of results, and information through appropriate formats (e.g., diagrams and written work)

Extract and interpret information from a variety of sources (e.g. information texts, lab instructions, Internet, electronic databases)

Characteristics of Living Things

Every individual living thing is made of smaller parts. The smaller parts have different functions, but all of the parts work together to enable the individual to live and survive in its environment. The smaller parts are made of even smaller parts, which are made of smaller parts, and smaller parts, until you reach the smallest part of all: the **cell**. The cell is the basic building block of all living things.

What makes something alive? A bird walking around and eating is obviously alive. A crab walking on a rock is alive. Is an amoeba alive? It has no legs, brain or eyes. Can something that small be alive? To a biologist the answer is "yes". When biology says something is alive it is not based on thinking and consciousness but about surviving and reproducing. There are some **basic rules** for defining life.

Things that are alive do the following 8 basic things:

(1) They move. It might be as obvious as a walking dog or something very subtle like the sap flowing through a tree. Rocks are not alive because they do not move on their own.

(2) Things that are alive (on Earth) have cells. They might be one cell or billions. The basic organization of an organism is a cell. Trees have cells. Animals have cells. A teapot does not have cells. An amoeba is only one cell but still a cell.

(3) Those cells have chemical reactions happening. Inside of all cells there are thousands of reactions happening all of the time. Scientists call all of those reactions the cell's **metabolism**.

(4) Cells and organisms like to stay healthy. Just think about you. Your body likes to be a certain way. When you are hungry you eat and when you are tired you sleep. Your body wants to be healthy and feel its best. Scientists call that desire to stay a certain way **homeostasis**.

(5) Living things grow and change. You start as one cell and wind up as millions. A tree might start as one cell and grow to be 100 feet tall. An amoeba gets bigger and bigger until it needs to divide. Leading to…

(6) Living things reproduce. They may have babies or they may just split into two pieces like an amoeba. When an organism has a baby it is called **sexual**

reproduction. Splitting in two pieces is called **asexual reproduction**. Asexual and sexual reproduction are two ways that organism can reproduce. Both concepts will be covered in Lesson 3.

(7) Organisms also react to their environment. You pull back when someone pokes you with a pin. An amoeba might ooze away if it senses poison in the water. Even a tree will grow a certain way to get the best light. Those reactions lead to…

(8) Creatures change over time. We're not talking about your moving from a hot to a cold area. We're talking about over millions of years. Organisms and species change. They may get better suited for their surroundings and do well. They may also change for the worse and die off. Rocks don't change over millions of years. It may become sand but its structure and makeup haven't changed.

Are there things that may or may not be alive? Yes. There are things called **viruses**. While a virus may be able to move and react to its surroundings, it needs a host cell for growth and reproduction. Scientists know it is not dead like a rock or a microwave oven. But it fails to meet the criteria (definitions) of a living organism.

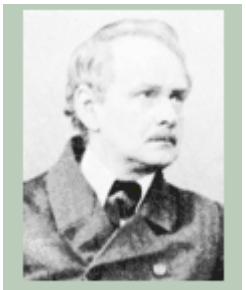
Cells and Their History

Every organism that you can think of, whether it be an octopus or a bird, a snail or an ant, is made of cells. Humans are made of literally *billions* of cells. We can't see them though, because cells are so small that they can only be seen under a microscope. Most organisms, like us, are made up of many different types of cells. Some carry oxygen in our blood, some produce sweat, and some allow us to feel whether it's hot or cold.

The study of cells is known as **cytology**. **Cytology** began in 1665, when **Robert Hooke**, an English scientist, first glimpsed into the microscopic world of cells by examining dead cork cells under a primitive microscope which he constructed. However, all Hooke was able to observe were the thick walls that surrounded each cell. The thought that cells might be the basis for life was not to come for nearly two centuries.


Rudolf Virchow

During the next 170 years, other scientists used microscopes to further advance their knowledge of cells. The most important discovery during that period came in 1838, when a German botanist named **Matthias Schleiden** suggested that all plant tissues are made of cells. Just one year later, zoologist


Matthias Schleiden

Theodore Schwann made a similar proposal for animals. In 1858, **Rudolf Virchow** suggested that all cells come from pre-existing cells. The ideas of these three scientists led to the creation of what is now called the **Cell Theory**. The three main aspects of the **Cell Theory** are:

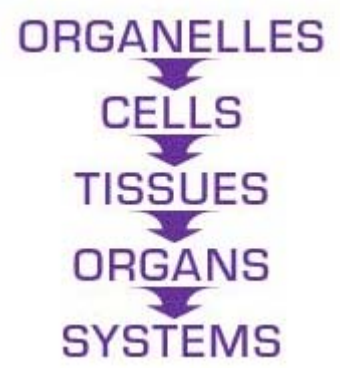
1. **All living things are composed of one or more cells.**
2. **Cells are the basic unit of life.**
3. **All cells come from other cells**.

Support Question ***(the following questions are NOT to be submitted for evaluation)***

1. Describe, in your own words, five characteristics of living things.
2. Discuss what contribution **Robert Hooke** made to the discovery of the cell.

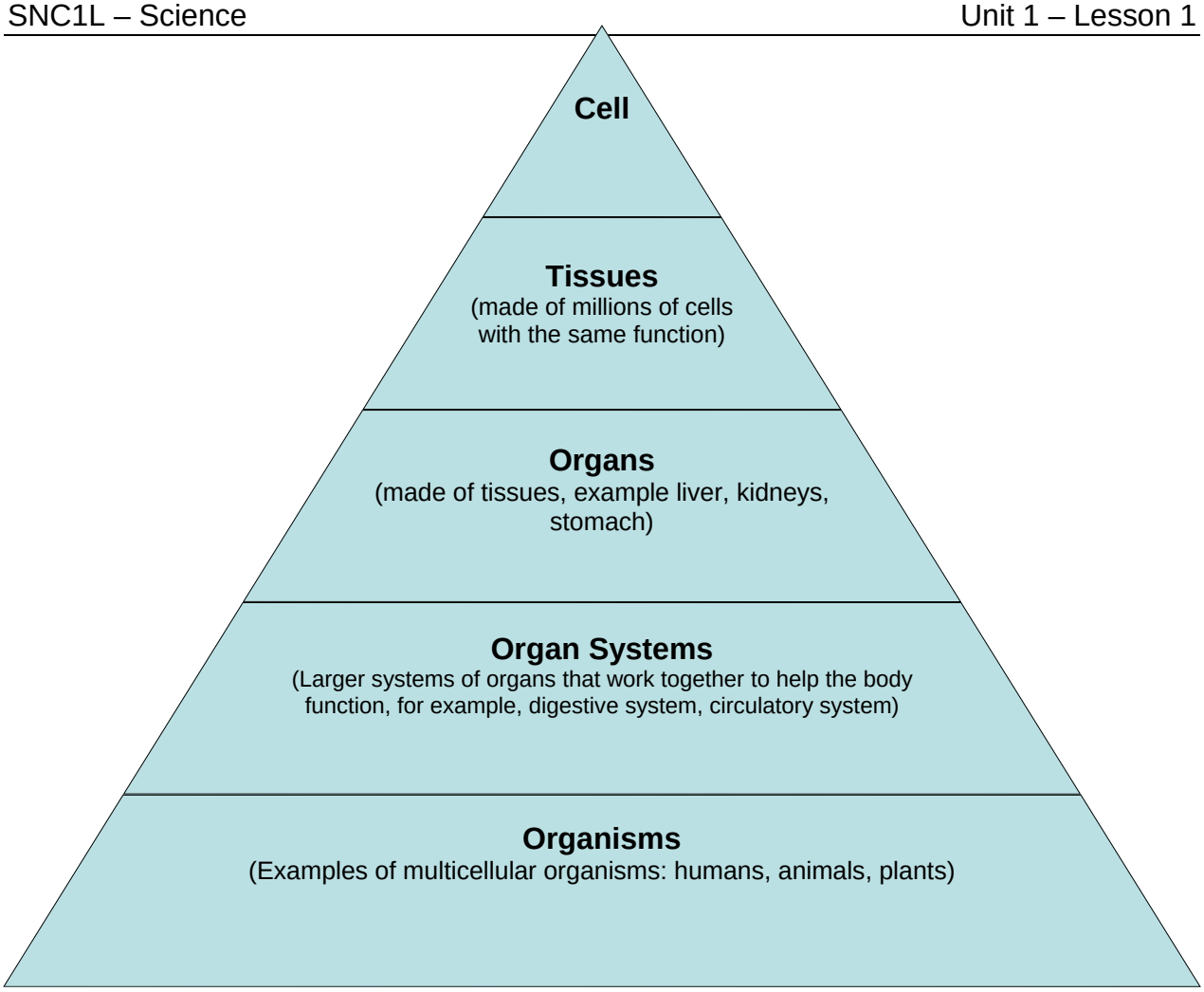
Cell Organization

A main purpose of a cell is to **organize**. Cells hold a variety of pieces, which are called **organelles**, and each cell has a different set of **functions**. It is easier for an organism to grow and survive when cells are present. You could only get to a certain size if you were one cell. Being one cell you certainly would not have the ability to think, lift objects, and run.



There are billions of different kinds of cells. In organisms that contain more than one cell, referred to as **multi-cellular** organisms (**multi** means ***many***), cells are arranged in groups called **tissues**. The individual cells that make up the tissues all have the same structure and function. For example, your heart is a muscle, made of tissue, which consists of thousands of specific cells that all carry out the same function or job. The job of the heart is to contract and relax so that oxygenated blood is pumped throughout your body, therefore each individual cell of the heart muscle works together to carry out the function of the heart. Every part of your body has a different kind of cell, cells to carry out the specific function of the body part. Liver cells are different from blood cells, which in turn are different than bone cells and lung cells.

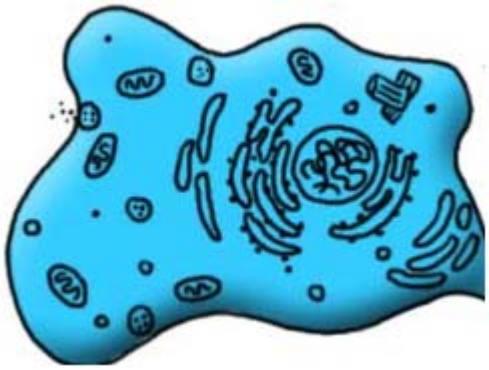
The diagram following summarizes how cells are organized in multi-cellular organisms, plants or animals.



Support Questions ***(the following questions are NOT to be submitted for evaluation)***

3. List the **3** statements that make up the **Cell Theory**, and explain them in your own words.
4. Discuss the importance of ***cell organization***.

Plant & Animal Cells



There are many types of cells. You will usually work with plant-like cells and animal-like cells. We say animal-like because an animal type of cell could be anything from a tiny organism, like an amoeba, to a nerve cell in your brain.

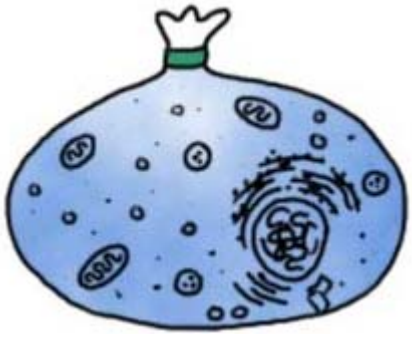
Cells have tiny structures inside of them called organelles. Organelles are very similar to human organs in that they help perform specific functions. However, cells don't have organelles called the liver or the heart. Some of the names of cell organelles include the mitochondria, lysosome, and the endoplasmic reticulum.

The cell organelles float around in a fluid like substance called the cytoplasm. The cytoplasm is similar to very watery jelly. As the cytoplasm moves around within the cell, organelles can come into contact with one another, allowing certain processes to occur. Just like humans, cells need to perform certain processes similar to our processes for eating, breathing, and reproduction.

Structures and Functions

Cell Membrane and Cell Wall

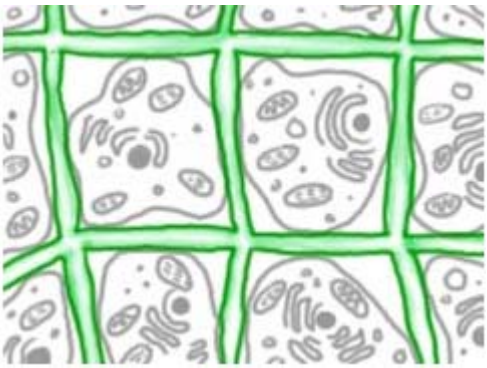
Surrounding every cell is some sort of covering that keeps what's inside the cell inside and prevents harmful particles from the outside environment from entering the cell. There are two types of organelles which serve as a covering for the cell: the **cell membrane** and the **cell wall**. All cells have a cell membrane and certain cells also have a cell wall.



Let's look at the **cell membrane** and see how that membrane keeps all of the pieces inside. When you think about a membrane, imagine it is like a big plastic bag with some tiny holes. That bag holds all of the cell pieces and fluids inside the cell and keeps any nasty things outside the cell. The holes are there to let some things move in and out of the cell. The **cell membrane** controls what is allowed in or out of the cell.

While cell membranes might be around every cell, **cell walls** are only found in plant cells. **Cell walls** are made up of specialized sugars called **cellulose**. This cellulose provides a protected framework for a plant cell to survive. It's like taking a water balloon and putting it in a cardboard box. The balloon is protected from the outside world.

Cell walls are around to help a plant keep its **shape**. While they do **protect** the cells,



cell walls and cellulose also allow plants to **grow to great heights**. While you might have a skeleton to hold you up, a 100 foot tall redwood tree does not. It uses the cell walls to maintain its shape. For smaller plants, **cell walls** provide elasticity. Wind can push them over and then they bounce back.

