School:	South Ridge High School	Subject:	Biology	Teacher:	Ms.Jorge	Lesson Plan Date:	2/3/17

PRE-PLANNING

OBJECTIVE What will your students be able to learn?	**BENCHMARK**:
How and why Meiosis functions the way it does, and what it's differences from mitosis are (in context of which cells it occurs in and why)	SC.912.L.16.16 Describe the process f meiosis, including independent assortment and crossing over. Explain how reduction division results in the formation of haploid gametes or spores

ASSESSMENT *"Begin with the End in Mind"*
How will you know whether your students have made progress toward the objective? How and when will you assess mastery?

Can the students distinguish between meiosis and mitosis? Can they describe what recombination and independent assortment is and why it is important? Do they understand why this does not occur in somatic cells, and why it is important for sex cells?

ESSENTIAL QUESTION
A higher order question that is directly derived from the benchmark, introduced at the beginning of the lesson, discussed throughout the lesson, and answered by students at the end of the lesson to show understanding of the concepts taught.

What is the purpose of Meiosis, and in what ways does it achieve this (understand and also compare/contrast to mitosis)

HIGHER ORDER QUESTIONS (3-5)
What questions will be answered to provoke higher order thinking and include Moderate to High FCAT Complexity Levels? What would the ideal student response be for each question?

See Slides *12-14*
Which of the following highlights a key difference between meiosis and mitosis? (12)
Crossing over during prophase occurs during which cycle of division? (13)
True/False (14)

- *Meiosis occurs in Somatic cells (F)*
- *The Law of Independent Assortment dictates that parental chromosomes randomly assort and align across the equatorial access during Meiosis (T)*
- *Bonus: A zygote is a diploid (T)*

LESSON CYLCE

BELLRINGER Follow the Focus Calendar to provide reinforcement of previously taught skills.	**TIME** Approximate
Draw mitosis in book and discuss steps with group- then participate answer about each step from each group Slide 2- refer to image for review of steps	*10 min*

INTRODUCTION
Brief part of the lesson when students learn the objective/essential question and how mastering the objective leads to achieving the bigger goal of the course.

- Provide a hook to motivate students and link to prior knowledge in order to introduce a new concept.
- Explain the relevance of lesson and the importance of learning the concept.
- Introduce important vocabulary using the word wall as an interactive learning tool.

Slide 3- students are asked questions that will prompt critical thought of lesson, including reference to understanding of mitosis (ENGAGE)
Slide 4- Students will be shown meiosis and have to answer questions on the slide that EXPLORE new material and elicit critical application of previous knowledge

MODELING *"I DO"*

Component of the lesson when teacher explicitly models to students exactly what they are expected to do during guided practice and eventually during independent work.

- Conduct a think aloud while modeling the steps to completing an activity or solving a problem.
- Model the use of a graphic organizer.
- Use questioning techniques such as re-directing, wait-time and prompting.

Slide 5- EXPLAIN

- Give terms, explain there are two stages to achieve goal of meiosis, and ask "Based off of that last image what do you think Meiosis I accomplishes?"
- Move on to explain crossing over in Meiosis I (Ms. Jorge requested emphasis on this topic) (See SLIDE 6--- continuation of explain)

GUIDED PRACTICE *"WE DO"*

Guide students to independent practice by providing an opportunity to work in small groups and practice what was taught during the modeled portion of the lesson.

- Incorporate the use of a collaborative strategy in small groups.
- Encourage student accountable talk during group discussion.
- Perform checks for understanding.

Discuss crossing over and what it allows for (Slide 6)-- What are the implications of this
How is this beneficial for organisms?
Hint: Crossing over is specific to sex cells" Discuss in groups then discuss as class
(Slide 7) Go into steps of meiosis and describe each based off of what they think is going on as relative to meiosis and the coloration of chromatids (---recombined chromosomes)
Reference the Blue and purple stars that point out crossing over and independent assortment. Why are these two necessary, and when do they occur? Review- What are they?
Discuss explicitly Crossing over (Slide 8)

COLLABORATIVE PRACTICE *"THEY DO"*

Guide students to independent practice by providing an opportunity to work in small groups and practice what was taught during the shared portion of the lesson.

- Incorporate the use of a collaborative strategy in small groups.
- Circulate throughout the room and provide guidance to each group as needed.

Put up images from Slide 7 and Slide 9, allow students to copy steps into power notes, and describe from their own memory what is going on, cellular components involved, etc. on the power notes provided. Walk around to help students understand steps.

INDEPENDENT PRACTICE *"YOU DO"*

Differentiate your instruction to reach the diversity of learners in your classroom.

- Assign students independent work that is directly aligned with the "I Do" and "We Do" portions of the lesson.
- Conduct Center Rotations
- Circulate around the room to provide individual support.
- Pull small groups or individuals for more intensive support.

Review the two stages briefly, discuss Slide 13 (difference between haploid and diploid) and ask them to describe the terms in power notes based on what we discussed (see power notes provided)

CLOSURE — *5 min*

Wrap up the lesson and help students organize the information learned into a meaningful context.

- Have students reflect on or answer the Essential Question.

