IB Bio Quiz Cell Division Questions and Answers PDF

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During which phase of mitosis do chromosomes align at the cell equator?

- ◯ Prophase
- ◯ **Metaphase ✓**
- ◯ Anaphase
- ◯ Telophase

> During the metaphase of mitosis, chromosomes align at the cell equator, preparing for separation. This alignment ensures that each daughter cell will receive an identical set of chromosomes during cell division.

Which of the following statements about the cell cycle are true?

- ☐ The G1 phase is primarily for DNA replication.
- ☐ **Cyclins are proteins that regulate the cell cycle. ✓**
- ☐ **The S phase is when DNA replication occurs. ✓**
- ☐ **Cytokinesis is part of the M phase. ✓**

> The cell cycle consists of distinct phases including interphase (G1, S, G2) and mitotic phase (mitosis and cytokinesis), during which the cell grows, replicates its DNA, and divides. Key regulatory mechanisms ensure proper progression through these phases, maintaining cellular integrity and function.

Explain the role of checkpoints in the cell cycle and discuss how they contribute to preventing cancer.

Checkpoints are critical control mechanisms in the cell cycle that monitor and regulate the progression of the cell through its various phases. They ensure that the cell is ready to proceed to the next phase, preventing the replication of damaged DNA and thus reducing the risk of cancer by stopping the division of potentially harmful cells.

What is the primary function of the S phase in the cell cycle?

- ◯ Cell growth
- ◯ **DNA replication ✓**
- ◯ Preparation for mitosis
- ◯ Cytokinesis

The S phase is crucial for DNA replication, ensuring that each daughter cell receives an identical set of chromosomes during cell division. This phase is essential for maintaining genetic continuity across generations of cells.

Which processes occur during interphase?

- ☐ **DNA replication ✓**
- ☐ Chromosome condensation
- ☐ **Cell growth ✓**
- ☐ Nuclear envelope breakdown

Interphase is the phase of the cell cycle where the cell prepares for division, and it includes processes such as DNA replication, cell growth, and the synthesis of proteins and organelles.

Describe the process of binary fission in prokaryotes and compare it to mitosis in eukaryotes.

Binary fission is the asexual reproduction process in prokaryotes, where a single cell divides into two identical daughter cells. The process involves the replication of the circular DNA molecule, followed by the elongation of the cell and division into two. In contrast, mitosis in eukaryotes is a more complex process that includes several stages (prophase, metaphase, anaphase, and telophase) to ensure that each daughter cell receives an identical set of chromosomes, thus maintaining genetic stability.

Which phase of the cell cycle is characterized by the preparation for mitosis?

- ◯ G1 phase
- ◯ S phase
- ◯ **G2 phase ✓**
- ◯ M phase

> The phase of the cell cycle characterized by preparation for mitosis is called the G2 phase. During this phase, the cell undergoes final preparations, including the replication of organelles and the synthesis of proteins necessary for mitosis.

Which of the following are components of the mitotic spindle?

- ☐ **Microtuules ✓**
- ☐ **Centrosomes ✓**
- ☐ Chromatin
- ☐ Actin filaments

> The mitotic spindle is primarily composed of microtuules, which are dynamic structures made of tubulin proteins. Additionally, spindle fibers, centrosomes, and kinetochores play crucial roles in the organization and function of the spindle during cell division.

Discuss how mutations in genes regulating the cell cycle can lead to cancer. Provide examples of specific genes involved.

> **Mutations in genes that regulate the cell cycle, such as p53 and R b, can lead to cancer by allowing cells to bypass normal regulatory mechanisms. For instance, p53 is known as the 'guardian of the genome' because it helps prevent the division of cells with damaged DNA. When p53 is mutated, cells can proliferate uncontrollably, leading to tumor formation. Similarly, mutations in R b can disrupt the cell cycle checkpoints, further contributing to cancer progression.**

What is the primary difference between cytokinesis in plant cells and animal cells?

