BIOL 101: Guided Reading Questions (GRQs)

Complete and submit this GRQ as a PDF **before** lecture and **before** your online Mastering Assignment

L9 GRQs: Genetics

Reading Objectives:

- Contrast asexual and sexual reproduction in outcome and types of organisms/cells that use each.
- Recognize/describe the stages of mitosis, contrasting animal and plant cells.
- Articulate how the cell cycle differs in normal, dividing cells compared to nerve cells or cancer cells.
- Explain the significance of a mutated BRCA-1 gene in terms of risks and consequences.

Module 8.1: Cell division plays many important roles in the lives of organims

1. Contrast asexual from sexual reproduction.
Asexual production does not require another parent. It is with a single parent and the child is a genetically identical offspring of the parent. Sexual reproduction requires the fusion of gametes, egg, and sperm and the child is not a clone but resembles the parents.
2. What does cell division have to do with human embryonic development?
It allows sexually producing organisms to develop from a single cell into an adult organism. The cells of an organism are the result of repeated cell divisions that began with a single fertilized egg cell.

Module 8.2: Prokaryotes reproduce by binary fission

1. When prokaryotes divide, which is called binary fission, what needs to be divided to daughter cells? As the chromosome is duplicating, one copy moves toward the opposite end of the cell and the cell elongates and when the chromosome duplication is complete and the cell is double in size, the plasma membrane pinches inward.

2. True or False? Prokaryotes have one circular chromosome. True.

Module 8.3: The large, complex chromosomes of eukaryotes duplicate with each cell division

1. True or false? Be sure to Correct false statements:

True Eukaryotes have more genes than prokaryotes.
False. Humans are smarter and more complex than hedgehogs, therefore we have more chromosomes. We have more chromosomes, but we are not smarter or more complex necessarily.
False. Each human chromosome has one gene on it. It has hundreds or thousands of genes.
False. Humans have over 100,000 genes. Under 21,000 genes.

2. How is DNA compaction/coiling analogous to moving to a new apartment? It compacts like you would pack up your belongings and move all your belongings into one place before moving.

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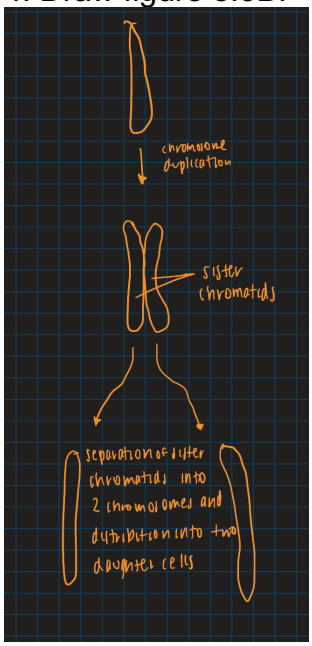
3. A chromosome replicates and stays joined to its replicated partner. These are now called sister chromatids. Once they separate from each other to move into different daughter cells, each will be known as a chromosome again.

4. Draw figure 8.3B:



Module 8.4: The cell includes growth and division phases

1. Interphase is made of three parts:
G1 phase, the S phase, and the G2 phase.

2. What is the other part of the cell cycle called and what happens during this?
Mitotic phase, where the cell physically divides.

3. Draw Figure 8.4

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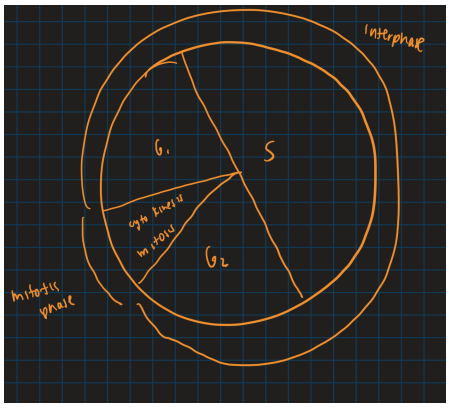

4. You find a cell that is currently replicating its DNA. What part of the cell cycle is it in?
Interphase (S phase)
5. What will happen next?
The G2 or mitotic phase will happen next.

Module 8.5: Cell division is a continuum of dynamic changes

1. For a spindle to form in which chromosomes move along its microtubules, what cellular structure must dissolve during prophase and prometaphase?

The nuclear envelope.

2. List the stages of mitosis in order with a very brief description for yourself about what is happening to the chromosomes at each stage (or a drawing):
Prophase, prometaphase, metaphase, anaphase, and telophase.
In prophase, chromatin condenses to form structures. In prometaphase, the nuclear envelope fragments. In metaphase, the cell's duplicated chromosomes are lined up. In anaphase, sister chromatids separate from each other. In telophase, daughter nuclei form at the two poles of a cell.

