

# REPRODUCTION

## Unit B – Reproduction

### B1 – ESSENTIAL OUTCOMES (40% + exam)

Outcome Questions	Vocabulary & Concepts	Textbook	Activities	Assessment								
<p><b>S1-1-13:</b></p> <ul style="list-style-type: none"> <li>How are the terms DNA, chromosome, genes, and trait connected? <input type="checkbox"/></li> </ul>	<p>Chromosomes DNA Genes Trait Heredity</p>	<p><i>Text:</i> p.112-119</p>	<p>What do you know?  Heredity &amp; Genes</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;">Date</th> <th style="width: 50%;">%</th> </tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> </table>	Date	%						
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<p><b>S1-1-02:</b></p> <ul style="list-style-type: none"> <li>Why do cells divide and how does it work? <input type="checkbox"/></li> </ul>	<p>Interphase      <i>Cell Cycle</i> Mitosis Cytokinesis Asexual Binary Fission</p>	<p><i>Text:</i> p.138-145  p.152-161</p>	<p>Asexual Reproduction  Asexual Forms</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;">Date</th> <th style="width: 50%;">%</th> </tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> </table>	Date	%						
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<p><b>S1-1-07:</b></p> <ul style="list-style-type: none"> <li>What role do gametes play in reproduction? <input type="checkbox"/></li> </ul>	<p><i>Genetic Diversity      Meiosis</i> Gamete Diploid Haploid Homologous Pair</p>	<p><i>Text:</i> p.170-175  p.176-177</p>	<p>Sexual Reproduction</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;">Date</th> <th style="width: 50%;">%</th> </tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> </table>	Date	%						
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<p><b>S1-1-09:</b></p> <ul style="list-style-type: none"> <li>What parts make up the male and female sex systems and what is the function of each part? <input type="checkbox"/></li> </ul>	<p><i>Hormone</i> Testosterone Estrogen Progesterone</p>	<p><i>Text:</i> p.196-197</p>	<p>Sexual Physiology</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;">Date</th> <th style="width: 50%;">%</th> </tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> </table>	Date	%						
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### B2 – EXTENSION OUTCOMES (70% + exam)

<p><b>S1-1-10:</b></p> <ul style="list-style-type: none"> <li>How does a fertilized egg turn into a baby and what determines the gender? <input type="checkbox"/></li> </ul>	<p>Ovulation      <i>Fertilization</i> <i>Menstrual Cycle</i>      Zygote Embryo Fetus</p>	<p><i>Text:</i> p.198-200</p>	<p>Fetal Development</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;">Date</th> <th style="width: 50%;">%</th> </tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> </table>	Date	%						
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<p><b>S1-1-12:</b></p> <ul style="list-style-type: none"> <li>How are the features of the parents inherited to create unique offspring? <input type="checkbox"/></li> </ul>	<p>Allele      Homozygous Dominant      Heterozygous Recessive      <i>Punnett Square</i> Phenotype Genotype</p>		<p>Genetics &amp; You</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;">Date</th> <th style="width: 50%;">%</th> </tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> </table>	Date	%						
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<p><i>S1-1-08:</i></p> <ul style="list-style-type: none"> <li>• <i>What are some ways plants and animals improve their chances to reproduce?</i></li> </ul> <input type="checkbox"/>	<p><i>Natural Selection</i> <i>Adaptation</i></p>			<table border="1"> <thead> <tr> <th>Date</th> <th>%</th> </tr> </thead> <tbody> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> </tbody> </table>	Date	%						
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<p><i>S1-1-15:</i></p> <ul style="list-style-type: none"> <li>• <i>How can lifestyle choices affect your genetics and development?</i></li> </ul> <input type="checkbox"/>	<p><i>Mutation</i> <i>Mutagen</i> <i>Cancer</i> <i>Carcinogen</i></p>	<p><i>Text:</i> p.122-127 p.146-147</p>	<p><i>Mutations &amp; Life</i></p>	<table border="1"> <thead> <tr> <th>Date</th> <th>%</th> </tr> </thead> <tbody> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> </tbody> </table>	Date	%						
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**B3 – EXPLORATION OUTCOMES (80% + exam)**

<p><i>S1-1-03:</i></p> <ul style="list-style-type: none"> <li>• Describe some specific types of asexual reproduction that occur in plant and animal species?</li> </ul> <input type="checkbox"/>
<p><i>S1-1-14:</i></p> <ul style="list-style-type: none"> <li>• <i>What is a pedigree and how is it used to track the inheritance of a trait?</i></li> </ul> <input type="checkbox"/>
<p><i>S1-1-17:</i></p> <ul style="list-style-type: none"> <li>• <i>What new biotechnologies are being explored in genetics and reproduction?</i></li> </ul> <input type="checkbox"/>

**WHAT DO YOU KNOW?**

1. Complete the **table** below, giving definition / function and location / shape of each new structure.  
(To the best of your ability - you can use **Google, or the textbook** for some of information in you are stuck)

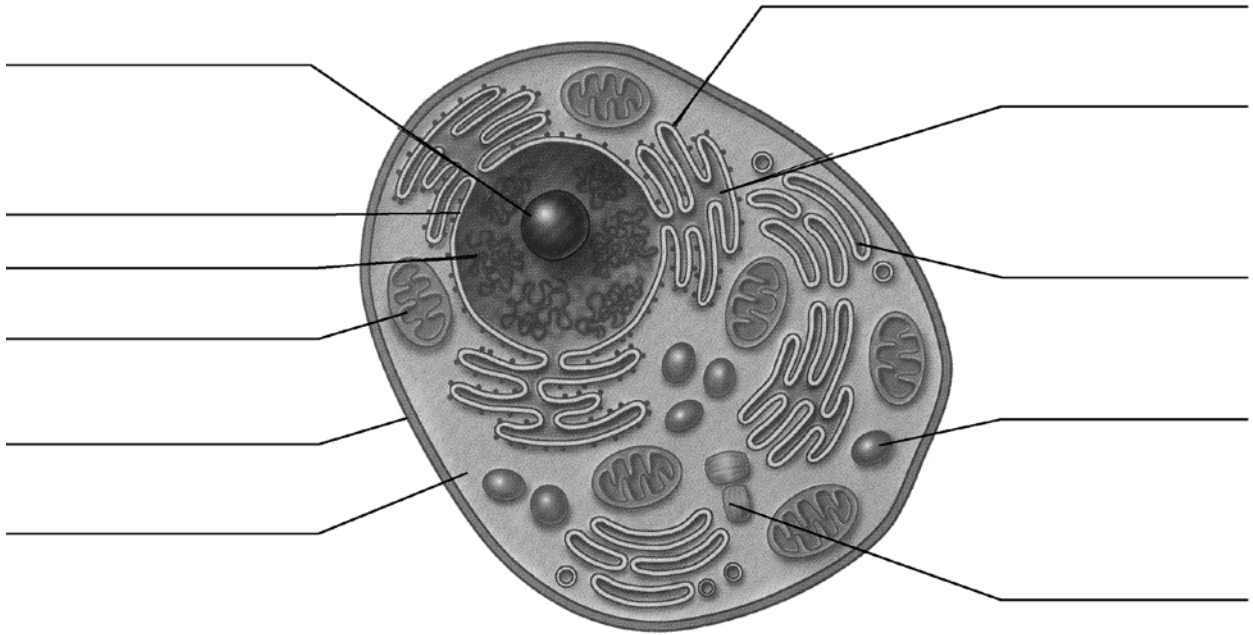
<b>STRUCTURE</b>	<b>DEFINITION and FUNCTION</b>	<b>LOCATION and/or SHAPE</b>
<b>Organelle</b>		
<b>Cell membrane</b>		
<b>Nucleus</b>		
<b>Cytoplasm</b>		
<b>Chromosome</b>		
<b>Mitochondria</b>		
<b>Cell wall</b>		
<b>Chloroplast</b>		