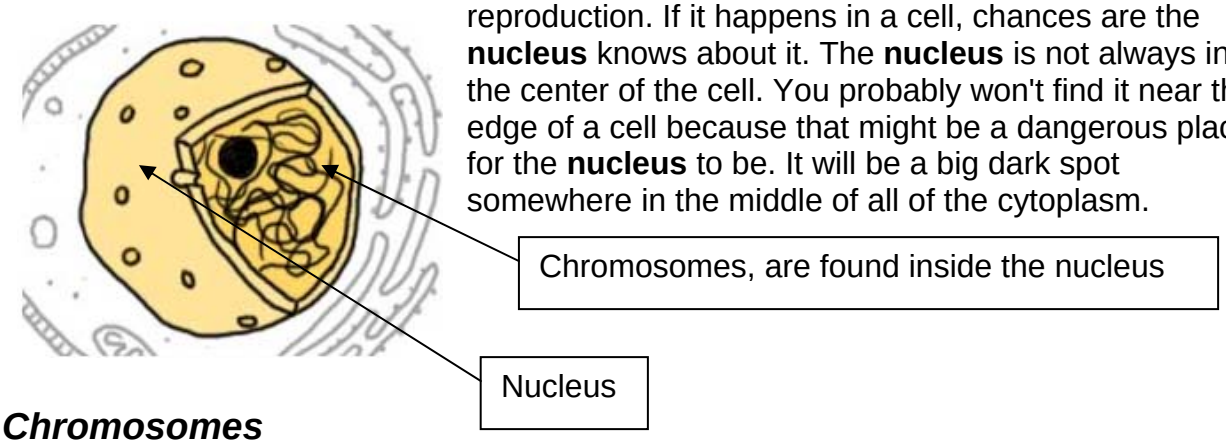
A cell wall is not a fortress around the delicate plant cell. There are actually small holes in the wall that let nutrients and waste pass through.

Cytoplasm

Cytoplasm is the fluid that fills a cell. Scientists used to call the fluid **protoplasm**. The organelles of the cell are suspended in the **cytoplasm**. While you will discover that the various different organelles set up a "skeleton" of the cell, the **cytoplasm** fills the spaces. The **cytoplasm** has many different molecules dissolved in solution. You may discover enzymes, fatty acids, sugars, and amino acids that are used to keep the cell working. Waste products are also dissolved before they are taken in by vacuoles or sent out of the cell.

Cell Nucleus

The **cell nucleus** is like the brains of the cell. It helps control eating, movement and reproduction. If it happens in a cell, chances are the **nucleus** knows about it. The **nucleus** is not always in the center of the cell. You probably won't find it near the edge of a cell because that might be a dangerous place for the **nucleus** to be. It will be a big dark spot somewhere in the middle of all of the cytoplasm.

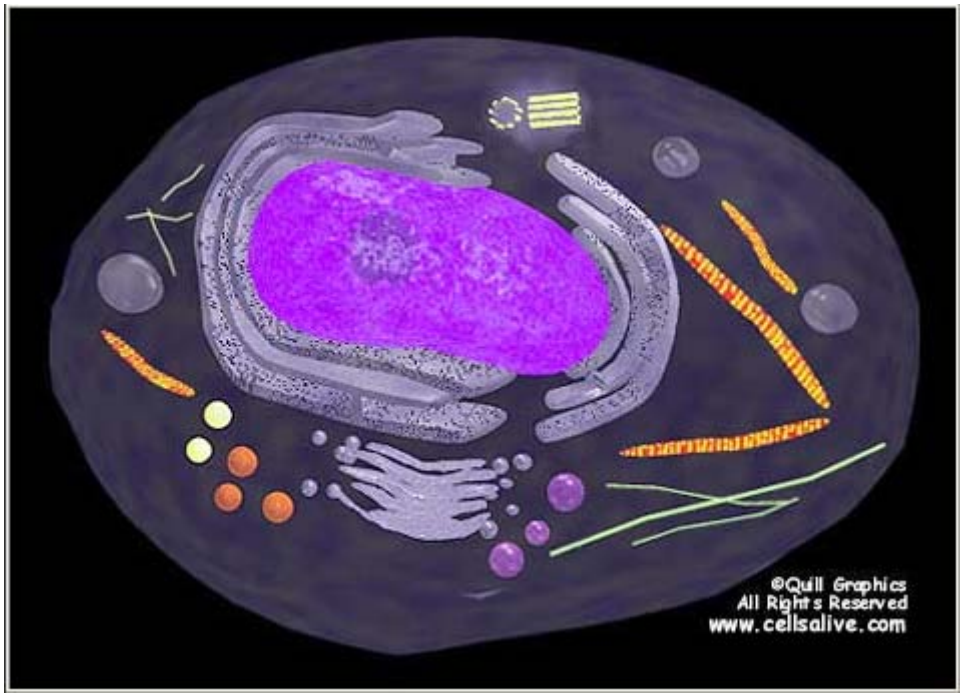


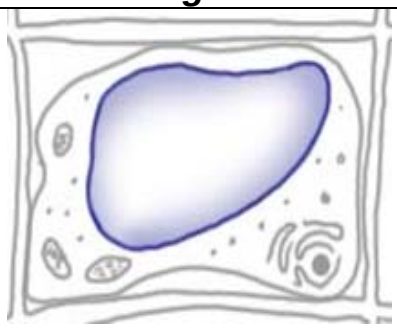
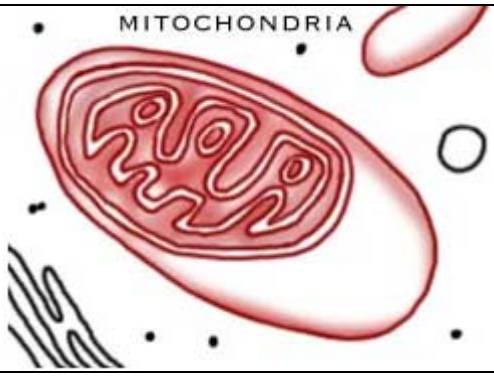
Chromosomes

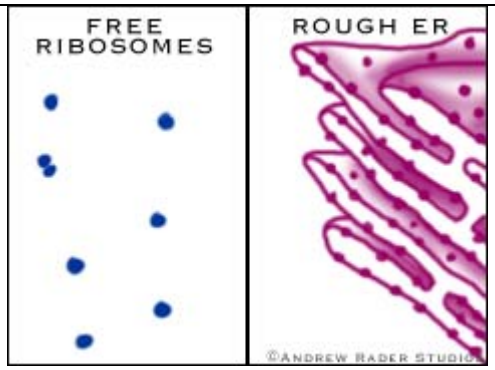
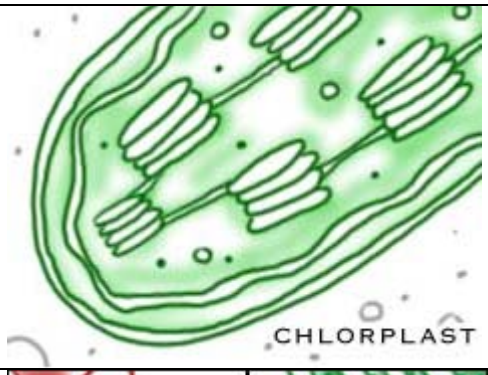
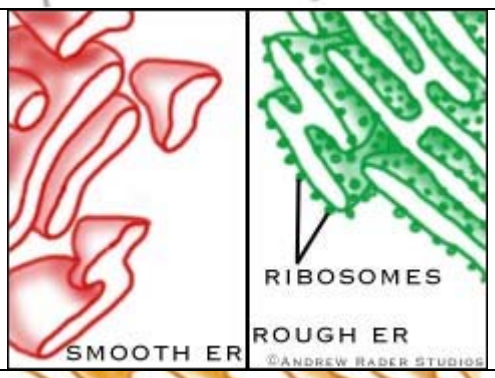
Chromosomes are the things that make organisms what they are. You have already read that the nucleus of a cell acts as the control centre for all cellular functions. Inside the nucleus is the genetic material **deoxyribonucleic acid (DNA)**. This genetic material is organized into threadlike structures called **chromosomes**. Each chromosome contains many different **genes**, small units of DNA that contain the information necessary for all cell functions and that determine the characteristics of an individual.

Your genes make you who you are. Your genes will decide if you have blonde hair, brown eyes, if you become short or tall in height or whether you have athletic abilities or artistic abilities. You will find the chromosomes and ***genetic material in the nucleus of a cell***.

The following diagram is a typical **animal cell**.

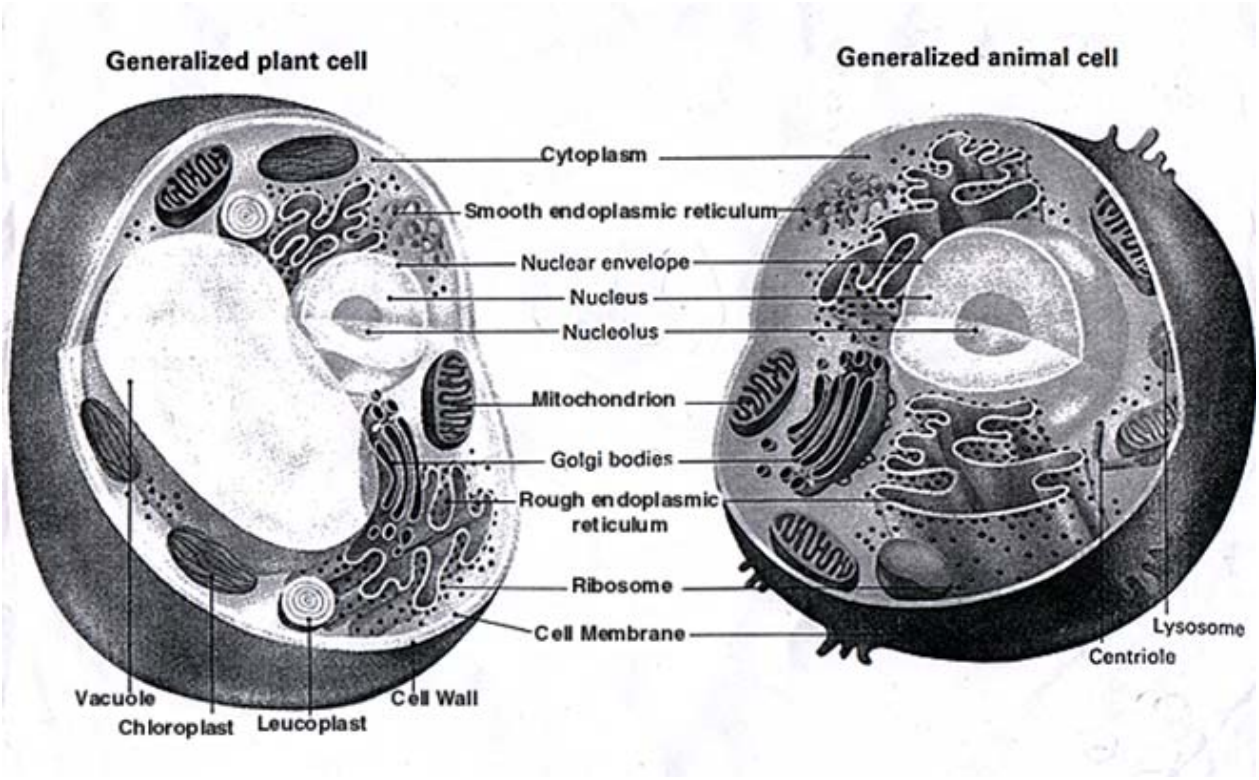


Cell Organelle	***Diagram***	***Function***
Vacuole		Vacuoles are storage bubbles that are found in cells. They are found in both animal and plant cells but are much larger in plant cells. Vacuoles might store food or any variety of nutrients the cell would need to survive.
Mitochondria		The mitochondria are known as the powerhouses of the cell. They are the organelles that act like a stomach that takes in nutrients, breaks them down, and creates energy for the cell.

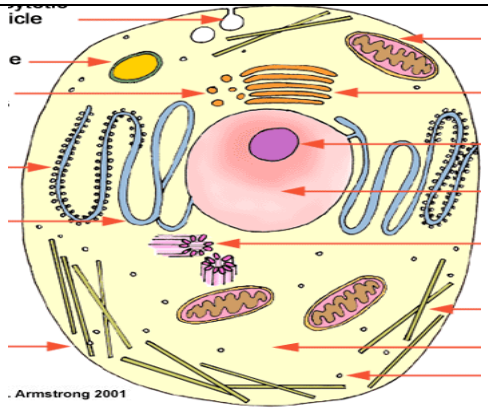
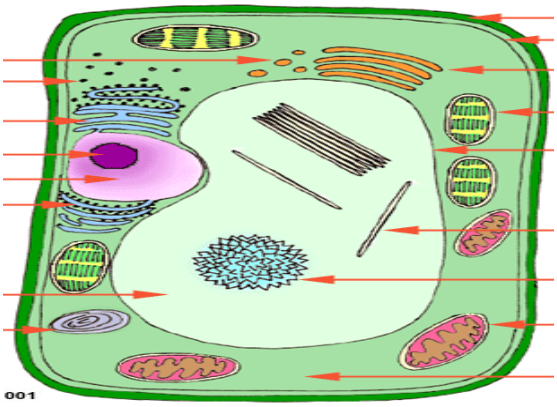
Ribosome		Cells need to make proteins. Those proteins might be used as enzymes or as support for other cell functions. When you need to make proteins you look for ribosomes. Ribosomes are the protein builders or the protein synthesizers of the cell.
Chloroplast		Chloroplasts are the food producers of the cell. They are only found in plant cells.
Endoplasmic Reticulum		The Endoplasmic Reticulum (ER) acts as a packaging system. It creates a network of membranes throughout the entire cell. The ER may also look different from cell to cell, depending on the cell's function.
Golgi Apparatus		The Golgi Apparatus is another packaging organelle like the endoplasmic reticulum. The Golgi Apparatus gathers simple molecules and combines them to make more complex molecules. It then takes those big molecules, packages them in vesicles and stores them for later use.

Lysosome		You will find organelles called lysosomes in nearly every animal-like cell. Lysosomes hold enzymes that were created by the cell. They exist in the cell to digest. They might be used to digest food or break down the cell when it dies.

