

LESSON PLAN: MITOSIS AND MEIOSIS

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Lesson plan: mitosis and meiosis

TEACHER'S GUIDE

TARGET GRADE

This plan is suitable for 4º ESO, 1º Bachillerato and 2º Bachillerato

- **4º ESO:**

The development of the complete plan will take almost one month, which is a long time given the length of the curriculum. For this reason, it is recommended to select those activities that best fit the level and work ability of the students. It would be a good idea to start with written and drawn activities and then try to make a mitosis video.

- **1º Bachillerato**

This is the grade more suitable for the complete plan. If you have started the previous grade, they will have acquired enough background for more complex video of meiosis.

- **2º Bachillerato**

How to apply the lesson plan in this level will depend on the student learning abilities, due to their course finished before and they are under university access test pressure.

SUGESTIONS FOR MAKING THE VIDEO

- The plasticine has to be of good quality since if it is not cracked and manipulated with difficulty.
- Chromosomes have not to be longer than 5-6 cm
- When students draw the cell organelles, they have to take into account that they must be distributed around the cell, so otherwise they will not have enough space to place the spindle and the chromosomes.

Unit/Lesson: CELL DIVISION: MITOSIS AND MEIOSIS

Stage 1. Desired results

Established goals: learn about mitosis and meiosis

Because of this lesson student will understand:

1. The meaning of cell division
2. The meaning of meiosis.
3. The relationship between crossing-over and genetic diversity.
4. The connexion between gametes production and meiosis.

Because of this lesson student will know:

1. Every stage of mitosis and meiosis
2. The processes that take place in every stage of mitosis and meiosis.
3. The differences between mitosis and meiosis.

Because of this lesson students will be able:

1. Represent any stage of mitosis or meiosis.
2. Create a stop motion video using a video editor software.

Essential questions:

1. What kind of cell divide by mitosis?
2. How is the ploidy of these cells?
3. What kind of cell divide by meiosis?
4. How is the ploidy of these cells?
5. Where does meiosis division take place?
6. Which means that meiosis is a reductional division?
7. What is the relevance of crossing-over chromosomes?
8. How do cells prevent wrong chromosomes disjunction?
9. Which is the role of the spindle?

Stage 2. Assessment evidence

1. Stop motion videos (mitosis and meiosis)
2. Questionnaires
3. Case of Study

Stage 3. Learning plan

Learning activities

1. Engage: Videos mitosis and meiosis in vivo. <https://drive.google.com/file/d/0B-m37cPp9oBJQUc0OTJtY0IzclE/view?usp=sharing>
2. Explore: laboratory session-. Observing mitosis in onion roots. <https://drive.google.com/file/d/0B-m37cPp9oBJYUc2WlhIVWY5SWM/view?usp=sharing>
3. Explain: power point presentations. <https://recursocienciasnaturales.wordpress.com/biologia-2o-bachillerato/bloque-iii-division-celular/>
4. Elaborate: Answer the questions and create two stop motion videos, one for mitosis and another for meiosis
5. Revision: Case of Study: More than a just a cough: Exploring the role of cytoskeleton in fertility. http://sciencecases.lib.buffalo.edu/cs/collection/detail.asp?case_id=788&id=788
6. Evaluate: Rubrics for videos contents, writing test and resolution of the case study.

1 SESSION-. Engage activities

1. Videos of Mitosis and Meiosis in living cells
2. Introductory talk about sexual and asexual reproduction

2 SESSION-. Explore activity

Observing mitosis in onion roots

3-4 SESSION-. Explain and Practice

Explanation of mitosis and complete activities 1, 2, 3

5-6 SESSION-. Elaborate

Create a stop motion video: activity. Activity 4.