- ◯ Plant cells form a cleavage furrow, while animal cells form a cell plate.
- ◯ **Animal cells form a cleavage furrow, while plant cells form a cell plate. ✓**
- ◯ Both plant and animal cells form a cleavage furrow.
- ◯ Both plant and animal cells form a cell plate.

> The primary difference between cytokinesis in plant cells and animal cells is that plant cells form a cell plate to divide, while animal cells undergo cleavage furrow formation to separate the two daughter cells.

What are the key features of prophase in mitosis?

- ☐ **Chromosomes condense ✓**
- ☐ **Nuclear envelope dissolves ✓**
- ☐ Chromosomes align at the equator
- ☐ **Spindle fibers form ✓**

> Prophase is the first stage of mitosis where chromatin condenses into visible chromosomes, the nuclear envelope breaks down, and the mitotic spindle begins to form. These changes prepare the cell for the subsequent stages of mitosis.

Explain the significance of cyclins and cyclin-dependent kinases (CDKs) in the regulation of the cell cycle.

> **Cyclins and cyclin-dependent kinases (CDKs) are crucial for the regulation of the cell cycle. Cyclins are proteins whose levels fluctuate throughout the cell cycle, while CDKs are enzymes that, when activated by binding to cyclins, phosphorylate target proteins to drive the cell cycle forward. This regulation ensures that the cell only progresses to the next phase when it is ready, maintaining genomic integrity and proper cell function.**

During which phase of mitosis do sister chromatids separate and move to opposite poles?

- ◯ Prophase
- ◯ Metaphase
- ◯ **Anaphase ✓**
- ◯ Telophase

> During the anaphase of mitosis, sister chromatids are pulled apart by the spindle fibers and move toward opposite poles of the cell. This separation is crucial for ensuring that each daughter cell receives an identical set of chromosomes.

Which of the following occur during telophase?

- [ ] **Chromosomes de-condense ✓**
- [ ] **Nuclear envelopes reform ✓**
- [ ] **Spindle fibers disappear ✓**
- [ ] Chromosomes align at the equator

> During telophase, the chromosomes begin to de-condense back into chromatin, the nuclear envelope re-forms around each set of chromosomes, and the nucleolus reappears. This phase marks the near completion of cell division, leading to the final separation of the two daughter cells.

Describe the process of cytokinesis in animal cells and explain how it differs from mitosis.

> **Cytokinesis in animal cells is the process that follows mitosis, where the cytoplasm divides to form two separate daughter cells. This occurs through the formation of a cleavage furrow, which is created by the contraction of actin filaments, pinching the cell membrane inward until the cell is split into two. This process is distinct from mitosis, which specifically refers to the division of the nucleus and its contents.**

Which phase of mitosis is characterized by the reformation of the nuclear envelope?

- ◯ Prophase
- ◯ Metaphase
- ◯ Anaphase
- ◯ **Telophase ✓**

> The phase of mitosis characterized by the reformation of the nuclear envelope is called telophase. During this stage, the chromosomes begin to de-condense, and the nuclear envelope re-forms around each set of chromosomes at opposite poles of the cell.

Which of the following are true about cancer cells?

- [x] **They have uncontrolled cell division. ✓**
- [ ] They always form benign tumors.
- [x] **They can metastasize to other parts of the body. ✓**
- [ ] They are regulated by normal cell cycle checkpoints.

> Cancer cells are characterized by uncontrolled growth, the ability to invade surrounding tissues, and often exhibit mutations that allow them to evade normal cellular regulatory mechanisms.

Analyze the role of the mitotic spindle in ensuring accurate chromosome segregation during cell division.

> **The mitotic spindle plays a crucial role in ensuring accurate chromosome segregation during cell division. It is composed of microtuules that extend from centrosomes and attach to the kinetochores of chromosomes. This attachment allows the spindle to exert forces that pull sister chromatids apart and guide them to opposite poles of the cell, ensuring that each daughter cell receives an identical set of chromosomes. Any failure in the function of the mitotic spindle can lead to aneuploidy, where daughter cells have an abnormal number of chromosomes.**

In which phase of the cell cycle does the cell spend the majority of its time?