2. List some differences between plant cells and animal cells?

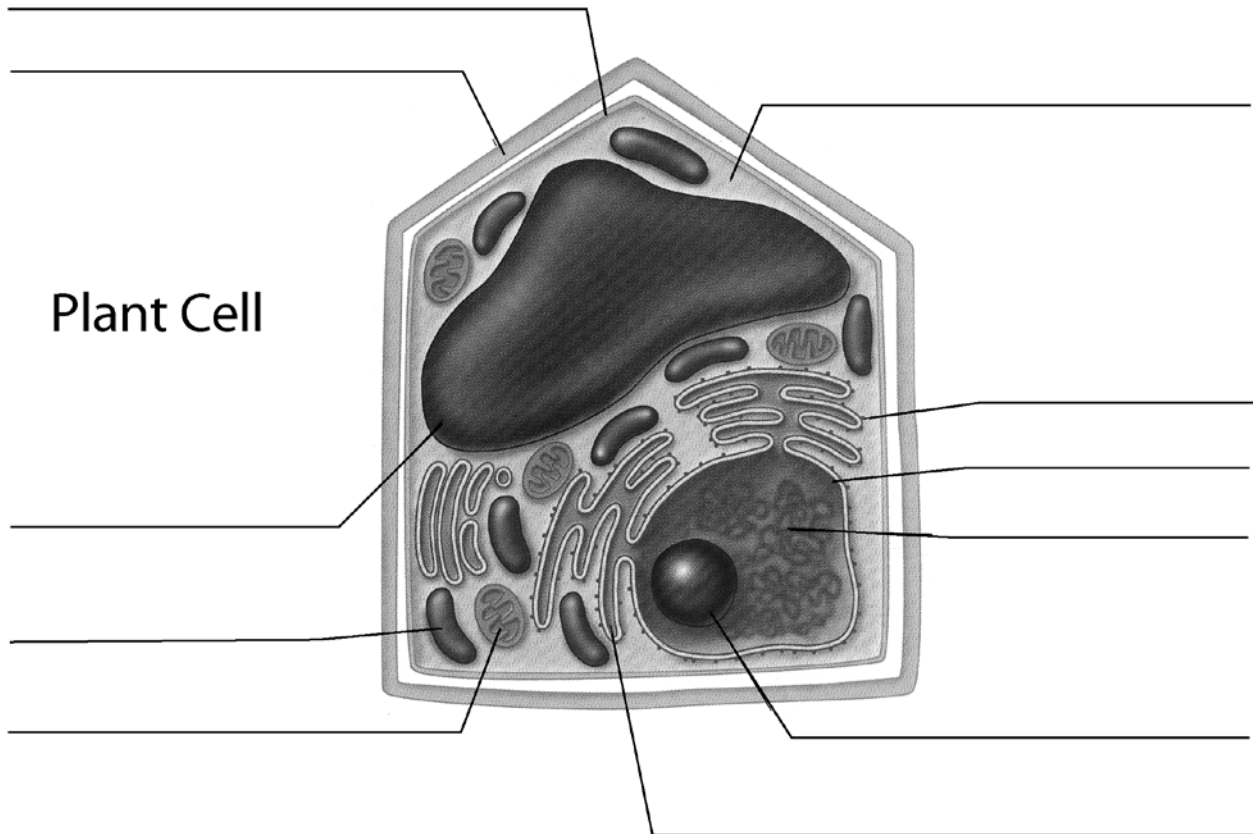
3. Research the word **Photosynthesis**. Write a chemical reaction and some information down below:

4. Label the **diagrams** given for a plant and an animal cell to the best of your memory.  
*(Only label those things you are sure you know – or can find)*

### Animal Cell



### Plant Cell



*SI-1-13: How are the terms DNA, chromosome, genes, and trait connected?*

Chromosomes

DNA


Genes

Trait

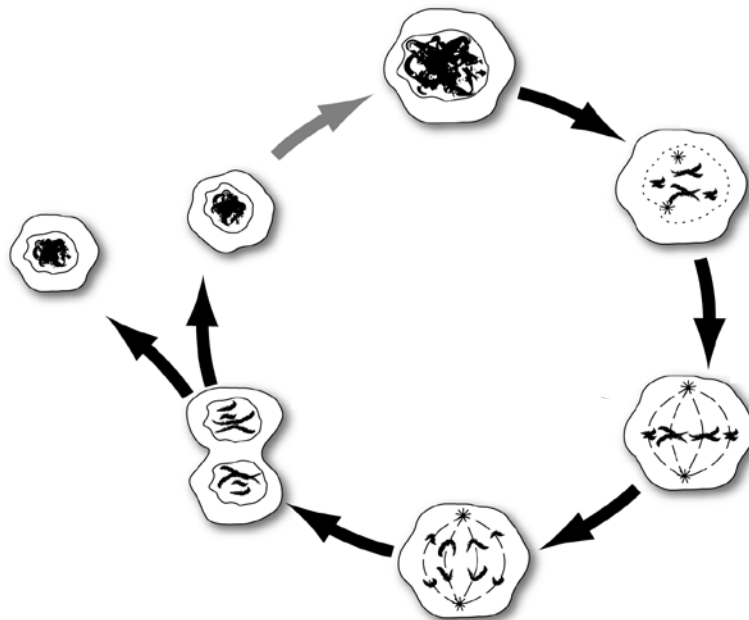
Heredity


# HEREDITY & GENES

SI-1-13: How are the terms DNA, chromosome, genes, and trait connected?

	<p>1. Use the diagram on the left to help explain the following terms:</p> <ul style="list-style-type: none"> <li>a) Chromosome:</li> <li>b) DNA</li> <li>c) Gene:</li> <li>d) Trait:</li> </ul>
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2. Label the division stage and the interphase in the diagram below.



