

# Unit 3

# Reproduction and Human Development

Grade 9 Science

Period \_\_

Ms. Hayduk

Name: \_\_\_\_\_

# Contents

Cells.....	6
Growth and Living Things.....	6
Characteristics of Living Things .....	6
What are Cells? .....	6
Cell Theory .....	6
Plant and Animal Cells .....	6
Activity: Plant and Animal Cells .....	7
The Cell Cycle .....	8
Why Do Cells Reproduce? .....	8
The Cell Cycle .....	8
Cell Type and the Cell Cycle.....	8
Mitosis.....	9
DNA and the Nucleus.....	9
Interphase.....	9
Prophase.....	9
Chromosomes.....	9
Metaphase.....	10
Anaphase.....	10
Telophase.....	10
Cytokinesis .....	10
Haploid and Diploid Cells.....	10
Activity: Mitosis Poster .....	11
Cancer and Cell Division .....	13
Activity: Cell Division in Normal and Abnormal Cells.....	15
Asexual Reproduction .....	17
Kingdoms of Organisms.....	17
Asexual Reproduction .....	17
What is Asexual Reproduction?.....	17
Advantages of Asexual Reproduction.....	17
Disadvantages of Asexual Reproduction.....	17
Asexual Reproduction of Bacteria .....	17
Binary Fission.....	17

Asexual Reproduction of Protists .....	18
Binary Fission.....	18
Asexual Reproduction of Fungi.....	18
Fragmentation.....	18
Budding.....	18
Spores .....	19
Asexual Reproduction of Animals.....	19
Fragmentation and Budding .....	19
Parthenogenesis.....	19
Asexual Reproduction of Plants.....	19
Vegetative Reproduction.....	19
Grafting .....	19
Sexual Reproduction .....	20
Sexual Reproduction .....	20
What is Sexual Reproduction?.....	20
Advantages of Sexual Reproduction .....	20
Disadvantages of Sexual Reproduction .....	20
Sexual Reproduction of Animals .....	20
External Reproduction .....	20
Internal Reproduction .....	20
Hermaphrodites .....	20
Lab: Investigating Reproductive Strategies.....	21
Sexual Reproduction of Plants .....	22
Pollination.....	22
Types of Plants with Seeds .....	22
Seed Dispersal.....	22
Activity: Structure of a Flower .....	23
Lab: Flower Dissection.....	25
Activity: Asexual and Sexual Reproduction.....	27
Genetics .....	29
Variation and Characteristics.....	29
Variation, Characteristics and Traits.....	29
Heredity.....	29
Variation.....	29

Dominant and Recessive Traits .....	29
Punnett Squares .....	29
Activity: Exploring Genetic Possibilities .....	29
Project: Genetic Engineering .....	31
Meiosis and the Reproductive System.....	33
Male Reproductive System .....	33
Meiosis (Sperm) .....	33
Male Reproductive System .....	34
Structures and Functions .....	34
Transport of Sperm.....	35
Female Reproductive System .....	35
Meiosis (Egg) .....	35
Female Reproductive System .....	36
Structures and Functions .....	36
Hormones and Menstruation .....	38
Hormones .....	38
Testosterone.....	38
Estrogen.....	38
Menstruation.....	38
Menstrual Cycle .....	38
Flow Phase.....	38
Follicular Phase .....	38
Ovulatory Phase .....	39
Luteal Phase.....	39
Summary .....	39
Activity: Hormone Cycles in the Female Body.....	41
Pregnancy and Fetal Development .....	43
Fertilization and Implantation.....	43
Pregnancy .....	43
Pregnancy Symptoms .....	43
First Trimester.....	43
Second Trimester.....	43
Third Trimester .....	44
Birth.....	45

Multiple Babies.....	45
Reproductive Technologies.....	45
Contraceptives.....	45
Contraception.....	45
The Pill .....	45
Contraceptive Injections.....	45
Intrauterine Device (IUD) .....	45
Artificial Reproductive Technology .....	46
Artificial Insemination.....	46
In Vitro Fertilization.....	46

# Cells

## Growth and Living Things

### Characteristics of Living Things

There are six main characteristics of living things:

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

### What are Cells?

- Cells are \_\_\_\_\_.
- They are the \_\_\_\_\_.
- All \_\_\_\_\_ are made up of cells.

It is important to know that most cells are not organisms, because most cells cannot survive on their own (e.g. a skin cell dies if it is removed from your body).

### Cell Theory

①
②
③
④

### Plant and Animal Cells

Plant and animal cells have different structure and \_\_\_\_\_ (“little organs”) because they make up very different organisms.

Plant cells are designed to:

Animal cells need to be:

Name: \_\_\_\_\_

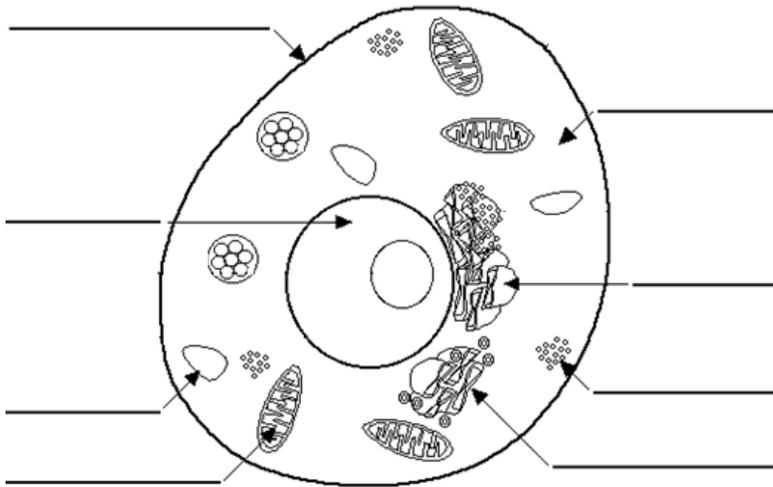
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**Activity: Plant and Animal Cells**

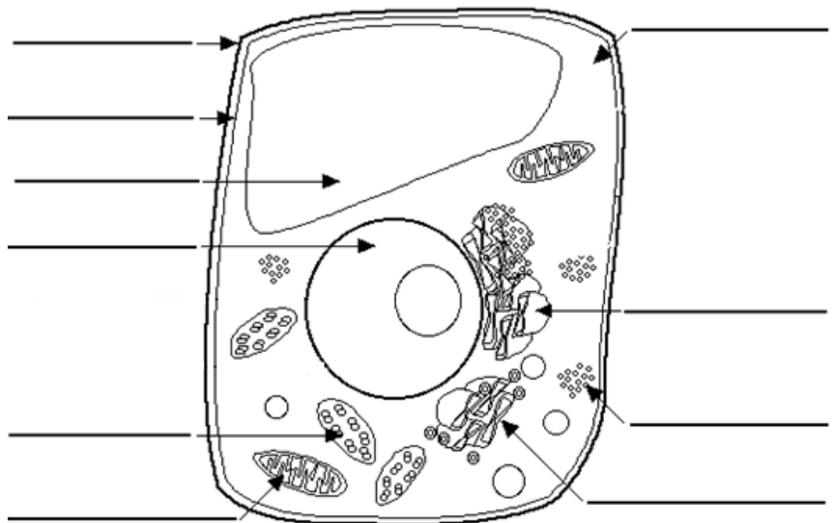
Use the information in the chart to label the two cells diagrams.

Organelle	Description and Function
Cell membrane	Semi-permeable membrane surrounding the cell; controls movement of substances into and out of the cell
Nucleus	Spherical organelle in the centre of the cell, bounded by a membrane; controls the cell
Cytoplasm	Fluid within the cell; transports substances and allows movement of organelles
Vacuole	Membrane bound sack, much larger in plant than animal cells; stores water, food and wastes
Cell wall	Fibrous structure surrounding plant cells; supports and creates the shape of the cell
Mitochondria	Football-shaped organelle with layers of stacked membrane; creates energy for the cell
Chloroplasts	Green organelle found in plant cells; produces energy through photosynthesis
Endoplasmic reticulum	White, maze-like organelle surrounding the nucleus; used to transport food or other materials
Ribosomes	Tiny, round organelles that float in cytoplasm or attach to ER; manufacture proteins
Golgi apparatus	Stack of saucer-like membranes; transports materials across the cell



**Questions**

1. Label each cell as a plant or animal cell.
2. Describe the difference in the shapes of the two cells. Why do they need to have different shapes?
3. What organelles does a plant cell have that an animal cell does not? Why are these organelles important?



## The Cell Cycle

### Why Do Cells Reproduce?

- 
- Cells may be damaged or die from injury to the organism or because they are old.
  - New cells replace dead or damaged cells.
- 
- When new organisms are created (babies), cells reproduce to create the new organism
- 
- An organism can only get bigger if its cells increase in size or if new cells are created.
  - When cells are too big, it takes too long for nutrients to travel through the cell. Also, the nucleus can't handle all of the extra tasks needed for a cell that is too big.
  - Cell division changes one big cell into two smaller cells, which will be more efficient.

### The Cell Cycle

Cells go through a series of phases in their life.

\_\_\_\_\_:  
The “rest phase” of the cell. During this time, it does its normal job, grows and prepares to divide itself.

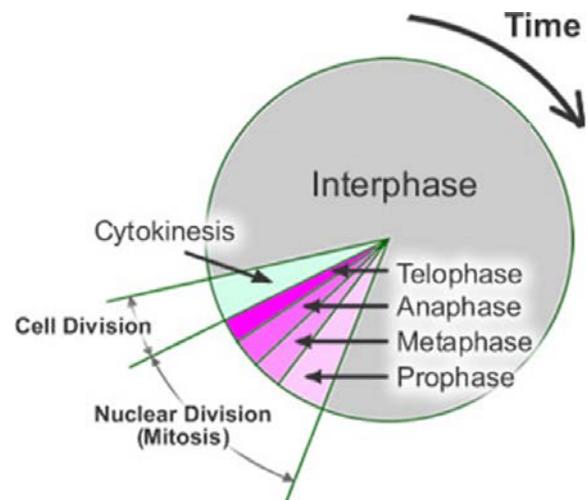
\_\_\_\_\_:  
The process of cell division. Within mitosis, there are four individual steps, where the nucleus of the cell divides into two new cells.

\_\_\_\_\_:  
Occurs after the nucleus has duplicated; two new cells are fully formed.

### Cell Type and the Cell Cycle

Different types of cells have different life spans because they have different functions.

Example:



# Mitosis

## DNA and the Nucleus

The nucleus is the \_\_\_\_\_ of the cell. It is called this because it contains \_\_\_\_\_, or DNA, which stores the cell's \_\_\_\_\_.

DNA tells the cell what its job is, how fast it should grow and when it should reproduce.

In the nucleus, DNA forms long strands called \_\_\_\_\_ that are scattered throughout the nucleus.