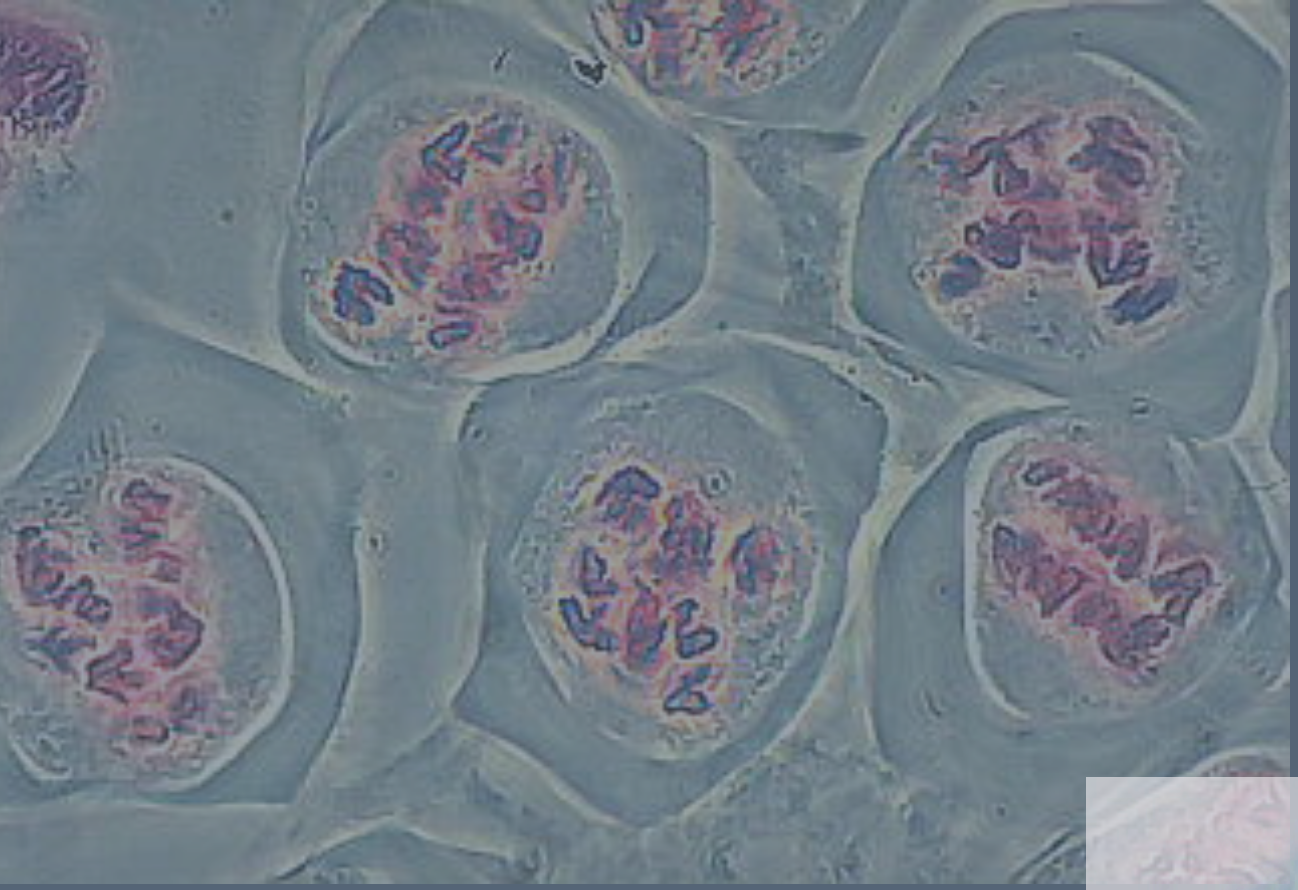
Help students connect today's learning to their bigger goal in the course.

Slides 12-14 Questions

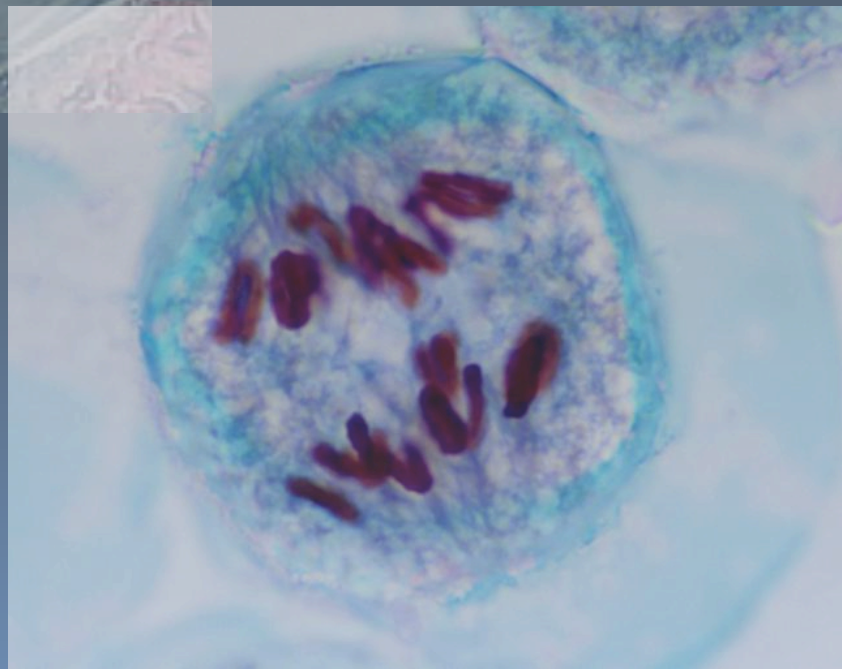
HOME-LEARNING

How will students practice what they learned? How will opportunities be provided for students to maintain mastery of previously mastered skills/concepts?

