G8 Biology Guidebook

Page Tsien

2024-11-20

Contents

Chapter 1

Overview

G8 Biology

2024 Fall

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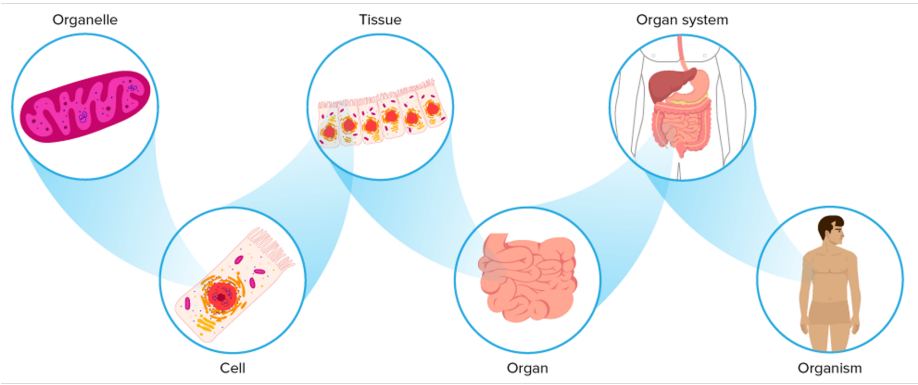
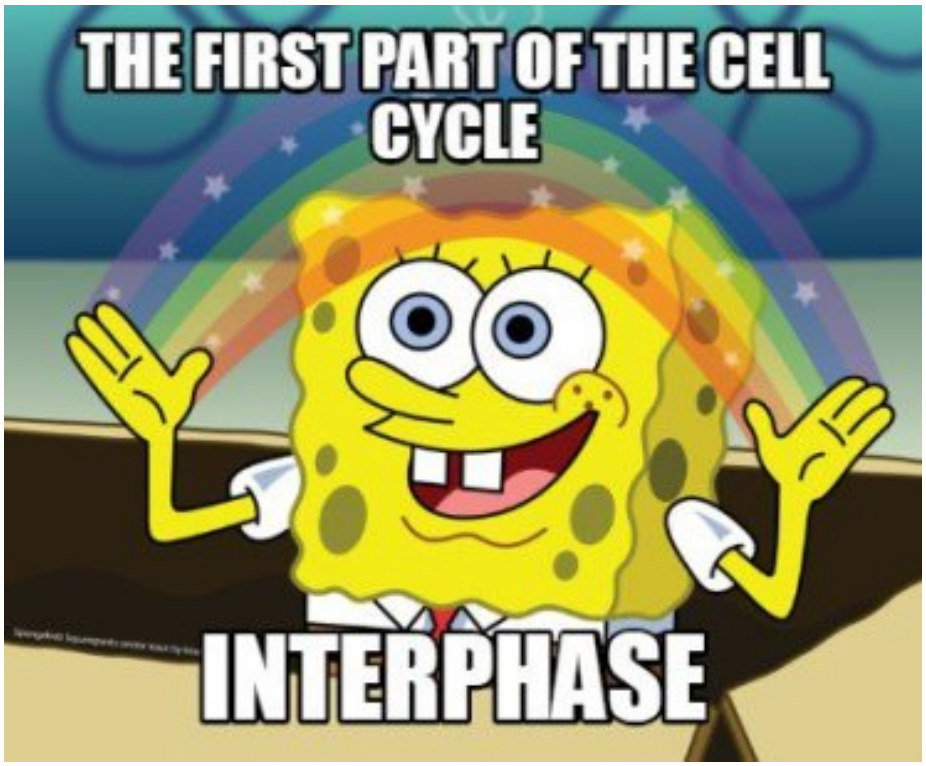
Mr. Page
A304