## Interphase

Interphase is the \_\_\_\_\_ of the cell cycle.

In addition to the normal functions of the cell, during this phase, the chromatin make \_\_\_\_\_ of themselves. This prepares the cell to reproduce.



## Prophase

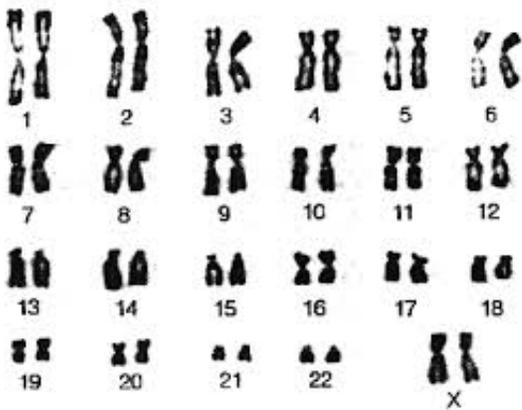
The duplicated strands of chromatin \_\_\_\_\_ themselves very tightly into structures called \_\_\_\_\_. Each chromatid is attached to its copy by a \_\_\_\_\_. This x-shaped structure is called a \_\_\_\_\_.

The membrane around the nucleus begins to \_\_\_\_\_ and \_\_\_\_\_.

\_\_\_\_\_ start to form. \_\_\_\_\_ move to the poles of the cell.



## Chromosomes



Chromatin, chromatids and chromosomes are all versions of the same thing. In interphase, the genetic material in the chromatin is accessible, allowing the cell to perform its role in the body.

Once the chromatin duplicates and condenses, it is more easily transported and divided to produce new cells.

Chromatin are invisible when viewed under a microscope, but can be viewed clearly once they become chromatids.

Different types of animals have different numbers of chromosomes.

Humans have \_\_\_\_\_ (46 chromosomes total). One pair of these chromosomes is responsible for sex-linked traits.

Metaphase

The spindle fibres attach to the chromosomes.

Chromosomes line up along the \_\_\_\_\_ of the cell in a straight line.

Anaphase

The spindle fibres begin to \_\_\_\_\_ and \_\_\_\_\_.

The chromosomes are separated so that one chromatid from each is pulled to each \_\_\_\_\_ of the cell.

Telophase

A \_\_\_\_\_ begins to form around each identical set of chromatids.

The chromatids begin to \_\_\_\_\_ and become \_\_\_\_\_, turning back into chromatin.

The \_\_\_\_\_ disappear.

Cytokinesis

The cytoplasm is divided to create two, identical \_\_\_\_\_.

In animal cells, the cell membrane pinches in to divide the cytoplasm, a process called \_\_\_\_\_.

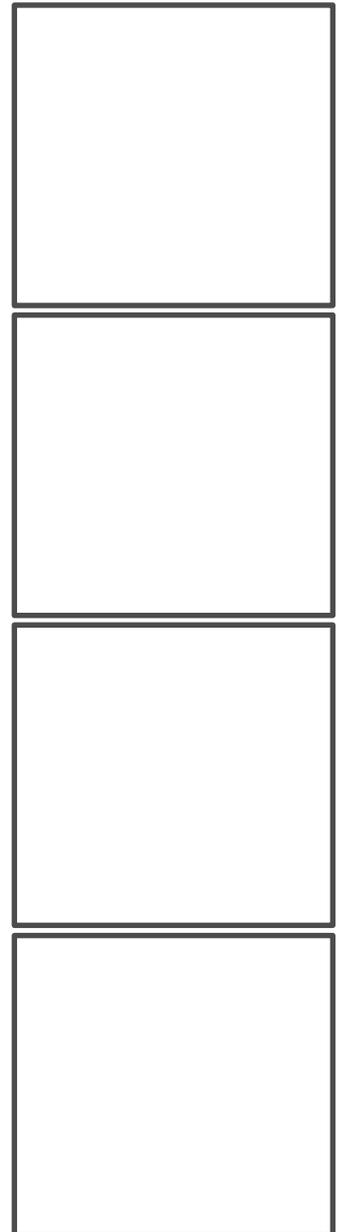
In plant cells, a \_\_\_\_\_ forms between the two nuclei to divide the cytoplasm.

Haploid and Diploid Cells

For organisms with two parents, we call these cells \_\_\_\_\_ cells, because there is one set of chromosomes from the mother and another from the father.

All of our body cells except \_\_\_\_\_ (sperm and eggs) are produced through mitosis, so they are all diploid cells.

Sex cells are called \_\_\_\_\_ cells because they have half of the number of chromosomes that diploid cells.



Name: \_\_\_\_\_

Date: \_\_\_\_\_

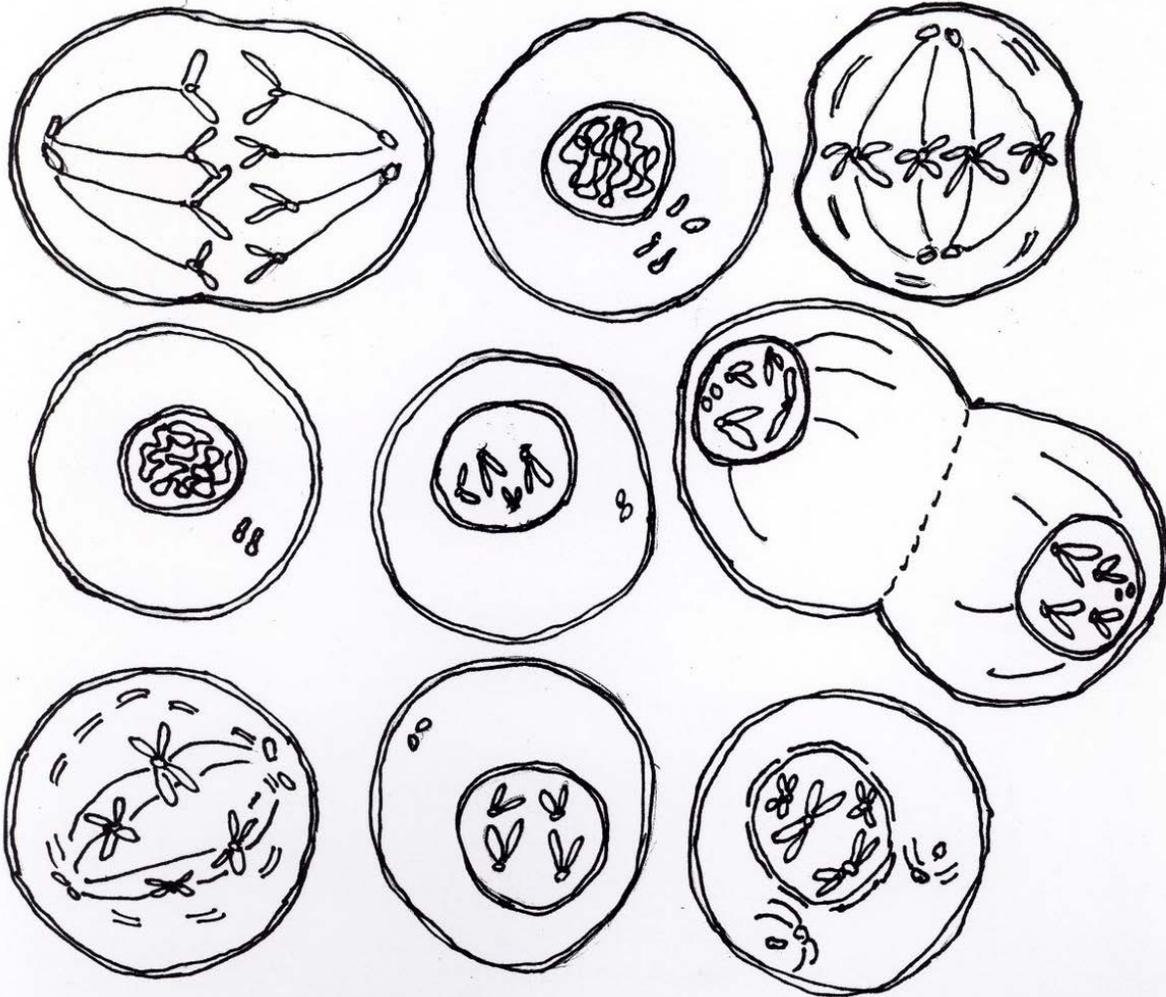
Period: \_\_\_\_\_

Due Date: \_\_\_\_\_

### Activity: Mitosis Poster

#### Instructions

1. Cut out the cells.
2. Arrange them in a circle so that the parent cell divides and forms into two new, identical cells.
3. Tape each cell on to the paper. **Do not write anything until Ms. Hayduk has checked your layout!** (2 marks)
4. Draw arrows between each stage. (1 mark)
5. Write the **name** of each stage. (6 marks)
6. Write one sentence next to each arrow explaining what is happening. (6 marks)





## Cancer and Cell Division

Cancer is the term used when cell growth is \_\_\_\_\_. Basically, cancer occurs when there is \_\_\_\_\_.

Cancer cells spend very little time in \_\_\_\_\_, because most of their time is spent in mitosis. They grow very quickly and reproduce at a very rapid rate.

When cancer is present in the body, normal cells suffer because so much energy is used up by the cancer cells.

Cancer cells can break off of groups of cells and travel throughout the body, and also have \_\_\_\_\_ that allow them to “grab on” to other cells and tissues.

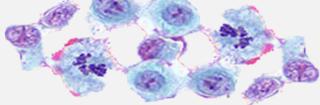
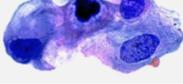
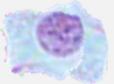
Cancer is caused by \_\_\_\_\_ cells, which can occur from a variety of sources, including \_\_\_\_\_.

A \_\_\_\_\_ is a cluster of cells going through \_\_\_\_\_.

\_\_\_\_\_ have cells that do not migrate, meaning the cancer will not spread to other parts of the body.

\_\_\_\_\_ can migrate.

A \_\_\_\_\_ is a medical process in which a sample of cells is removed and analyzed. This can determine whether there is cancer present and how dangerous it is.

Normal	Cancer	
		Large, variably shaped nuclei
		Many dividing cells; Disorganized arrangement
		Variation in size and shape
		Loss of normal features

There are three main techniques used to treat cancer. The choice depends on the type of cancer, how much it has spread and the general health of the person.

\_\_\_\_\_ uses radiation directed at a tumor to kill the cancer cells.

\_\_\_\_\_ uses chemicals injected into the body. This kills cancer cells, but also many normal cells.

\_\_\_\_\_ can be used to remove the tumor and hopefully prevent it from spreading.