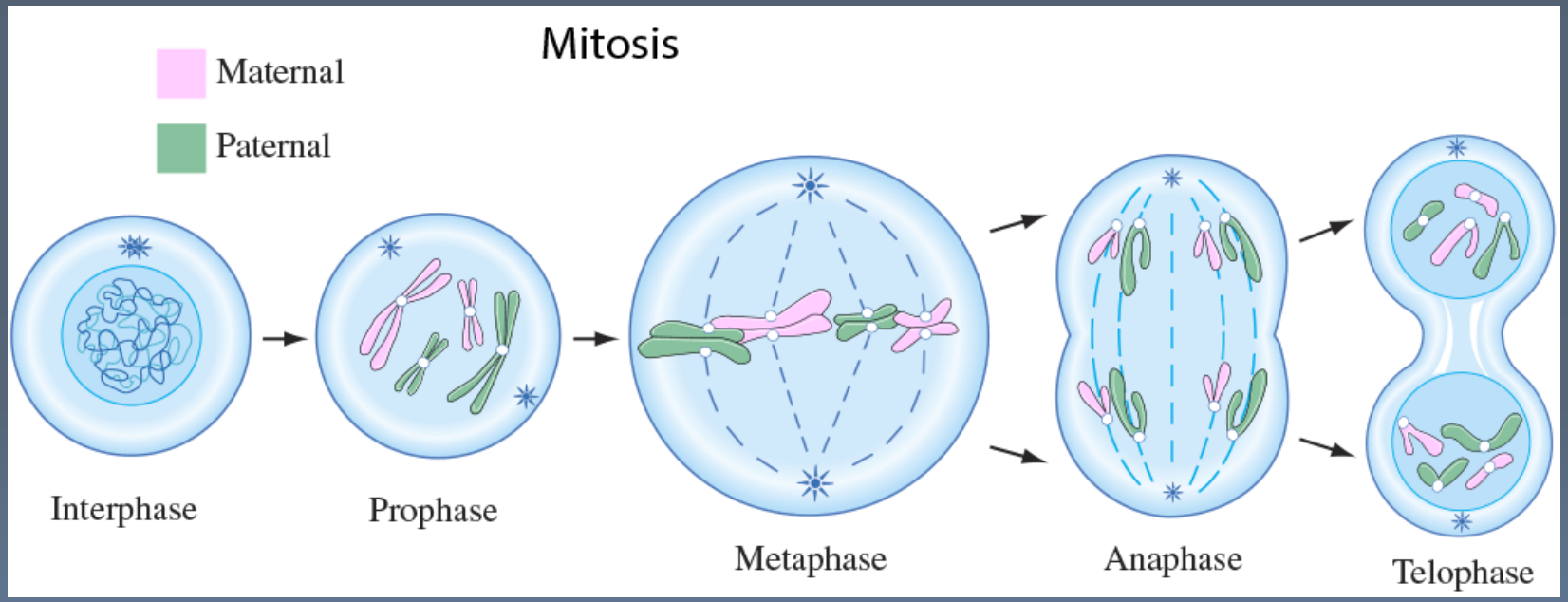
Complete power notes



MEIOSIS



Review: Mitosis



-→What's the difference between meiosis and mitosis

- *Prompts:*

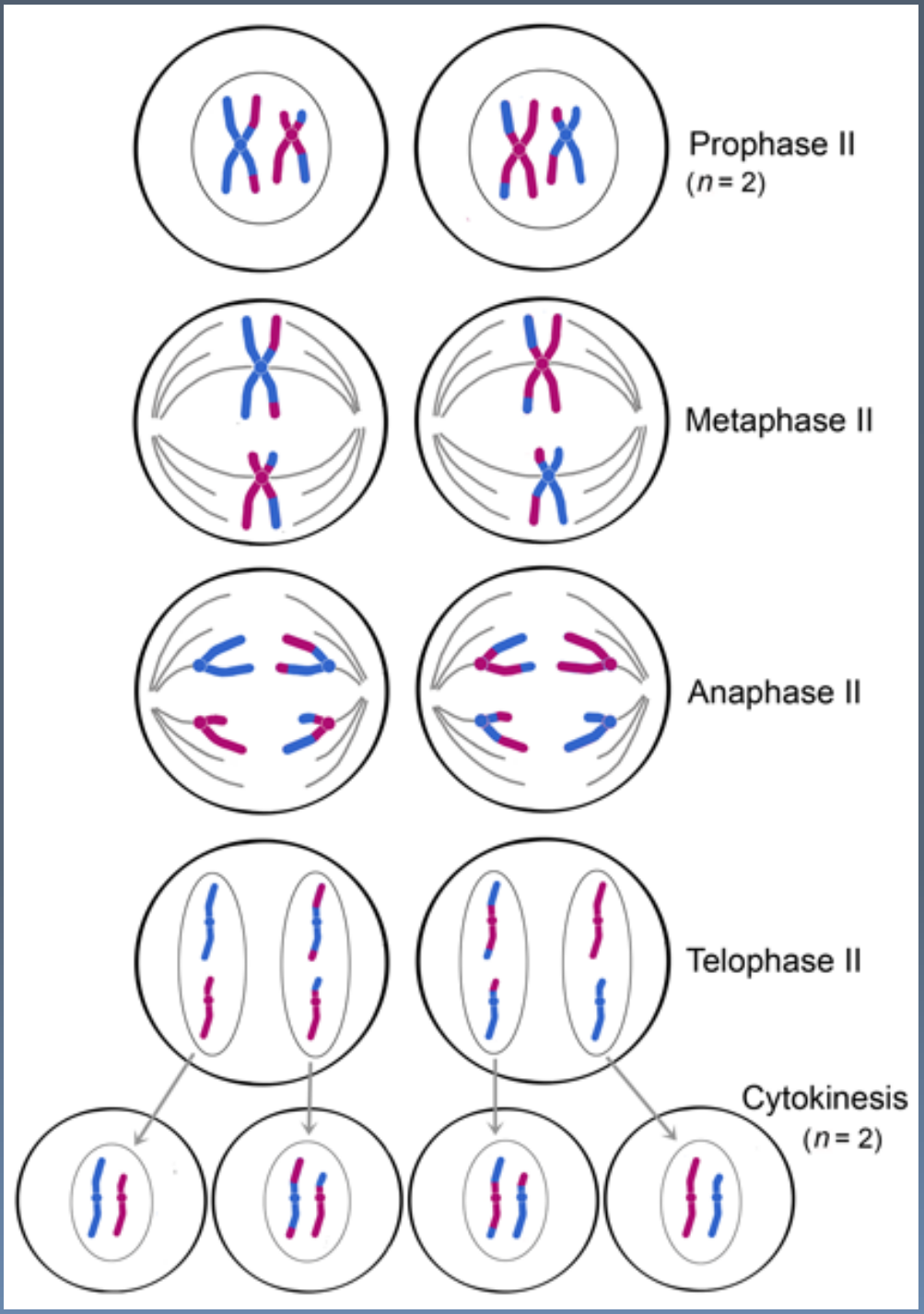
① What cells does Mitosis occur in?

② How many cells does Mitosis produce?

③ Compare chromosome in the daughter cells to that in the parental cells

WHAT IS WRONG WITH THESE CHROMOSOMES???

WHAT DO YOU NOTICE THAT IS DIFFERENT FROM MITOSIS?