- (x) **G1 phase ✓**
- ( ) S phase
- ( ) G2 phase
- ( ) M phase

> The cell spends the majority of its time in interphase, which is the phase of the cell cycle where the cell grows, duplicates its DNA, and prepares for mitosis.

Which events occur during anaphase of mitosis?

- [ ] Chromosomes condense
- [x] **Sister chromatids separate ✓**

- [x] **Chromosomes move to opposite poles ✓**
- [ ] Nuclear envelope reforms

> During anaphase of mitosis, sister chromatids are pulled apart and move toward opposite poles of the cell, ensuring that each daughter cell will receive an identical set of chromosomes.

Critically discuss the differences between mitosis and meiosis in terms of their purpose and outcomes.

> **The primary difference between mitosis and meiosis lies in their purpose and outcomes. Mitosis is a process of cell division that results in two genetically identical daughter cells, which is essential for growth, tissue repair, and asexual reproduction. In contrast, meiosis is a specialized form of cell division that occurs in germ cells, producing four genetically diverse gametes (sperm and eggs) for sexual reproduction. This genetic diversity is achieved through processes such as crossing over and independent assortment during meiosis, which are not present in mitosis.**

Which of the following best describes the function of CDKs in the cell cycle?

- ○ They break down cyclins.
- ○ They activate cyclins.
- ○ **They phosphorylate target proteins to regulate the cycle. ✓**
- ○ They are degraded at the end of the cell cycle.

> Cyclin-dependent kinases (CDKs) are crucial regulatory enzymes that control the progression of the cell cycle by phosphorylating specific target proteins, thereby driving the cell through various phases of the cycle.

Which of the following are involved in the regulation of the cell cycle?

- [x] **Cyclins ✓**
- [x] **CDKs ✓**
- [ ] Actin filaments
- [x] **Checkpoints ✓**

> The regulation of the cell cycle involves various proteins, including cyclins, cyclin-dependent kinases (CDKs), and tumor suppressor proteins like p53. These components work together to ensure proper cell division and prevent uncontrolled growth.

Explain how the cell cycle is altered in cancer cells and the implications of these changes for treatment strategies.

> **In cancer cells, the normal regulation of the cell cycle is often disrupted, allowing them to bypass critical checkpoints that would normally prevent damaged or unregulated cells from dividing. This leads to uncontrolled cell proliferation and tumor formation. The implications for treatment strategies are significant, as many cancer therapies aim to target these alterations, either by restoring normal cell cycle regulation or by inducing cell death in rapidly dividing cancer cells.**

What is the primary role of checkpoints in the cell cycle?

- ◯ To initiate DNA replication
- ◯ **To ensure the cell is ready to proceed to the next phase ✓**
- ◯ To degrade cyclins
- ◯ To form the mitotic spindle

> Checkpoints in the cell cycle serve as critical control mechanisms that ensure the proper progression of the cell cycle by monitoring and regulating key events, such as DNA replication and cell division. They help prevent the division of damaged or incomplete cells, thereby maintaining genomic integrity.

What are the functions of the G1 phase in the cell cycle?

- ☐ DNA replication
- ☐ **Cell growth ✓**
- ☐ **Organel duplication ✓**
- ☐ Chromosome segregation

> The G1 phase is crucial for cell growth and preparation for DNA synthesis, where the cell increases in size, synthesizes proteins, and produces organelles. It also involves the assessment of environmental conditions and DNA integrity before proceeding to the S phase.

Evaluate the impact of environmental factors on the regulation of the cell cycle and the potential development of cancer.

Environmental factors, such as exposure to radiation, chemicals, and certain viruses, can significantly impact the regulation of the cell cycle. These factors can cause DNA damage, leading to mutations in genes that control cell division and growth. When these regulatory mechanisms are disrupted, it increases the risk of uncontrolled cell proliferation, which can result in cancer. Understanding these impacts is crucial for developing preventive strategies and treatments.