Name: \_\_\_\_\_

Date: \_\_\_\_\_

Period: \_\_\_\_\_

Due Date: \_\_\_\_\_

**Activity: Cell Division in Normal and Abnormal Cells**

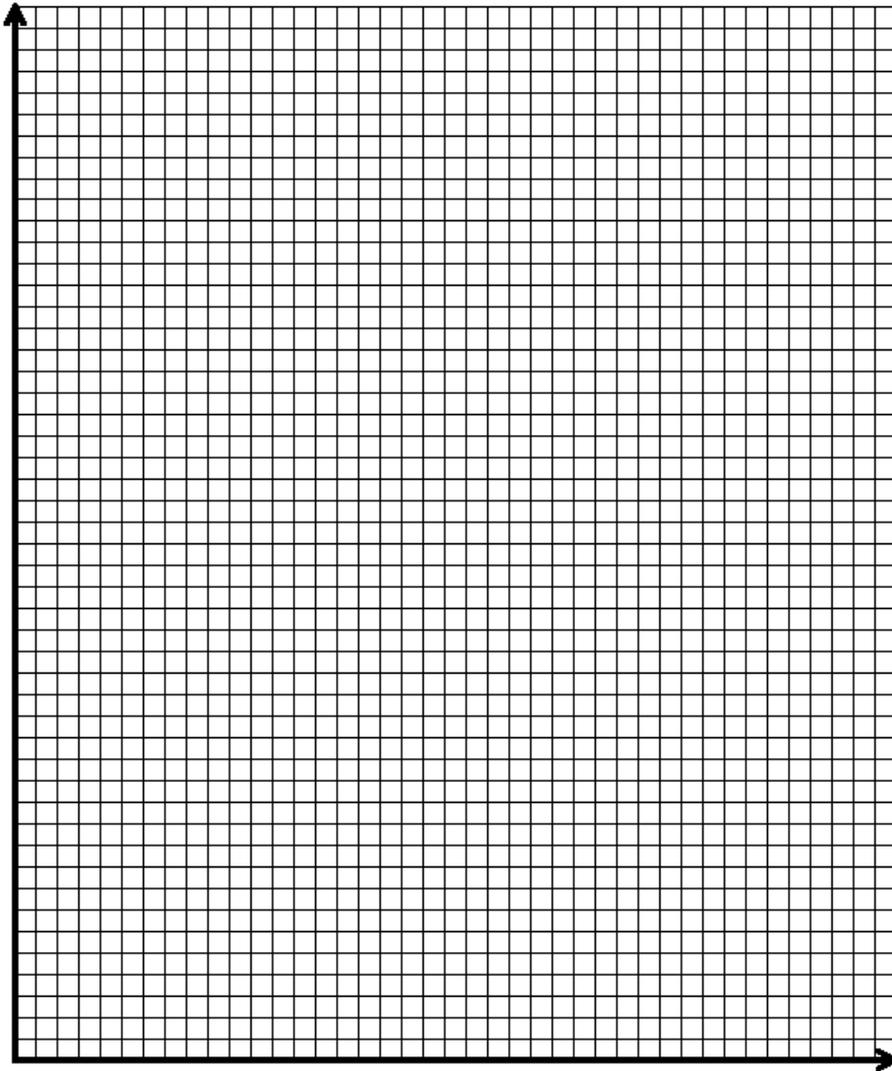
Cell A reproduces once every 24 hours, producing two new cells. (# cells  $\times$  2 every 24 hrs)

Cell B reproduces once every eight hours, producing two new cells. (# cells  $\times$  2 every 8 hrs)

Record the number of cells produced from the original cell each day for the first four days.

Time (hours)	0	8	16	24	32	40	48	56	64	72	80	88	96
Cell A (#)	1	1	1	2									
Cell B (#)	1	2	4										

Graph the number of cells on the grid. Make each line a different colour or a different marker. Each square on the y-axis should be 100 cells. (Graph is 6 marks)





# Asexual Reproduction

## Kingdoms of Organisms

- \_\_\_\_\_
- \_\_\_\_\_
  - Vertebrates (mammals, reptiles, amphibians, bird, fish)
  - Molluscs (clams, snails, octopuses)
  - Arthropods (insects, spiders, lobsters)
  - Annelids (worms)
  - Cnidarians (jellyfish, anemones, coral)
  - Sponges
- \_\_\_\_\_
  - Mostly single-celled organisms that do not fit into other kingdoms (\_\_\_\_\_ - nucleus)
- \_\_\_\_\_
  - Single-celled (\_\_\_\_\_ - no nucleus)
- \_\_\_\_\_
  - Moulds, yeast, mushrooms

## Asexual Reproduction

### What is Asexual Reproduction?

Asexual reproduction is a way for organisms to reproduce \_\_\_\_\_.

All of the offspring are created from one parent, and are \_\_\_\_\_ to each other (and to the parent).

Each of the offspring is called a \_\_\_\_\_.

### Advantages of Asexual Reproduction

•
•
•

### Disadvantages of Asexual Reproduction

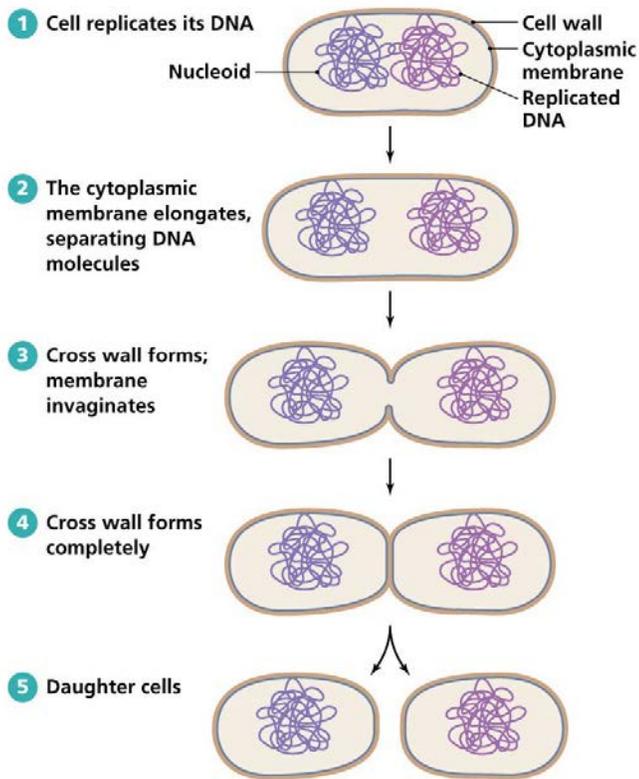
- No genetic variation

•
•
•

## Asexual Reproduction of Bacteria

### Binary Fission

Binary fission occurs when \_\_\_\_\_ organisms divide into two new, identical organisms. It is very much like the process of mitosis, except that bacteria have no nucleus, so it is simpler. Binary fission can occur in as little as \_\_\_\_\_.

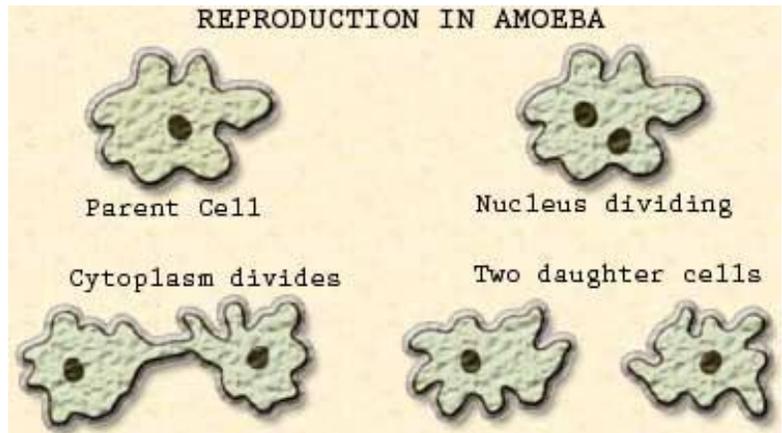


## Asexual Reproduction of Protists

### Binary Fission

Protists also undergo binary fission, but the process is slightly different, since these organisms have a nucleus.

Just like with bacteria, two identical organisms are created, but the nucleus needs to divide as well.



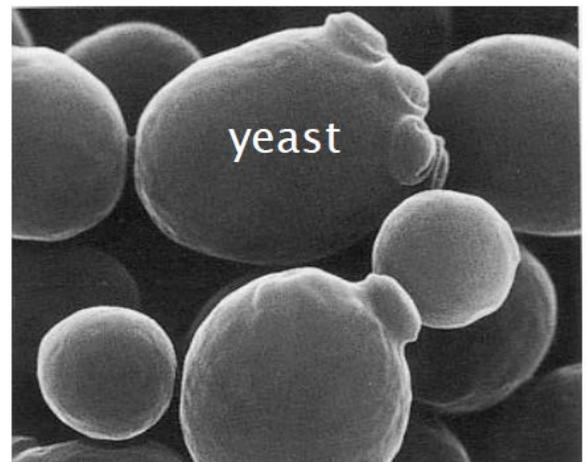
## Asexual Reproduction of Fungi

### Fragmentation

Fragmentation occurs when a small piece of the main organism \_\_\_\_\_ and grows into a new, genetically identical organism. For fragmentation to be successful, \_\_\_\_\_ from the parent organism must be present in the piece that separates.

### Budding

The parent produces a small bud (basically a tiny clone – like a baby!), which grows out of the parent and can eventually detach to be a completely new offspring. Yeast reproduces using this method.



## Spores

Most fungi can reproduce by spores, but it is especially common for moulds. A spore is a \_\_\_\_\_ that grows into a new organism through \_\_\_\_\_.



Spores travel to a new place by water or wind, where they grow into a new organism.

## **Asexual Reproduction of Animals**

Asexual reproduction in animals is mostly limited to \_\_\_\_\_, animals without a backbone. These can include sponges, jellyfish, worms, shellfish and insects.

### Fragmentation and Budding

Fragmentation for animals is mainly limited to specific types of worms, that can be cut in two and each half becomes its own organism.

Other animal species cannot be fragmented, but do have the same \_\_\_\_\_ ability to regrow lost limbs.

Invertebrates like hydra and sponges can reproduce by budding, similar to yeast.

### Parthenogenesis

Certain species of insects and some reptiles can reproduce from unfertilized eggs. These eggs develop into full organisms, but may be different or less complex than organisms of the species from fertilized eggs.

For example, in bees, unfertilized eggs develop into worker drones (male) and fertilized eggs become female workers.



## **Asexual Reproduction of Plants**

### Vegetative Reproduction

Vegetative reproduction has many methods:

- \_\_\_\_\_ (the cutting, in water, will grow roots which can be planted)
- \_\_\_\_\_ (plant puts out shoots that grow along the ground - roots develop and new plants grow along the length of the runner)
- \_\_\_\_\_ (new plants grow from pieces of the old bulb or organism)

### Grafting

Grafting is a process for plants when one part of one plant is joined on to another plant. The two plants continue to grow as one plant, but their DNA does not change - so they look like separate plants.