Chapter 2

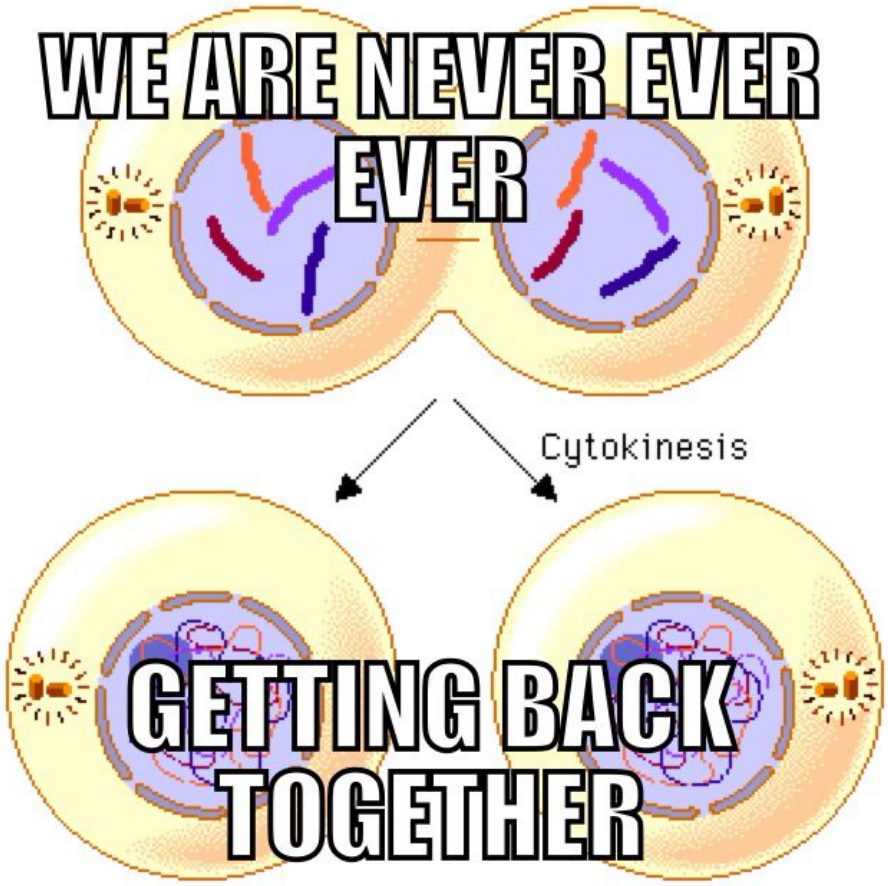
Chapter I: From A Cell To An Organism



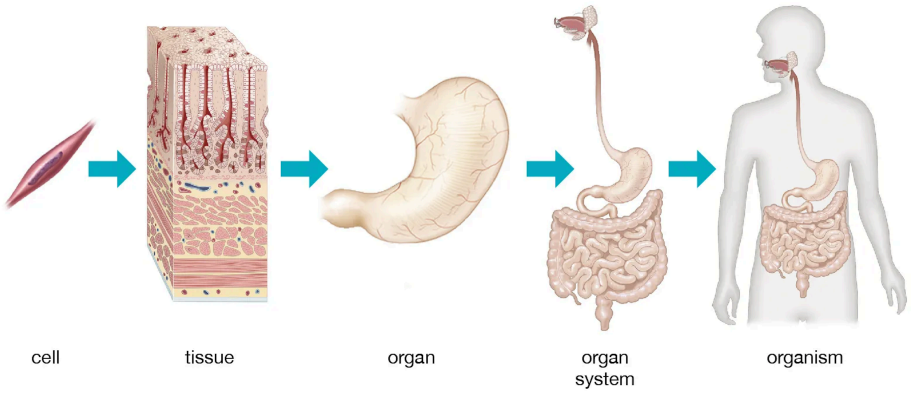
2.1 Lecture 1: Cell Cycle



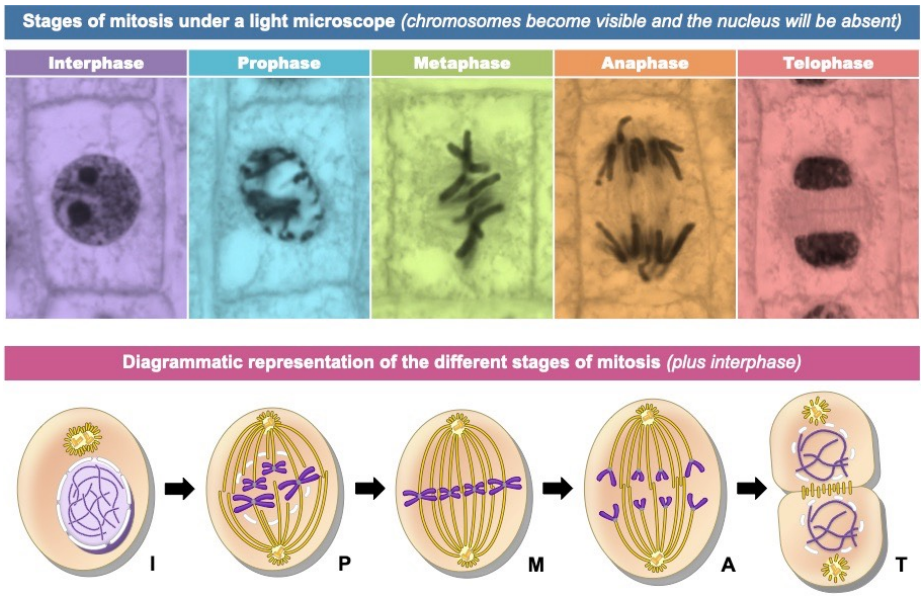
2.2 Lecture 2: Cell Division



2.3 Lecture 3: Levels of Organization

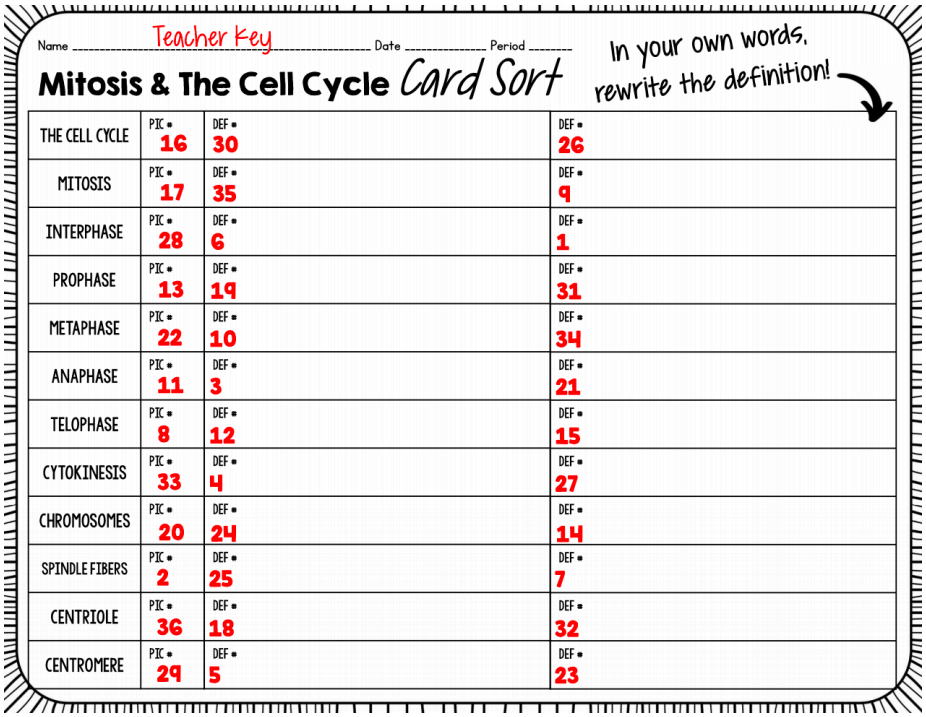


2.4 Experiment 1: Observing Mitosis In Plant Cells



2.5 Experiment 2: Cell Differentiation

2.6 Project 1: Mitosis & The Cell Cycle



Name Teacher Key Date _____ Period _____

Mitosis & The Cell Cycle *Card Sort*

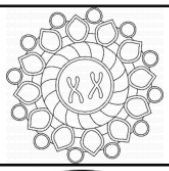
In your own words, rewrite the definition!