- *Meiosis*: cell division that produces reproductive cells in reproducing organisms; the nucleus divides into four nuclei each containing half the chromosome number (leading to gametes in animals and spores in plants)

- There are actually TWO stages of Meiosis (Meiosis I/ Meiosis II)
- Based off of that last image what do you think Meiosis I accomplishes?

Meiosis I: *First round of division*

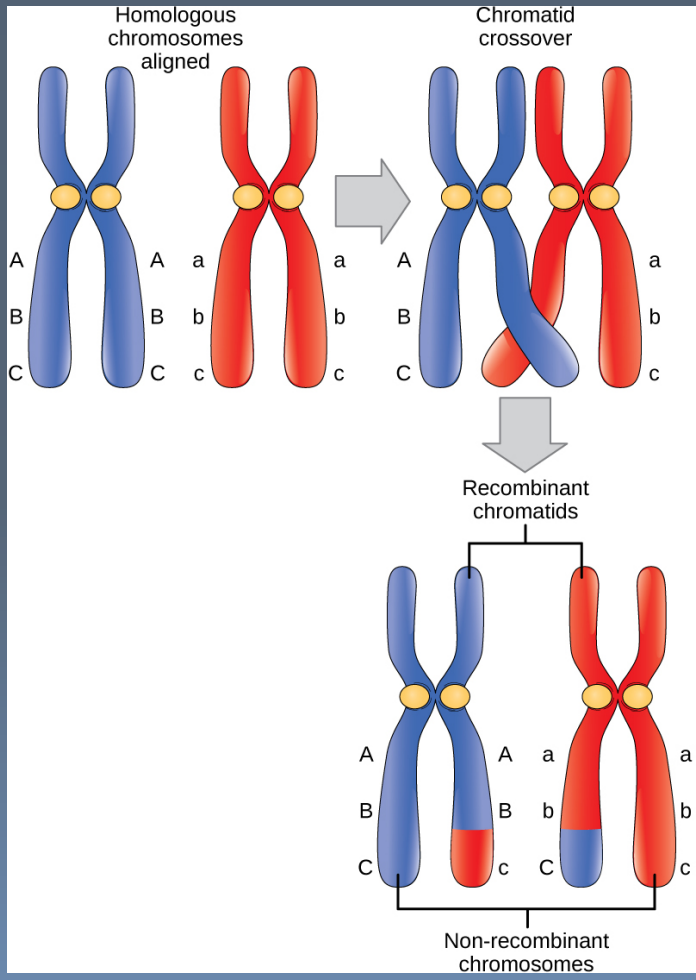
- What it accomplishes: separates *homologous pairs*
  What are homologous pairs?