3. List some facts about each of these stages of cell life.

*S1-1-01: Why do cells divide and how does it work?*

Interphase    Mitosis    Cytokinesis    Asexual Reproduction    Cell Cycle

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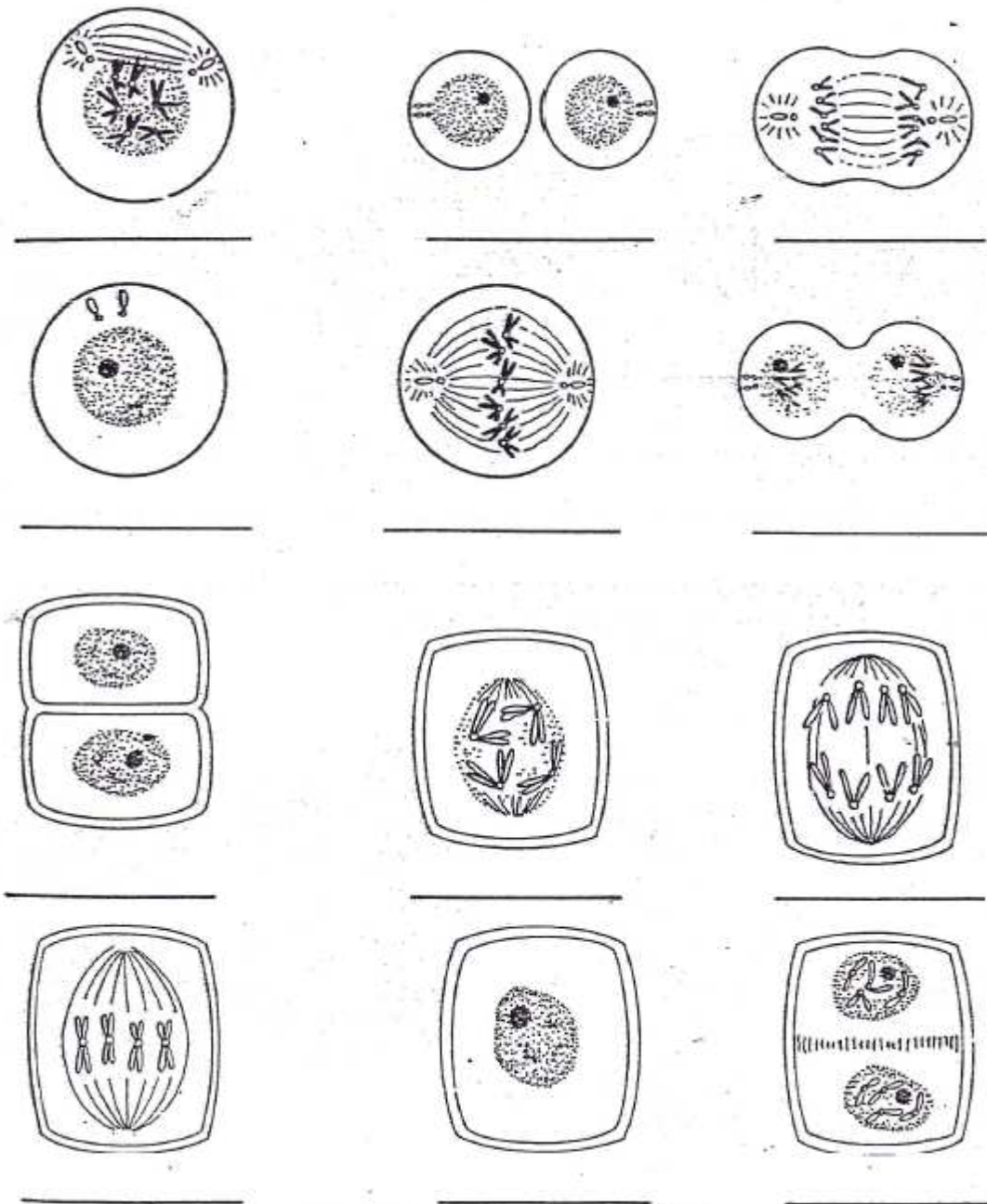
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# **ASEXUAL REPRODUCTION**

*SI-1-01: Why do cells divide and how does it work?*

1. Label each stage of mitosis represented in the diagrams below:



2. What is unusual about the second set of diagrams? What do they represent?

3. Complete the table with the information you have or from textbook pages 139 to 144.

*Not all stages have activity in both the cell and the nucleus.*

Cell Cycle Stage	What is happening in the cell?	What is happening in the nucleus?
Interphase		
Prophase		
Metaphase		
Anaphase		
Telophase		
Cytokinesis		

4. Match the Term on the left with the best Descriptor. Each Descriptor may be used only once.

Term	Descriptor
_____ 1. interphase	A. chromosomes become visible
_____ 2. prophase	B. cell grows and DNA replicates
_____ 3. metaphase	C. single-stranded chromosomes move toward opposite poles
_____ 4. anaphase	D. double-stranded chromosomes form a line across the middle of the cell
_____ 5. cytokinesis	E. nuclear membrane forms around each set of chromosomes

5. Write the name of the stage of the animal cell cycle that corresponds to each event described below. You may use some cycles more than once.
- a. Nuclear membranes form around each mass of chromosomes. \_\_\_\_\_
  - b. Single-stranded chromosomes separating and move to opposite ends of the cell. \_\_\_\_\_
  - c. A copy of each chromosome is made. \_\_\_\_\_
  - d. Cell membrane pinches together and the cytoplasm of the cell divides. \_\_\_\_\_
  - e. The nuclear membrane disappears. \_\_\_\_\_
  - f. Daughter cells form. \_\_\_\_\_
  - g. Double-stranded chromosomes line up in the centre of the cell. \_\_\_\_\_
  - h. It makes up most of a cell's life. \_\_\_\_\_
6. Summarize the end result of mitosis with one sentence or with one picture:

*SI-1-05: What role do gametes play in reproduction?*

Genetic Diversity   Gamete   Diploid   Haploid   Homologous Pair   Meiosis

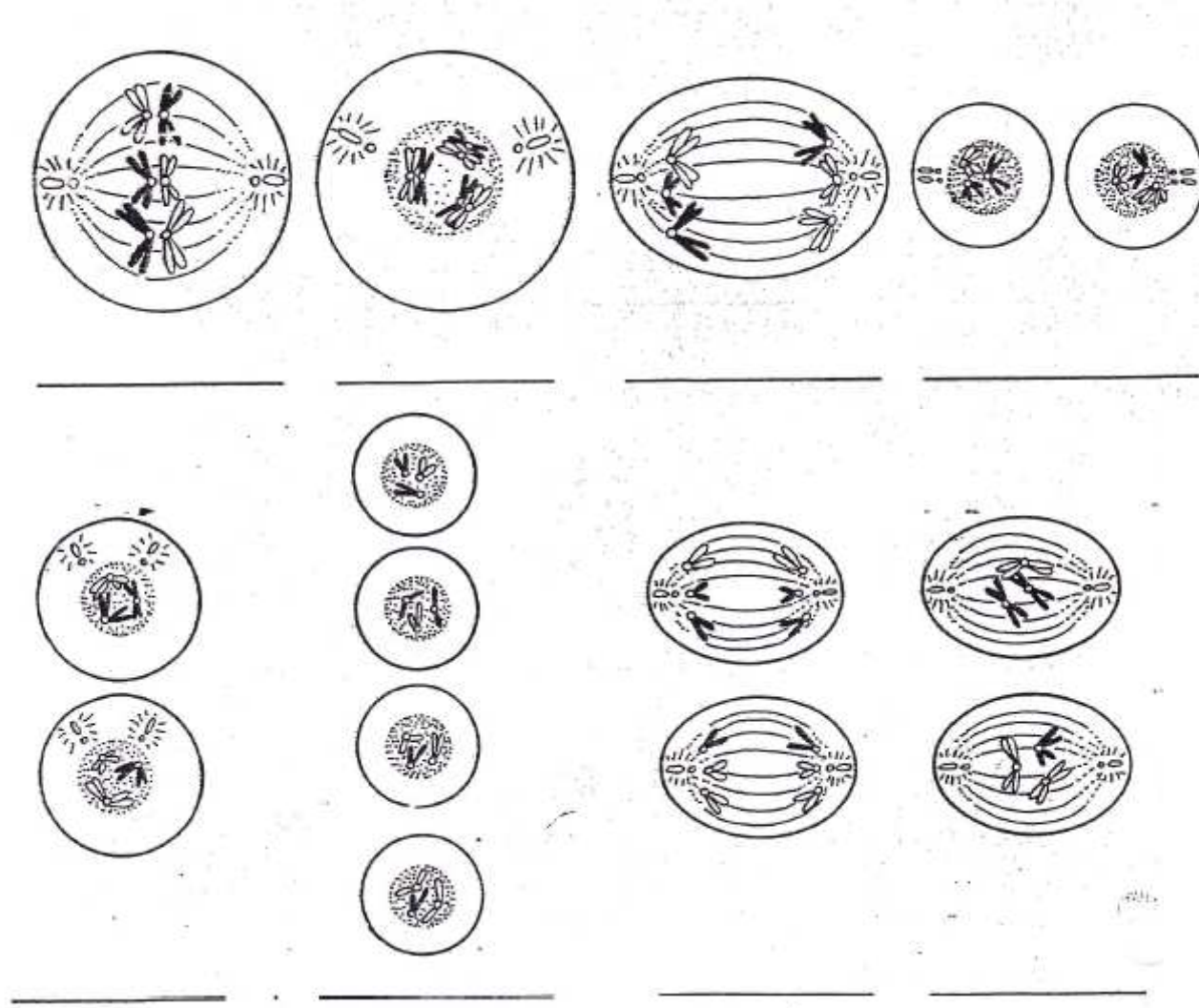
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# SEXUAL REPRODUCTION

SI-1-05: *What role do gametes play in reproduction?*

7. Label each stage of meiosis represented in the diagrams below (indicate if it is meiosis 1 or meiosis 2):



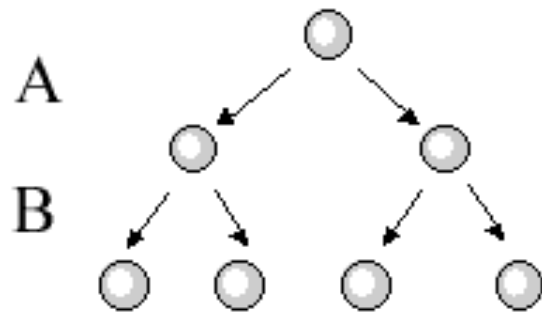
- 8. What is the big difference between the arrangement of chromosomes during metaphase I in meiosis and metaphase in mitosis?
  