# Sexual Reproduction

## Sexual Reproduction

### What is Sexual Reproduction?

Sexual reproduction is:

Sex cells, also called \_\_\_\_\_, refers to egg (from females) and sperm (from males). The union of the egg and sperm is called \_\_\_\_\_.

Sexual reproduction occurs for most species of plants and animals, and generally involves two organisms.

### Advantages of Sexual Reproduction

The offspring of sexual reproduction have a combination of genes from both parents.

\_\_\_\_\_ in a population allows the organisms to adapt and survive through disease and other dangers.

### Disadvantages of Sexual Reproduction

Sexual reproduction takes more time, so populations do not grow as quickly.

## Sexual Reproduction of Animals

### External Reproduction

In external reproduction, the eggs are \_\_\_\_\_, then \_\_\_\_\_. The eggs are abandoned to develop on their own.

This happens in \_\_\_\_\_ environments with simpler organisms, which lay thousands of eggs at one time to ensure survival of as many of the offspring as possible.

### Internal Reproduction

Internal reproduction occurs when the egg is fertilized \_\_\_\_\_ through sexual intercourse.

For animals, this egg is then either \_\_\_\_\_ (reptiles, amphibians, birds) or \_\_\_\_\_ (mammals).

### Hermaphrodites

Hermaphrodites can produce \_\_\_\_\_.

They usually reproduce with each other, but in some cases (e.g. diminished population) they can \_\_\_\_\_. When two hermaphrodites reproduce, \_\_\_\_\_.

Some animals can also change sex to fill the need in a population (think Jurassic Park).

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Period: \_\_\_\_\_

Due Date: \_\_\_\_\_

## Lab: Investigating Reproductive Strategies

### Purpose

To investigate internal and external reproduction and to identify advantages and disadvantages of each

### Pre-Lab Questions

1. My assigned animal is: \_\_\_\_\_
2. Type of fertilization:    internal                  external
3. Type of development: internal                  external
4. How will I care for my developing young?
  
5. How will I attend to my own needs (getting food, avoiding predators) while I care for my young?

### Hypothesis

Do you think you will be able to care for your young in this way long enough to ensure that they remain unharmed and are able to hatch/be born?

### Post-Lab Questions

1. Were you able to care for your young until they hatched? Why or why not?
2. Did you have any trouble gathering food? Why or why not?
3. Were you able to protect yourself and your offspring?
4. What are at least two advantages and two disadvantages of your kind of development? Explain!
5. What are at least two advantages and two disadvantages of your kind of fertilization? Explain!
6. What kind of development keeps the growing young the safest?

Criteria	Great (5)	Good (4)	Average (3)	Poor (2)	Missing (0)
Pre-lab questions and hypothesis are answered correctly and completely, using logic and insightful thinking.					
Lab was performed accurately. All students in lab group demonstrated a good amount of effort.					
Discussion questions are answered using scientific language and are accurate, detailed and insightful.					

## Sexual Reproduction of Plants

### Pollination

\_\_\_\_\_, which carries sperm, is transported from the male part of one plant to the female part of another plant.

Animals like birds, insects and bats transfer pollen when they are attracted to the scent or bright colour of the plant and the pollen sticks to them. They move it around as they visit different plants.

Pollen can also be transported by wind or water.

Some plants with both male and female organs can \_\_\_\_\_, which is when the pollen is transferred within the same plant.

\_\_\_\_\_ occurs when pollen is transferred between plants.

The embryo that formed from pollination develops in a \_\_\_\_\_, which protects the embryo and stores food.

### Types of Plants with Seeds

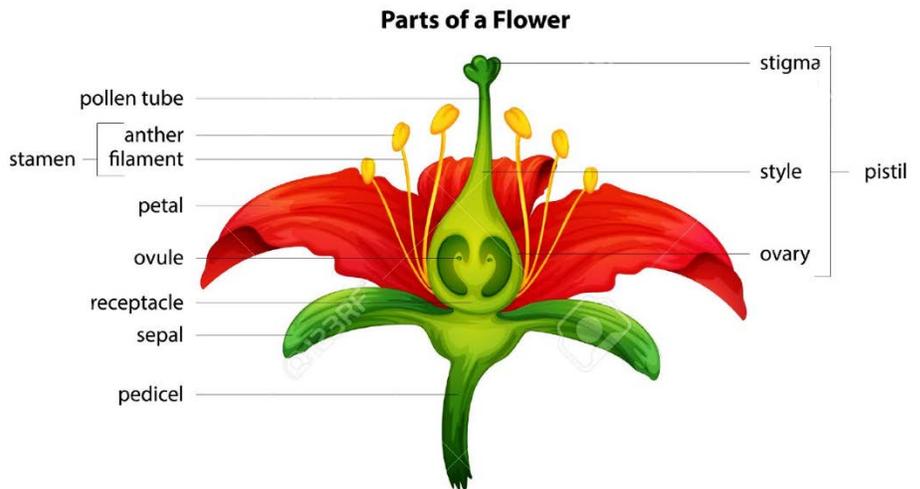
\_\_\_\_\_ reproduce using male and female \_\_\_\_\_ . The male cones produce pollen and the female cones develop seeds.

\_\_\_\_\_ reproduce using flowers. These are the most common type of plants. Some angiosperms develop fruit around their seeds.

### Seed Dispersal

The embryo in seeds stays dormant (undeveloped) until the conditions are right for it to grow.

Many seeds reach soil by gravity, but others are spread around by wind, water or animals, who eat or bury the seeds or spread seeds around that are stuck to their fur or feathers.



Name: \_\_\_\_\_

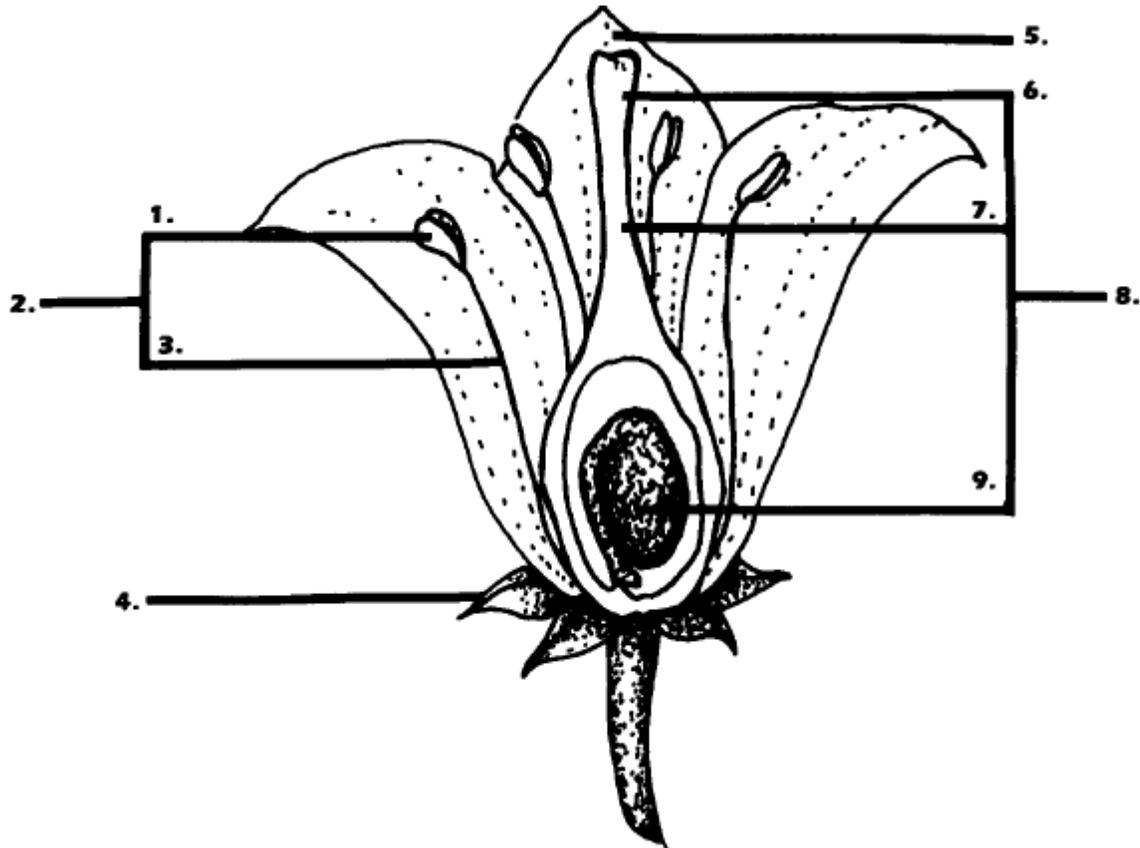
Date: \_\_\_\_\_

Period: \_\_\_\_

### Activity: Structure of a Flower

Use the terms below to label the diagram of the flower and to fill in the statements that follow.

Stigma	Anther	Sepals	Style	Filament
Petals	Pistil		Stamen	Ovary



1. The \_\_\_\_\_ contains the egg cells.
2. The \_\_\_\_\_ is sticky and is located on top of the pistil.
3. The petals are surrounded by the \_\_\_\_\_.
4. The anther is supported by the \_\_\_\_\_.
5. The \_\_\_\_\_, a stalk-like structure, has the stigma on its tip and the ovary at its base.
6. Often brightly coloured, the \_\_\_\_\_ are surrounded by the sepals.
7. Located at the top of the filament, the \_\_\_\_\_ contains the pollen.
8. The \_\_\_\_\_ is the collective term for the flower's female reproductive structures consisting of the stigma, style and ovary.
9. The \_\_\_\_\_ is the collective term for the flower's male reproductive structures consisting of the anther and the filament.



Name: \_\_\_\_\_

Date: \_\_\_\_\_

Period: \_\_\_\_\_

Due Date: \_\_\_\_\_

## Lab: Flower Dissection

### Objectives

1. Identify the reproductive organs of angiosperms
2. Describe the functions of the major reproductive organs of a flower
3. Explain how flowers produce seeds

### Materials

- Flower
- Scalpel
- Tweezers
- Magnifying glass
- Dark paper
- Apple (for reference)

### Procedure

1. Examine a flower using the diagram in your notes as a reference. Look for the sepals of the flower. They are typically on the outside of the flower, and are often green.
2. Examine the texture and colour of the flower's petals. Record observations.
3. Carefully pull back the petals of the flower to examine the stamens. Remove one anther and brush it against a dark piece of paper. Use the magnifying glass to examine the pollen grains. Record observations.
4. To see the pistil clearly, gently separate the flower from the sepals and base. The stamens will usually stay with the flower petals and the pistil remains attached to the base.
5. Locate the pistil. Identify the three parts: the stigma at the top, the long shaft called the style and the ovary at the bottom. Carefully cut the pistil open with the razor blade to see the ovary and the ovules within it. Compare the inside of the pistil to the interior of the apple. Record observations.
6. Draw a sketch of the flower you examined on a piece of white paper. Properly label the reproductive parts. Your drawing must be large, clear and neat.