The diagrams below show typical cells as viewed with a microscope.



Differences Between Plant and Animal Cells

Animal Cell	***Plant Cell***
	
• Animal cells only have a cell membrane	• Plant cells have both a **cell wall** and a cell membrane
• The mitochondria is responsible for creating energy for the cell	• Plant cells have chloroplast to help produce energy. Chloroplast converts energy from the sun into a useable form used by the plant.
• The animal cell has **many small vacuoles** for storage.	• The plant cell has **one large vacuole** used for storage.

Support Questions ***(the following questions are NOT to be submitted for evaluation)***

5. Discuss the importance of the following cell parts: nucleus, cytoplasm, mitochondria, chromosomes, chloroplast, ribosome and lysosome.
6. Discuss **2** different ways that a plant cell is different from an animal cell.

Key Questions #1

A) Explain why the **nucleus** is considered to be the control center of the cell. (2 marks)

B) Discuss why the **cell wall** is necessary for plant cells but **not** for animal cells.

C) On a 8 ½ x 11 (regular size) piece of paper, create a very detailed diagram of either a plant or animal cell (your choice). Include labels of each of the organelles mentioned in Lesson 1. Your diagram must be **neatly drawn**, labeled organelles should be **written in pencil**, and a **ruler** must be used so that the labels are written horizontally on the page. (2 marks for neatness + 2 marks for accuracy of drawing + 10 marks for labels = **total 14 marks**)

These Questions must be submitted for evaluation!

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Lesson 2

Cell Division

Introduction

Have you every wondered how an organism grows? There are approximately 100 trillion cells in your body, all of which started from a single cell – a fertilized egg. Every living organism must grow and reproduce. Neither growth nor reproduction can occur without cell division. Cell division and all of the functions of cells are determined by the genetic information contained in the nucleus of each cell. In this lesson, you will learn about how living things grow through the process of cell division.

What You Will Learn

After completing this lesson, you will be able to

Describe the basic life-sustaining processes of organisms, including single celled and complex organisms (e.g., ingestion of food, waste removal, gas exchange, material transport, response to environmental stimuli, reproduction) using appropriate scientific vocabulary

Relate structures involved in life-sustaining processes to their function (e.g., nucleus and reproduction, membranes and diffusion, components of respiratory system to gas exchange)

Communicate observations, interpretation of results, and information through appropriate formats (e.g., diagrams and written work)

Extract and interpret information from a variety of sources (e.g. information texts, lab instructions, Internet, electronic databases)

The Cell Cycle

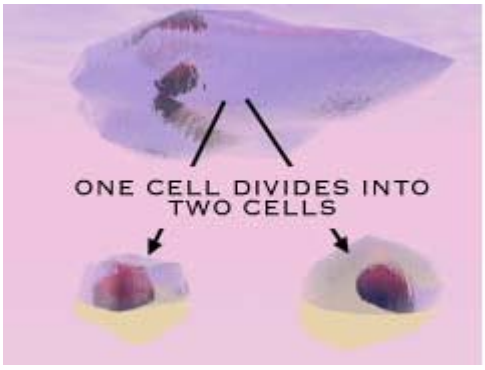
During their lifetime, cells undergo a process of growth which ends either in death or reproduction. Since the general stages of this cycle are the same for all cells, it has been called the cell cycle. It has two main stages. The first stage, **mitosis**, refers to the division of the nucleus and the genetic information contained inside the nucleus, called DNA. The other stage is called **interphase.** Interphase is the stage of growth which occurs between each division of the nucleus.

Reasons for Cell Division

Where and when does mitosis occur? Eventually cells need to duplicate. Cells divide for the following reasons:

- **Growth** – all growth (increase in number of cells) in individual organisms takes place by mitosis, from the fertilized egg to death.
- **Replacement** – many cells are routinely replaced in organisms. The replacement of cells is done by mitosis. For example, we replace the cells that line our digestive track every one to three days.
- **Repair & Maintenance** – mitosis is used for repair and replacement of damaged cells or tissues, whenever possible. This includes regeneration of lost parts of some organisms.
- **Reproduction** – cells divide to create new organisms. A single-celled bacterium divides to form two identical bacteria. Cell division is also necessary to reproduce multi-cellular organisms.

The Process of Cell Division



There are two main methods of replication, **Mitosis** and **Meiosis**. The process of Mitosis is the process by which the cell gives identical copies of its DNA to each of the new daughter cells produced. Mitosis ensures that somatic cells replicate producing two new exact copies of the original cell. Nothing changes in these new cells, all of the same organelles and genetic information are present. Meiosis is the process used for reproducing sex cells. Sex cells would be the cells used for reproduction, for example, in the case of human reproduction sperm or egg cells would replicate by Meiosis.

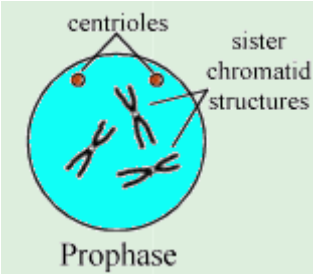
This lesson will talk about mitosis. The big idea to remember is that mitosis is the simple duplication of a cell and all of its parts. The cell duplicates its DNA (genetic information) and the two new cells, always referred to as ***daughter cells***, have the same pieces and genetic code. Two identical copies come from one original. Start with one; get two that are the same. You get the idea.

The Phases of Mitosis

Mitosis is the process by which the cell gives identical copies of its DNA to each of the new daughter cells. Although the process does not start and stop into different stages, biologists have separated it into four phases in which major changes occur. These phases are prophase, metaphase, anaphase, and telophase. You should remember the term **PMAT** (pronounced PeeMaht). **PMAT** is the acronym for the phases of a cell's existence. It breaks down to PROPHASE - METAPHASE - ANAPHASE – TELOPHASE. We suppose it would be good to know what happens during those phases. Always remember - PMAT!

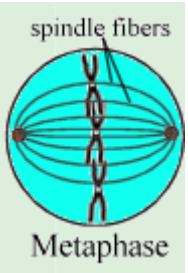
Prophase

A cell gets the idea that it is time to divide. First, it has to get everything ready. You need to duplicate DNA, get certain pieces in the right position, and generally prepare the cell for the process of mitotic division.



During prophase, the chromosomes in the nucleus shorten and thicken and become visible. Both the nucleus and the membrane that surrounds the nucleus disappear. The genetic information is released into the cell so that it can be organized for later stages when it will be evenly divided between the two new daughter cells. It becomes obvious that the cell is getting ready to divide.

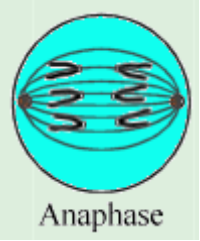
Metaphase



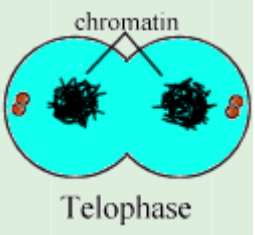
Now all of the pieces have aligned themselves for the big split. The DNA lines up along a central axis, or middle of the cell. Metaphase ends when all of the chromosome pairs are aligned in the center of the cell.

Anaphase

The separation begins. Half of the chromosomes are pulled to one side of the cell; half go the other way. When the chromosomes get to the side of the cell, it's time to move on to telophase.

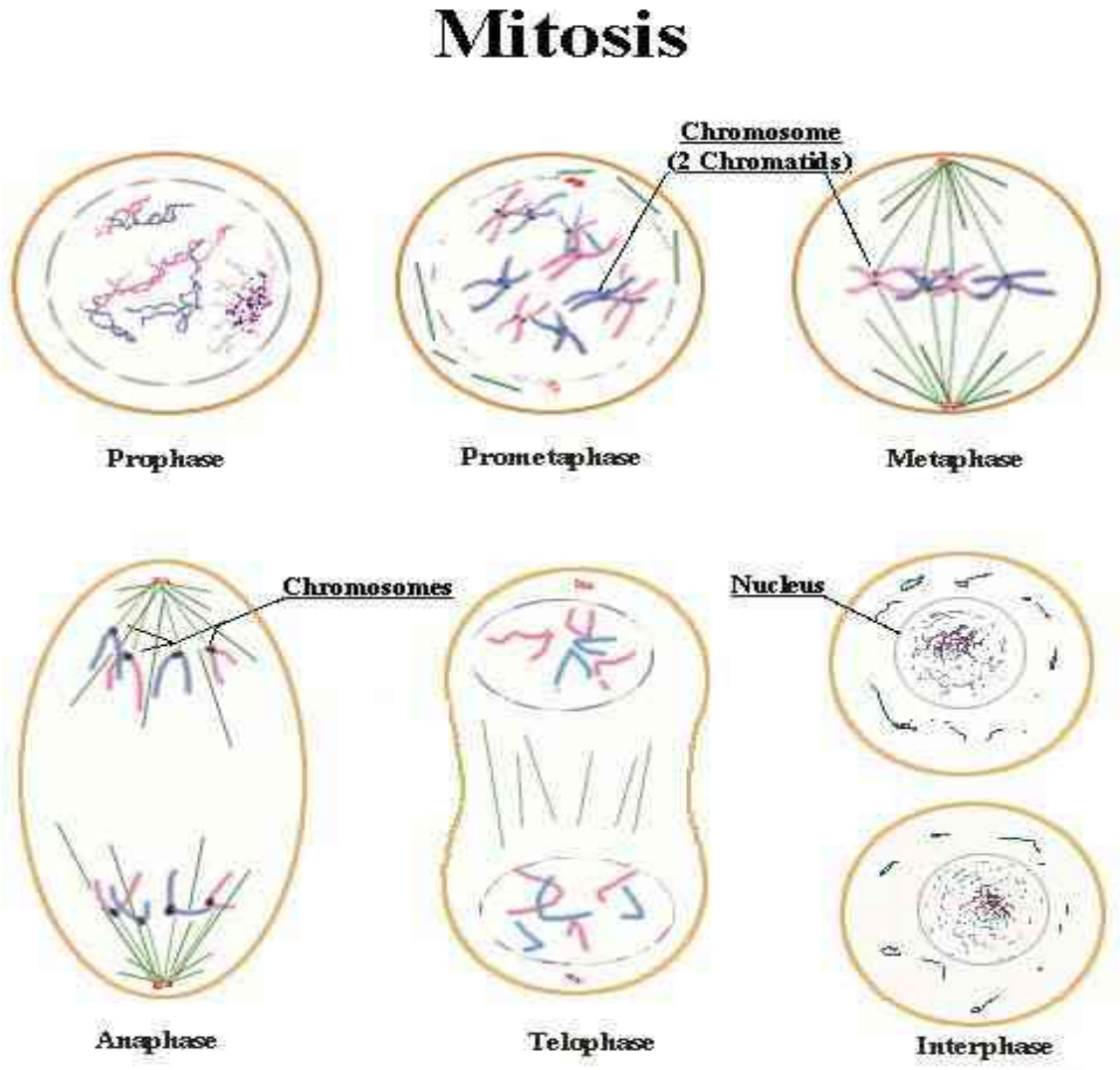


Telophase



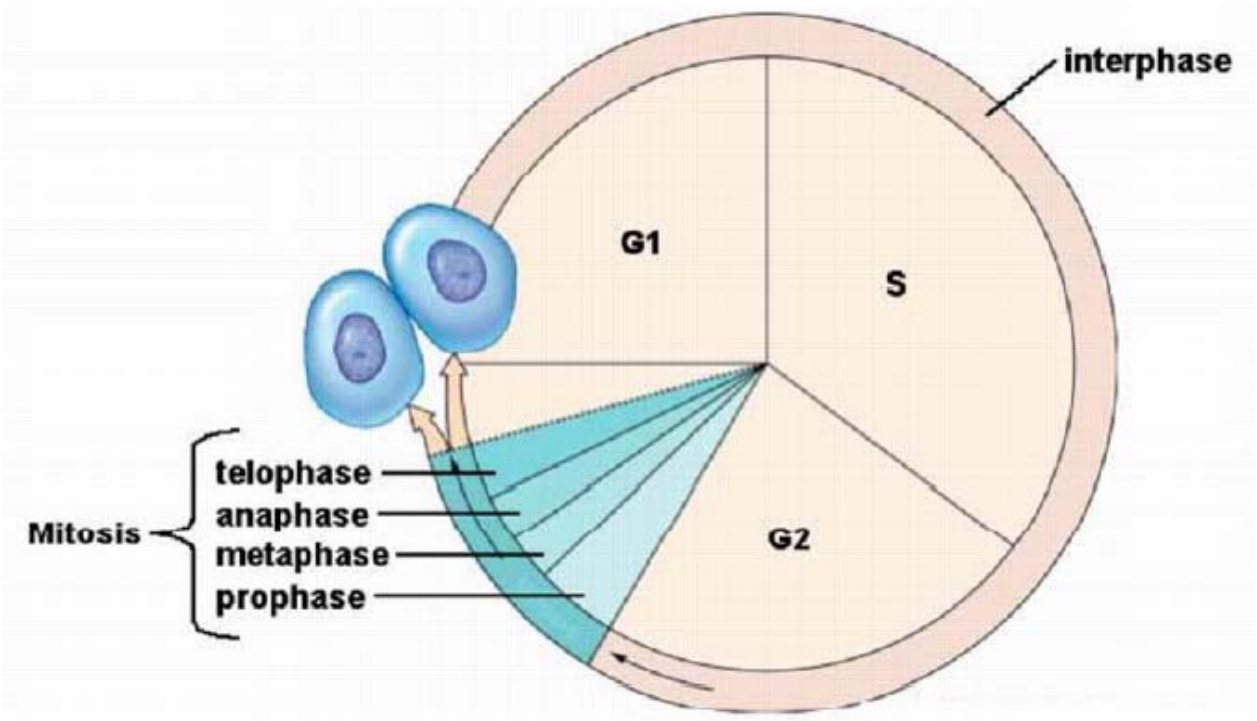
Now the division is finishing up. This is the time when the cell membrane closes in and splits the cell into two pieces. You have two separate cells each with half of the original DNA.