- 9. How do the end results of meiosis and mitosis differ?
  
- 10. Predict what would happen if gametes were produced by mitosis rather than meiosis.

11. Determine whether the following characteristics apply to mitosis, meiosis, or both by putting a check (✓) in the appropriate column(s):

Characteristic	Meiosis	Mitosis
Daughter cells are created unique		
Associated with sexual reproduction		
No pairing of homologous chromosomes occurs		
Two divisions		
Four daughter cells are produced		
Chromosome number is maintained		
Associated with growth and asexual reproduction		
One division		
Two daughter cells are produced		
Involves duplication of chromosomes		
Produces haploid cells		
Daughter cells are identical to the parent cell		
Produces gametes		

12. Read each statement below. If the statement is true, write “T” on the line in front of the statement. If it is false, write “F” and fix the bolded word in the statement to make it true:

T/F	Statement	
	Gametes have <b>twice</b> as many chromosomes as body cells.	
	<b>Zygotes</b> are produced by the union of sperm and egg cells.	
	<b>Meiosis</b> may form egg cells.	
	Gametes are formed during <b>mitosis</b> .	
	Only a zygote with the <b>diploid</b> number of chromosomes can function as the offspring’s first body cell.	
	<b>Four</b> new cells are formed from each parent cell in meiosis.	
	There are two cell divisions during <b>mitosis</b> .	
	If a cell with six chromosomes undergoes mitosis, each new cell will also have <b>six</b> chromosomes.	



- 13.
- What are the two stages of meiosis labelled in the diagram above by the letters A and B?
  - For each stage of meiosis shown in the diagram above, state the number of chromosomes.

14. Draw a picture to represent the difference between homologous pair and sister chromatids.

15. State two differences between a somatic cell and a reproduction cell.

16. State one pro and one con of sexual and asexual reproduction.

17. Use the terms to complete the sentences. You will not need to use every term.

*somatic cells, chromosomes, diploid, haploid, ova, gametes, meiosis, zygote, mitosis, sperm*

- a. The main job of \_\_\_\_\_ is to join together to produce a new organism.
- b. In humans, \_\_\_\_\_ cells have 46 chromosomes.
- c. Gametes are the only cells that are \_\_\_\_\_ and produced by \_\_\_\_\_.
- d. \_\_\_\_\_ are the female gametes, and \_\_\_\_\_ are the male gametes.
- e. \_\_\_\_\_ contain the instructions that tell a cell how to develop.
- f. When two gametes unite, they form a \_\_\_\_\_.

18. Complete the table to compare meiosis and mitosis for a cell that has **four** chromosomes.

Question	Meiosis	Mitosis
How many homologous pairs are in the original cell?		
How many individual chromosomes are in each new daughter cell at the end of division?		
How many homologous pairs are in each new daughter cell at end of division?		
What type of cell results from this process?		

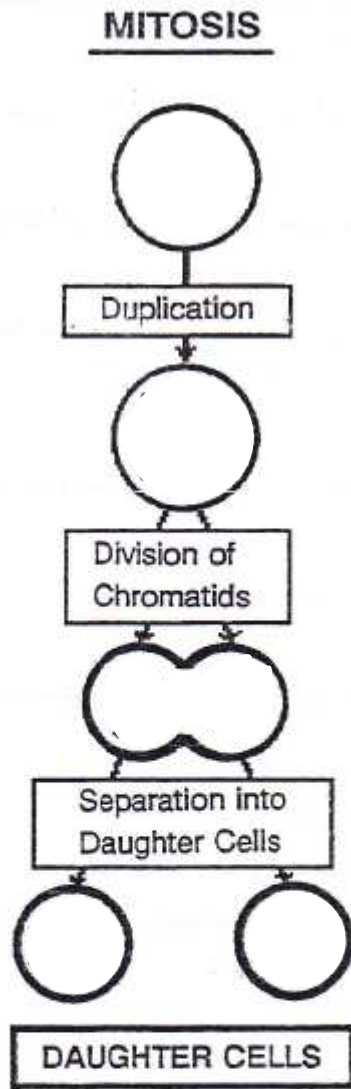
19. Based on this statement, answer the following questions:

**An animal has 20 chromosomes in a somatic cell.**

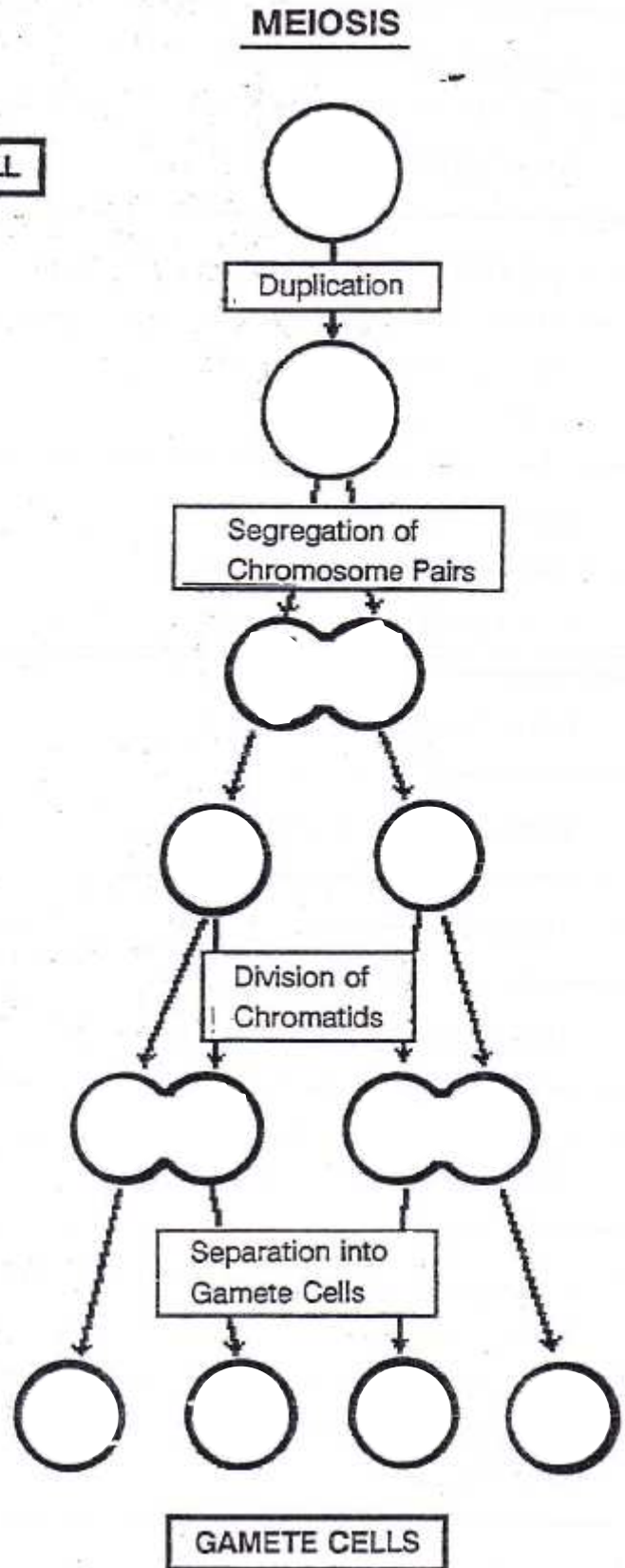
- a. The diploid number for this animal is \_\_\_\_\_.
- b. The haploid number for this animal is \_\_\_\_\_.
- c. A gamete will have \_\_\_\_\_ chromosomes.
- d. An egg will have \_\_\_\_\_ chromosomes.
- e. When the egg and sperm combine, there are \_\_\_\_\_ chromosomes.
- f. A cell taken from the animal's muscle has \_\_\_\_\_ chromosomes.