3. You view an animal cell through a microscope and observe dense, duplicated chromosomes lined up in the middle of the cell. Which stage of mitosis are you looking at? Metaphase.

4. How would you know if a cell was in anaphase? If the two centromeres of each chromosome come apart, separating the sister chromatids.

Module 8.7: The rate of cell division is affected by environmental factors

1. Scientists have learned how to grow cells outside of the body in plastic trays (although not all cells of the body cooperate and divide). You may find yourself in a lab in the future asked to "maintain cells in tissue culture". This is what we call this technique. **Describe,**

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not simply list, three factors (chemical or physical) that influence how normal cells divide, based on what scientists have learned from these cell cultures.
They exhibit anchorage dependence where they must be in contact with a solid surface to divide. Another is density-dependent inhibition, where the crowded cells stop dividing. They also need essential nutrients and if it left out of the culture medium, then the cells fail to divide.

Module 8.8: Growth factors signal the cell cycle control system

Are check points in the cell cycle more like traffic lights with red or green lights?
They are more like red lights unless they are overridden by specific go-ahead signals in the form of growth factor proteins.

Looking at Figure 8.8, what allows a cell to overcome the G1 checkpoint?
The cell overcomes a G1 checkpoint if it receives a go ahead signal at the G1 checkpoint and from there it will enter the S phase.

Not all cells do divide because they never receive the go ahead signal to move through G1. These cells enter a permanent non-dividing state. What are some cell types that are non-dividing cells?
Mature nerve cells and muscle cells.

Applying what you learned: If the cell cycle is carefully controlled by proteins that are present only temporarily to help turn on the cell cycle (i.e. growth factors) and other proteins that halt the cycle (checkpoint proteins), what do you suppose would happen if a cell was continuously exposed to growth factors?
It would perhaps mature and divide even before it is ready, even if they have mutations or are incomplete in replication.

What do you supposed would happen to a cell in which checkpoints were faulty?
If checkpoints were faulty, it could be we would have more cells that have mutations and abnormalities.

How does all of this relate to one of our major themes—interactions within and between systems?
It relates because the checkpoints are triggered by proteins and enzymes outside of the cell so there is interaction between the outside and inside of the cell.

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Module 8.9: Growing out of control, cancer cell produce malignant tumors

What makes a tumor malignant?
If the abnormally reproducing cells spread into neighboring tissues and invade other parts of the body.

What does the word immortal mean in cell biology?
The cells can go on dividing indefinitely, as long as they have a supply of nutrients.

Are the words tumor and cancer interchangeable? Why or why not?
No, they are not interchangeable. A tumor is the mass of abnormally growing cells, cancer cells. Cancer begins when a single cell undergoes changes that convert a normal cell to a cancer cell.

The text gives a few examples of how some chemotherapy drugs work.

What does taxol do? It freezes the mitotic spindle after it forms, which stops actively dividing cells from proceeding past metaphase.

What does vinblastinn do? A chemotherapeutic drug that prevents the mitotic spindle from forming in the first place.

Why do these work on cancer cells mainly? They stop the cells from dividing.

Would other cells in the body affected by taxol or vinblastin? Yes, nausea results from the impact on intestinal cells, hair loss comes from the effects on hair follicle cells, and the compromised immune system is from the effects on immune cell production.

Module 8.10: The best cancer treatment may vary by individual

1. Is the study described a prospective or retrospective observational study? (You may need to review these terms from chapter 1)
Retrospective observational study.

2. What scientific question did scientists hope to answer with the study?
Which subsets of people bear a substantially higher risk of death?

3. What did they find?
They found that women who are under 40 or are black, bear a substantially higher risk of death.

4. How does the knowledge they discovered affect women in society?
They recommended that people that may be in those groups consider the most aggressive treatment options.

FOR MORE INFORMATION: Hereditary Breast Cancer:

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https://myriad.com/patients-families/disease-info/breast-cancer/

1. People with a gene mutation in either BRCA-1 or BRCA-2 genes are at what risk of developing breast cancer by age 70? 87%

2. How does this compare to the general population (people without these mutations?) 8%

3. Carrying a defective BRCA gene affects your risk of breast cancer, but also significantly increases your risk of what other kind of cancer in women? Ovarian cancer.

4. Who is a good candidate for gene testing? (i.e. what are the risk factors?) The risk factors are if you have ever had breast cancer, triple negative breast cancer, ovarian cancer, are male and have had breast cancer at any age, or you are of Ashkenazi Jewish descent and have a personal or family history of breast, ovarian, prostate or pancreatic cancer.