7-8-9 SESSION-. Explain and Practice

Explanation of meiosis and complete activities 5, 6, 7,9,10

10-11 SESSION-. Elaborate

Create a stop motion video. Activity 8

12-13 SESSION-. Revision

Case Study: More than a just a cough: Exploring the role of cytoskeleton in fertility.
Vocabulary revision
Key concepts

14 SESSION-. Final exam

Example of meiosis video
<https://drive.google.com/file/d/0B-m37cPp9oBJU0hWN0ICeGo2ZjA/view?usp=sharing>

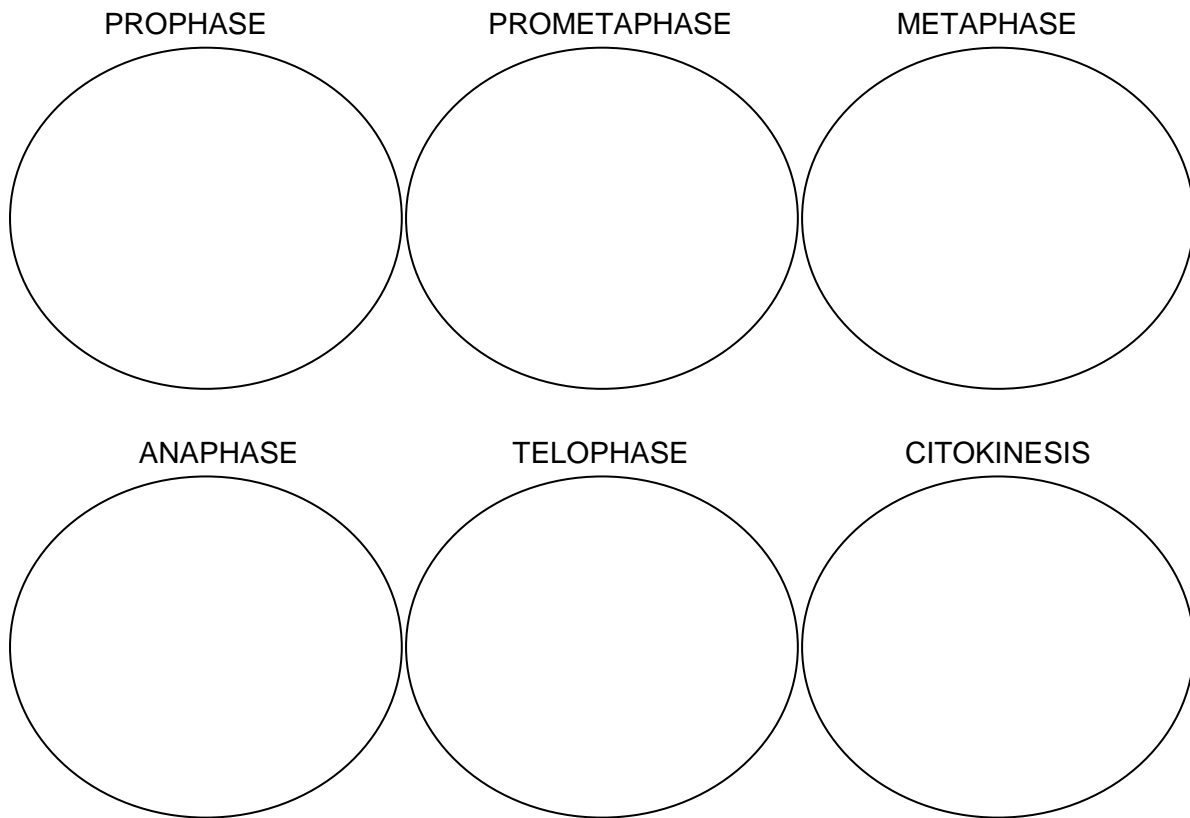
Lesson plan: mitosis and meiosis

ACTIVITIES

1. Complete the following table about how some cell organelles change in every phase

	Prophase	Prometaphase	Metaphase	Anaphase	Telophase	Citokinesis
Nuclear envelope						
Chromatine						
Nucleolus						
Kinetochores						
Microtubules						
Spindle fibers						

2. You have to study the mitosis division of a diploid organism with 4 chromosomes ($2n=4$). You have already processed the cells in your lab and now you have to observe them under the microscope. What is supposed you will observe?