# Comparing Mitosis and Meiosis



PARENT CELL



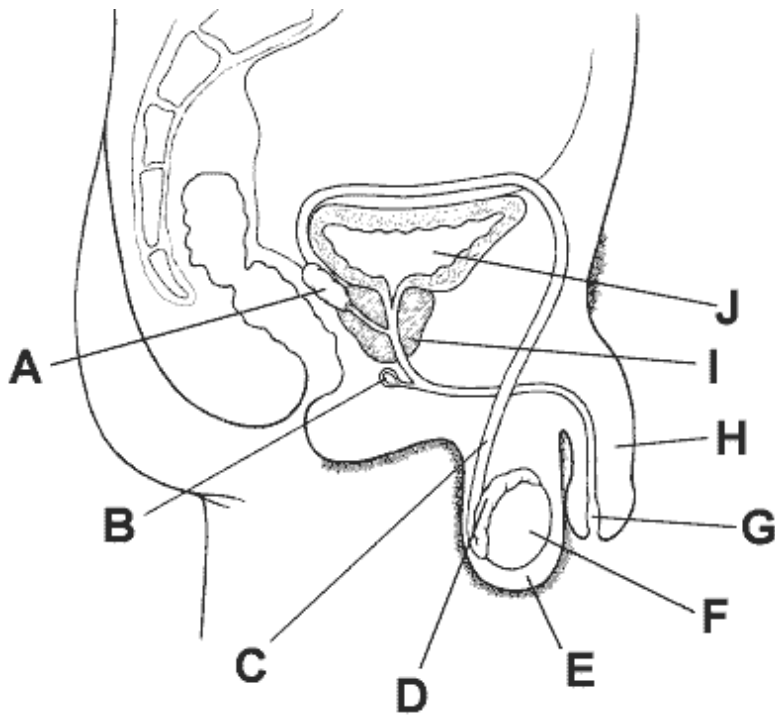
*S1-1-09: What parts make up the male and female sex systems and what is the function of each part?*

Hormone	Testosterone	Estrogen	Progesterone

**SEXUAL PHYSIOLOGY**

*SI-1-09: What parts make up the male and female sex systems and what is the function of each part?*

1. The main function of the male reproductive system is to produce and store \_\_\_\_\_.
2. The main sex organ of the male is \_\_\_\_\_.
3. Complete the table below using the following diagram.



A:
B:
C:
D:
E:
F:
G:
H:
I:
J:

4. Write a brief description of the function of the sex organ in the table below.

Sex Organ	Function
Urethra	
Epididymis	
Testes	
Vas deferens	
Prostate gland	
Seminal vesicle	
Scrotum	

5. The part of the brain responsible for the production of hormones is the \_\_\_\_\_.
6. The brain produces 2 hormones that influence sexual reproduction: \_\_\_\_\_ and \_\_\_\_\_.
7. Testosterone is produced in the \_\_\_\_\_.
8. What is the function of testosterone?
  
9. Give three examples of secondary sexual characteristics in males:

10. MALE REPRODUCTIVE SYSTEM: *Fill in the blanks with the correct answers*

The human male gamete, or \_\_\_\_\_, is highly specialized for its role as a carrier of genetic information. Produced by meiosis, sperm cells have \_\_\_\_\_ chromosomes instead of the 46 found in other cells of the male body. The sperm-producing organs, the \_\_\_\_\_, hang between the legs of the male, maintaining a temperature about 3°C cooler than the rest of the body for optimal sperm development. The testes contain cells that secrete the male sex hormone \_\_\_\_\_. Sperm production, \_\_\_\_\_, takes place inside the seminiferous tubules of the testes.

After a sperm cell is manufactured, it is delivered to a long, coiled tube called the \_\_\_\_\_, where it matures. Mature sperm are relatively simple cells, consisting of a 3 parts: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.

From the epididymis, the sperm is delivered to another long tube, the \_\_\_\_\_. When released during intercourse, they go to the \_\_\_\_\_, where the reproductive and urinary tracts join, emptying through the penis. Sperm is released in a fluid called \_\_\_\_\_.

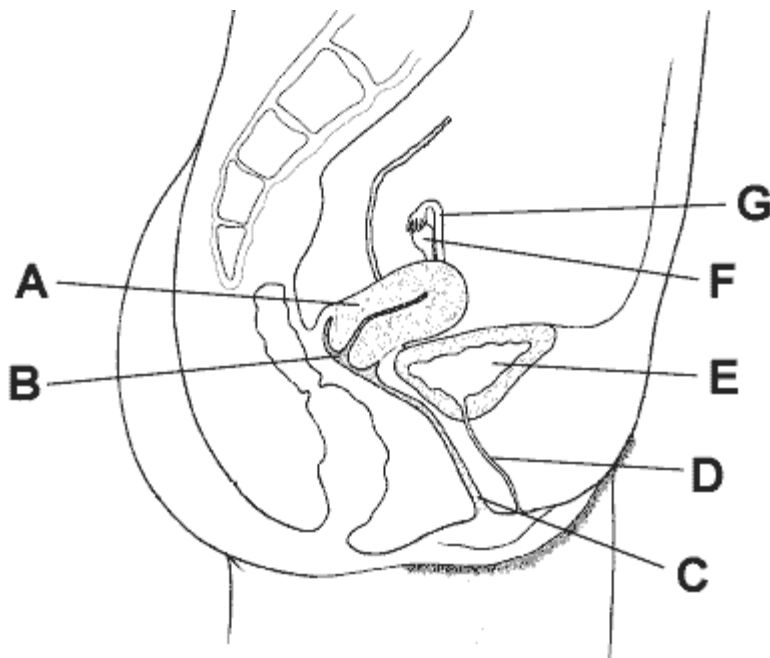
An adult male produces \_\_\_\_\_ continuously, several hundred million each day of his life. Those that are not ejaculated from the body are \_\_\_\_\_ in a continual cycle of renewal.

11. What is the main purpose of the female reproductive system?

12. The main sex organ in a female is the \_\_\_\_\_.

13. The main reproductive hormones of the female are \_\_\_\_\_ and \_\_\_\_\_.

14. Complete the table below using the following diagram.



A:
B:
C:
D:
E:
F:
G:

15. How do the production of gametes in males and females differ?

16. Why is the female gamete (ovum) so much larger than a male gamete (sperm)?

17. What two hormones are present in both males and females?

18. Give three examples of secondary sexual characteristics in females:

*SI-1-10: How does a fertilized egg turn into a baby and what determines the gender?*