THE CELL CYCLE	PIC # 16	DEF # 30	DEF # 26
MITOSIS	PIC # 17	DEF # 35	DEF # 9
INTERPHASE	PIC # 28	DEF # 6	DEF # 1
PROPHASE	PIC # 13	DEF # 19	DEF # 31
METAPHASE	PIC # 22	DEF # 10	DEF # 34
ANAPHASE	PIC # 11	DEF # 3	DEF # 21
TELOPHASE	PIC # 8	DEF # 12	DEF # 15
CYTOKINESIS	PIC # 33	DEF # 4	DEF # 27
CHROMOSOMES	PIC # 20	DEF # 24	DEF # 14
SPINDLE FIBERS	PIC # 2	DEF # 25	DEF # 7
CENTRIOLE	PIC # 36	DEF # 18	DEF # 32
CENTROMERE	PIC # 29	DEF # 5	DEF # 23

Name Key Date

Mitosis & The Cell Cycle Coloring Page

For each question, there is one correct answer and a color associated with that answer. On the coloring page, each ***question number*** *section should be filled in with that color!*



1

During what phase of mitosis do the chromosomes line up in the center of the cell?

anaphase LIGHT BLUE	telophase RED	metaphase PURPLE

2

After mitosis, daughter cells have how many chromosomes compared to parent cells?

exact same LIGHT GREEN	double YELLOW	half PURPLE

3

In which stage of the cell cycle do eukaryotic cells spend most of their life?

telophase DARK BLUE	prophase RED	interphase ORANGE

4

Which of the following acronyms correctly identifies the stages of the cell cycle in order?

IPMATC RED	MPIATC DARK BLUE	TCAIMP ORANGE

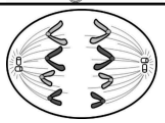
5

During what phase of mitosis do two cellular membranes begin to appear?

interphase BLACK	telophase YELLOW	prophase LIGHT GREEN

6

What phase of mitosis?



prophase LIGHT GREEN	anaphase LIGHT BLUE	cytokinesis DARK GREEN

7

What phase of mitosis?

prophase LIGHT GREEN	metaphase PURPLE	telophase RED

8

What phase of mitosis?

interphase ORANGE	anaphase DARK BLUE	telophase RED

9

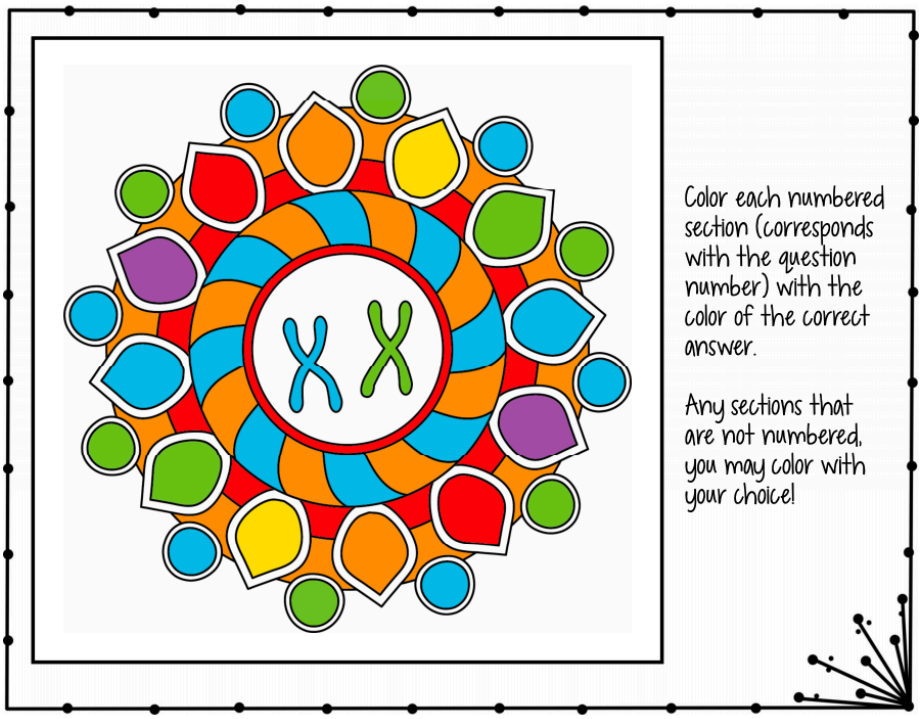
What phase of mitosis?