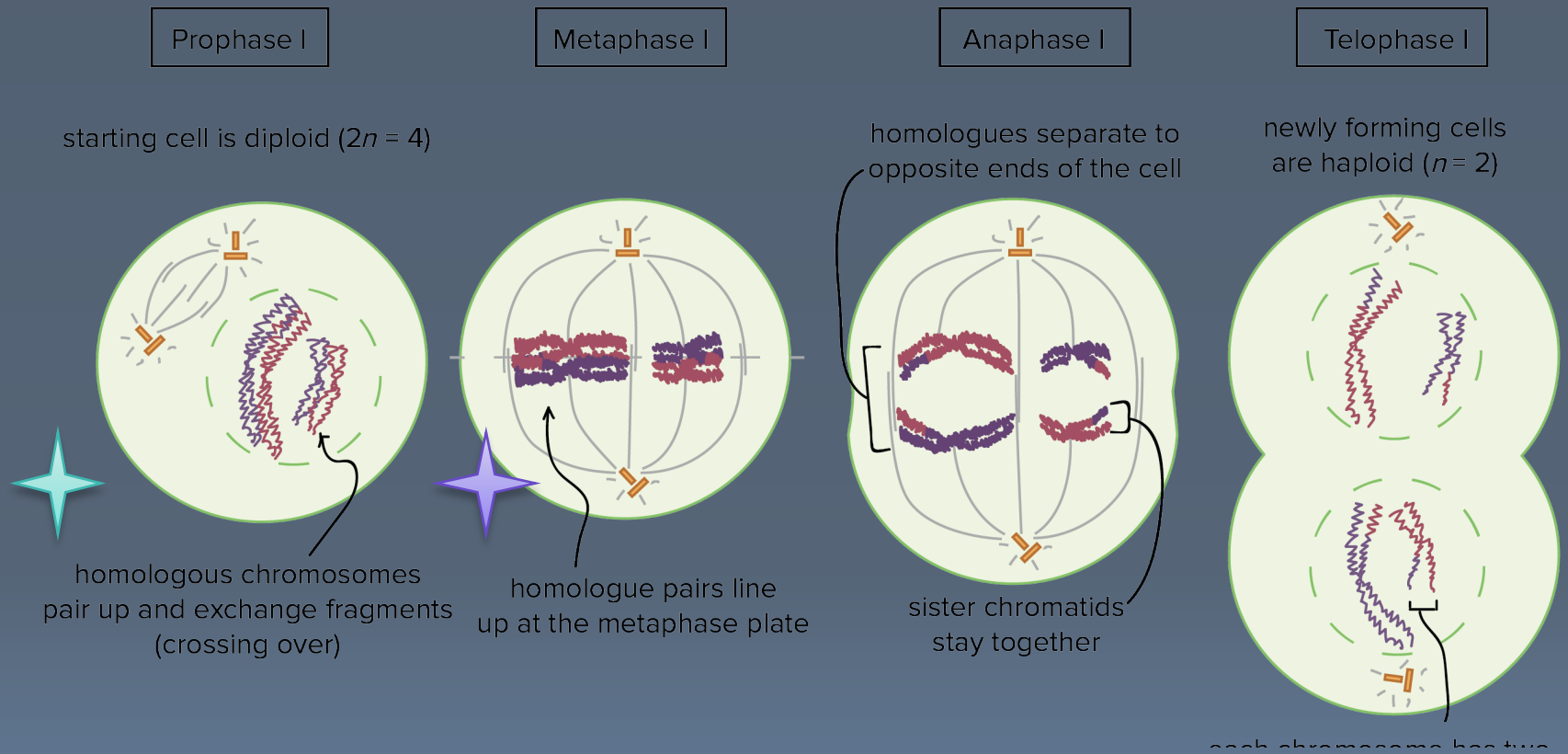
- How? CROSSING OVER

- Discussion

What are the implications of this

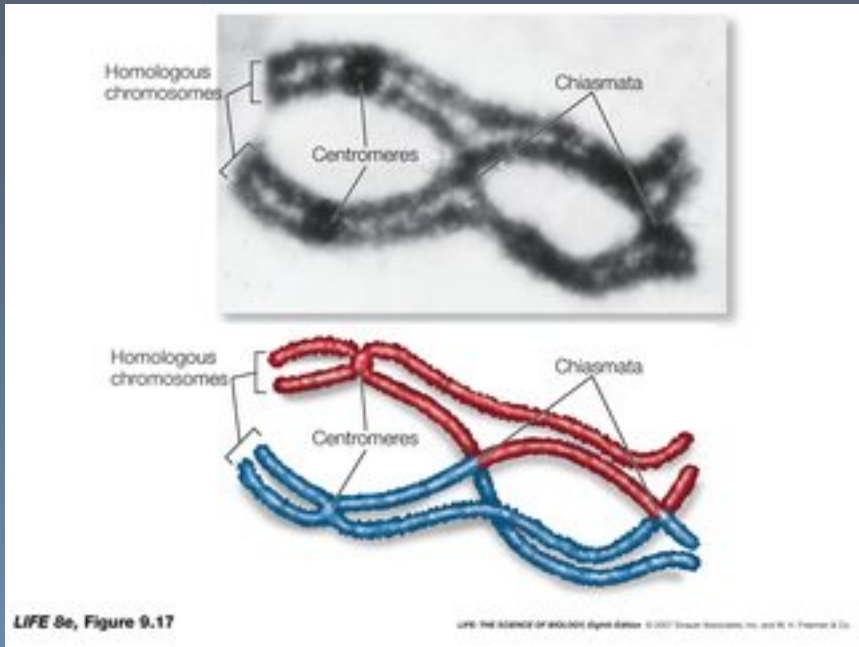
How is this beneficial for organisms?
Hint: Crossing over is specific to sex cells