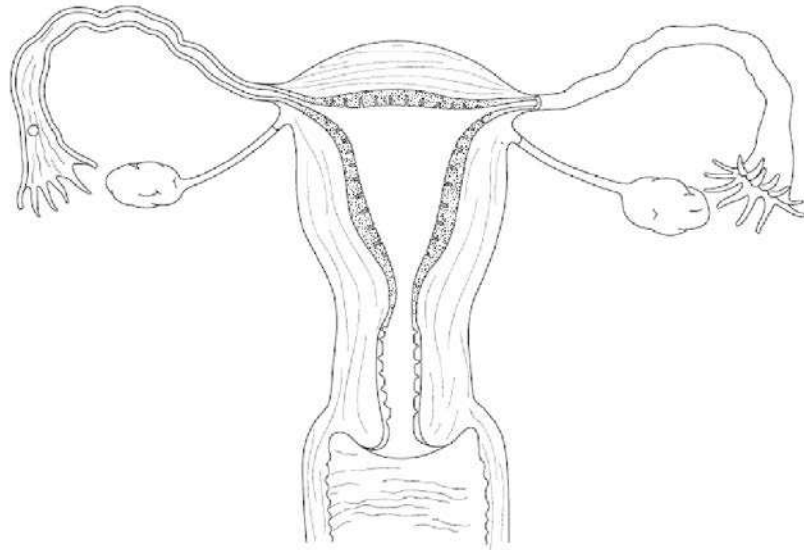
Ovulation    Menstrual Cycle    Fertilization    Zygote    Embryo    Fetus


## **FEMALE AND FETAL DEVELOPMENT**

*SI-1-10: How does a fertilized egg turn into a baby and what determines the gender?*

1. Label the parts of the female reproductive system on the diagram below:

- a. Ovary
- b. Uterus
- c. Endometrium
- d. Vaginal canal
- e. Cervix
- f. Fallopian tubes



2. FEMALE REPRODUCTIVE SYSTEM: *Fill in the blanks with the correct answers*

In females, eggs or ovum develop from cells called \_\_\_\_\_, located within the female gonads – \_\_\_\_\_. In females all of the oocytes needed for a lifetime are already present at birth. With the onset of puberty, females mature sexually. This is controlled by the release of chemicals in the brain called \_\_\_\_\_. Usually only a single oocyte is initiated to continue development and be released, in a process called \_\_\_\_\_. Approximately every \_\_\_\_\_ days, another oocyte matures and is released, although the timing varies. Only about 400 of the approximately 2 million oocytes a woman is born with mature and are ovulated during her lifetime.

The \_\_\_\_\_ (also called fallopian tubes) transport ova from the ovaries to the \_\_\_\_\_. In humans, this is a muscular, pear-shaped organ about the size of a fist that narrows to a muscular ring called the \_\_\_\_\_, which leads to the vaginal canal.

The inner-lining of the uterus is called the \_\_\_\_\_. The surface of the lining is shed approximately once a month during \_\_\_\_\_, while the underlying portion remains to generate a new surface during the next cycle. Ovulation and Menstruation are controlled by the hormonal interaction of the brain and the ovaries using the female sex hormones \_\_\_\_\_, and \_\_\_\_\_.

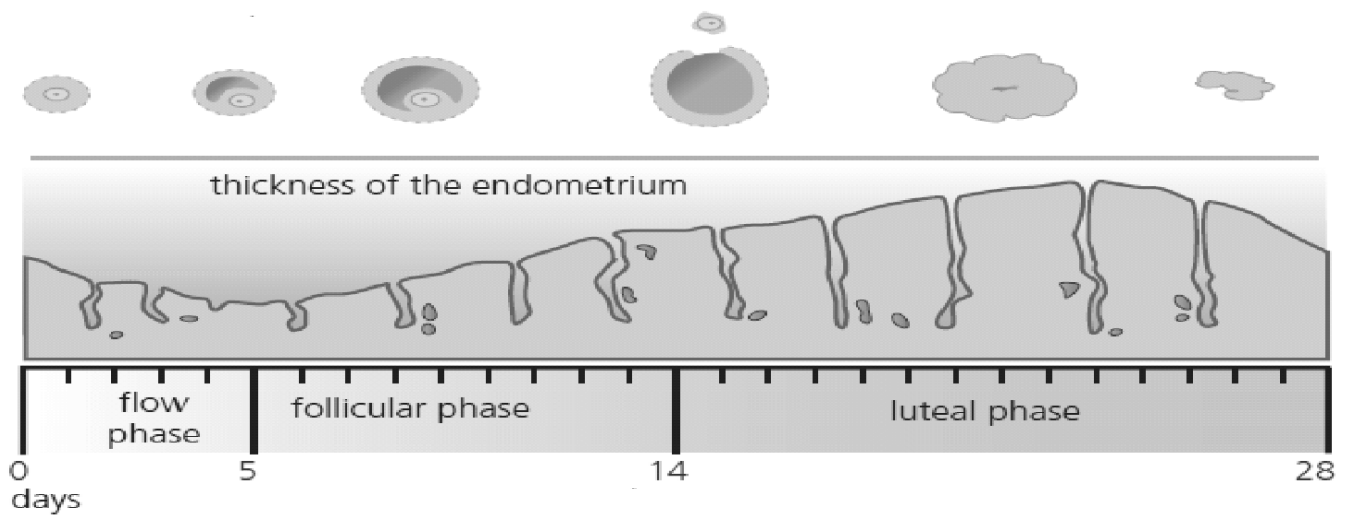
3. Give a brief description of the two stages in the female reproductive cycle:

Ovulation	Menstruation

4. Circle True or False for each statement:

Statement	T/F	
The menstrual cycle is exactly 28 days long.	TRUE	FALSE
Menopause signals the end of a menstrual cycle.	TRUE	FALSE
Ovulation is the term for maturing ova in the ovary.	TRUE	FALSE
Only one ovum is released during each menstrual cycle.	TRUE	FALSE
Immature oocytes are stored in the uterus.	TRUE	FALSE
Once fertilization occurs, zygote growth occurs by mitosis.	TRUE	FALSE
The zygote will be a haploid cell.	TRUE	FALSE

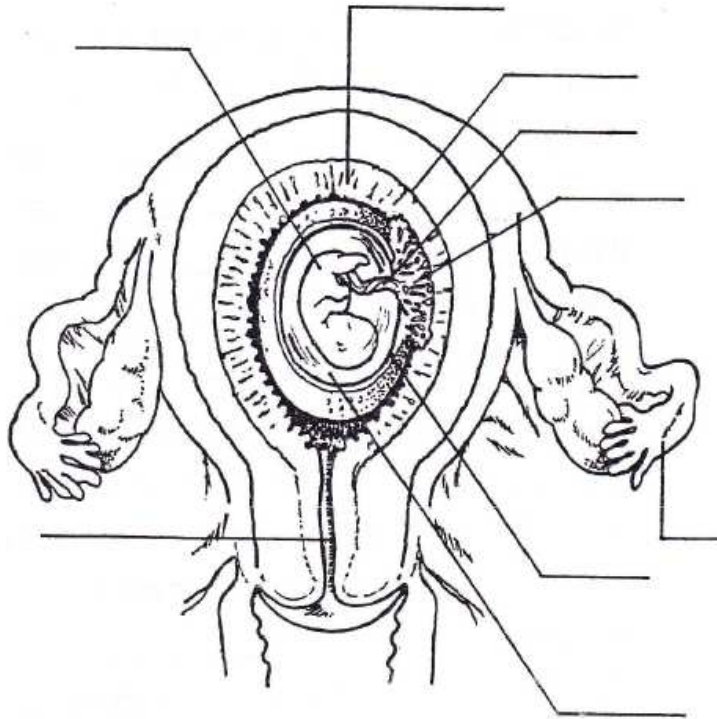
5. In the diagram below, label the major events of each “phase” and the hormones involved:





6. Label only the following parts of the developing embryo in utero:

- Endometrium*
- umbilical cord*
- amniotic sac*
- placenta*
- amniotic fluid*



7. Use the diagram of the female system to predict the correct term to fill in the blanks:

Fetus	Labour	Umbilical cord	Diploid
Implantation	Placenta	Organogenesis	Mitotic
Amniotic sac	Zygote	Endometrial	Pregnancy

When haploid nucleus of the ovum combines with the haploid nucleus of the sperm, a \_\_\_\_\_ cell called a \_\_\_\_\_ is formed. The fertilized cell then begins a series of \_\_\_\_\_ divisions traveling down the fallopian tube over six days. It reaches the uterus, attaches itself to the \_\_\_\_\_ lining in a process called \_\_\_\_\_, establishing the \_\_\_\_\_. The zygote now begins to grow rapidly by cell division into many distinct layers: the outer \_\_\_\_\_, will enclose the developing embryo, the inner layer will join with the uterus wall to form the \_\_\_\_\_, which will nourish the growing embryo. The \_\_\_\_\_ of the placenta connects the developing embryo to the mother as a way to exchange nutrients and waste. In the fourth week of pregnancy, the body organs begin to form, a process called \_\_\_\_\_. During the second month of pregnancy, limbs and bones of the embryo assume their adult shapes, while the brain continues to develop even after birth. From this point on, the developing human is referred to as a \_\_\_\_\_ rather than an embryo. What remains is essentially growth. At approximately 40 weeks from the last menstrual cycle, the process of birth begins as hormonal changes in the mother initiate the onset of \_\_\_\_\_.