The following diagram is a visual representation of the entire process.



Interphase

This is the **normal state** of a cell. When it comes to cell division, you could call this the **resting state**. Interphase is the "holding" stage or the stage between two successive cell divisions. Some 90 percent of a cell's time in the normal cellular cycle may be spent in interphase. The cell's time is spent going about its daily business of surviving and making sure it has all of the nutrients and energy it needs. The cell is also getting ready for another division that will happen one day. Interphase happens in three separate stages:



The **first growth phase** (also referred to as **G1**) allows the small cell that has just recently been a product of division, time to grow. In this stage a cell will synthesize (make) proteins, and the cell organelles (mitochondria, golgi bodies, endoplasmic reticulum, etc.) increase in number.

The next phase is referred to as the "**S**" phase, where the "**S**" represents synthesis. This is the period of time during the cell cycle where the genetic information is duplicated. In most cells, there is a narrow window of time during which DNA is synthesized.

The **second growth phase**, (referred to as **G2**) allows the cell more time to grow. The cell continues to produce proteins and organelles. It's necessary for the cell to increase in size as it prepares to divide again.

You can view the following internet cites to view animation of cells, and cells that are undergoing the process of Mitosis:

http://www.cellsalive.com/

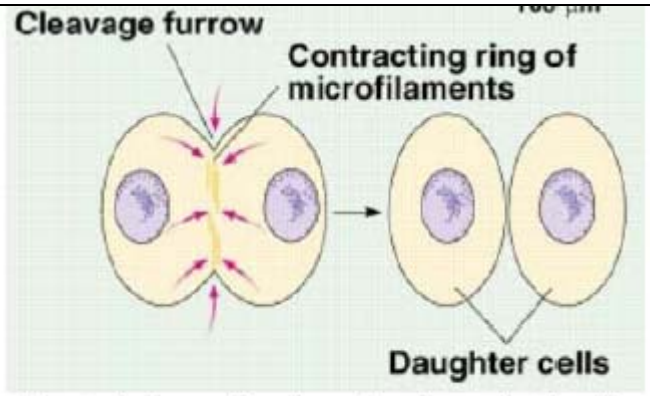
http://www.biology.arizona.edu/cell_bio/tutorials/cell_cycle/cells3.html

http://www.bbc.co.uk/education/asguru/biology/04genesgenetics/02replicationmitosis/01mitosis/index.shtml - this site is highly recommended!

Cytokinesis

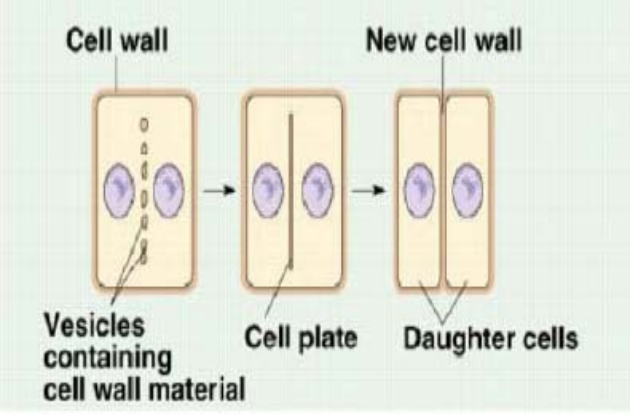
Once the cell has undergone the four phases of mitosis; **prophase, metaphase, anaphase and telophase**, the process is near being complete but there is still one step that is necessary to ensure the production of two new daughter cells.

While the function of mitosis is to divide the chromosomes exactly to the two daughter cells, the cytoplasm must also be divided, along with the organelles. **Cytokinesis** is the separation of the cytoplasm of the original cell into the two new daughter cells. Cytokinesis coincides with the events of telophase. Although the end result of mitosis is always the same, the mechanism of separation between **plant** and **animal** cells is different.



Cytokinesis in Animal Cells

In **animal cells**, cytokinesis starts with the formation of the cleavage furrow, a depression or pinching of the cell membrane. This is caused by a contractile ring, composed of proteins, which form across the middle of the cell after the chromosomes have separated in anaphase. The ring contracts pinching the membrane toward the centre of the cell, which eventually pinches the cell in two.



Cytokinesis in Plant Cells

In **plant cells**, the process is similar, but involves the fusing of the cell wall. Remember, animal cells do not have a cell wall. During cytokinesis, new wall material must be synthesized. The formation of the new cell wall is called **cell plate formation**. Cell plate formation involves making a cross wall at the middle of the original cell. Golgi vesicles containing wall material fuse along forming a disk like structure called the **cell plate**. As cellulose and other fibers are deposited, the cell plate is formed creating a boundary and new cell wall between the two new cells.

Support Questions ***(the following questions are NOT to be submitted for evaluation)***

7. Discuss ***why*** it is necessary for ***cells to divide***.

8. What are the ***4*** stages of ***mitosis***.

9. Why is ***interphase*** important to the cell cycle?

10. What is ***cytokinesis***?.

Key Question #2

A) Complete the **Mitosis Flip Book** assignment (following)

B) Mitosis is the division of which cell part?

C) List the ***4*** major phases of mitosis and indicate what happens in each of the phases.

D) Name ***3*** reasons cell division is important.

These Questions must be submitted for evaluation!

Mitosis Flip Book Assignment

You will be drawing the stages of mitosis in slow motion succession. That means that you will have to make small changes in each picture until you have finished the entire process. Begin with a normal cell in prophase and work through metaphase, anaphase, and telophase.

Materials

- Approximately 5 sheets of white paper
- Pencil
- Markers and coloured pencils
- Scissors
- Diagrams of each stage of mitosis
- Computer with internet access to view the internet cite: http://www.bbc.co.uk/education/asguru/biology/04genesgenetics/02replicationmitosis/01mitosis/index.shtml **OR** **www.geocities.com/.../ Olympus/5297/mitosis.html** (these sites will allow you to watch a cell as it progresses through the stages of mitosis)

Instructions

1. Have your materials ready and in front of you before you start this assignment.
2. Begin by cutting the 5 pages of white paper into 4 equal parts, this should give you 20 smaller pieces of paper and will allow you to draw the pictures on a smaller scale.
3. Label each piece of paper with a number from 1 to 20. Print the number in pencil in the bottom right corner of each piece of paper. Small enough that it won't interfere with the mitosis diagram you are about to start drawing.
4. Begin drawing the first phase of mitosis (prophase) on your first piece of paper (the piece that you have designated as number 1) **USE PENCIL** when sketching the diagrams.
5. On the second page (page labeled #2), you will draw the same cell slightly further in the process of mitosis. You many **NOT** draw the cell in metaphase, but what the cell would look like as it was progressing through prophase and into metaphase.
6. Continue drawing diagrams that are each a little different from the one before until you have finished all 4 phases of mitosis. Remember to use your numbered pages in order of 1 – 20.
7. There should be at least 4 pages of drawings for each progression through a phase, giving a minimum of 16 pages of drawings.
8. **The aim is that you can flip through the book and watch to process of mitosis.**
9. When all of your diagrams are finished, you may use pencil crayons and markers to color the cells that you have drawn.
10. You may also add any notes in the book that will help you understand the process of mitosis.

SNC1L

Lesson 3

Classifying Living Things

Introduction

Over 2000 years ago, Scientist began developing a system of classification that grouped organisms according to whether they were plant or animal.

In the 1900s, as knowledge about the great diversity of organisms on Earth exploded, it became clear that separating organisms into only two groups, plant or animal, wasn't good enough any more. For example, bacteria are just too different from either plants or animals to be grouped with either. Likewise, fungi such as bread mould, yeast, and the many kinds of mushrooms are very different from plants and animals. Some very influential Scientists at the time were supporting the idea that a new method for classifying organisms was needed. Thus, since the 1960s a system that classifies organisms into five different kingdoms was largely accepted and still used today.

What You Will Learn

After completing this lesson, you will be able to

Describe the basic life-sustaining processes of organisms, including single celled and complex organisms (e.g., ingestion of food, waste removal, gas exchange, material transport, response to environmental stimuli, reproduction) using appropriate scientific vocabulary

Relate structures involved in life-sustaining processes to their function (e.g., nucleus and reproduction, membranes and diffusion, components of respiratory system to gas exchange)

Communicate observations, interpretation of results, and information through appropriate formats (e.g., diagrams and written work)

Extract and interpret information from a variety of sources (e.g. information texts, lab instructions, Internet, electronic databases)

Analyse how specific equipment and safe practices are used to protect personal health and safety at home and in the workplace.

Examine case studies of common workplace environments to develop a checklist of safety practices necessary to sustain systems and processes critical to life.

Introduction

In lesson 1 you learned about the basic unit of life, the cell. Life exists on earth as a result of the cell. Cells create simple single celled organisms (an amoeba) and complex multi-cellular organisms (humans and other animals).

You learned that cells consist of specific parts and functions that carryout out the life sustaining processes necessary for life. Some examples are; the mitochondria is responsible for creating energy for the cell so that it can survive, the ribosome is responsible for creating proteins for the cell to aid in building more genetic material, and the nucleus is the control centre of the cell, which provided all of the instructions for the cell and was responsible for housing the genetic material, the DNA.

You also learned that there are some basic rules for defining life. For example, whether the organism breathes, moves, eats or reproduces.

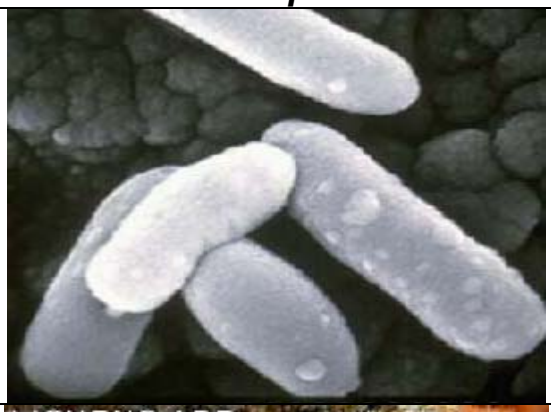
Furthermore, you learned that since cells are the basic unit for all life functions, then they must be properly organized to ensure that life exists. For example, a grouping of specific cells produces tissues, which in turn form organs, which in turn form the organ systems that are necessary to create a successful organism.

In lesson 2, you learned that in order for life to thrive successfully cells must be able to reproduce for the purposes of regeneration, reproduction, healing, maintenance, and growth. This process of cell division involves the cell cycle, which depends on the process of mitosis.

All of the above topics were significant to the creation of life, but what are some examples of living organisms and how are they classified? The obvious being of course plants and animals, but are bacteria that make us sick considered alive, viruses that cause us to catch the common cold, are they considered cells? In lesson 3, you will read about how life has been classified into **kingdoms**, which have been organized to include all types of living organisms. You will also learn that there are two types of cells, eukaryotic cells, the most common type of cells, introduced in lesson 1, and prokaryotic cells, not as common and lacking a control center (nucleus).

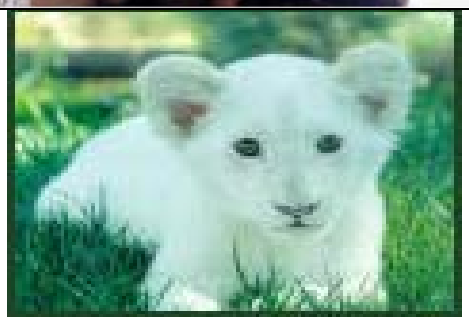
Classification of Living Things

You have already read that the **kingdom** is the most general way that organisms can be described. It is the broadest category for normal classification. **The top five kingdoms are the following.**

Top 5 Kingdoms	***Examples***
MONERA: • These are the simplest of all the organisms on Earth. • Includes all organisms which do not have a nucleus • These creatures are called prokaryotes • You will find bacteria in this kingdom	
PROTOCTISTA: • The protists are usually single celled organisms. • They have a distinct nucleus. • They are a kingdom of more advanced single-celled organisms than the monerans • You will find amoebas and some types of algae in this kingdom	
FUNGI: • This kingdom is made up of the decomposers (they are usually breaking down food materials and giving back nutrients to the soil) • The best example of a fungus that you might know is a mushroom • Other members of the kingdom are moulds (in your shower or on your bread) • Some of the members of this kingdom are fungi, slime moulds, yeast, mould, and mushrooms.	
PLANTAE: • A group of organisms that you might know as plants • The characteristics of plants are that they have chlorophyll, cell walls (cellulose), and vacuoles. • The variety ranges from algae in your fish tank to redwoods that grow to hundreds of feet tall.	

ANIMALIA:

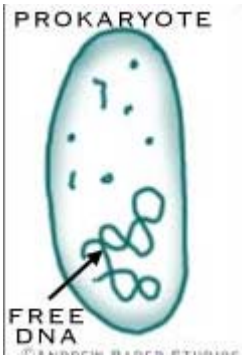
- A groups of organisms that you might know as animals
- These are the most complex organisms on the planet.
- One big thing about animals is that they must eat other organisms to survive.
- They cannot create their own food
- They are able to move around, and most have sense organs of some type, because they have those sense organs, they have nervous systems.
- Animals include species such as anemone, insects, lizards, and mammals.



Prokaryotic & Eukaryotic Cells

Prokaryotic Cells

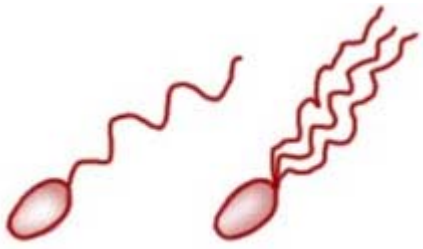
Prokaryotes do not have an organized nucleus. Their DNA is kind of floating around the cell. It's clumped up, but not inside of a nucleus.



Most prokaryotes are bacteria and bacteria can do amazing things. Although they are very simple organisms, they are found everywhere on the planet. Some scientists even think that they may be found on other planets (maybe even Mars). Some places you can find bacteria every day are in your intestines, a cup of natural yogurt, or a bakery. Prokaryotes are the simplest of simple organisms.

