Chapter 10 Project

Cyclin Round the Cell

Project Goal + Timeline

In this project, you will reinforce what you have learned about the cell cycle and mitosis by examining the consequences of mutations and/or disruptions to these processes. You'll recapitulate the process through which much of this knowledge was gained in the first place—through careful examination of mutants and disorders in our species and others. The initial phase of this project, applying your knowledge, will be short. The second part, making predictions and then finding information in the OMIM database, may take one to two hours. Finally, you may spend several days working with a partner to put together an appropriate presentation on a particular gene. This project should help you draw connections between the material and important human disorders.

Directions

Eukaryotes, such as *Homo sapiens* (us!), need to carefully control cell division. Not only do cells need to divide at the appropriate times, but the act of replicating, aligning, and separating 46 individual chromosomes is a precisely controlled molecular ballet. The importance of all the factors involved, particularly cell-cycle checkpoints, is underscored by the symptoms and disorders that result when one or more factors do not work properly.

Part 1: Apply Your Knowledge

1. What specific molecules or factors in the cell are involved in the process of cell division and mitosis?
2. What diseases or disorders do you think might develop from improper timing or mechanics in cell division?

Part 2: Use OMIM to Investigate Gene Variations

To examine variations in human genes for cell-cycle control, you will utilize the "Online Mendelian Inheritance in Man" database, or OMIM (hawkes.biz/OMIM). Entries in this database will contain basic information on a particular gene, often accompanied with information on the variants or alleles that exist for it and how they contribute to different phenotypes.

To begin, you should fill out the following table as an outline. In the "role" and "prediction" columns, use your knowledge of biology to describe the role of each factor or gene as well as a prediction for what would result from a mutation of the factor or gene. Then, search OMIM to locate specific mutations and their associated diseases to complete the remainder of the table. For many factors involved in the cell cycle, there may exist multiple forms of each, and then different variants or alleles of each form. If you are working with a partner, you should each select a different gene and/or form and then examine different alleles.

TABLE 1

Factor/Gene	Role	Prediction for Mutant Form	OMIM Representative	Associated Diseases
Kinetochore				
Mitotic Spindle				
Condensin				
Cyclin A/Cdk2				
Cyclin D/Cdk4				
Cyclin E/Cdk2				
DNA Polymerase				
Another Factor of Your Choice:				

Compare your results for each of the above genes with a partner.

1. Did the findings from OMIM match your predictions? Why or why not?

Part 3: Present Your Findings

Finally, you should pick one of the categories/rows in Table 1 and develop a 10-minute presentation about it to highlight the importance of that factor for the rest of the class. In your presentation, you should focus on doing the following:

- Establish and describe the role the factor has in the cell cycle, emphasizing its importance.
- Talk about the different forms of the gene you found. Some of these exist as multiple forms or have accessory proteins that form a complex. Describe these in more detail for one specific case.
- Highlight at least one disorder or condition that results from having an allele for one of the genes involved in the role you are describing. Make sure to connect the phenotype observed to the role the gene has!

Project Materials

- Project worksheet and a pen, or a computer with a word processor
- Access to OMIM (hawkes.biz/OMIM)
- Presentation software, such as PowerPoint

Student Checklist

- ☐ Complete the Apply Your Knowledge questions
- ☐ Add the role and your prediction for each gene or factor to Table 1
- ☐ Complete the Table 1 by querying genes on OMIM
- ☐ Compare your results to those of a partner
- ☐ Work with your partner to develop a presentation on a gene you examined