8. Fill in the blanks from the words list below. Words may be used more than once:

Semen	Progesterone	Ovary	Vas deferens
Puberty	Prostate	Testes	Vagina
Fertilization	Ovulation	Seminal vesicles	scrotum
Seminal Fluid	Estrogen	Hormones	Oocytes
	Menstruation	Uterus	

HUMAN REPRODUCTIVE SYSTEM: *Fill in the blanks with the correct answers*

The production of sperm takes place in the \_\_\_\_\_. These paired glands are contained in a sac called the \_\_\_\_\_. The sperm travel to the urethra through a long tube called the \_\_\_\_\_. During this passage, \_\_\_\_\_, secreted by the \_\_\_\_\_, \_\_\_\_\_ and Cowper's glands are mixed with the sperm. This mixture is called \_\_\_\_\_. The female gonad is called the \_\_\_\_\_. Beginning at \_\_\_\_\_, \_\_\_\_\_ released from the pituitary gland to stimulate maturation of eggs. Usually, only one of the \_\_\_\_\_ matures fully each month. As the oocyte develops, a thick outer layer called the follicle secretes the hormone \_\_\_\_\_ which causes the lining of the \_\_\_\_\_ to thicken. After about 9 to 19 days, a surge in hormones causes the release a mature egg - this is called \_\_\_\_\_. The empty outer layer of the follicle now becomes a mass of yellow tissue called the corpus luteum that secretes the hormone \_\_\_\_\_; which further thickens the lining of the uterus in preparation for receiving and nourishing a fertilized ovum. If no fertilization occurs, \_\_\_\_\_ will start as the next cycle begins. During sexual intercourse, semen is released through the urethra and deposited in the female's \_\_\_\_\_. An ovum is only functional within 24 hours of ovulation, while sperm can remain viable for up to six days. Therefore, if sexual intercourse takes place five days before ovulation or one day after, \_\_\_\_\_ may occur.

*S1-1-12: How are the features of the parents inherited to create unique offspring?*

Allele	Dominant	Recessive	Genotype	Phenotype	Homozygous	Heterozygous	Punnett Square
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**GENETICS & YOU**

*SI-1-12: How are the features of the parents inherited to create unique offspring?*

Use your knowledge of genetics to complete this worksheet:

1. Scientists at Bikini Bottoms have been investigating the genetic makeup of the organisms in this community. Use the information provided and your knowledge of genetics to answer each question. For each genotype below, indicate whether it is a heterozygous (He) OR homozygous (Ho).

TT: \_\_\_\_\_ Bb: \_\_\_\_\_ DD: \_\_\_\_\_ Ff: \_\_\_\_\_ tt: \_\_\_\_\_ dd: \_\_\_\_\_

Dd: \_\_\_\_\_ ff: \_\_\_\_\_ Tt: \_\_\_\_\_ bb: \_\_\_\_\_ BB: \_\_\_\_\_ FF: \_\_\_\_\_

- a. Which genotypes in question 1 would be considered “purebred?”
- b. Which genotypes in question 1 would be considered “hybrids?”
2. Determine the phenotype for each genotype using the information provided about SpongeBob. *Yellow body colour is dominant to blue.*

a) Yy: \_\_\_\_\_ b) yy: \_\_\_\_\_ c) YY: \_\_\_\_\_

*Square shape is dominant to round.*

a) Ss: \_\_\_\_\_ e) SS: \_\_\_\_\_ f) ss: \_\_\_\_\_

3. For each phenotype, give the genotypes that are possible for Patrick. *A tall head (T) is dominant to short (t).*

a) Tall: \_\_\_\_\_ b) Short: \_\_\_\_\_

*Pink body colour (P) is dominant to yellow (p)*

c) Pink body: \_\_\_\_\_ d) Yellow body: \_\_\_\_\_

4. SpongeBob SquarePants recently met SpongeSusie Roundpants at a dance. SpongeBob is heterozygous for his square shape, but SpongeSusie is round. Create a Punnett square to show the possibilities that would result if SpongeBob and SpongeSusie had children. HINT: Read question #2!

a) List the possible genotypes and phenotypes for their children.

b) What are the chances of a child with a square shape?

c) What are the chances of a child with a round shape?

5. Patrick met Patti at the dance. Both of them are heterozygous for their pink body colour, which is dominant over a yellow body colour. Create a Punnett square to show the possibilities that would result if Patrick and Patti had children. HINT: Read question #3!
- List the possible genotypes and phenotypes for their children.
  - What are the chances of a child with a pink body?
  - What are the chances of a child with a yellow body?
6. Everyone in Squidward's family has light blue skin, which is the dominant trait for body colour in his hometown of Squid Valley. His family brags that they are a "purebred" line. He recently married a nice girl who has light green skin, which is a recessive trait. Create a Punnett square to show the possibilities that would result if Squidward and his new bride had children. Use B to represent the dominant gene and b to represent the recessive gene.
- List the possible genotypes and phenotypes for their children.
  - What are the chances of a child with light blue body?
  - What are the chances of a child with light green body?
  - Would Squidward's children still be considered purebreds? Explain!
7. Assume that one of Squidward's sons, who is heterozygous for the light blue body colour, married a girl that was also heterozygous. Create a Punnett square to show the possibilities that would result if they had children.
- List the possible genotypes and phenotypes for their children.
  - What are the chances of a child with light blue body?
  - What are the chances of a child with light green body?
8. Mr. Krabbs and his wife recently had a Lil' Krabby, but it has not been a happy occasion for them. Mrs. Krabbs has been upset since she first saw her new baby who had short eyeballs. She claims that the hospital goofed and mixed up her baby with someone else's baby. Mr. Krabbs is homozygous for his tall eyeballs, while his wife is heterozygous for her tall eyeballs. Some members of her family have short eyes, which is the recessive trait. Create a Punnett square using T for the dominant gene and t for the recessive one.

Did the hospital make a mistake? Explain your answer.

9. Use the information for SpongeBob's traits to write the phenotype (physical appearance) for each genotype:

Trait	Dominant Gene	Recessive Gene	a) LL: _____	e) Rr: _____
Body Shape	Squarepants (S)	Roundpants (s)	b) yy: _____	f) ll: _____
Body Color	Yellow (Y)	Blue (y)	c) Ss: _____	g) ss: _____
Eye Shape	Round (R)	Oval (r)	d) RR: _____	h) Yy: _____
Nose Style	Long (L)	Stubby (l)		

10. Use the information in the above chart to determine the genotype (type of alleles) for each phenotype:

- a) Yellow body - \_\_\_\_\_
- b) Stubby nose - \_\_\_\_\_
- c) Roundpants - \_\_\_\_\_
- d) Round eyes - \_\_\_\_\_
- e) Oval eyes - \_\_\_\_\_
- f) Squarepants - \_\_\_\_\_
- g) Long nose - \_\_\_\_\_
- h) Blue body - \_\_\_\_\_

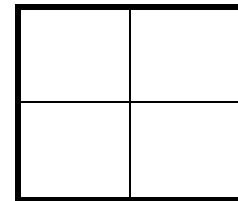
11. Determine the genotypes for each using the information in the chart in #9.