Characteristics of Prokaryotes

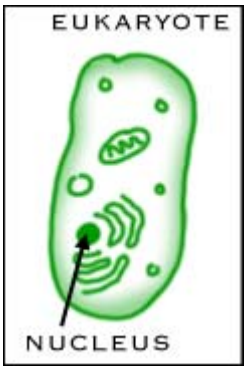
- Prokaryotes have **no organized nucleus**. Like we said, the DNA is clumped in an area but there is no organized nucleus with a membrane.
- Prokaryotes **do not usually have any organelles**. No chloroplasts. No mitochondria. No nucleus. Not much at all.
- Prokaryotes are **very small** because they don't have all of the normal cell machinery, they are limited in size. As always in



biology, there are exceptions, but generally prokaryotes are very small (compared to other cells). Mind you, compared to a virus they are big, but next to an amoeba, tiny.

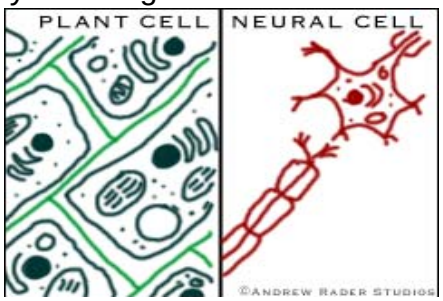
- Prokaryotes **don't have mitosis or meiosis like other cells**. Scientists don't really have a good way of describing how they duplicate, but it's not through normal means.

Eukaryotic Cells



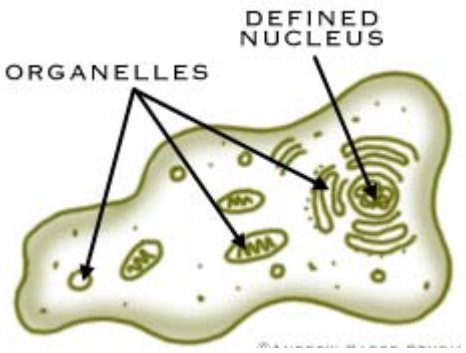
Eukaryotes are what you think of when you think of a classic "**cell**"(Learned in Lesson 1). There are cells without organized nuclei or organelles that are called prokaryotes, but the eukaryotic cell is completely different.

Eukaryotes are cells that can do anything. They are the cells that have helped organisms advance to new levels of specialization beyond imagination. You wouldn't be here if eukaryotic cells did not exist.



Characteristics of Eukaryotic Cells

- Eukaryotic cells have an **organized nucleus**. They have a "brain" for the cell. They have a discreet area where they keep their DNA. It is also said that they have a "true nucleus."
- Eukaryotic cells usually **have organelles**. They might have mitochondria, maybe a chloroplast, or some endoplasmic reticulum. They have parts that work to make the cell a self-sufficient organism.
- Although limited in size by the physics of diffusion, eukaryotic cells can get very large. Generally, eukaryotic cells are a couple hundred times the size of a prokaryotic cell.
- Eukaryotic cells have extra stuff going on and extra parts attached. Since they have organelles and organized DNA they are able to **create parts**. One example is the flagellum (a tail-like structure to help it move). They could also create cilia (little hairs that help scoot the cell through the water).



Classifying Living Things

The organisms and their kingdoms are shown in the table below:

	Monera	Protista	Fungi	Plant	Animal
Type of Cells	Prokaryotic	Eukaryotic	Eukaryotic	Eukaryotic	Eukaryotic
Number of Cells	One-Celled	One and Many Celled	One and Many Celled	Many-Celled	Many-Celled
Movement	Some Move	Some Move	Don't Move	Don't Move	Move
Nutrition	Some members make their own food, other need to obtain it from other organisms	Some members make their own food, other need to obtain it from other organisms	All members obtain food from other organisms	Members make their own food	Members eat plants or other organisms

Support Question ***(the following questions are NOT to be submitted for evaluation)***

11. Copy the following chart in your own notes and summarize the differences between ***monera*** and ***protesta.***

	Monera	Protista
Number of Cells		
Location of Genetic Material		
Type of Cells		

12. Copy the following chart in your own notes and summarize the similarities and differences between ***plants*** and ***animals***.

	Plants	Animals
Type of Cells		
Number of Cells		
Nutrition		

13. What is the difference between ***eukaryotic*** and ***prokaryotic*** cells?

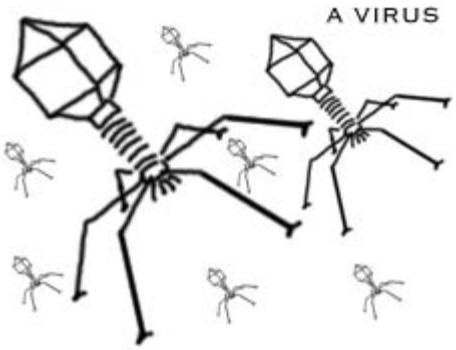
Micro-organisms

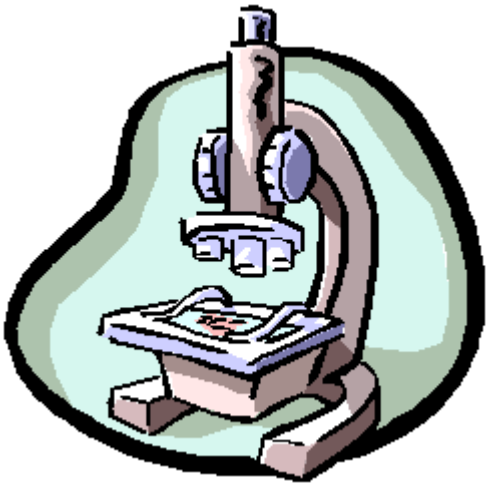
What are micro-organisms?

Micro-organisms are any living thing that is **too small to see with the naked eye**. Micro-organisms are everywhere. Some are useful and some are harmful. Like larger organisms, micro-organisms are classified according to characteristics that they share.

There is a huge variety of creatures that are too small to be seen by the naked eye. They can work alone or in groups, they can help you or hurt you, and, most important, they make up the largest number of living organisms on the planet. It helps to be that small.

As with all of science, discovery in biology is a huge thing. While micro-organisms like bacteria, fungi, and viruses, have always existed, scientists did not always know they were there. They may have seen a mushroom here or there, but there were hundreds of thousands of species to be discovered. It took one invention to change the way we see the world of micro-organisms - the **microscope**.

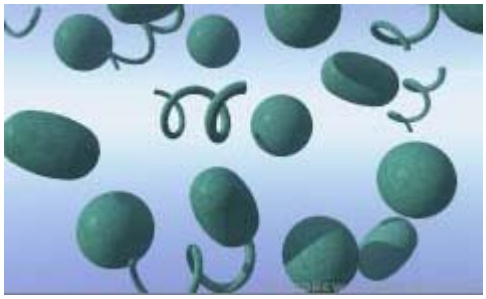




In 1673, **Anton von Leeuwenhoek** put a couple of lenses together and was able to see a completely new world. He made the **first microscope**. It wasn't that impressive, but it started a whole history of exploration. More important to us, scientists were eventually able to discover the cause and cure of many diseases. Common micro-organisms that will be discussed in this lesson are bacteria and viruses.

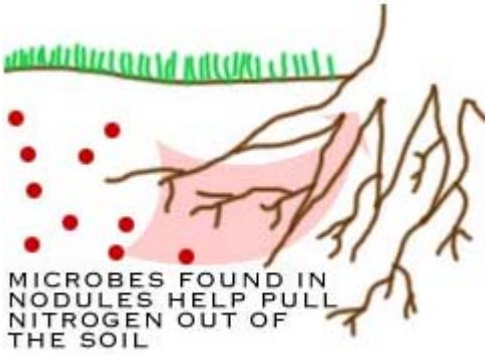
Bacteria

Bacteria are the simplest of creatures that are considered alive. Bacteria are everywhere. They are in the bread you eat, the soil that plants grow in, and even inside of you. They are very simple cells that fall under the heading **prokaryotic**. Therefore, they do not have an organized nucleus. Bacteria are small single cells whose whole purpose in life is to replicate.



What do they do? All sorts of things! They do just about everything. Some help plants absorb nitrogen from the soil. Some cause diseases. Some bacteria even live inside the stomachs of cows to help them break down cellulose (plant material). Cows on their own can digest grass and plants about as well as we do. They don't get many nutrients out of the plants and can't break down the cellulose. With those super bacteria, the cellulose can be broken down into sugars and then release all of the energy they need.

Many species of bacteria cause disease in humans, animals, and even plants. Humans worry about bacteria that cause botulism (bacteria living in spaces without oxygen, such as cans), tetanus and *E. coli*. You should know that there are also some good forms of *E. Coli* living in your intestines. They help break down food and live a simple life. There are also *E. Coli* that can be passed to you from undercooked meat. These bad bacteria can make you very sick and even kill you.

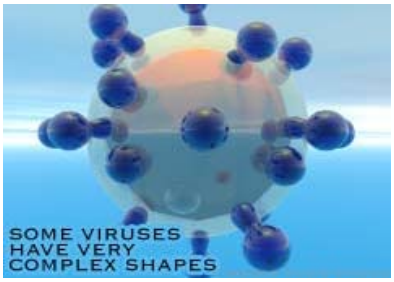


There are bacteria that go through a process called **fixing** nitrogen. These bacteria, living in the roots of plants, actually help them absorb nitrogen from the surrounding soil. The nitrogen is very important for the growth of the plant, and these little bacteria give them an advantage for survival.

Viruses

Some scientists argue that viruses are not even living things. Viruses are unusual. A virus has no cell parts. A virus is just made up of a substance called nucleic acid covered by an overcoat of protein. The outer coat is called a **capsid**. The capsid makes up most of the virus. Capsids give viruses their shapes. Some viruses are round. Others look like long rods. Some have very unusual shapes.

A virus does not ingest or digest food. It does not breathe. In fact, a virus does not carry out any of the life processes except reproduction and it is only capable of reproducing when it is inside another living organism. When a virus is outside a living cell, it is just a chemical.



Because viruses do not have all the characteristics of living things, they are not classified in the 5 kingdoms. Instead, most scientists classify viruses according to the living things they infect. Compared to viruses, bacteria are giants!

When a virus infects a cell, it may cause disease. Viruses cause many diseases in plants and animals. When you have the flu, you are infected with a virus. Viruses also infect bacteria.

They are an important piece of evolution and natural selection. Weaker and older animals are more easily infected. Those organisms are removed from the population so that healthier animals can survive. But the virus life cycle only hurts the organisms. Some even destroy cells in order to reproduce. And don't think you are the only one to get sick. Viruses attack plants and even bacteria. No organism is safe from damage. Examples of viruses include Rabies, Pneumonia, and Meningitis.

Support Questions ***(the following questions are NOT to be submitted for evaluation)***

14. What is a micro-organism?

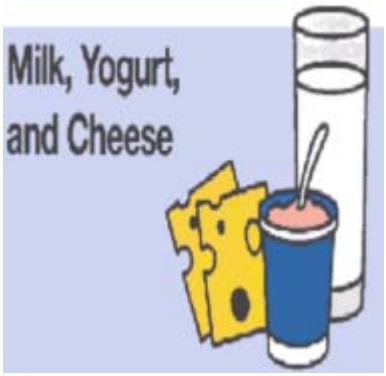
15. How can bacteria be beneficial (useful) micro-organisms?

16. How can a virus be a harmful micro-organism?

Micro-Organisms in the Kitchen

Many useful micro-organisms help make certain foods.

- Examples:
  - A certain type of yeast is used to make bread
  - Blue cheese is produced by adding beneficial mould
  - Yogurt, sour cream and buttermilk are made from milk to which certain species of bacteria are added.



Food Poisoning

Food poisoning is caused by eating food that contains harmful micro-organisms. Symptoms of food poisoning include: severe cramping, diarrhoea and vomiting.

Common Causes of Food Poisoning	
• Storing food in a way that allows micro-organisms to grow quickly	• Passing micro-organisms from your unwashed hand, utensils, surfaces or from other foods
• Under-cooking food • Cooking kills any harmful micro-organisms that might be present	• Handling of food by someone who is sick

Controlling Micro-Organisms that Cause Disease

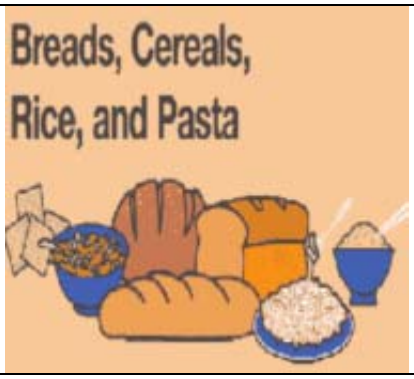
Controlling harmful bacteria can be easy if people pay attention to how food is prepared and stored. One thing to remember is that you must keep hands and counters clean.

- The following are a list of guidelines to control harmful micro-organisms
  - Surfaces where food is prepared should be cleaned with soapy water or bleach
  - Items used to prepare or serve food should be kept very clean
  - People involved with handling food must be very clean; hair tied back, hands washed thoroughly and frequently
  - Foods needs to be cooked at temperatures that are high enough to kill micro-organisms especially ground meat and chicken
  - Food that is to be stored in cans or bottles at room temperature must be put into a sterilized container while it is still hot so that micro-organisms can't grow
  - Foods that spoil must be stored in a refrigerator or freezer. Cold temperatures only slow the growth of micro-organisms, all foods in cold storage should only stay there for a certain amount of time.

Food producers have found ways to prepare foods that control growth of micro-organisms.

- Canning
- Drying foods
- Preservatives (chemicals that control the growth of micro-organisms)
- Irradiation (food is exposed to high energy beams while it is fresh and in wrapping)

Common Food Preservatives		
Preservative	**Purpose**	**Example**
Nitrates	Prevent the growth of the bacteria that causes botulism, a deadly form of food poisoning	
Sulphates	Slow the growth of harmful bacteria	

Sodium Propionate	Prevents the growth of certain bacteria and moulds	

Support Question ***(the following questions are NOT to be submitted for evaluation)***

17. What are some common causes of food poisoning?
18. Discuss how you can control micro-organisms in the kitchen.

Key Question #3

Complete the micro-organism ***Disease Poster Assignment***.