metaphase ORANGE	telophase PINK	interphase YELLOW

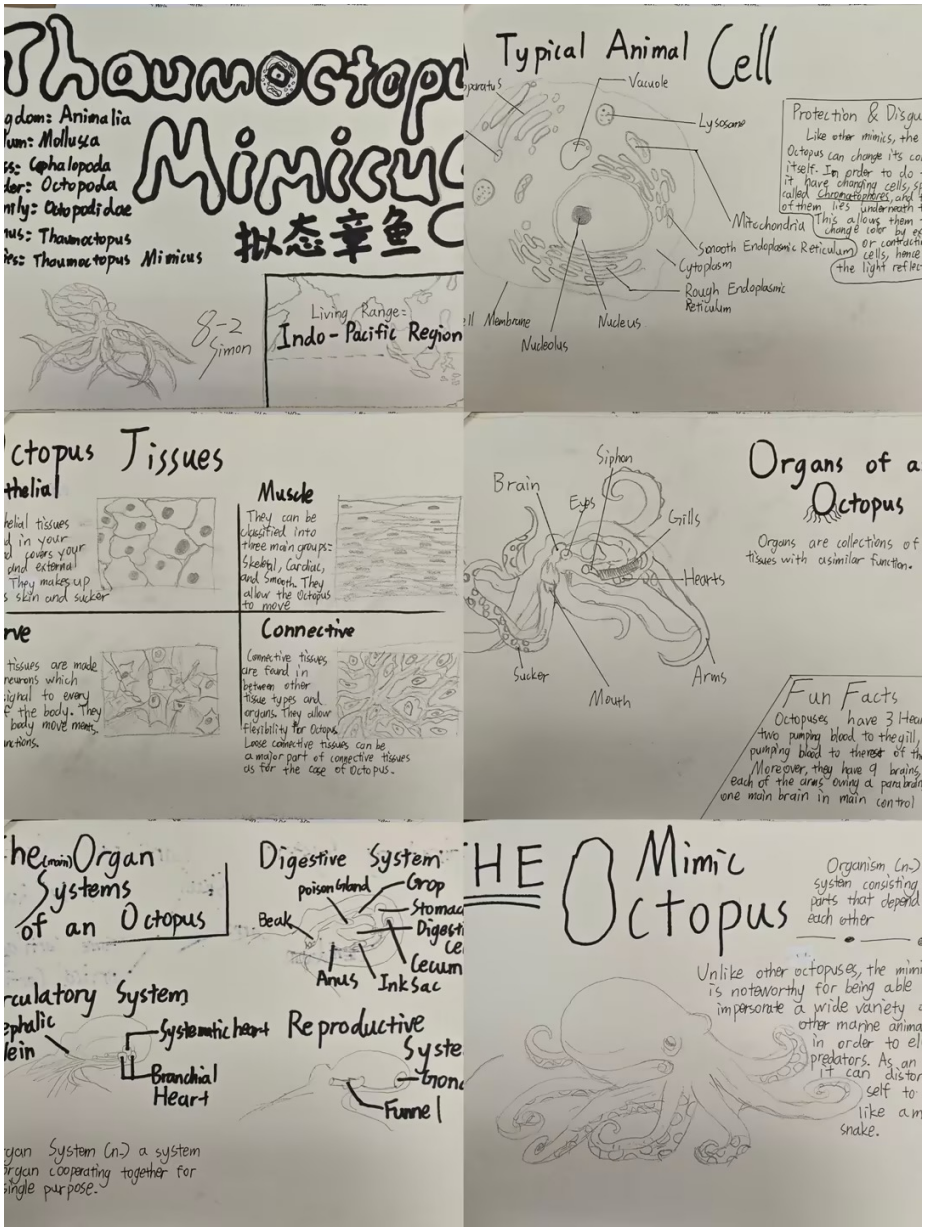
10

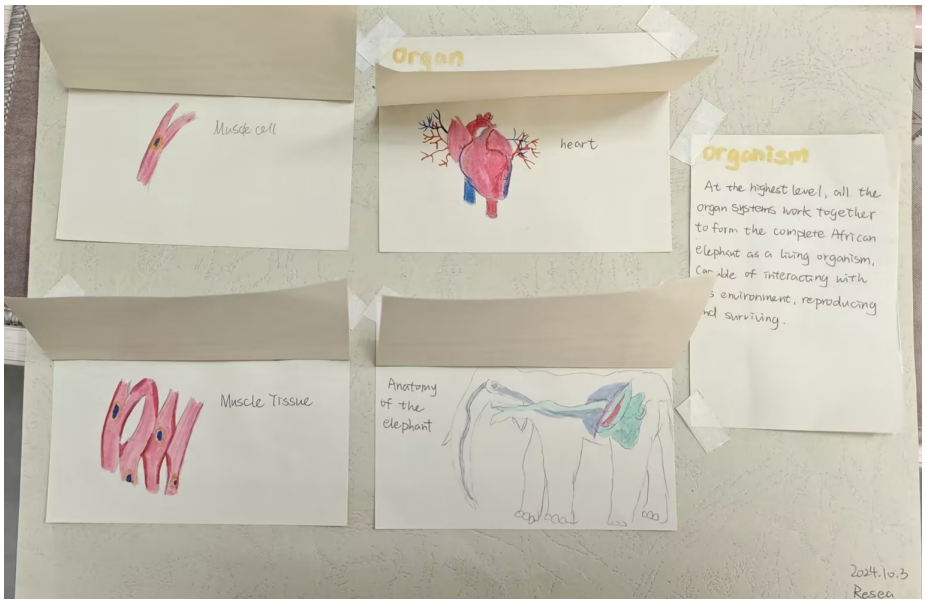
What phase of mitosis?

interphase LIGHT BLUE	prophase LIGHT GREEN	metaphase DARK GREEN


Color each numbered section (corresponds with the question number) with the color of the correct answer.
Any sections that are not numbered, you may color with your choice!

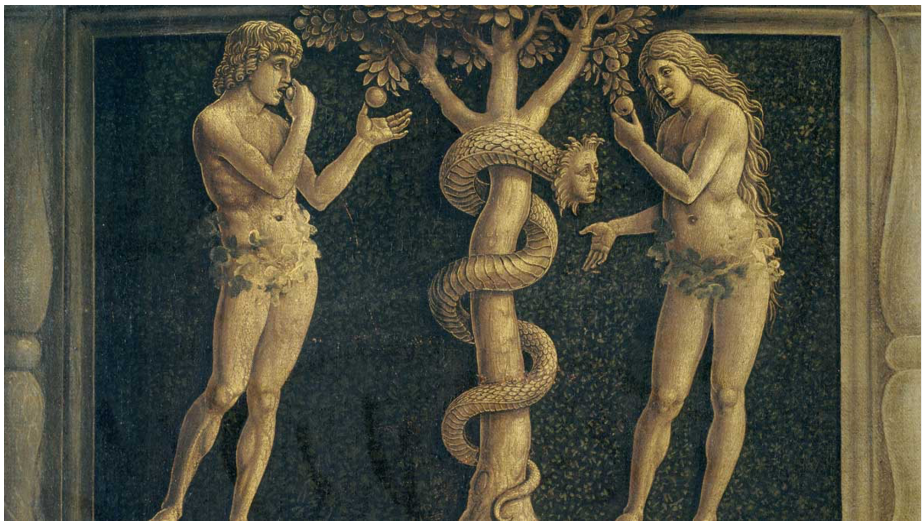
2.7 Project 2: Biological Organization




Muscle cell
Organ
heart
Organism
At the highest level, all the organ systems work together to form the complete African elephant as a living organism, capable of interacting with its environment, reproducing and surviving.
Muscle Tissue
Anatomy of the elephant
2024.10.3

Chapter 3

Chapter II: Reproduction Of Organisms



3.1 Lecture 4: Sexual Reproduction

3.1.1 Keywords

Sexual Reproduction
Meiosis
Sperm
Egg
Fertilization
Zygote
Haploid
Diploid
Homologous chromosomes

3.1.2 Lesson outline

A. What is sexual reproduction?
1. Sexual reproduction produces an offspring when genetic materials from two different sex cells combine.
a. The female sex cell, a(n) egg, forms in an ovary.
b. The male sex cell, a(n) sperm, forms in a testis.
2. During a process called fertilization, an egg cell and a sperm cell join together. The new cell that forms is called a(n) zygote.