3. Compare your drawings with those of your mate's team:
- Have you drawn all similar structures and process?
 - Did you miss anything?
 - If the answer is yes, what have you missed? In which stage?
 - What do you think that absence could affect the complete process?
4. Now is time to action. The next step is create a stop motion video using play dough following the next instructions:
- You have two templates, in the first one you have to draw all the cell organelles except those directly implicated in mitosis that will be represented using play dough.
 - In the second one, you are going to represent every stage of mitosis.
 - For the representation follow the next colour index:
 - Black: nuclear envelope
 - Red: Chromosomes
 - Pink: Centromere

White: Kinetochores
Green: Centrosome
Yellow: Spindle fibres

d) How to make a stop motion video?

- First, take into account that for 1 second you will need 10 photos.
- Take a first photograph of your first cell with your mobilphone
- Then, change gradually every structure taking a picture every time you make a rearrangement.
- Once you have all your pictures upload them and start to design your video.
- Every stage must be properly labelled with a short explanation about the most relevant facts.
- You can use some tools, like Video Maker or Vimeo.

5. Complete the next table explaining what does happen in every phase during meiosis I.

PROPHASE MEIOSIS I					
	Leptotene	Zygotene	Pachytene	Diplotene	Diakinesis
Nuclear envelope					
Chromatine					
Chromatids					
Centromere					
Kintechore					
Synaptonemal complex					

MEIOSIS I					
	Prometaphase	Metaphase	Anaphase	Telophase	Citokinesis
Nuclear envelope					
Chromatine					
Nucleolus					
Kinetochores					
Microtubules					
Spindle fibers					

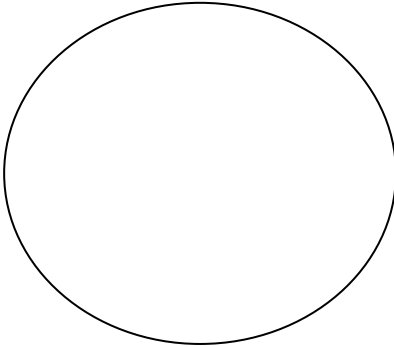
MEIOSIS II						
	Prophase	Prometaphase	Metaphase	Anaphase	Telophase	Citokinesis
Nuclear envelope						
Chromatine						
Nucleolus						
Kinetochores						
Microtubules						
Spindle fibers						

6. You still are studying the cells of that organism with 4 chromosomes ($2n=4$), but in this occasion you have to investigate these cells in meiosis. You have already processed the cells in your lab and now you have to observe them under the microscope. What do you will observe?