Micro-organism Disease Poster Assignment

Choose from the list of disease or cell disorder to research
Purchase a poster board from a local store, size should be no smaller then 11'x17'
Purpose: to make a poster board, about the disease you have chosen, including the following information:

1. Name of the disease chosen
2. Description of the disease – what is it?
3. Symptoms suffered as a result of having the disease
4. Causes
5. Prevention
6. Treatment
7. Risks
8. Explain why it is important to have this information about diseases, explain how people can become susceptible to the disease through either their workplace or every day social interactions.

BE CREATIVE! Make sure that you have included all the required information.

This assignment must be submitted for evaluation!

SNC1L

Lesson 4

Cell Reproduction
Asexual Reproduction

Introduction

There are two main types and many different methods of reproduction. In Lesson 2, you learned how cells divide with the purpose of creating new cells. In this lesson you will learn how previously existing cells divide to create new living organisms, like how a new plant is created or new animal born.

Reproduction is the creation of a new individual or individuals from previously existing individuals. In plants and animals, this can occur in two primary ways: through **asexual reproduction** and through **sexual reproduction**.

In this lesson you will examine how organisms primarily reproduce through asexual means.

What You Will Learn

After completing this lesson, you will be able to

Describe the basic life-sustaining processes of organisms, including single celled and complex organisms (e.g., ingestion of food, waste removal, gas exchange, material transport, response to environmental stimuli, reproduction) using appropriate scientific vocabulary

Relate structures involved in life-sustaining processes to their function (e.g., nucleus and reproduction, membranes and diffusion, components of respiratory system to gas exchange)

Communicate observations, interpretation of results, and information through appropriate formats (e.g., diagrams and written work)

Extract and interpret information from a variety of sources (e.g. information texts, lab instructions, Internet, electronic databases)

Analyse how specific equipment and safe practices are used to protect personal health and safety at home and in the workplace.

Examine case studies of common workplace environments to develop a checklist of safety practices necessary to sustain systems and processes critical to life.

Make accurate observations of structures, using microscopes and relate them to functions of systems and processes of simple and complex organisms.

Introduction

In lesson 2 you learned about cell division that occurs for healing and repair and for growth. Cell division is also the process that allows reproduction, and therefore allows species to continue.

Organisms of all species reproduce. There are two types of reproduction: **asexual** and **sexual**.

In **asexual reproduction**, a single organism produces offspring (a new organism) with identical genetic information, therefore they identical to the original parent cell. To achieve this type of reproduction, only one parent is necessary to reproduce a new organism. Most single-celled organisms, such as an amoeba (from lesson 1) as some multi-cellular organisms (such as plants and fungi) use asexual reproduction.

In **sexual reproduction**, genetic information from two cells is combined to produce a new organism. Usually, sexual reproduction occurs when two specialized sex cells (and egg cell and sperm cell) join to form a zygote (fertilized egg), which then develops into a new organism.

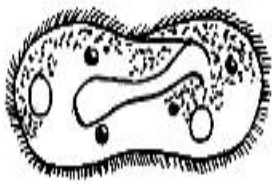
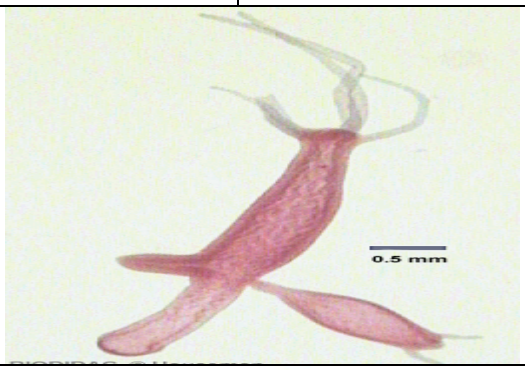
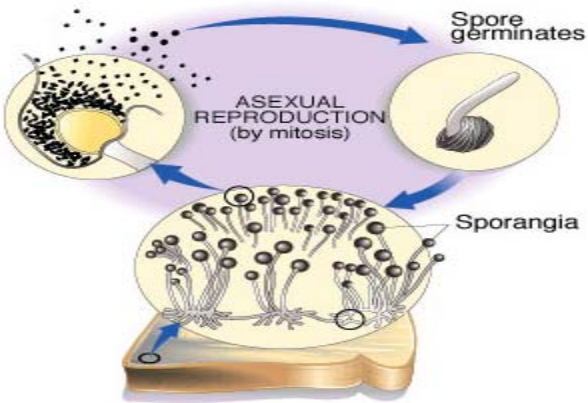
Comparison of Asexual and Sexual Reproduction

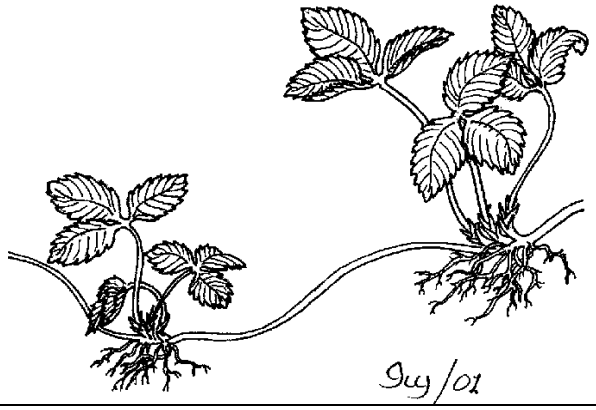
Characteristic	Asexual	Sexual
Number of parents required to produce a new cell	**One** parent is needed	**Two** parents are needed
Presence of sex cells are necessary (ex. sperm and eggs cells)	**No** – sex cells not needed	**Yes** – sperm and eggs cells are required
Genetic information of newly produced cell compared to the parent cell	New offspring is identical to parent cell, therefore has the exact same DNA	New offspring is created based on two different parent cells, therefore it will have its own set of DNA different from the parents.

Types of Asexual Reproduction

Type	*Description*	*Example*
Binary Fission	• Organisms split into 2 equal sized offspring • Each with exact copies of genetic information from parent cell • Simplest method of asexual reproduction	• Bacteria • Paramecium • amoeba
Budding	• New cell begins as a small outgrowth from parent cell • The “new bud” eventually breaks off becoming a new organism	• Yeast cells
Fragmentation	• New organism forms from a part of the parent cell that breaks off from parent and becomes a new organism	• Algae • Starfish • Sponge
Spore Formation	• Parent cell undergoes many cell divisions and contains casing that contain thousands of spores • Spores are thread-like projections that root themselves into whatever they land on • When the spore case is large enough it will break releasing thousands of spores • If the temperature, moisture and landing location is right, a new plant is produced • Most common example is bread mould	• Moulds • Yeast • Fern plants
Vegetative Reproduction	• Occurs in plant cells • A root, stem, bud or leaf reproduce one or more plants • Plant produces “runners” that develop into new plant with identical genetic information	• Spider plants • Strawberry plants

Visual Examples of Asexual Reproduction

Figure	*Explanation*
 • A paramecium undergoing **binary fission**  • Eventually splits into 2 cells, equal in size	• **Binary fission** and budding are very rapid ways of reproducing. • For example, if conditions are good, the cell of a Paramecium can divide, grow, and divide again in the space of 8 hours.
	• The diagram shows how a **bud** is created from a parent cell • The bud is shown growing in size at the bottom right corner • The bud eventually grows big enough and breaks off, becoming a new organism
	• Starfish reproduce by fragmentation
	• The diagram shows the spores within the spore casing • The spore casing breaks realising thousands of spores into the air • This shows how bread mould develops

	• This diagram shows how **runners** are created from strawberry plants • Runners create a new plant that eventually grows roots and lives independently from the original parent plant

Advantages and Disadvantages of Asexual Reproduction

Advantages

- ✓ Organisms do not need to dependent on finding a mate to reproduce
- ✓ Organisms can reproduce asexually quickly

Disadvantages

- ✓ No genetic variation in offspring, each individual is exactly the same, therefore if the organism has a disease, or weakness, that weakness will be reproduced into the offspring or new cells

Support Question ***(the following questions are NOT to be submitted for evaluation)***

19. What are the ***two types of reproduction***?

20. What are the ***differences*** between the two types of reproduction?

21. List the different ***types*** of ***asexual reproduction***.

Key Question #4

A) Complete the **Looking at Fungi Activity**.

(This lab activity must be submitted for evaluation!)

Looking at Fungi Activity

Introduction

An important role of many fungi is to recycle the chemicals in organism after they have died. If left too long or outside of refrigerated storage, food can grow fungi. As the fungi (mould) break down the food, some produce chemicals that can make humans sick.

Purpose

In this activity, you will allow fungi to grow on some common food item, and then observe the characteristics of these organisms.

Materials

Hand lens
Piece of bread
Piece of cheese
2 sandwich size Ziploc plastic bags
Paper towel

Procedure

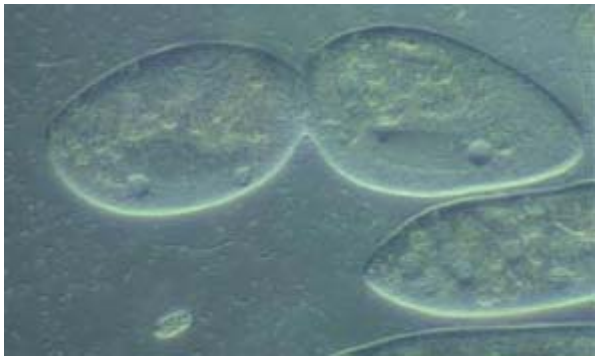
1. Slightly wet half of a piece of paper towel (2-3 drops of water only)
2. Place the damp piece of paper towel inside one of the sandwich size plastic bags
3. Place a quarter size piece of the bread inside the plastic sandwich bag and seal the bag shut. (Do not open the bag again once it's been sealed closed)
4. Repeat steps 1-3 for the piece of cheese.
5. Place the bags out of sight, away from light for a significant period of time, at least a week. Recommendation location for storing the bags of bread and cheese would be at the back of a kitchen cupboard that does not get used regularly.
6. After a period of a least a week, retrieve the bag and make your observations.
7. Use you hand lens (small magnification lens) to view the mould spores.

Analysis and Conclusion

1. Do you think there was more than 1 type of mould growing on the food item? Give reasons for your answer.
2. How do mould cells reproduce?
3. Did the mould cells reproduce during the experiment? Explain your answer.
4. Describe a situation in your own home where food has gone mouldy and attempt to explain why.

The answers to the analysis questions and your two bags of mouldy cheese and bread must be submitted for evaluation.

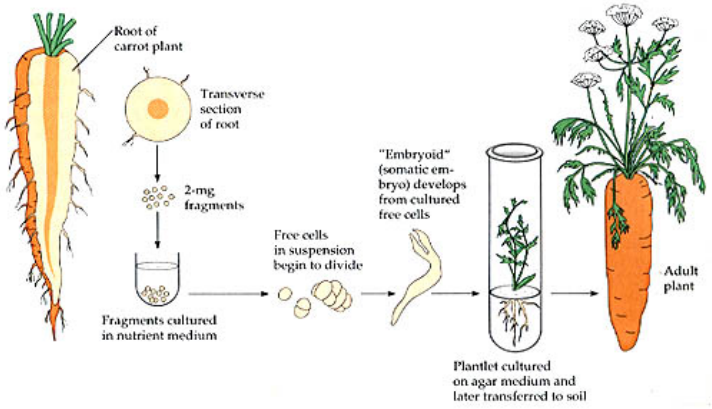
Cloning



Cloning is a natural process, repeated daily in nature. The vast majority of organisms on our planet produce exact copies of themselves by asexual reproduction, using the process of binary fission. The mother cell divides into two identical new cells, or **clones**, as shown in the following figure.

Cloning is the process of forming identical offspring from a single cell or tissue. The clone originates from a single parent; it is genetically identical to that parent. Therefore, cloning is referred to as asexual reproduction.

However, the process of cloning is very different and much more involved then binary fission. Cloning is a form of asexual reproduction but unlike binary fission; cloned organisms can be multicellular complex organisms like frogs, sheep and cows.



In 1958, a Scientist named Frederick Stewart, claimed that he cloned a whole carrot from a single cell. The process involved removing a single cell from a carrot, the cell was then placed in a special sterilized environment. A growth hormone was added (similar to a plant fertilizer), to help promote cell division. Eventually an entire carrot grew from the single cell. Carrots, ferns, tobacco, petunias and lettuce seem to be a few of the many types of plants that can be successfully cloned.

Much scientific research is being conducted into the cloning of animals. Animals have been cloned before using the nucleus of an embryo cell in the very early stages of development. The new cell that receives the nucleus can then develop into a new individual that is genetically identical to the embryo. The biggest breakthrough happened in 1997 when Dr. Ian Wilmut, of the Roslin Institute in Scotland, announced that he had cloned a sheep using genetic material from an adult sheep. The genetically cloned sheep was later named Dolly and is very well know today.

Key Question #4 Continued…

B) Complete the following investigative activity ***Cloning From Plant Cuttings****.*

This activity must be submitted for evaluation!

Cloning From Plant Cuttings

Some plants naturally reproduce asexually when part of the plant, such as the stem or leaf, breaks off and drops to the ground. Roots develop on the broken part and penetrate the soil. The broken part grows into a new plant.

Cuttings from seedless-grape vines have been grafted to grapevines all over the world. You wouldn't be able to eat seedless grapes if it were not for cloning.

In this investigation, you will grow a plant from a cutting, thereby making a clone of the original plant.