B. Diploid Cells
1. Organisms that reproduce sexually make two kinds of cells—body cells and sex cells.
2. Body cells are diploid; they have pairs of chromosomes.
3. If a zygote has too many or too few chromosomes, it will not develop properly.
4. Different organisms have different numbers of chromosomes.
5. Homologous chromosomes are pairs of chromosomes that have genes for the same traits arranged in the same order.

C. Haploid Cells
1. Sex cells are haploid; they have only one chromosome from each pair of chromosomes.
2. In meiosis, one diploid cell divides and makes four haploid cells.

3.1.3 Homework

Matching
1. G
2. B
3. H
4. C
5. I
6. A
7. D
8. F
9. E

Multiple Choice Questions
10. A
11. B

Short Answer Questions
12. Sexual reproduction is the production of an offspring that results when the genetic material from two different cells combine.
(Hint: Check "how to write a definition" in extension)
s
13. A zygote is a new cell that forms when an egg cell and a sperm cell join during fertilization.
(Hint: Check "how to write a definition" in extension)
s
14. A diploid cell has pairs of chromosomes and is located in body cells. A haploid cell has only one set of chromosomes and is located in sex cells.
(Hint: a pair or chromosomes/two sets of chromosomes vs. one chromosome from each pair/one set of chromsomes)

3.1.4 Extension

How to write a definition?

A formal definition is based upon a concise, logical pattern that includes as much information as it can within a minimum amount of space. The primary reason to include definitions in your writing is to avoid misunderstanding with your audience. A formal definition consists of three parts:

1. The **term** (word or phrase) to be defined
2. The **class** of object or concept to which the term belongs
3. The **differentiating characteristics** that distinguish it from all others of its class

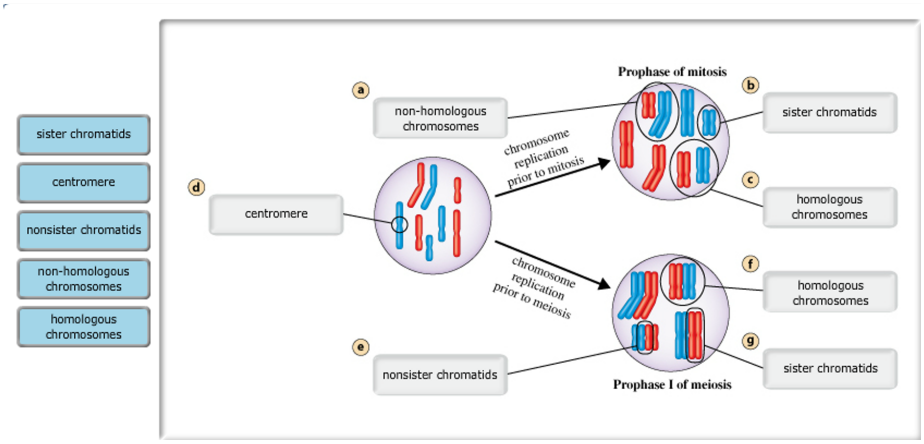
For example:

- Water (term) is a liquid (class) made up of molecules of hydrogen and oxygen in the ratio of 2 to 1 (differentiating characteristics).
- Comic books (term) are sequential and narrative publications (class) consisting of illustrations, captions, dialogue balloons, and often focus on super-powered heroes (differentiating characteristics).
- Astronomy (term) is a branch of scientific study (class) primarily concerned with celestial objects inside and outside of the earth's atmosphere (differentiating characteristics).

Sources:
1. https://owl.purdue.edu/owl/general_writing/common_writing_assignments/definitions.html
2. https://www.sjsu.edu/aanapisi/docs/DefinitonLessonPlanbyEdSams.pdf

3.2 Lecture 5: Meiosis-1

3.2.1 Lesson outline



D. The Phases of Meiosis

1. Meiosis involves two divisions of the nucleus and the cytoplasm. These divisions, known as meiosis I and meiosis II, result in four haploid cells.
2. During interphase, the reproductive cell grows and duplicates its chromosomes.
3. During meiosis I, each pair of duplicated homologous chromosomes separates.
4. After meiosis I, the two cells formed during this stage go through a second division of the nucleus and cytoplasm called meiosis II. During meiosis II, sister chromatids separate to produce four haploid cells.

E. Why is meiosis important?

1. Meiosis forms sex cells with the correct haploid number of chromosomes. This maintains the correct diploid number of chromosomes in organisms when sex cells join. Meiosis creates genetic variation by producing haploid cells.