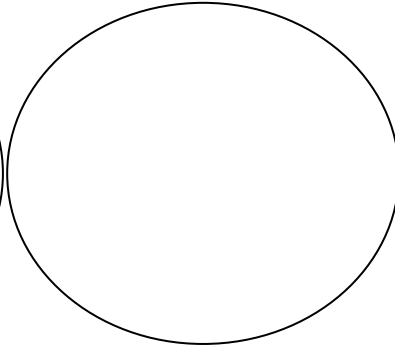
MEIOSIS I

PROPHASE I

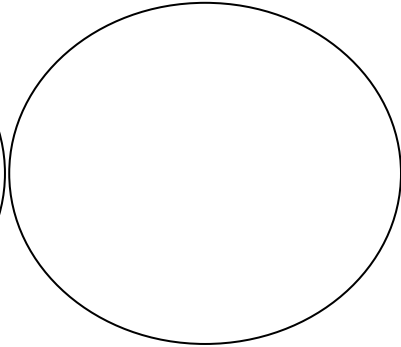
LEPTOTENE



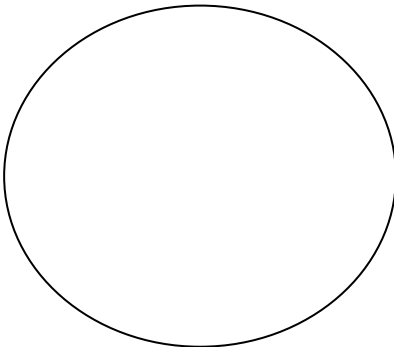
ZYGOTENE



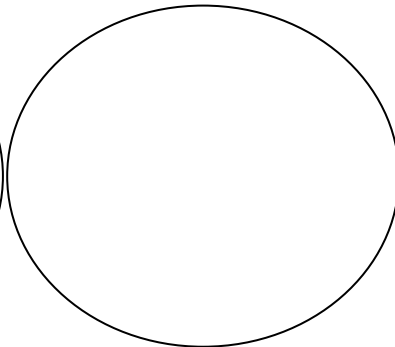
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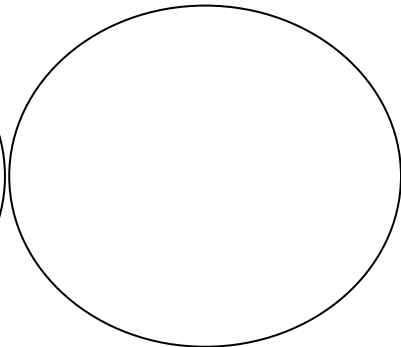
PACHYTENE