Materials

All of the items listed below can be purchased at your local Home Depot, Canadian Tire or local Nursery Store (for example Sheridan Nurseries)

- **Knife** *(typical knife found in your kitchen, one that would be appropriate for cutting vegetables)*
- **Coleus plant** *(ask for help when looking for this type of plant, if you need an alternative plant, explain to the salesperson what it is you are trying to do and ask them to recommend an appropriate plant)*
- **3 small glass jars** *(3 small baby food jars would be acceptable)*
- **Potting soil** *(**1** small bag)*
- **3 small plastic flower pot** *(should be twice the size of the jars that were used previously)*
- **Twist ties** *(at least 3)*
- **Popsicle sticks** *(at least 3)*

Procedure

1. Carefully cut off the tip of three coleus stems from the plant that you have chosen to use for this activity. Be sure to include 2 or 3 leaves on each stem.
2. Fill each of the 3 jars with water, place each stem cutting into a jar of water.
3. The water must cover as much of the stem as possible without covering any of the leaves. You may need to support the stems to keep them upright (a popsicle stick in each jar would do the trick, tie the plant cutting to the stick with a twist tie)
4. Put all 3 jars in a sunny place and check them daily to maintain the water level.

5. Record your observations every other day in a chart like the one provided. (Copy the chart that is provided with your investigation instructions in your notes and add more days as you progress through the activity)
6. After the roots appear on the stems, allow an additional week's growth and then transplant each cutting into the 3 small plastic flower pots. Before planting, you will need to fill each flower pot to the rim with the moist potting soil that you have purchased for this investigation.

Observations
(sample chart that you should copy in your notes and complete throughout this investigation, be sure to add more days if needed)

Day	Roots are visible? Yes or No – if so how long are they?	Observations (What do you see? Has anything changed?)
Day 2		
Day 4		
Day 6		
Day 8		
Day 10		

Analysis and Conclusion

Analyze your results by answering the following questions:

1. What evidence suggests that coleus has the ability to regenerate parts of the plant lost to injury or damaged?
2. In what ways would the new coleus plants resemble the parent plant?
3. Suggest two ways to prove that the roots from the coleus cuttings are growing.

The observation chart, one plant cutting, and the analysis questions must be submitted for evaluation.

SNC1L

Lesson 5

Cell Reproduction
Sexual Reproduction

Introduction

In lesson 4 you learned how organisms can reproduce through asexual means. If animals or even humans were cloned like plants, we would all look the same!

Generally, less complex organisms produce offspring by asexual reproduction, while more complex organisms reproduce sexually. Genetic information from two specialized cells (sperm and egg cells) combine to form a unique composition for a new organism.

In the simplest form of asexual reproduction, a single cell, the mother cell, duplicates genetic information and becomes two daughter cells, but in all forms of asexual reproduction the offspring have the same genes as the parent. These genes will allow the offspring to meet any environmental challenges as well as the parent did, but it's not likely they would do any better.

Sexual reproduction is different because it allows for genetic information from both parents to create a new organism, therefore being an entirely different organism with new traits and characteristics.

What You Will Learn

After completing this lesson, you will be able to

Describe the basic life-sustaining processes of organisms, including single celled and complex organisms (e.g., ingestion of food, waste removal, gas exchange, material transport, response to environmental stimuli, reproduction) using appropriate scientific vocabulary

Relate structures involved in life-sustaining processes to their function (e.g., nucleus and reproduction, membranes and diffusion, components of respiratory system to gas exchange)

Communicate observations, interpretation of results, and information through appropriate formats (e.g., diagrams and written work)

Extract and interpret information from a variety of sources (e.g. information texts, lab instructions, Internet, electronic databases)

Examine case studies of common workplace environments to develop a checklist of safety practices necessary to sustain systems and processes critical to life.

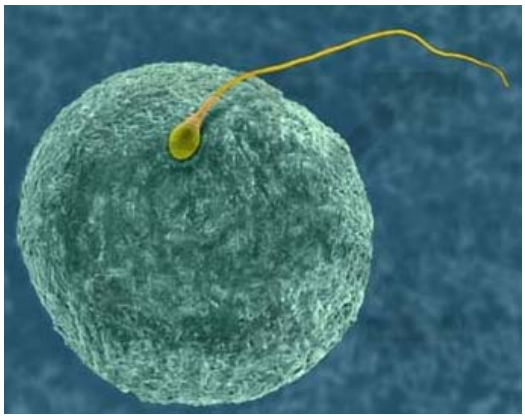
Make accurate observations of structures, using microscopes and relate them to functions of systems and processes of simple and complex organisms.

Sexual Reproduction

Sexual reproduction is common among multi-cellular organisms. In sexual reproduction, two individuals produce offspring that have genetic characteristics from both parents. Sexual reproduction introduces new gene combinations in a population. In complex animals, this usually involves two specialized sex cells, called **gametes**, which are typically **sperm and eggs.** The gametes combine to form a **zygote**. Zygote is a fancy word for a **fertilized egg**.

Offspring are not identical to either parent, or even to each other. Sexual reproduction produces new combinations of genes that may allow organisms to adapt better to a given environment.

Meiosis, Gametes and Zygotes



In animals, sexual reproduction encompasses the fusion of two distinct gametes to form a zygote. Gametes are produced by a type of cell division called **meiosis.** The gametes (sex cells) are haploid which means that they contain only one set of chromosomes, while the zygote is diploid, which means that it contains 2 sets of chromosomes. One set comes from the sperm, the other from the egg, when fertilization occurs, the zygote has 2 sets, or a full set of chromosomes, one set from each gamete. In most cases, the **male gamete**, called **sperm**, is relatively motile, therefore it moves and travels towards the egg. The **female gamete**, the **egg**, also called the ovum, is non-motile and relatively large in comparison to the male gamete.

A zygote is a single cell. Soon after it forms, it divides. It becomes two cells. Each of these cells then divides. They become four cells. Then these cells divide. Cell division continues over and over again. A young organism or embryo forms. As the cells divide, they form tissues. The tissues form organs, the embryo grows in size. As it grows, it takes on the form of its parents. When the embryo reaches full size it is born. The offspring is now an organism on its own. It must carry out all the life functions by itself.

In some animals, fertilization takes place outside the body. In other animals, fertilization takes place inside the female's body.

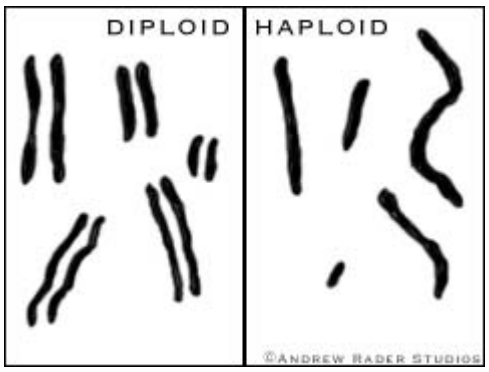
Fertilization that takes place outside the body is called **external fertilization**. Amphibians and most fish reproduce by external fertilization.

Fertilization that takes place inside the body is called **internal fertilization**. Birds, reptiles, and mammals reproduce by internal fertilization.

Important Terms used in Sexual Reproduction

Term	*What does it mean?*
Gamete	• The term used to represent **reproductive cells**. • Specifically how we refer to the sperm and egg
Zygote	• A **fertilized egg cell**, the product of sexual reproduction. • Occurs when an egg cell and sperm cell unite.
Meiosis	• The process of cell division that **creates sex cells** used during sexual reproduction.
Chromosome	• A threadlike structure that contains **genetic information**. • Made up of genes, which are units of genetic information that determine a specific characteristics of an individual
Haploid	• Cells that have ***half the number of chromosomes*** as would normally be found in an organism • Important during sexual reproduction, cells divide through the process of meiosis to produce haploid cells. • In humans, the egg or sperm produced have **23** chromosomes • The number 23 is half of 46
Diploid	• Cells that have the ***total number of chromosomes*** • In humans this number would be **46** • Every cell in the human body other than the egg or sperm cell has 46 chromosomes

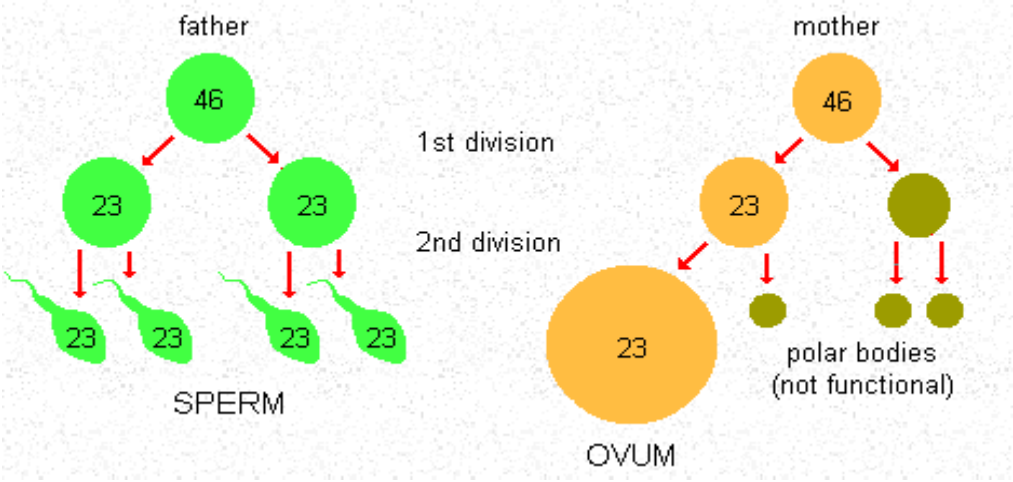
Meiosis



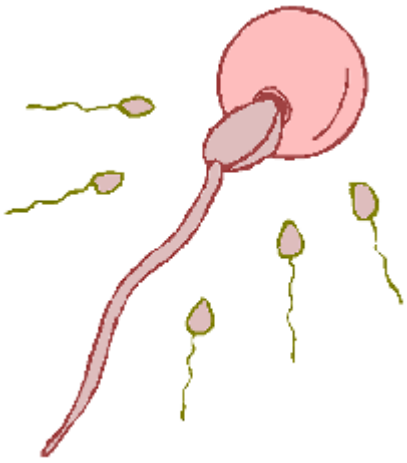
Meiosis is the process of cell division that produces **haploid gametes** needed for sexual reproduction.

For Example, the chromosome number and the formation of sex cell in humans is explained:

Human cells contain **46** chromosomes. For sexual reproduction to occur there must be a way to **reduce** the number of chromosomes. This is why **sex cells** are formed. The process that forms sex cells is called **meiosis**. During this process, the chromosome number is reduced by **half**. A human cell containing **46** chromosomes undergoes **meiosis** to produce sex cells that have **23** chromosomes. The 46 chromosomes number is referred to as the **diploid** chromosome number. The 23 chromosome number is referred to as the



haploid chromosome number. The union of a **haploid** sperm cell and a **haploid** egg cell creates a **diploid zygote**. The process of meiosis produces 4 new haploid cells, therefore every time meiosis occurs in males, 4 sperm are produced, and in females 4 eggs are produced, 3 of which are not used during fertilization and therefore considered not functional.



Most cells in your body are diploid. Only the sex cells (sperm and egg) are haploid. This is so that when the sperm and egg combine, the zygote then has a full set of chromosomes.

Organisms that reproduce **sexually** show a greater range in their characteristics than those that reproduce asexually. Offspring carry **genetic information** from **each** parent. You receive the **same** amount of genetic information from each parent: a set of **23** chromosomes. Each of the **23**

chromosomes that you receive from your father is **matched** by one of the 23 chromosomes from your **mother**. Meiosis is the type of cell division that prevents the fertilized egg from ending up with a total of **92** (46 + 46 = 92) chromosomes. If a human ended up with 92 chromosomes, they wouldn't be able to survive.

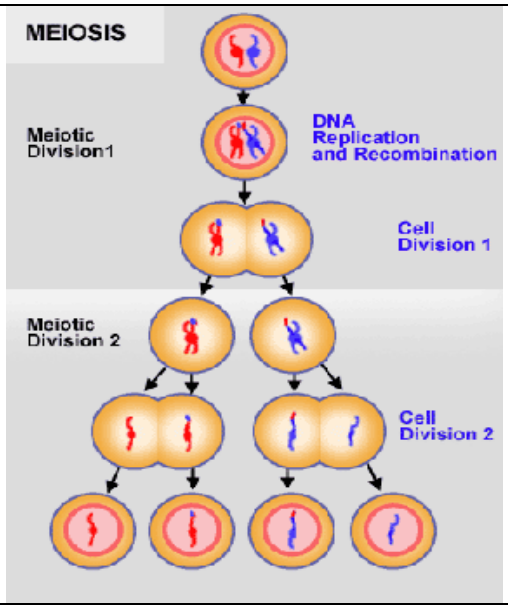
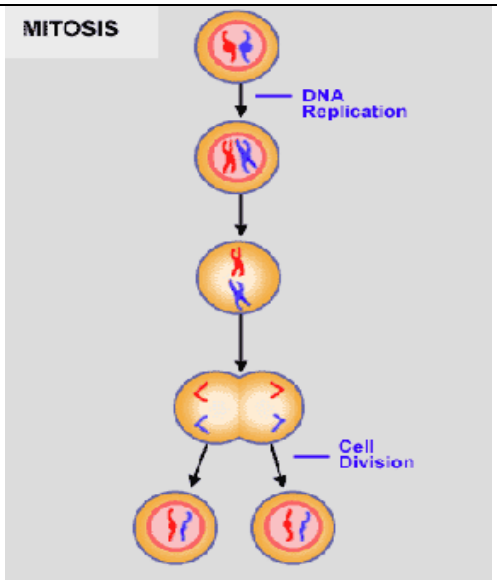
Support Questions ***(the following questions are NOT to be submitted for evaluation)***

22. How do the new organisms produced by ***sexual reproduction*** resemble the original organism?

23. Explain why the offspring of an organism that reproduces sexually might be able to ***adapt better*** to a new environment than offspring of an organism that reproduces asexually.

Comparing Meiosis and Mitosis

Meiosis, which is used to produced **sex cells** needed for sexual reproduction compared to mitosis which is used primarily for asexual reproduction.