Prophase I
Metaphase I
Anaphase I
Telophase I
starting cell is diploid (2n = 4)
homologous chromosomes pair up and exchange fragments (crossing over)
homologue pairs line up at the metaphase plate
homologues separate to opposite ends of the cell
sister chromatids stay together
newly forming cells are haploid (n = 2)

Crossing Over

- *When? Prophase I*
- **Crossing over** : when homologous chromosomes cross at a chiasmata, and exchange genes resulting in a mixture of _____ genes
- *Discuss: The nature of the genes*
- *exchanged*



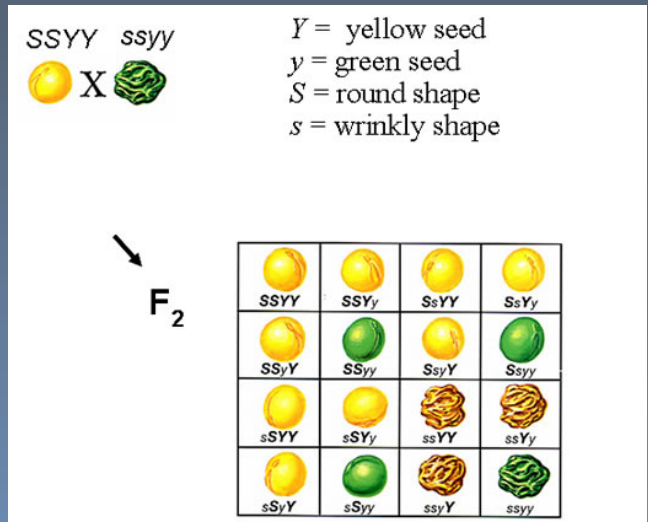
LIFE 8e, Figure 9.17

Law of Independent Assortment