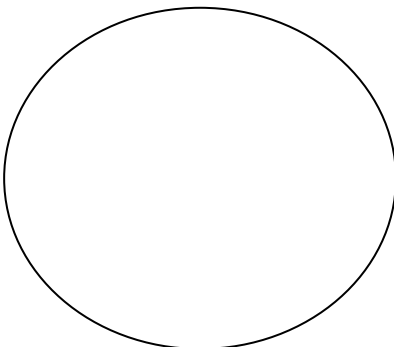
DIPLTENE



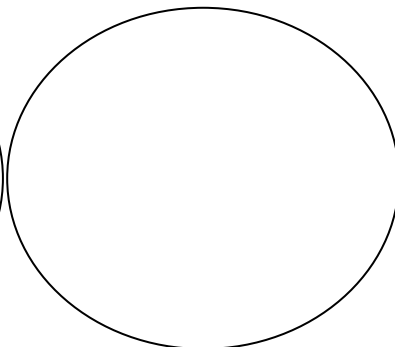
DIAKINESIS



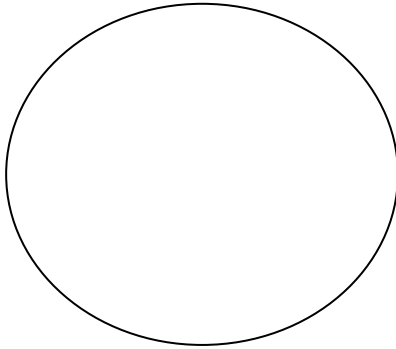
PROMETAPHASE I



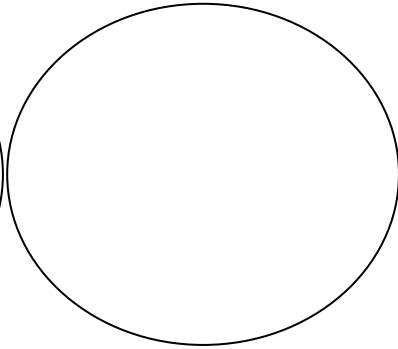
METAPHASE I



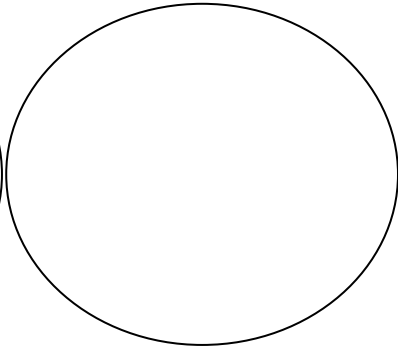
ANAPHASE I



TELOPHASE I

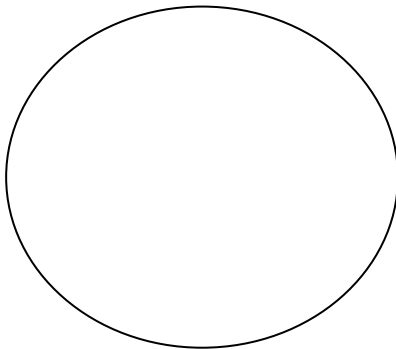


CITOKINESIS I

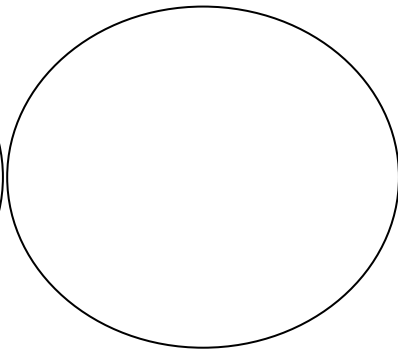


MEIOSIS II

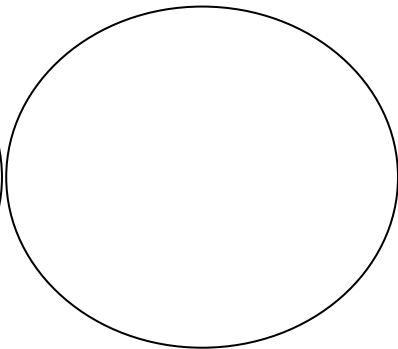
PROPHASE II



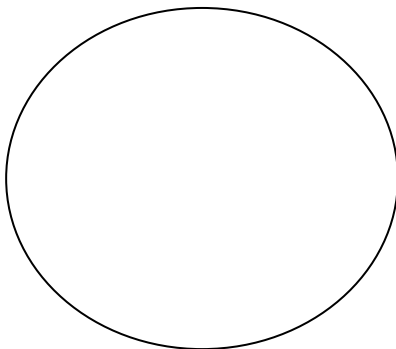
PROMETAPHASE II



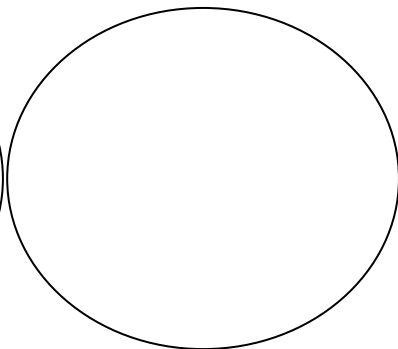
METAPHASE II



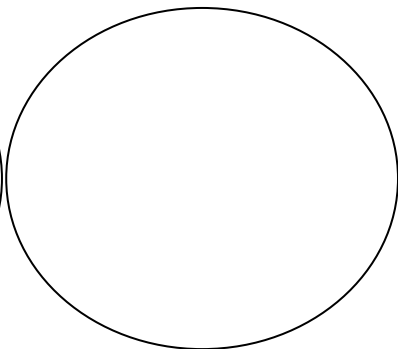
ANAPHASE II



TELOPHASE II



CITOKINESIS II



7. Compare your drawings with those of your mates team:
- a) Have you drawn all similar structures and process?
 - b) Did you miss anything?
 - c) If the answer is yes, what have you missed? In which stage?

- d) What do you think that absence could affect the complete process?
8. Now, that you have experience making videos, follow the same steps as before to make a video about meiosis. In this case, use red for maternal chromosomes and blue for paternal ones.
9. Complete the following table showing the main differences between mitosis and meiosis

	MITOSIS	MEIOSIS
Daughter cells are exactly equals to mother cell		
Generate variability		
Occur in unicellular organism		
It is related with sexual reproduction		
Generate four daughter cells		
Daughter cells are haploids while mother cell is diploid.		
Generate two daughter cells		
Mother cell divides twice		
It is the way in which somatic cells are reproduced		
It is the way gametes are generated		
It is a conservative process		

10. In your opinion, comparing mitosis and meiosis which is the most different stage?