Meiosis	***Mitosis***
	
The process of meiosis begins with a single cell containing 46 chromosomes and results in four reproductive cells (sperm or eggs), each of which carries 23 chromosomes. These 23 chromosomes are a unique mix of the genes present in the original single cell. You resemble your parents because half of the instructions — genes — for making you came from your father and half from your mother.	Each chromosome within our body contains 46 chromosomes. Each cell in our body divide for growth and repair through the process of mitosis. The only exception to this rule is the egg and sperm cells used for sexual reproduction which in turn have 23 chromosomes, which is half of 46.

Types of Sexual Reproduction

External Reproduction

External fertilization is when sex cells unite outside the female's body. For example, marine animals, amphibians and fish all rely on the process of external fertilization to reproduce.

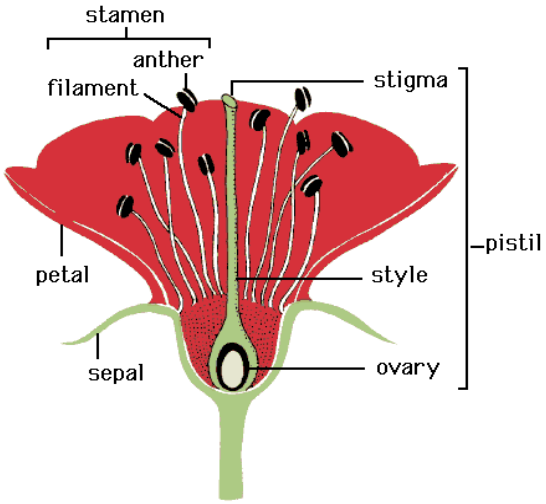
External fertilization occurs mostly in wet environments and requires both the male and the female to release their gametes into their surroundings (usually water). An advantage of external fertilization is that it results in the production of a large number of offspring. One disadvantage is that environmental hazards such as predators greatly reduce the chance of surviving into adulthood. Amphibians (salamanders, snakes and frogs) and fish are examples of animals that reproduce this way.

Internal Fertilization

Most land animals, including reptiles, birds, and mammals, use internal fertilization to reproduce. The male has a penis for copulation and deposits the sperm inside the female's body. The male also has glands that produce fluids for transporting, nourishing and protecting the sperm. The eggs are fertilized inside the female's body, away from external factors such as currents, changes in temperature, harmful environment, and away from predators.

After they have been fertilized, the eggs may be released and may develop externally, or, in some cases of mammals, may develop within the uterus until born.

Sexual Reproduction in Plants



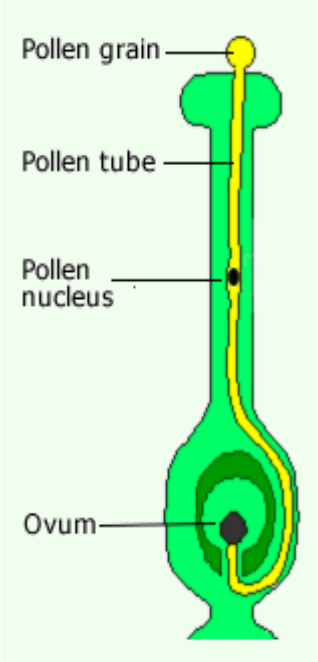
Sexual reproduction is the formation of new plants through the joining of male and female sex cells. Flowers represent proof of a plant's survival and offers assurance that a plant species will produce more of its own kind.

Insects pollinate flowers with color, odour and nectar. The arrival of the pollen on the pistil of the flower is called **pollination**. Pollination is the process where pollen is moved from the anther to the egg cells and fertilizes them. Most pollinators are insects, but hummingbirds also pollinate flowers. As the animal crawls into the flower to collect nectar, pollen from the anther falls on its body. When the animal

moves on to the next flower in search of more nectar, some of the pollen brushes off onto the pistil. Animals may deposit pollen over a wide area. Wind also carries pollen.

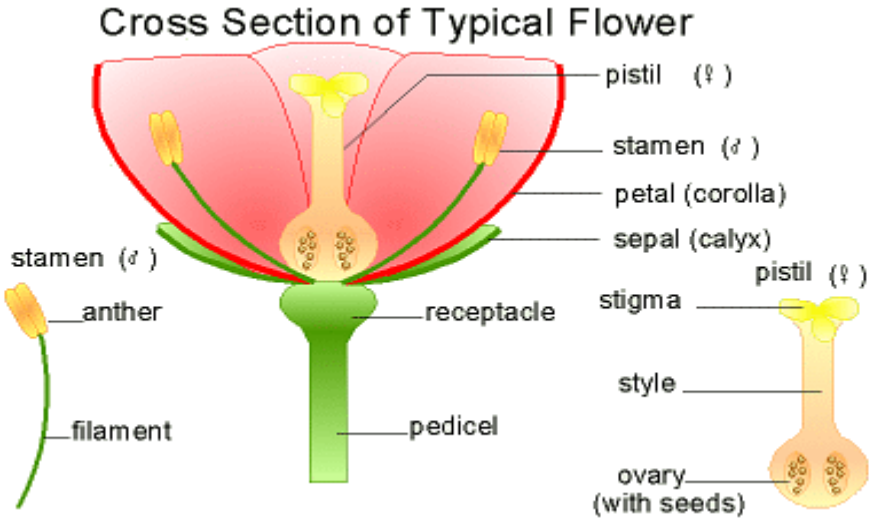
How Pollination Occurs

Pollen lands on the stigma during fertilization. The top of the pistil is sticky and traps the pollen. A small tube grows into the stigma from the pollen. The pollen tube continues to grow down the pistil. The sperm move into the pollen tube. The pollen tube reaches the ovary. Two sperm enter the ovule. The ovules contain eggs. The sperm fertilizes an egg and also provides the food for forming future seeds. The seed then grows to form a plant.



The male sex cells of the flower, the pollen, are produced in the anthers, which are the tips of the stamens.

Female sex cells, called eggs, are located in a structure called the ovary, which is at the base of the pistil.



Seed and Fruit Formation

The fertilized eggs (zygotes) of the flower become the seeds. The petals slowly shrivel and fall from the plant. In some species, the ovary surrounding the zygotes develops into the fruit. Fruits help protect and disperse the seeds.

There are many different types of fruits, from pea pods to apples. Many birds and animals eat fruits and scatter the seeds, often in their droppings.

Support Question ***(the following questions are NOT to be submitted for evaluation)***

24. Name the ***male*** and ***female sex cells*** of the flower.

25. What is ***pollination***? How does it occur?

Key Question #5

A) Complete the following investigation: Flower Anatomy

This investigation must be submitted for evaluation!

Flower Anatomy

In this investigation you will examine different flowers to see which structures they have in common and which are different. You will also look at the functions of the parts of a flower.

Purpose

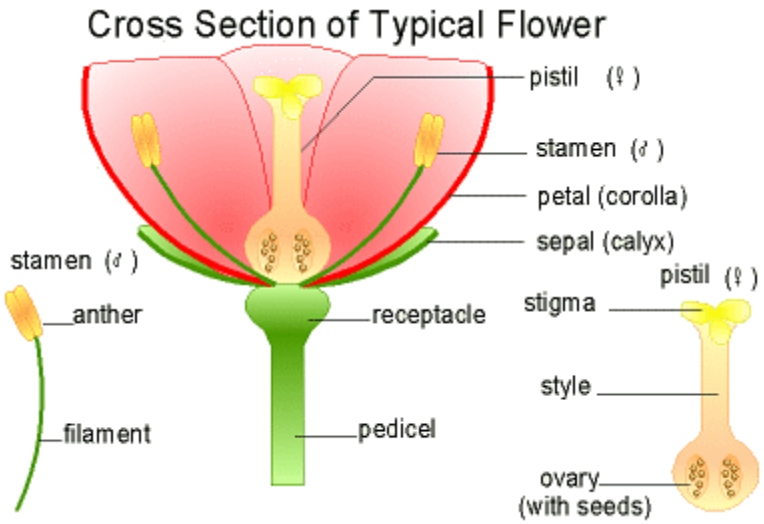
To determine how flowers differ from each other.

Materials

Whole flowers (at least 2, maximum 4)
Coloured pencils
Small paint brush
Hand lens (magnifying glass)
Tweezers
Small knife

Procedure

1. Examine the following figure and read the descriptions of the various parts. Not all flowers are alike. Your flower may differ from the diagram.



2. Obtain two flowers and examine them closely with a hand lens.
3. Record the number of petals, sepals and stamens on each flower. Leave space on your data table for the data from more flowers.

Sample Data Chart – Record Your Observations			
Type of Flower	**# of Petals**	**# of Sepals**	**# of Stamens**

4. Compare the number of petals, sepals and stamens on your flowers with those of similar and different flowers being examined by other groups.
    a. Do similar flowers have the same number of petals, sepals, and stamens?
    b. Do different flowers have the same number of petals, sepals, and stamens?
5. Remove a few adjoining petals and sepals. Examine the inside of the flowers carefully.
    a. How many pistils do you see?
    b. Draw a diagram of your flowers and label the parts. Identify which parts are the female reproductive system and which are the male reproductive system.
6. Carefully cut vertically through the pistil of each flower.
    a. Draw a diagram of the inside of the pistil and label the structures.

(The answers and drawings to questions 4, 5 and 6 must be submitted for evaluation!)

Analysis and Conclusion

Compare the flowers you examined by answering the following questions:

1. Why do you think the flowers were different?
2. Why do you think the similar parts of your flowers were similar?
3. Did any flowers you examined lack one or more of the parts shown in the figure?
4. What happens when the pollen reaches the egg?
5. In what part of the flower do seeds form?
6. How do insects and birds help with the process of pollination?

You must submit the pieces of flowers used during this investigation, the answers and drawn diagrams for the procedure questions 4, 5 & 6 and the analysis and conclusion questions 1-6. The questions are to be completed in you course notebook.

Follow the procedures for drawing Scientific Drawings!

Scientific Drawings

Rules:

- Always draw in pencil
- Never shade structures
- Draw exactly what you see, do not add any additional structures
- Place a title at the top of the drawing to indicate what it is
- Drawings should be done in pencil first, then coloured once finished
- When labelling the diagram make sure to use straight lines and write in pencil

Answer to Support Questions Unit 1

1. Organisms react to their environment. Organisms reproduce creating new organisms. Organisms, over time create new organisms. Organisms grown and change. Organisms move and if they are alive, they are made of cells.
2. Robert Hooke discovered the unit of life – the cell.
3. The 3 points of the cell theory are: All living things are composed of one or more cells. Cells are the basic unit of life. All cells come from other cells.
4. Cell organization is important because, cells are able to organise themselves in such a way that allows them to create tissues, organs, organs systems and as a result, living organisms.
5. Nucleus – the control centre of the cell and it contains all the cells DNA. The cytoplasm is the jelly within the cell that helps with all cell processes. The mitochondria and chloroplast (for plants) provides food and therefore energy for the cell. The ribosomes create proteins and the lysosome help to get rid of waste.
6. Plant cell contains chloroplast, have one large vacuole and has a cell wall. Animal cells don't have a cell wall and they have many small vacuoles.
7. Cells divide so that an organism can grow, repair themselves, reproduce and maintain already existing organs and organ systems.
8. The four stages of mitosis are prophase, metaphase, anaphase and telophase.
9. Interphase is important because it is the stage that allows the cell time to grow and time to replicate its genetic material (chromosomes).
10. Cytokinesis is the splitting (separation) of the cytoplasm. Happens at the end of telophase to complete the process of cell division.
11.

	Monera	**Protista**
Number of Cells	One cell	One cell
Location of Genetic Material	Genetic material floats in cytoplasm, no nucleus	Genetic information found inside the nucleus
Type of Cells	Prokaryotic	Eukaryotic

12.

	Plants	**Animals**
Type of	Eukaryotic	Eukaryotic

Cells		
Number of Cells	Many-celled	Many-celled
Nutrition	Members make their own food	Members eat other plants and animals

13. The difference between ***eukaryotic*** and ***prokaryotic*** cells is that eukaryotic cells have an organised nucleus containing genetic information, and prokaryotic cells do not.
14. Micro-organisms are organisms too small to see with the naked eye.
15. Bacteria can be useful because it helps to fix levels of nitrogen into the soil of the earth so that plants can grow to be healthy organisms. It also helps cows to digest their food.
16. Viruses can make plants and animals sick. For example, you can get sick with the flu from a virus.
17. Common causes of food poisoning are:

Common Causes of Food Poisoning	
• Storing food in a way that allows micro-organisms to grow quickly	• Passing micro-organisms from your unwashed hand, utensils, surfaces or from other foods
• Under-cooking food • Cooking kills any harmful micro-organisms that might be present	• Handling of food by someone who is sick

18. You can control micro-organisms in the kitchen by cleaning regularly with disinfectants (antibacterial cleaners), making sure surfaces are clean, washing your hands regularly when handling food, tying your hair back, storing foods at the proper temperatures, in the fridge or freezer and throwing spoiled food away.
19. Two types of reproduction are asexual and sexual.
20. Asexual requires one parent and produces exact copies of organisms, sexual reproduction is when organisms combine genetic information from two parents creating a new organism with new traits and characteristics.
21. The different types of asexual reproduction are: binary fission, budding, fragmentation, spore formation and vegetative reproduction.
22. Offspring resemble their original parent because they still contain half of the parents genetic information, they resemble, carry some of the same traits but are not identical to the parent.
23. Offspring that has been reproduced by sexual means is better able to adapt to a new environment because they have been given genetic information from two parents, therefore, new traits and characteristics are constantly being pasted on from parent to offspring. Sexual reproduction produces new combinations of genes that may allow organisms to adapt better to a given environment.

24. The male parts of the flower are the stamen and the anther. The female parts of the flower are the pistil, stigma, style and ovum, which contains the ovaries and eggs.
25. Pollination is the process where pollen is moved from the anther to the egg cells and fertilizes them.