### Discussion

1. How similar was your flower to the one in the diagram? How was it different?
2. What feature of the stigma makes it suited for capturing pollen grains? What feature of the pollen grains makes them suited for being brushed off by insects and blown away by air currents?
3. What is the difference between self-pollination and cross-pollination?
4. Where are the male and female gametes produced in the flower?

### Evaluation

Criteria	Great (5)	Good (4)	Average (3)	Poor (2)	Missing (0)
Observations are written using scientific language and are accurate, detailed and insightful.					
Flower sketch is large, clear and neat. All relevant parts of the flower are accurately labelled. A ruler is used where necessary.					
Discussion questions are answered correctly and completely.					



Name: \_\_\_\_\_

Date: \_\_\_\_\_

Period: \_\_\_\_\_

Due Date: \_\_\_\_\_

**Activity: Asexual and Sexual Reproduction**

**Instructions**

1. Go to the site <http://learn.genetics.utah.edu/content/variation/reproduction>
2. For each organism on the site, read the description, then determine if it reproduces sexually, asexually or both. Fill in the chart as you go.
3. Complete the second chart, then identify advantages and disadvantages of asexual and sexual reproduction.

**Chart 1: Organisms**

Honey Bee	Sexual	Both	Asexual	Garden Strawberry	Sexual	Both	Asexual
Sea Horse	Sexual	Both	Asexual	Sand Scorpion	Sexual	Both	Asexual
Giant Amoeba	Sexual	Both	Asexual	Monarch Butterfly	Sexual	Both	Asexual
Grizzly Bear	Sexual	Both	Asexual	Leopard Frog	Sexual	Both	Asexual
Coast Redwood	Sexual	Both	Asexual	Baker's Yeast	Sexual	Both	Asexual
Brittle Star	Sexual	Both	Asexual	Bald Eagle	Sexual	Both	Asexual
Pink Salmon	Sexual	Both	Asexual	Salmonella	Sexual	Both	Asexual
Sunflower	Sexual	Both	Asexual	Flatback Sea Turtle	Sexual	Both	Asexual
Volvox	Sexual	Both	Asexual	Red Kangaroo	Sexual	Both	Asexual
Earthworm	Sexual	Both	Asexual	Saguaro Cactus	Sexual	Both	Asexual
Whiptail Lizard	Sexual	Both	Asexual				

**Chart 2: Asexual versus Sexual Reproduction**

	Asexual	Sexual
<b>Number of organisms involved</b>		
<b>Amount of genetic variation</b>		
<b>Types of organisms</b>		
<b>Amount of time/frequency</b>		
<b>Number of offspring produced</b>		
<b>PROS</b>		
<b>CONS</b>		

**Evaluation**

<b>Criteria</b>	<b>Great (5)</b>	<b>Good (4)</b>	<b>Average (3)</b>	<b>Poor (2)</b>	<b>Missing (0)</b>
Chart 1 is complete and correct.					
Chart 2 is complete, accurate, detailed and insightful.					

# Genetics

## Variation and Characteristics

### Variation, Characteristics and Traits

A \_\_\_\_\_ is a feature of an organism, like wing span, eye colour or leaf shape.

A \_\_\_\_\_ is how characteristics vary among different individuals of an organism. This \_\_\_\_\_ is present because organisms that reproduce sexually pass on a mixture of genes from each parent.

### Heredity

\_\_\_\_\_ is the word used to describe characteristics that are genetically determined, or passed on from parent to offspring.

Some characteristics are heritable, and are influenced by genes, while others are non-heritable. If children demonstrate similar non-heritable characteristics as their parents, they are more likely learned through conditioning.

### Variation

Some characteristics are \_\_\_\_\_, meaning they show in one form or another, such as earlobes being attached or not.

Other characteristics are \_\_\_\_\_, and may have a range of possibilities depending on the genes of the parents. Height or weight is an example of this.

## Dominant and Recessive Traits

A \_\_\_\_\_ is a variation of a characteristic that will appear in the offspring if one parent contributes it.

\_\_\_\_\_ are only expressed if both parents contribute the gene.

A \_\_\_\_\_ is a combination of two parents with all dominant traits.

### Punnett Squares

A Punnett square is a way to show the possibility of how a gene will be expressed in the offspring based on the genes of the parents.

This can be demonstrated with blood types. There are four blood types: A, B, AB and O. A and B are both types of antigens present in the blood, and O is the lack of either A or B antigens.




## Activity: Exploring Genetic Possibilities

Complete the activity in Saskatchewan Science 9 on pg. 57 called *Exploring Genetic Possibilities*. Hand in questions 1-5.

# Genetic Engineering

Genetically modified "super" corn can resist heat, cold, drought, and insects.



**W**hat would happen if you crossed a cactus with a rose? Well, you'd either get an extra spiky flower, or a bush that didn't need to be watered very often. Until recently, this sort of mix was the stuff science fiction was made of. But now, with the help of genetic engineering, it may be possible.

Genetic engineering is a way of taking genes—sections of DNA that produce certain traits, like the color of a flower or the shape of a nose—from one species and giving them to another.

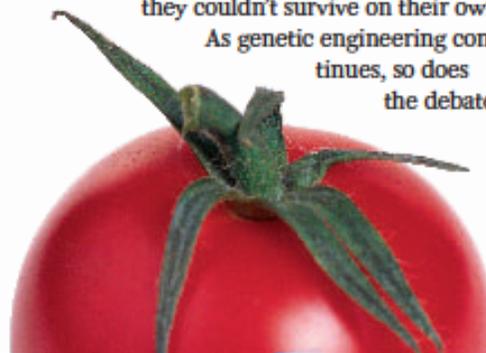
In 1983, the first plant was genetically modified, or changed. Since then, many crops in the U.S. have been modified in this way, including soybeans, potatoes, tomatoes, and corn.

One purpose of genetic engineering is to transfer an organism's traits. For example, scientists have changed lawn grass by adding to it the gene from another grass species. This gene makes lawn grass grow slowly, so it doesn't have to be mowed very often. Genetic engineering can also make plants that grow bigger and faster, repel insects, or resist herbicides. These changes could allow farmers to produce more crops with fewer chemicals. Scientists predict that genetic engineering soon will produce crops that are more nutritious and that can resist cold, heat, or even drought.

Genetic engineering is a relatively new process, and some people are worried about the long-term risks. One concern is that people might be allergic to modified foods and not realize it until it's too late. Other people say that genetic engineering is unnatural. Also, farmers must purchase the patented genetically modified seeds each growing season from the companies that make them, rather than saving and replanting the seeds from their current crops.

People in favor of genetic engineering reply that there are always risks with new technology, but proper precautions are being taken. Each new plant is tested and then approved by U.S. governmental agencies. And they say that most "natural" crops aren't really natural. They are really hybrid plants bred by agriculturists, and they couldn't survive on their own.

As genetic engineering continues, so does the debate.



**Debate** Research the pros and cons of genetic engineering at the link shown to the right. Decide whether you are for or against genetic engineering. Debate your decision with a classmate.

Balance **online**

For more information, visit  
[life.msscience.com/time](http://life.msscience.com/time)

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Period: \_\_\_\_\_

Due Date: \_\_\_\_\_

### **Project: Genetic Engineering**

#### **Instructions**

With a partner, research the process of genetic engineering. Put together a 1-2 page report that outlines the following:

1. How is genetic engineering used to modify crops and livestock?
2. What are some of the advantages of genetic engineering?
3. What are some of the disadvantages or concerns about genetic engineering?
4. Come to a conclusion (and explain it) about whether genetic engineering should continue and, if so, if any changes needed to be made.
5. Include a works cited that includes scientifically appropriate sources.

#### **Evaluation**

<b>Criteria</b>	<b>Great (5)</b>	<b>Good (4)</b>	<b>Average (3)</b>	<b>Poor (2)</b>	<b>Missing (0)</b>
Report uses scientific language appropriately and is written in the student's own words.					
Clear understanding of the topic that is well explained.					
Conclusion is reasonable and well-supported.					
Works cited is complete and includes only reasonable and appropriate sources.					



# Meiosis and the Reproductive System

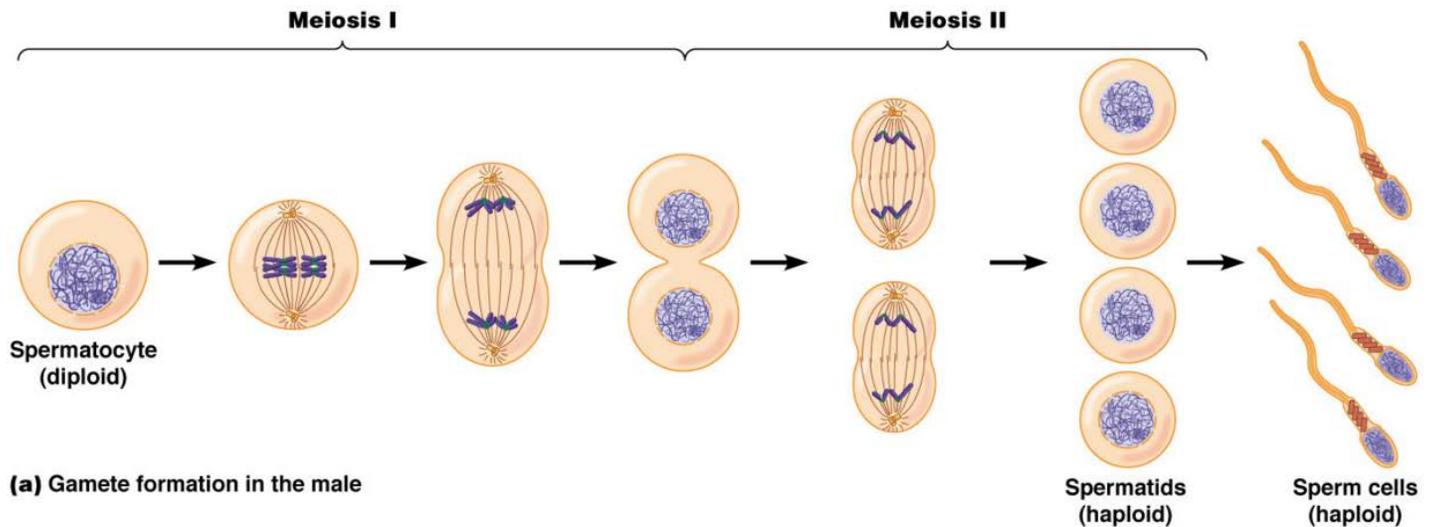
## Male Reproductive System

### Meiosis (Sperm)

The main function of the male reproductive system is to produce \_\_\_\_\_.