3.2.2 Homework

Fill in the Blanks

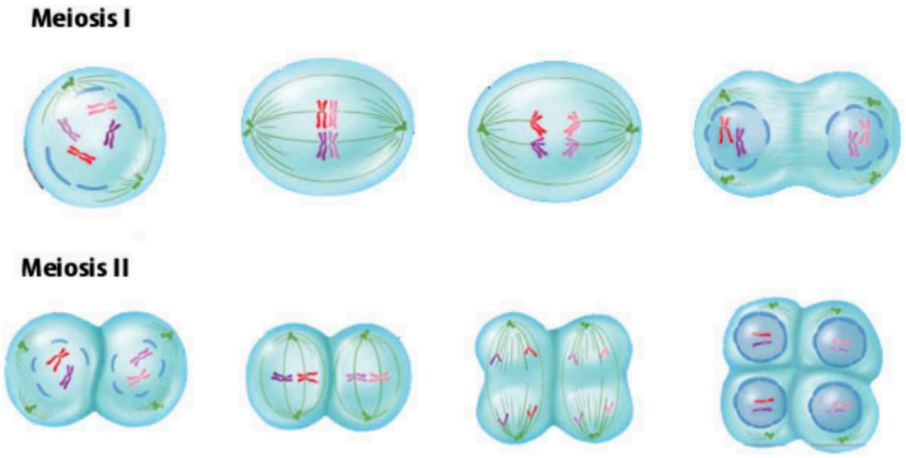
1. diploid; haploid
2. haploid; diploid
3. diploid
4. homologous chromosomes
5. homologous chromosomes
6. N/A
7. meiosis
8. sister chromatids
9. sister chromatids

10. meiosis; meiosis
11. meiosis

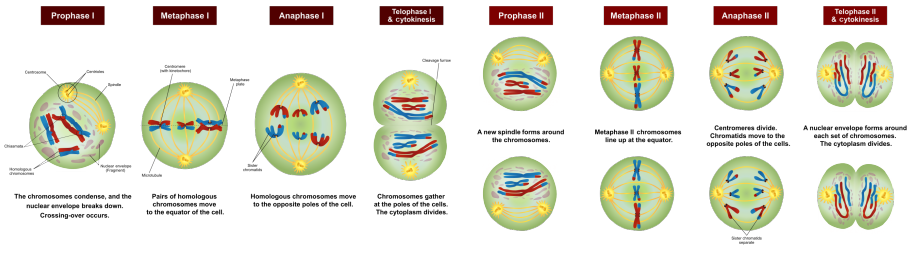
Short Answer Questions
12. Sex cells are haploid cells.

3.3 Lecture 6: Meiosis-2

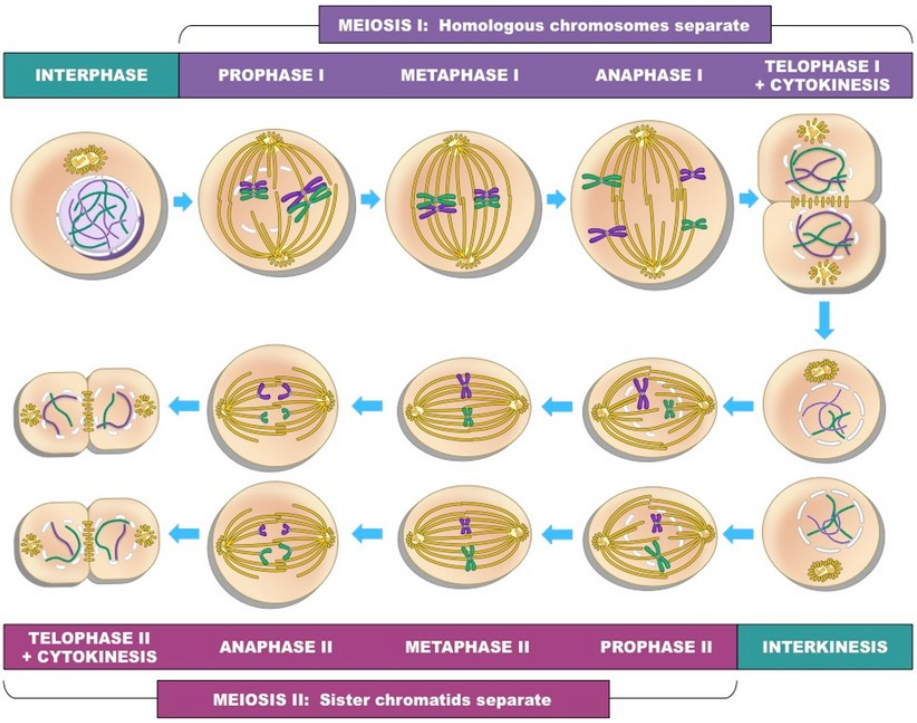
3.3.1 Lesson outline



meiosis illustration 1



meiosis illustration 2



meiosis illustration 3

1. interphase
2. Homologous chromosomes
3. breaks
4. middle
5. Spindle
6. homologous
7. Sister chromatids
8. two
9. Sister chromatids
10. Chromosomes; Nuclear membrane

11. align
12. pulled apart; opposite ends of the cells
13. chromosomes
14. four
15. half

3.3.2 Homework

Multiple Choice Questions
1. A
2. C
3. C
4. D

Short Answer Questions
(6 points maximum) One point for each of the following:

- Correct description of meiosis
  Germ cell is a diploid cell, and goes through meiosis to produce gametes, which are haploid cells.
- DNA replicates in interphase
  DNA replicates in interphase, and each chromosome then has a pair of identical sister chromatids.
- Homologous chromosomes pair in prophase I
- Spindle fibers move chromosomes pairs to poles in anaphase I
  In the end of meiosis I, two daughter cells are produced, and their chromosomes are halved.
- Two cycles/rounds of division in meiosis
- No additional replication before meiosis II
- Sister chromatids separate to poles in anaphase II
  Separation of sister chromatids doesn't change the number of chromsomes. The daughter cells are still haploid cells.

- 1 germ cell yields 4 gametes
  4 gametes, which are haploid cells, are produced in the end of meiosis.