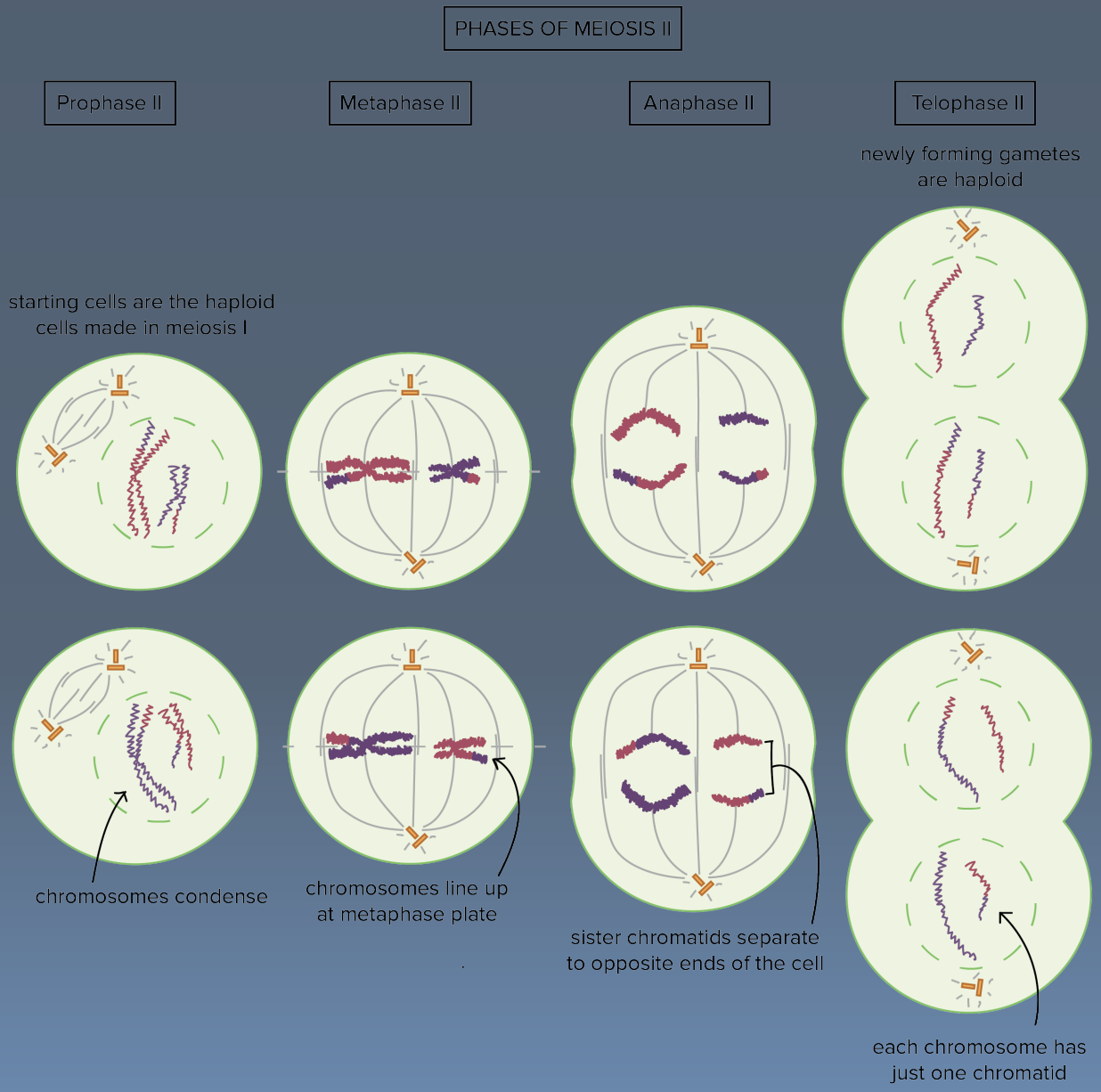
- *When? Metaphase I*

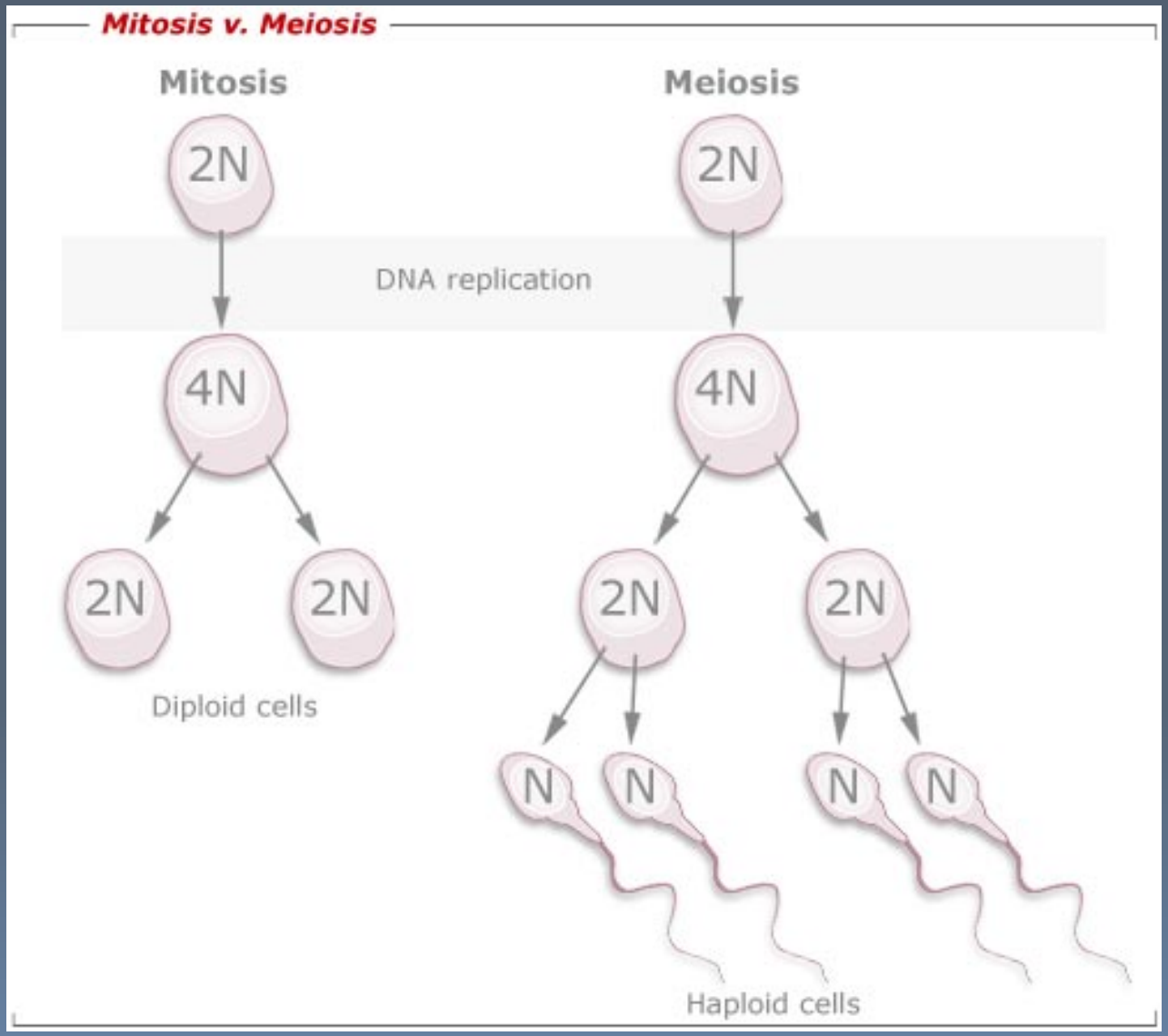
- **<u>Independent assortment:</u>** when the "crossed over" chromosomal pairs align along the equitorial axis, they sort independent of each other, and have equal chance of being included in either resulting cell after cytokinesis

Gregor Mendel asked- do genes tend to sort together or independently?



Meiosis II: *Second round of division*




Mitosis v. Meiosis
Mitosis
Meiosis
2N
2N
DNA replication
4N
4N
2N
2N
2N
2N
Diploid cells
N
N
N
N
Haploid cells

Which of the following highlights a key difference between meiosis and mitosis?