Sperm is produced when special cells in the \_\_\_\_\_ go through \_\_\_\_\_.

Meiosis is like mitosis, but it produces \_\_\_\_\_. Each cell has \_\_\_\_\_ chromosomes, instead of 46 like the other cells in the human body.



(a) Gamete formation in the male

One important thing to remember about meiosis is that the four cells that are produced are \_\_\_\_\_. This means that each sperm contains a different set of genes from each other sperm.

In meiosis, pairs of chromosomes undergo something called \_\_\_\_\_, where similar (but not identical) pairs trade sections of DNA.

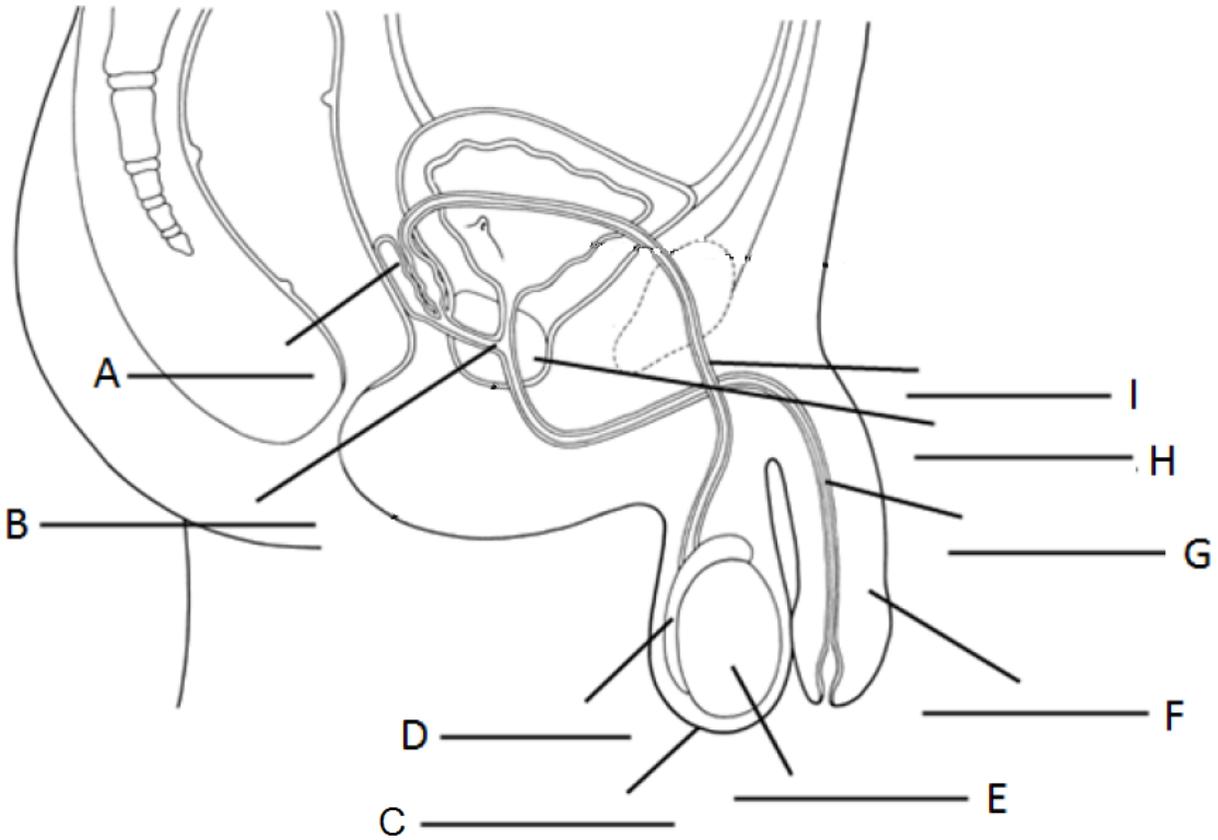
In humans' 46 chromosomes, two of them determine sex. If there are \_\_\_\_\_, the human is biologically female. \_\_\_\_\_ makes a biological male.

When sperm are created, they only have one sex chromosome. About half are X-sperm and half are Y-sperm.

Male Reproductive System

Ejaculatory Duct Epididymis	Penis Prostate	Scrotum Seminal Vesicles Testis (Testicle)	Urethra Vas Deferens
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Use the terms in the Word Bank above to label the diagram below.

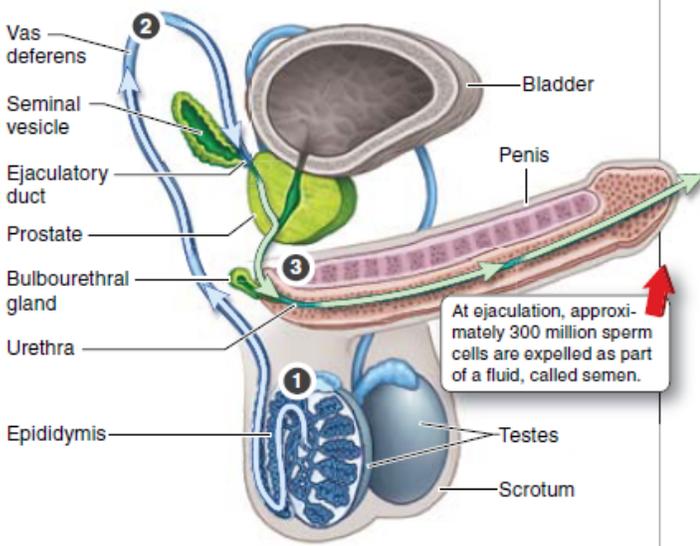


Structures and Functions

- \_\_\_\_\_ - Primary organ in transport of semen/urine  
(Semen is a combination of fluid and sugars, designed to help transport and nourish sperm.)
- \_\_\_\_\_ - sac containing the testes; used to control temperature of the testes by relaxing or contracting
- \_\_\_\_\_ - produce and store sperm
- \_\_\_\_\_ - structures responsible for production and transport of sperm
- \_\_\_\_\_ - structures responsible for production of semen

## Transport of Sperm

During ejaculation, sperm move from the male body as follows:



- 1 MATURATION**  
Sperm mature in the epididymis.
- 2 STORAGE AND TRANSFER**  
Muscle contractions cause sperm to move from the epididymis through the vas deferens.
- 3 DELIVERY**  
Sperm move through the ejaculatory duct into the urethra, where they can be expelled.

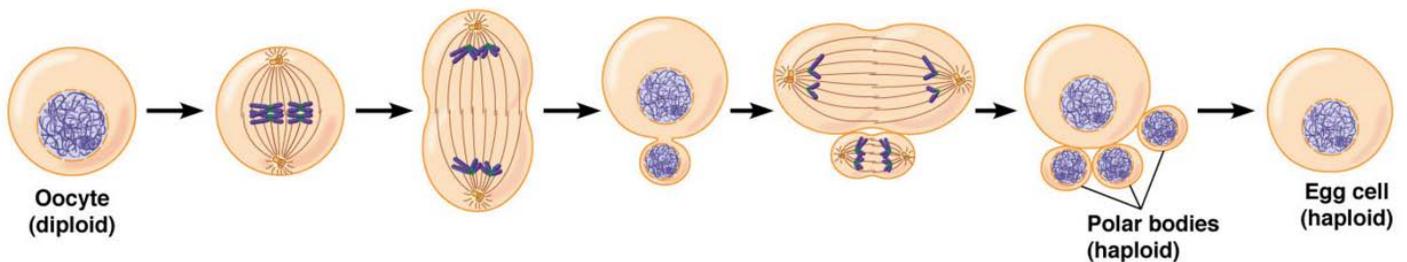
## Female Reproductive System

### Meiosis (Egg)

The two major functions of the female reproductive system are to \_\_\_\_\_ and for the \_\_\_\_\_.

Unlike sperm, which are produced very rapidly and in huge numbers, \_\_\_\_\_ (about one per month).

Females are born with 1-2 million immature eggs and do not produce more during their lifetime.



**(b) Gamete formation in the female**

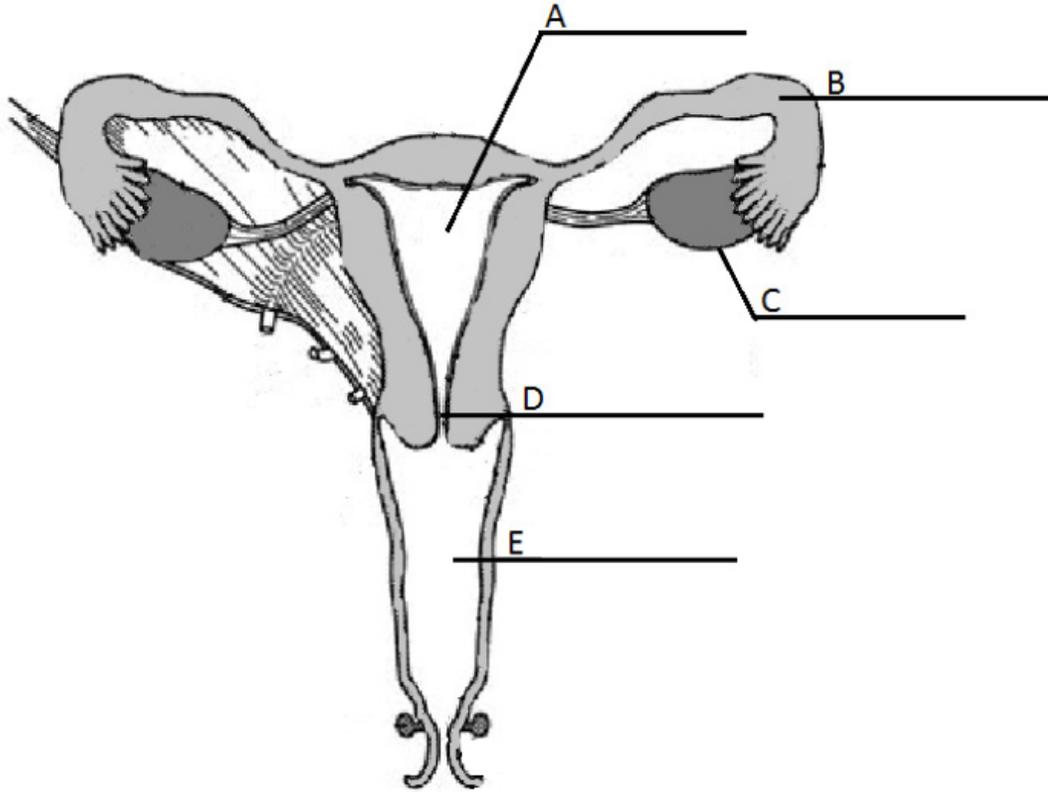
Just like with sperm, each egg cell produced is \_\_\_\_\_.