- a) Heterozygous round eyes - \_\_\_\_\_
- b) Homozygous long nose - \_\_\_\_\_
- c) Purebred squarepants - \_\_\_\_\_
- d) Hybrid yellow body - \_\_\_\_\_

12. One of One of SpongeBob's cousins, SpongeBillyBob, recently met a cute squarepants gal, SpongeGerdy, at a local dance and fell in love. Use your knowledge of genetics to answer the questions below.

a) If SpongeGerdy's father is a heterozygous squarepants and her mother is a roundpants, what is her genotype? Complete the Punnett square to show the possible genotypes that would result to help you determine Gerdy's genotype.

b) What is Gerdy's genotype?



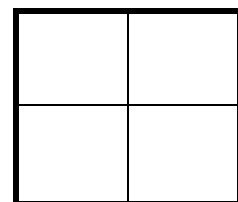
c) SpongeBillyBob is heterozygous for his squarepants shape. What is his genotype?

13. Complete the Punnett square to show the possibilities that would result if Billy Bob & Gerdy had children.

b) List the possible genotypes of the children.

c) What is the probability (%) of kids with squarepants?

d) What is the probability (%) of kids with roundpants?

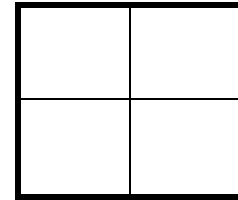


14. SpongeBob's aunt and uncle, SpongeWilma and SpongeWilbur, have the biggest round eyes in the family. Wilma is believed to be heterozygous for her round eye shape, while Wilbur's family brags that they are a pure line. Complete the Punnett square to show the possibilities that would result if SpongeWilma and SpongeWilbur had children.

- a) Give the genotype for each person. Wilma - \_\_\_\_\_ Wilbur - \_\_\_\_\_
- b) Complete the Punnett square to show the possibilities that would result if they had children.
- c) List the possible genotypes of the children.

d) What is the probability (%) of kids with round eyes?

e) What is the probability (%) of kids with oval eyes?



15. SpongeBob's mother is so proud of her son and his new wife, SpongeSusie, as they are expecting a little sponge. She knows that they have a 50% chance of having a little roundpants, but is also hoping the new arrival will be blue (a recessive trait) like SpongeSusie and many members of her family. If SpongeBob is heterozygous for his yellow body color, what are the chances that the baby sponge will be blue? Create a Punnett square to help you answer this question.

16. SpongeBob's aunt is famous around town for her itty, bitty stubby nose! She recently met a cute squarepants fellow who also has a stubby nose, which is a recessive trait. Would it be possible for them to have a child with a regular long nose? Why or why not? Create a Punnett square to help you answer this question.

17. If SpongeBob's aunt described in #16 wanted children with long noses, what type of fellow would she need to marry in order to give her the best chances? Create a Punnett square to help you answer this question.

*For the following examples, C represents the dominant gene for curly hair and c represents the recessive gene for straight hair.*

18. An egg cell with the C allele is fertilized by a sperm with the C allele:

The genotype of the resulting zygote will be:

- a. CC      b) cc      c) Cc

19. The zygote will be \_\_\_\_\_.

- a. heterozygous      b) homozygous

20. The resulting human will have the following phenotype, \_\_\_\_\_.

- a. curly hair      b) straight hair      c) part curly, part straight

21. The resulting human will be able to produce the following gametes, \_\_\_\_\_.

- a. C      b) c      c) C or c

22. If an egg cell c and a sperm cell c unite:

The genotype of the resulting zygote will be \_\_\_\_\_.

- a. CC      b) cc      c) Cc

23. The zygote will be \_\_\_\_\_.

- a. heterozygous      b) homozygous

24. The resulting human will have the following phenotype, \_\_\_\_\_.

- a. curly hair      b) straight hair      c) part curly, part straight

25. The resulting human will be able to produce the following gametes, \_\_\_\_\_.

- a. C      b) c      c) C or c

26. If an egg cell C and a sperm cell c unite:

The genotype of the resulting zygote will be \_\_\_\_\_.

- a. CC      b) cc      c) Cc

27. The zygote will be \_\_\_\_\_.

- a. heterozygous      b) homozygous

28. The resulting human will have the following phenotype, \_\_\_\_\_.

- a. curly hair      b) straight hair      c) part curly, part straight

29. The resulting human will be able to produce the following gametes, \_\_\_\_\_.

- a. C      b) c      c) C or c



Using the example below as a guide to how to answer the questions that follow.

30. Curly hair is dominant over straight hair. One parent has a curly hair and a straight hair allele. The other parent has two straight hair alleles.
- Write the dominant and recessive genes and assign letters to traits  
*The curly hair allele is dominant (C) and the straight hair allele is recessive (c).*
  - Write the parental phenotypes  
*Parent 1 - Curly haired      Parent 2 - Straight haired*
  - Write the parental genotypes  
*Parent 1 – Cc      Parent 2 – cc*
  - Write whether the parents are homozygous or heterozygous  
*Parent 1 – Heterozygous      Parent 2 - Homozygous*
31. One parent has a dominant allele for dark hair and and a recessive allele for light hair. The other parent has two recessive alleles for light hair.
- Write the dominant and recessive genes with symbol letters
  - Write the parental genotypes
  - Write the parental phenotypes
  - Write whether the parents are homozygous or heterozygous
32. One parent has two dominant alleles for dimples and the other parent has two recessive alleles for no dimples.
- Write the dominant and recessive genes with symbol letters
  - Write the parental genotypes
  - Write the parental phenotypes
  - Write whether the parents are homozygous or heterozygous

*SI-1-08: What are some ways plants and animals improve their chances to reproduce?*

*SI-1-15: How can lifestyle choices affect your genetics and development?*

Natural Selection    Adaptation    Mutation    Mutagen    Cancer    Carcinogen

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**MUTATIONS & LIFE**

*SI-1-15: How can lifestyle choices affect your genetics and development?*

This exercise has four scenarios. Pick **1** scenario from each pair and answer all questions with some detail:

**Scenario 1**

Manon regularly visits tanning salons. She does not realize that an ultraviolet ray has caused a mutation in one of the cells of her big toe. The modified gene produces an extra thick toe nail.

- Will Manon have problems?
- If Manon gives birth to a baby in a few months, will her child have a thick toe nail?

**OR**

**Scenario 2**

Rebecca has been pregnant for three months. Her fetus's cells have begun to differentiate and its brain is in full development. Rebecca eats too much meat that contains preservatives. These preservatives circulate in her bloodstream, causing a mutation of nervous cells that provide both with an extraordinary musical talent. Thirty years later, Rebecca's child, Peter, is internationally renowned, is married, and has many children.

- Will Peter's children become musically talented as well?
- Will his children necessarily have little musical talent?

**Scenario 3**

Patrick liked to sun bathe at his cottage. Unfortunately, he was unaware of the fact that the Sun's rays irradiated one of the chromosomes in the germinal cells of his testicles. This resulted in a mutation that caused his son to have a nose with three nostrils. Also, the water in which he liked to swim contained a mutagenic pesticide that changed the cells in his lungs, causing Patrick to develop asthma. Five years later, Patrick wonders if his children will also be sick.

- Will Patrick's children also be asthmatic?
- Will all of his children have problems?
- How could this mutation be an advantage to his children?

**OR**

**Scenario 4**

Freddy the frog is lazy and always hungry. His diet has many deficiencies, so much so that he is lacking ingredients for the proper mitosis of his germinal cells. Freddy does not realize that one of his sperm cells contains a gene that produces wings, and that he has fertilized an ovule that also contains a bizarre mutation that produces antennas.

- Will the flying frog with antennas also be lazy?
- Will the frog be able to feed more easily than Freddy?
- Will Freddy produce more flying frogs with antennas?