A- Meiosis involves two divisions, while mitosis involves only one

B- There is no metaphase stage in meiosis

C- Genetic mutations can only occur in meiosis; mitosis always results in identical daughter cells

D- All of the Above

Source: Varsity Tutors

Crossing over during prophase occurs during which cycle of division?

A- Mitosis

B- Meiosis I

C- Meiosis II

D- All of the above

Source: Varsity Tutors

Are the following statements True or False?

- *Meiosis occurs in Somatic cells*
- *The Law of Independent Assortment dictates that parental chromosomes randomly assort and align across the equatorial access during Meiosis*
- *Bonus: A zygote is a diploid*

Hint: What are gametes, (sperm or egg cells) haploid or diploid?

References

- https://online.science.psu.edu/bisc002_activeup001/node/9975https://www.khanacademy.org/science/biology/cellular-molecular-biology/meiosis/a/phases-of-meiosis
- http://cyberbridge.mcb.harvard.edu/mitosis_7.html
- Images
- https://i.stack.imgur.com/DjmFJm.jpg
- https://i.stack.imgur.com/l2sGr.jpg
- http://biology.about.com/od/meiosis/ss/meiosisstep.htm
- https://www.bio.purdue.edu/BCBLab/wp-content/uploads/2014/02/Mitosis.png
- https://www.integratedbreeding.net/courses/marker-assisted-breeding/images/iwefuh883.jpg

Name Period Date

Biology

SC.912.L.16.16 – Meiosis

1. **Gametes:** Reproductive cells, sperm and egg.
2. **Karyotype**: Number and appearance of chromosomes in the nucleus of a eukaryotic cell
3. **Autosomes**: Chromosomes that contain genes for characteristics not directly related to the sex of an organism. (Pairs 1 through 22)
4. **Sex chromosomes**: Chromosomes that control the development of sexual characteristics. (Pair 23)
5. **Spermatogenesis**: Process of sperm formation in the testes.
6. **Oogenesis**: Process of egg production in the ovaries.
7. **Meiosis**: Process of nuclear division that reduces the number of chromosomes in new cells to half the number in the original cell.
8. **Homologous chromosomes**: Chromosome pairs, one from each parent, that are similar in length, gene position and centromere location.
9. **Crossing over**: Process occurring during prophase I of meiosis wherein two homologous chromosomes pair up and exchange segments of their genetic material.
10. **Independent assortment**: Random separation of homologous chromosomes during anaphase I.

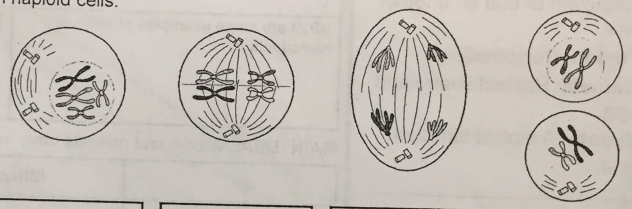
Topic 9 – Meiosis

Power Notes

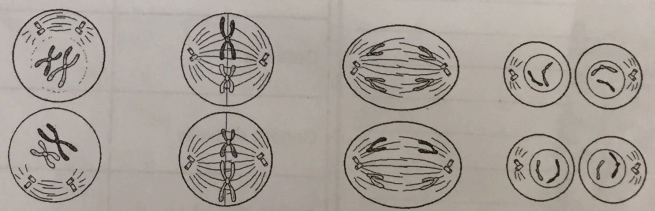
MAIN IDEA: Body cells are diploid; gametes are haploid.

What are **somatic cells?**	What are **germ cells?**
What are **diploid cells?**	What are **haploid cells?**

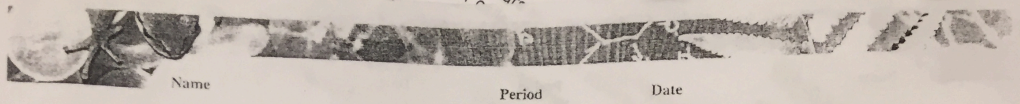
MAIN IDEA: During meiosis, diploid cells undergo two cell divisions that result in haploid cells.



Prophase I	Metaphase I	Anaphase I	Telophase I



Prophase II	Metaphase II	Anaphase II	Telophase II



Name Period Date

Biology

Topic 9 – Meiosis

Power Notes

SC.912.L.16.17 – Mitosis vs. Meiosis

1. **Parthenogenesis**: A type of asexual reproduction in which a female gamete or egg cell develops into an individual without fertilization
2. **Budding**: A form of asexual reproduction in which a new organism develops from an outgrowth or bud on another one.
3. **Fusion**: Combination.
4. **Gamete**: Haploid sperm and egg.
5. **Zygote**: A diploid fertilized egg.

MAIN IDEA: Reproduction can be sexual or asexual

What is **asexual reproduction**?	What is **sexual reproduction**?
What kind of offspring is produced from asexual reproduction?	What kind of offspring is produced from sexual reproduction?
What are some examples of asexual reproduction?	What are some examples of sexual reproduction?

MAIN IDEA: Mitosis and meiosis have important similarities and differences.

	Mitosis	**Meiosis**
Similarities		
Number of divisions		
Results in		
Cells are		
Genetic diversity		
Occurs in		
Crossing over		
Reproductive process		