However, only one \_\_\_\_\_ (“usable”) egg cell is produced for each meiosis cycle. The egg cell takes most of the \_\_\_\_\_, and the other three cells (\_\_\_\_\_) die off.

Female Reproductive System

Cervix	Ovary	Vagina
Fallopian Tube	Uterus	

Use the terms in the Word Bank above to label the diagram below.



Structures and Functions

- \_\_\_\_\_ - muscular organ that holds a growing baby (also called a \_\_\_\_\_)
- \_\_\_\_\_ - produce and store eggs, estrogen and progesterone
- \_\_\_\_\_ - transport eggs from ovary to uterus
- \_\_\_\_\_ - pathway for sperm, baby or menstrual blood (into or out of the body)
- \_\_\_\_\_ - expands and contracts to control movement into and out of the uterus

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Period: \_\_\_\_\_

### Practice: Meiosis and the Reproductive System

1. For each of the statements, identify whether it applies to mitosis, meiosis or both.

a. Makes two daughter cells	mitosis	meiosis	both
b. Produces gametes (sex cells)	mitosis	meiosis	both
c. All cells produced are genetically different	mitosis	meiosis	both
d. Crossing over occurs	mitosis	meiosis	both
e. Makes four daughter cells	mitosis	meiosis	both
f. Metaphase occurs twice	mitosis	meiosis	both
g. Produces cells with 46 chromosomes	mitosis	meiosis	both

2. What is the main way that gametes (egg and sperm cells) are different from body cells?

3. Write the structures through which sperm travels on the path they take to leave the body.

Epididymis → \_\_\_\_\_ → \_\_\_\_\_ → \_\_\_\_\_

4. What is the purpose of the scrotum? Why is this important?

5. What are two ways that the production of eggs and sperm are different?

6. List the structures of the female reproductive system that an egg will travel through, in order, on its way out of the body.

Ovary → \_\_\_\_\_ → \_\_\_\_\_ → \_\_\_\_\_ → \_\_\_\_\_

# Hormones and Menstruation

## Hormones

### Testosterone

\_\_\_\_\_ is the main male sex hormone. It is produced in the \_\_\_\_\_. It is responsible for the production of sperm.

It is responsible for many secondary sexual characteristics of males, including:

- \_\_\_\_\_
- Growth of the larynx (voice box), causing a \_\_\_\_\_
- \_\_\_\_\_

Testosterone is also produced in women, but in much smaller quantities.

### Estrogen

\_\_\_\_\_ is the main female sex hormone. It is produced in the \_\_\_\_\_. It is responsible for secondary sex characteristics in females, as well as preventing growth of facial hair. Estrogen is also produced in men, but in much smaller quantities.

## Menstruation

### Menstrual Cycle

The menstrual cycle (or \_\_\_\_\_) is a process, regulated by \_\_\_\_\_, through which eggs mature, are released from the ovary and then released from the body.

There are four phases of the menstrual cycle:

- \_\_\_\_\_ phase
- \_\_\_\_\_ phase
- \_\_\_\_\_ phase
- \_\_\_\_\_ phase

### Flow Phase

The first day of the menstrual cycle is the shedding of the \_\_\_\_\_, or the uterine lining. This is also known as a \_\_\_\_\_ or menstruation.

This phase takes approximately \_\_\_\_\_.

### Follicular Phase

In the follicular phase, a hormone called the \_\_\_\_\_ (FSH) is released. FSH causes 15-20 of the immature eggs in the ovaries to start growing. Each egg is in its own \_\_\_\_\_, like a shell. These eggs produce \_\_\_\_\_.

When enough estrogen is produced, \_\_\_\_\_. This prevents too many eggs from maturing at once.

One follicle becomes \_\_\_\_\_ and stops growth on the others, which die. The remaining follicle continues to mature and release estrogen.

At the same time, the endometrium \_\_\_\_\_.

The follicular phase lasts approximately \_\_\_\_\_.

### Ovulatory Phase

At the beginning of the phase, there is a surge of \_\_\_\_\_ (LH). This hormone causes the egg to break out of its follicle and to be released from the ovary, in a process called \_\_\_\_\_.

The egg is transported through the \_\_\_\_\_.

The \_\_\_\_\_ begins to increase the amount and thickness of mucus it produces, so that sperm can more easily reach the egg.

This phase is \_\_\_\_\_ long.

For \_\_\_\_\_ to occur, the sperm needs to reach the egg during this time. Sperm can survive for approximately \_\_\_\_\_ in the female body.

### Luteal Phase

The empty follicle, now called a \_\_\_\_\_, begins to produce the final hormone, called \_\_\_\_\_. Progesterone prepares the uterus for a fertilized egg to implant. The endometrium thickens.

If a fertilized egg is implanted, then the body will prepare for \_\_\_\_\_.

If no fertilized egg is implanted, the levels of estrogen and progesterone will decrease and the endometrium will begin to pull away from the uterus, indicating the beginning of the \_\_\_\_\_.

This phase is approximately \_\_\_\_\_.

### Summary

<b>Phase</b>	<b>Key Events</b>	<b>Length</b>
Flow	<ul style="list-style-type: none"><li>• Shedding of endometrium</li></ul>	3-7 days
Follicular	<ul style="list-style-type: none"><li>• FSH released</li><li>• Egg begins to develop in ovary and releases estrogen</li><li>• Endometrium begins to thicken</li></ul>	7-10 days
Ovulatory	<ul style="list-style-type: none"><li>• LH surge</li><li>• Egg is released from follicle and travels through the fallopian tube (ovulation)</li><li>• Fertilization must occur in this phase</li></ul>	1-2 days
Luteal	<ul style="list-style-type: none"><li>• Corpus luteum releases progesterone to prepare uterus for possible pregnancy</li></ul>	10-16 days

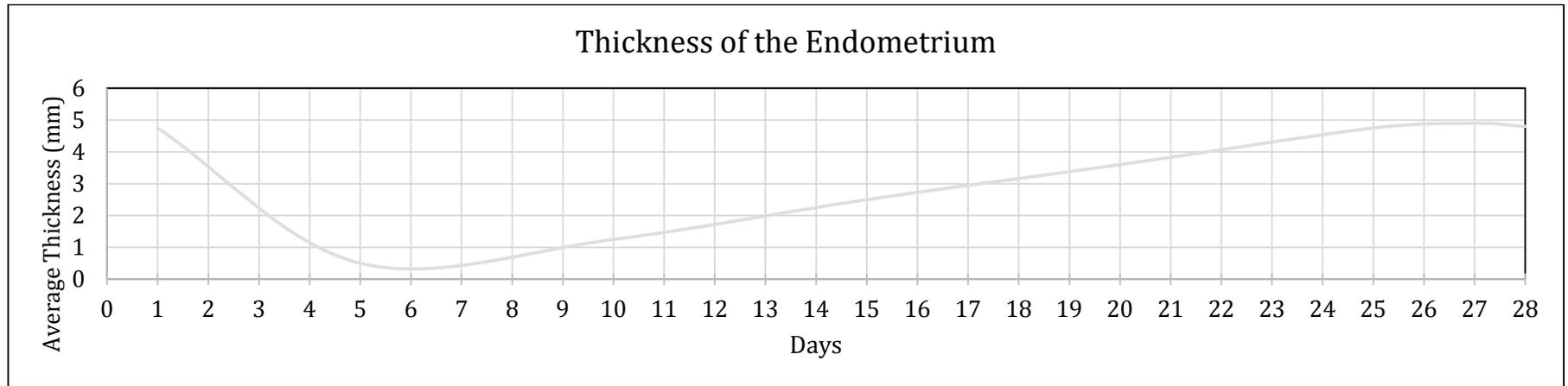
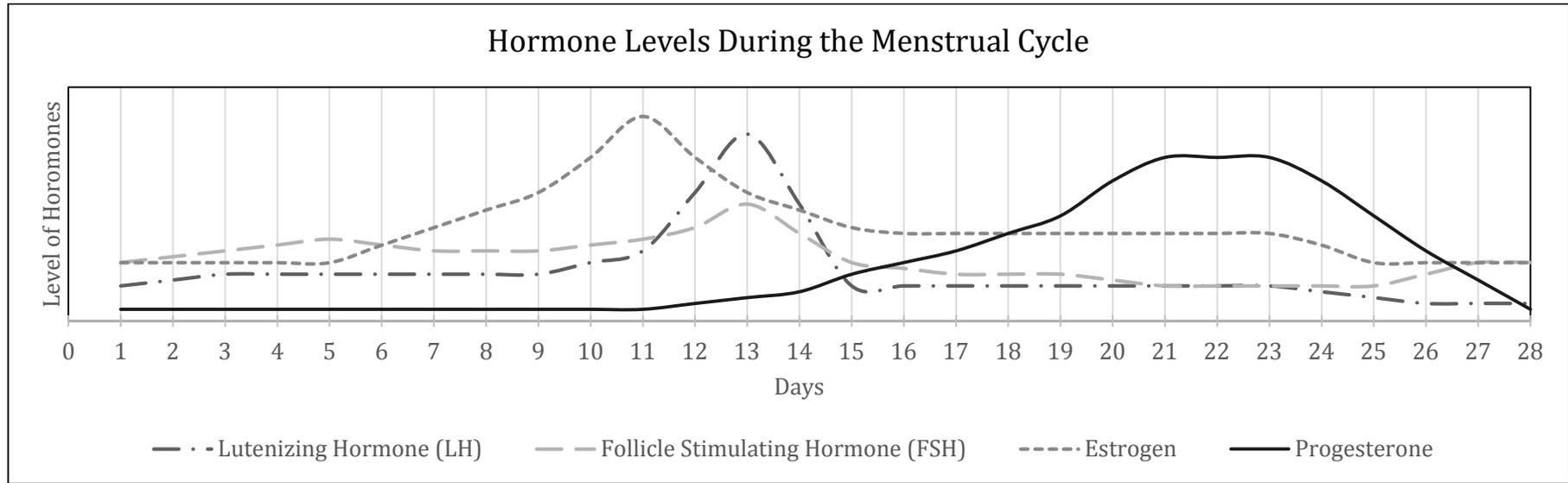


Name: \_\_\_\_\_

Date: \_\_\_\_\_

Period: \_\_\_\_\_

**Activity: Hormone Cycles in the Female Body**



1. On what day does the flow phase start?
2. What is happening on during the flow phase?
3. The day that the endometrium is the thinnest is the last day of the flow phase.
  - a. What day is this?
  - b. What is the thickness of the endometrium at this point?
4. The follicular phase starts on Day 6.
  - a. What hormone begins to increase during the follicular phase?
  - b. Where is it coming from?
5. Look at Day 13.
  - a. What happens to the hormone levels?
  - b. What happens to cause the hormone levels to do that?
6. What day does the luteal phase start?
7. Look at the progesterone levels over the full cycle.
  - a. What happens to the progesterone levels from Day 11 to 23?
  - b. What happens to the progesterone levels from Day 23 to 28?
  - c. Where does the progesterone come from?
8. What happens after Day 28?