Fill in the Blanks
1. Anaphase II
2. N/A
3. Metaphase I
4. Telophase II (not quite obvious)
5. Telophase I (not quite obvious)
6. N/A
7. Metaphase II
8. Prophase I
9. Prophase II
10. Anaphase I

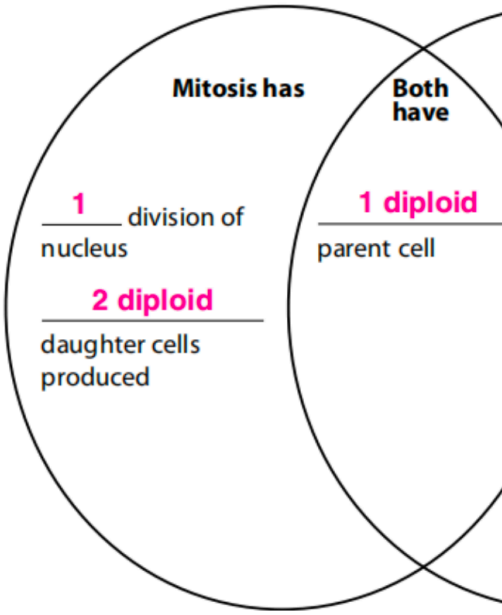
3.4 Lecture 7: Meiosis-3

3.4.1 Lesson outline

F. How do mitosis and meiosis differ?
1. During mitosis and cell division, a body cell and its nucleus divide once and produce two identical cells.
2. During meiosis, a reproductive cell and its nucleus divide twice and produce four cells—-two pairs of identical haploid cells.

G. Advantages of Sexual Reproduction
1. Sexual reproduction produces offspring that have a new combination of DNA. This results in genetic variation among individuals.
2. Genetic variation gives individuals within a population slight differences that might be an advantage if the environment changes.
3. Selective breeding has been used to develop desirable traits in plants and animals.

H. Disadvantages of Sexual Reproduction
1. One disadvantage of sexual reproduction is that organisms have to grow and develop until they are mature enough to produce sex cells.
2. Another disadvantage is that searching for a mate takes time and energy and might expose individuals to predators, diseases, or harsh environmental conditions.



Compare and contrast meiosis and mitosis and cell division

Explain why genetic variation and selective breeding are advantages of sexual reproduction.
Genetic variation: Instead of being exact genetic copies of parents, members of the same species have different traits, which enable some of them to survive environmental changes.
Selective breeding: The process of choosing and breeding individuals with desirable traits allows breeders to create offspring with those traits.

Identify two main disadvantages of sexual reproduction.
1. takes time and takes energy
2. sexual reproduction is limited by certain factors (For example, fertilization cannot take place during pregnancy, which can last as long as two years in some mammals.)

Explain how the process of meiosis relates to the way in which a child resembles but is not an exact copy of his or her parents.
Observable characteristics in a child, such as **eye color, hair type and color, the shapes of facial features, and height**, resemble those of his or her parents, because the child **inherits portions of DNA from each parent**. A child is not a exact copy of his or her parents because the child **does not carry identical DNA to either parent**.

3.4.2 Homework

Multiple Choice Questions
1. D
2. C
(Hint: Crossing over)

Short Answer Questions

- Organism: correct organism that produces sexually
- Mode: two different parents / egg and sperm combine in fertilization / gametes (1n) combine to form zygote (2n) / fertilization is random
- Advantage: increase genetic variations

Enrichment
1. For many generations, native plants that were resistant to disease and pests survived and reproduced. The resistant traits were passed on to their offspring. Meanwhile, those native plants that were not resistant to disease and pests died off. Eventually, the population of native plants was made up mainly of resistant plants.
2. Possible answers:
Preserve all: Many plants that have no current known value might have important uses in the future. Saving plants that aren't useful to people is still necessary because other organisms might depend upon these plants for survival.
Preserve some: Because of budget restrictions, some plants might be targeted for preservation and others are allowed to become extinct. In this situation, it would be best to determine which plants are likely to be useful to people.

3.5 Lecture 8: Asexual Reproduction

3.5.1 Keywords

Asexual reproduction
Fission
Budding
Regeneration
vegetative reproduction
Culture medium
Potential

Cloning

3.5.2 Lesson outline

A. What is asexual reproduction?
1. In asexual reproduction, one parent organism produces offspring without meiosis and fertilization.
2. Because the offspring of asexual reproduction inherit all their DNA from one parent, they are genetically identical to each other and their parent.

B. Types of Asexual Reproduction
1. Cell division in prokaryotes is known as **fission**.
2. During fission, DNA is copied and the cell splits to form two identical offspring. The original cell no longer exists.
3. Many unicellular eukaryotes reproduce by **mitotic cell division**. In this type of asexual reproduction, an organism forms two offspring through mitosis and cell division.
4. In **budding**, a new organism grows on the body of its parent by mitosis and cell division. When the bud becomes large enough, it can break from the parent and live on its own.
5. **Regeneration** occurs when an offspring grows from a piece of its parent.
a. Sea stars, sea urchins, sea cucumbers, and planarians can reproduce through regeneration.
b. Many animals can regenerate damaged or lost body parts. This is not reproduction; new individuals are not produced.
6. **Vegetative reproduction** is a form of asexual reproduction in which offspring grow from a part of a parent plant.
7. **Cloning** is a type of asexual reproduction developed by scientists and performed in laboratories. It produces identical individuals from a cell or from a cluster of cells taken from a multicellular organism.
8. Using a cloning method called tissue culture, plant growers and scientists use a meristem to make a copy of a plant with desirable traits.
9. Because all of a clone's chromosomes come from one parent, the clone is a genetic copy of its parent.
10. Asexual reproduction enables organisms to reproduce without a(n) mate.
11. Asexual reproduction also enables some organisms to rapidly produce a large number of offspring.
12. Asexual reproduction produces offspring that are genetically identical to each other and to their parent. This results in little genetic variation within a population.
13. Genetic variation is important because it can increase an organism's chance of surviving if the environment changes.
14. Genetic changes, called mutations, can occur and then be passed to off-

spring; this can affect the offspring's ability to survive.

3.5.3 Homework

Matching
1.B
2.A
3.C
4.D
5.F
6.E

Multiple Choice Questions
7.D
8.B
9.C
10.C
11.C
12.C
13.B
14.B

Enrichment
1. The extreme cold that preserved the woolly mammoths also damaged their cells. Scientists need whole cells to clone an animal.
2. Possible answer: Scientists might be able to understand why the animal became extinct. They might also learn more about the animal's physical characteristics and its behaviors, as well as its environment.

