MITOSIS

Task: Create a demonstration showing chromosome structure and movement during mitosis, beginning with Prophase and ending with Telophase. Use materials provided. Don't make snapshots that match images in a textbook, but make a model with parts that you physically move through each of the stages of mitosis.

Before you build your model, decide how you will represent the different components. Answer the questions below to help you determine your model's structure.

1. How many chromosomes does your hypothetical organism have? How will you show the difference between chromosomes?
2. How many copies of each chromosome are present at the beginning of prophase?
3. What's the difference between a chromosome and a sister chromatid?
4. How will you represent the centromere?
5. How will you represent the kinetochore?
6. How will you represent the spindle microtubules?
7. Where should the spindle microtubules attach to the chromosomes?
8. Some spindle microtubules do not attach to chromosomes. Are they attached to anything? How will you represent these non-chromosome-attached microtubules?
9. What aspect of chromosome movement is NOT well represented by your demonstration? Could you use different materials to better represent this aspect? What would you use? Limit your suggestions to items available at the grocery store, Home Depot/Lowes, or craft store.

Questions for Additional Review:

1. A grasshopper species has 46 chromosomes.
    a. How many DNA molecules are present during the G1 phase of the cell cycle?
    b. How many DNA molecules are present at the end of the S phase of the cell cycle?
2. Which structure is part of the chromosome, the kinetochore or the centromere?
3. Name the type of biomolecule that makes up the kinetochore and the type of biomolecule that makes up the centromere.
4. Is a microtubule an organelle? If so, which one?

Mitosis: Supplemental Homework Study Sheet

1. Define homologous chromosome:

2. What is a somatic cell? What is a gamete? Which one results from mitosis?

3. Is the cell haploid or diploid during mitotic interphase?

4. What is the difference between a homologous chromosome and a sister chromatid?

5. What is a centromere?

6. What is a centriole?

7. Where do the spindle microtubules attach to the chromosomes?

8. How many daughter cells are produced from one parent cell in mitosis?

9. Are the daughter cells haploid (1n) or diploid (2n) after mitosis?

10. Take colored pencils and sketch the process of mitosis with a cell containing 2 pairs of homologous chromosomes. Write a caption for each step in your sketches. No looking at your book until you are finished! If you cannot do this from memory, you are not prepared for the test! Check your work against the book when you are finished. Make corrections. Start over until you can do it perfectly.

Teaching Tips for Peer Mentors

Goal: To be able to explain the process of mitosis to someone else. If a student can't explain it, he/she doesn't know it well enough for an exam.

You need to justify to your students WHY they are doing the model building activity in class. The point of creating models is for students to find points that aren't clear to them, ask questions to get clarification, and understand the material at a deeper level. If you fail to explain this to them, they will balk at doing the activity and request you just lecture.

Explain to students that they must know mitosis inside and out. To master this difficult topic, students must practice repetition and recall. Emphasize to them that understanding the material while looking at your class notes or the book does not mean you know it well enough to do well on the test. You need to be able to explain it to someone else without the use of the book. If you can do that, than you know the material thoroughly. Stress these study concepts to the students!

Do not allow students to get away with just making drawings. Copying drawings does not help them identify what they don't know, but having to make a physical representation leads them to ask pertinent questions, for example, where is the kinetochore? Is it part of the chromosome or a separate structure?

Have students use the materials provided (playdough, pipe cleaners, beads, etc) to create a model of mitosis. They should be able to move their model nuclear envelope, chromosomes, spindle fibers, and cell membrane all the way through the process from Prophase to Cytokinesis.

AFTER they have made a moving model, have each group present their model to another team. Have students gather around the table. If you have a lot of groups, each TA can take half the class and the presentations can run simultaneously. Encourage students to video tape their explanations for future reference.

Once students have demonstrated their model, encourage them to draw the steps of mitosis. Writing information down is a form of repetition and will help them remember and recall the material later. Remind them of this study tip!

Questions at the bottom of page 1 should be worked out after recitation.

At the end of class, pass out the supplemental worksheet. It highlights vocabulary and concepts that students often get mixed up and provides one more round of repetition and recall. It will not be graded but it will provide extra practice.

Notes to Faculty

The model-building portion of this activity takes a full 50 minutes. The additional review questions and supplemental homework should be clearly identified as independent work to be completed after the recitation.

Supplies for models:
Colored string, play dough or modeling clay, pipe cleaners, plastic beads with holes in the center, scissors.

Play dough should be divided into small amounts (2.5 cm diameter spheres) in separate containers for each group. Otherwise students waste it and mix it together, making a mess.

Some of your peer mentors may be as resistant to this slightly messy activity as the students. If you really want the students to do something other than make copies of textbook pictures, you will have to emphasize to your peer mentors how much more attention to physical detail is required by model-building and how much that benefits the students.