# Pregnancy and Fetal Development

## Fertilization and Implantation

\_\_\_\_\_ is the union of a sperm and an egg. Each of these cells have \_\_\_\_\_ chromosomes, so when they fuse together, the resulting cell, called a \_\_\_\_\_, will have \_\_\_\_\_ chromosomes.

It takes 3 – 5 days for the zygote to travel through the fallopian tube to the uterus. It starts to divide during this time.

During this time, the zygote separates into a \_\_\_\_\_, which is a central group of cells surrounded by an outer shell.

The inner cells become the \_\_\_\_\_, which is the developing baby. The outer cells become the \_\_\_\_\_, which is the organ that connects the baby to the uterus and provides oxygen and nutrients.



\_\_\_\_\_ occurs when the blastocyst attaches itself to the \_\_\_\_\_, about 7 – 10 days after ovulation.

The blastocyst releases a hormone called \_\_\_\_\_ (hCG), which keeps the levels of estrogen and progesterone high and stops the body from starting menstruation.

\_\_\_\_\_ are designed to identify the presences of hCG in the body.

## Pregnancy

### Pregnancy Symptoms

Usually a pregnancy test will not be positive until two weeks after ovulation. Shortly after this, pregnancy symptoms (like nausea, food cravings and aversions, heartburn, swollen breasts and fatigue) may start. The main sign of pregnancy is a missed period.

### First Trimester

Pregnancy is divided into three \_\_\_\_\_, which are each about \_\_\_\_\_ long.

By the end of the first trimester, the baby is only about \_\_\_\_\_ long. During this time, most of the work being done is in making \_\_\_\_\_.

The first trimester is when the baby is at most risk for birth defects, which can be caused by drug and alcohol use or infectious diseases.

### Second Trimester

The second trimester starts at \_\_\_\_\_. Most of the development in this trimester is growth, since the majority of the body systems are in place and functional.

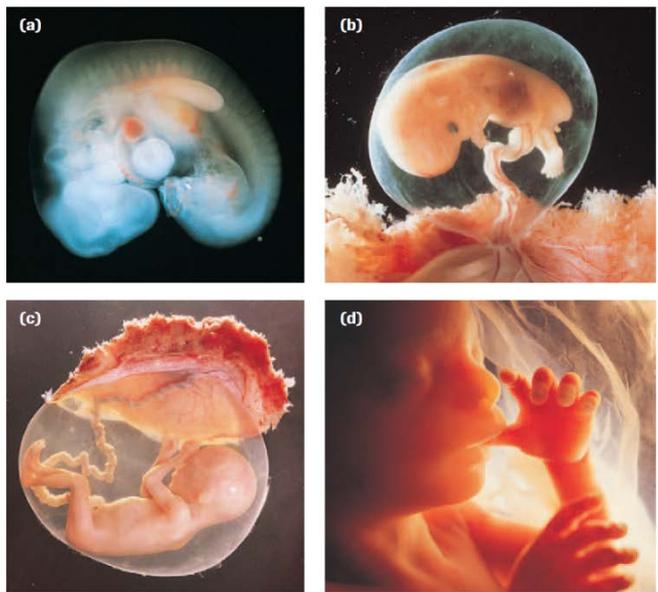
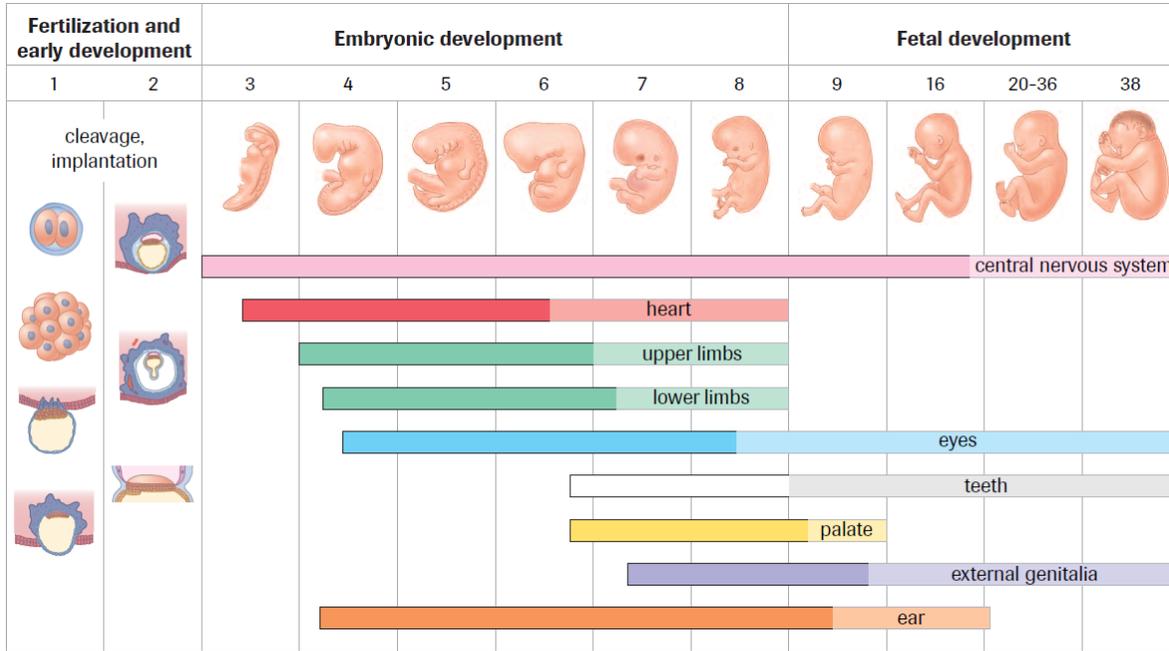
Often, pregnancy symptoms like nausea and fatigue will go away during this trimester.

The first \_\_\_\_\_, a way to see the baby inside the womb, is around 20 weeks. This is also when parents often find out the sex of the baby.

**Third Trimester**

The third trimester starts \_\_\_\_\_. Just like in the second trimester, most of the development in these months is growth and weight gain. The baby also starts to prepare for birth.

The \_\_\_\_\_ for a baby is at \_\_\_\_\_. At 37 weeks, babies are considered early but can survive on their own.



**Figure 5**  
 (a) Human embryo at 4 weeks  
 (b) Fetus at 9 weeks  
 (c) Fetus at 16 weeks  
 (d) Fetus at 18 weeks

## Birth

When the birth process begins, the uterus \_\_\_\_\_. It will do this until after the baby is born as a way of pushing the baby and the placenta out of the body.

The \_\_\_\_\_ begins to get thinner ( \_\_\_\_\_ ) and \_\_\_\_\_ to a diameter of 10 cm.

After the baby is born, the \_\_\_\_\_, that connects the baby to the placenta, is cut.

## Multiple Babies

\_\_\_\_\_ fetuses, also called \_\_\_\_\_, are formed from the same zygote that split into more than one embryo. These babies share the same DNA, which is why they look the same.

\_\_\_\_\_ fetuses, also known as \_\_\_\_\_ or polyzygotic, are formed when more than one egg is fertilized, resulting in multiple zygotes. These babies do not always look the same and are not always the same sex.

# **Reproductive Technologies**

## **Contraceptives**

### Contraception

\_\_\_\_\_ is a term used to describe technologies used to prevent unwanted pregnancies.

There are two major categories of contraception:

- \_\_\_\_\_ contraceptives prevent sperm from entering the female's body
- \_\_\_\_\_ contraceptives control female hormones

### The Pill

The pill is a combination of estrogen and progesterone. It works by controlling hormones so that an egg is not released during ovulation.

Menstruation still occurs, and is regulated on a 28-day cycle.

### Contraceptive Injections

Injections contain a form of progesterone. It is designed to prevent ovulation, similar to the pill.

It also keeps the uterine lining too thin for an egg to implant, if one was accidentally released and fertilized.

### Intrauterine Device (IUD)

An IUD is a metal device implanted in the uterus.

One form thickens the mucus in the cervix, making it impossible for sperm to pass through. Another form changes the chemistry of the reproductive system to make it inhospitable for sperm, making it impossible for them to survive.

## **Artificial Reproductive Technology**

\_\_\_\_\_ is the inability of a man or a woman to reproduce. For men, this is often a problem producing sperm. For women, infertility can be a problem producing viable eggs and problems with ovulation or implantation.

Couples who have trouble conceiving often try ART to help them have a baby.

### Artificial Insemination

Artificial insemination is used for a low sperm count or when sperm having trouble reaching the egg.

Semen (a mixture of sperm and seminal fluid) is injected directly into the cervix or uterus, which minimizes the distance the sperm needs to travel to reach the egg.

### In Vitro Fertilization

The egg is fertilized outside of the woman's body, then inserted into the uterus of the female.

Generally, multiple zygotes are inserted with the hopes that at least one will implant. This often leads to multiple births.

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Period: \_\_\_\_\_

Due Date: \_\_\_\_\_

## Activity: Reproductive Technologies

### Objective

The purpose of this activity is to investigate examples of contraceptive and reproductive technologies.

### Procedure

You are a doctor. A patient comes in looking for advice. You need to determine what your recommendation is, and be able to explain why. You will write out one paragraph to explain your answer and submit it to Ms. Hayduk before the end of the class.

Use your notes and pages 101-107 in your textbook.

### Example

*A woman has an irregular menstrual cycle. She wants to avoid getting pregnant with her long-term partner.*

Solution: The woman should start taking the birth control pill. The pill is a form of chemical contraception that contains estrogen and progesterone. The pill stops ovulation (the release of an egg from the ovaries) and will make her menstrual cycle more regular.

### Cases

1. A couple are having trouble getting pregnant. Some tests show that the man has a very low sperm count.
2. A man and woman have three children and don't want to have any more.
3. A young man is dating and wants to avoid getting anyone pregnant.
4. A couple are having trouble getting pregnant. Some tests show that the woman has no usable eggs, even though she is able to carry a baby (be pregnant).
5. A newly-divorced woman with two children doesn't want to have any more kids, even if she gets remarried.
6. A young woman wants to use birth control, but can't remember to take a pill every day.
7. A woman has had several miscarriages. Some tests show that her eggs are viable, but she is not able to carry a baby (be pregnant).
8. A single woman wants to have a baby on her own.
9. A young woman wants to use birth control, but doesn't have a doctor she can see regularly.

### Evaluation

Criteria	Definitely (5)	Mostly (4)	Somewhat (3)	Not Really (2)	Not At All (0)
Recommends a reasonable solution					
Explains solution well					
Uses scientific language					