

Lab: MITOSIS - MEIOSIS: Doing it on the Table

Synopsis

This activity (lab) is designed to help students to learn the critical distinctions between what happens to chromosomes during mitosis vs meiosis. Students manipulate pipe-cleaner chromosomes on a template showing stages of **mitosis** with one pair of chromosomes until approved by the teacher. Then they repeat the exercise for **meiosis** until approved. After each phase, students draw in chromosomes on a summary sheet, then help other students. An application phase asks students to show the same thing using *two* pairs of chromosomes. Students who think they understand the critical distinctions of these two processes going in, usually discover that it's not quite what they thought, and come out of this with a sharper understanding.

Concepts

In meiosis, replicated homologous chromosomes pair off during the first division, then these separate from each other, assuring that one member of each pair of chromosomes goes into two separate cells. Replicates separate in the second division. In mitosis, there is no pairing of replicated homologous chromosomes.

Meiosis provides a mechanism that prevents doubling and re-doubling of chromosome number with every generation, and also provides a mechanism that adds to variation with every generation (from crossing over and recombination).

Materials

Teacher Directions

Sets of pipe cleaner chromosomes, one set for each student (or team of 2); see Teacher Directions for details

Template for Mitosis (one page)

Template for Meiosis (two pages)

Red and blue pencils

Keys for teacher:

Worksheet Key

Summary Key 1 (for 1 pair of chromosomes)

Summary Key 2 (for 2 pairs of chromosomes)

Student Handouts

Worksheet: "Mitosis & Meiosis: On the Table" back to back with...

Mitosis-Meiosis Summary sheet

Extra M-M Summary sheet

Teaching Strategy

See Teacher Directions for details

Preparation:

Prepare multiple sets of pipe-cleaner chromosomes, as per directions (enough for each student in a class)

Prepare desktop templates of mitosis and meiosis (1 set for each student) (could be laminated or placed in plastic sleeves for re-use)

Run off Worksheet - Summary and extra summary pages for all students to work on.

Context

This lesson is best done after students have at least read about mitosis and meiosis, and/or seen a film, video, or online animation showing these two processes. Mitosis may have been studied earlier in the context of cell studies, or simple cell reproduction. But after an introduction to meiosis, where they've had a chance to get the essential ideas, along with distinctions from mitosis, and the significance of meiosis, have them do this lab. Most students discover that their understanding of critical aspects of meiosis are often not as clear as they should be. This lab will show them the way!

Presentation

The Worksheet is fairly self-explanatory.

1. Have the students read the Objective, Identification and Inventory, then ask them to report any chromosome sets with extra items or items missing.
2. Have them read the Assumptions. Emphasize that these are very important, and critical to success.
3. Have them read the Procedure, and commence doing it. They are to raise their hands when they think they've got their Mitosis sheet done correctly.
4. As they begin placing chromosomes on the Mitosis template, walk around quickly, looking for hands (where you should go as quickly as you can), and looking for proper progress (which you should confirm with "Good start", etc. If you see bad starts, say something like "Not quite... re-read Assumption #2" etc. You will find that you will get lots of exercise in this lab, moving through your entire array of desks many times.
5. See Teacher Directions for specific things to look for
6. As each student gets it right, over which you exclaim "She's got it!", that student proceeds to copy the layout on the **separate** Summary sheet, using the colored pencils (or shading in for blue chromosomes and leaving "pink" chromosomes open). As soon as the drawing is done, they are to put it UNDER their Worksheets (so neighbors can't just copy it easily) and proceed with the Meiosis phase.
7. Repeat #4-6 for the Meiosis phase.
8. When finished, and approved, student proceeds with #5 and 6. When class is done, students can begin parts F-H, and finish these for homework.

Next Day: Discussion

If you like, you could collect all worksheet/summary items (back-to-back) for homework check, or have kids exchange them for in-class correction, or they can just keep them while you go around to stamp them if done, then go over the results in class. Use the **Summary Key 1** on the overhead for the lab review, asking students to point out the critical distinctions. Point out where allowable variations can occur, and emphasize vertical continuity, so they recognize the flow, seeing each step as a frame in a film. Then have them look at the **Summary Key 2** on the overhead, (for the homework assignment), and ask how many got it essentially correct (you should point out where there can be allowable variations). Let them ask questions about where they differed with the key; you may need to go out and take a look at some individual Summaries.

Ask students to submit what they wrote into Part F, 2-3 students per line, with discussion where needed.

Ask students for their responses to Part H. Guide their responses toward those in the key, as needed. Be sure they all realize that mitosis maintains the chromosome number, and meiosis lowers the chromosome number from two sets to one set ($2n \rightarrow n$), and that this (in meiosis) is important for two reasons (see part H in the worksheet key).

Assessment

Use the concepts as a basis for building questions on the critical distinctions and functions of mitosis and meiosis, and the essential reason **why** these two processes occur (much more important than memorizing the names of every stage).