Chapter 4

Midterm Review

4.1 Midterm Review Scope

4.2 Midterm Review Practice 1

4.3 Midterm Review Practice 2

Chapter 5

Chapter III: Genetics

5.1 Lecture 9: Mendel and his Peas - 1

5.1.1 Keywords

Trait
Heredity

Genetics
Self-pollination
Cross-pollination
Pistil
Stamen
True-breeding
Hybrid

5.1.2 Lesson outline

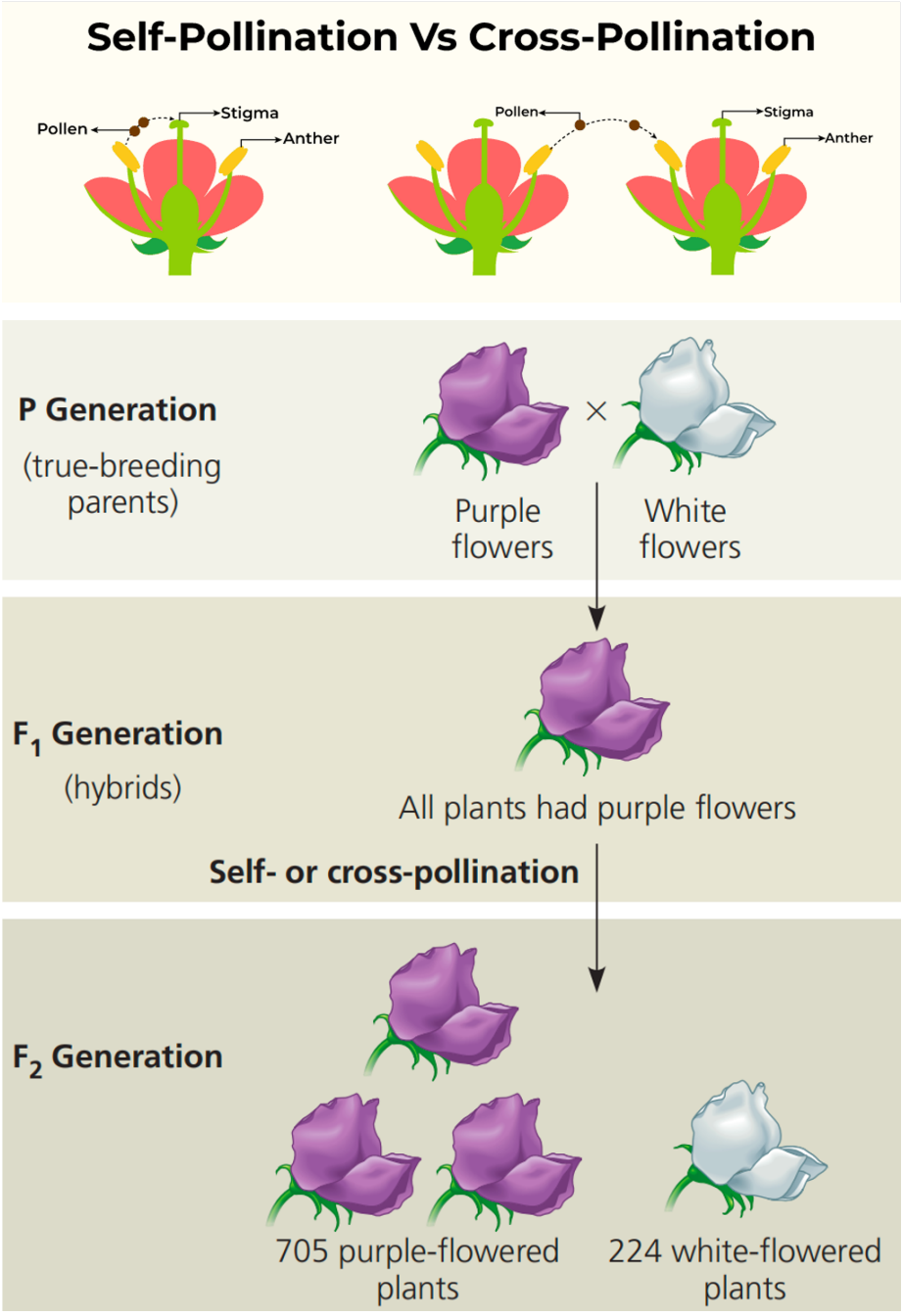
A. Early Ideas about Heredity
1. Heredity is the passing of traits from parents to offspring.
2. In the 1850s, Gregor Mendel, an Austrian monk, performed experiments that helped answer questions about how traits are inherited.
3. Genetics is the study of how traits pass from parents to offspring.

B. Mendel's Experimental Methods 1. Pea plants were ideal for genetic studies because they reproduce quickly; they have easily observed traits; and the experimenter can control which pairs of plants reproduce.
2. Mendel controlled which plants pollinated other plants.

a. When a(n) true-breeding plant self-pollinates, it always produces offspring with traits that match the parent.

b. By cross-pollinating plants himself, Mendel was able to select which plants pollinated other plants.
3. With each cross-pollination Mendel did, he recorded the traits that appeared in the offspring.

C. Mendel's Results
1. Mendel's crosses between true-breeding plants with purple flowers produced plants with only purple flowers. Crosses between true-breeding plants with white flowers produced plants with only white flowers.
2. Crosses between true-breeding plants with purple flowers and true-breeding plants with white flowers produced plants with only purple flowers.
3. The first–generation purple-flowering plants are called hybrid plants.
4. When Mendel cross-pollinated two hybrid plants, the trait that had disappeared in the first generation always reappeared in the second generation.
5. Mendel analyzed the data from many experiments on seven different traits. He always noted a 3:1 ratio; for example, purple flowers grew from hybrid crosses three times as often as white flowers.


Self-Pollination Vs Cross-Pollination
Pollen
Stigma
Anther
Pollen
Stigma
Anther
P Generation
(true-breeding parents)
Purple flowers
White flowers
F1 Generation
(hybrids)
All plants had purple flowers
Self- or cross-pollination
F2 Generation
705 purple-flowered plants
224 white-flowered plants