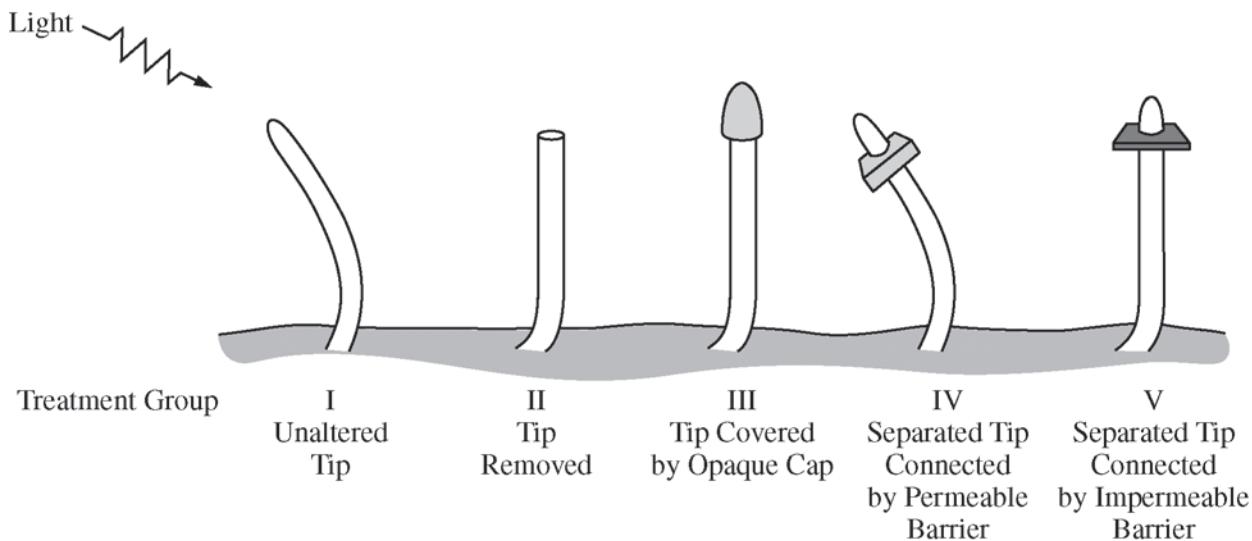


2015 AP® BIOLOGY FREE-RESPONSE QUESTIONS

- (a) The nervous system plays a role in coordinating the observed activity pattern of the mice in response to light-dark stimuli. **Describe** ONE role of each of the following anatomical structures in responding to light-dark stimuli.
- A photoreceptor in the retina of the eye
 - The brain
 - A motor neuron
- (b) Based on an analysis of the data in Figure 2, **describe** the activity pattern of the mice during the light and dark periods of the L12:D12 cycle.
- (c) The researchers claim that the genetically controlled circadian rhythm in the mice does not follow a 24-hour cycle. **Describe** ONE difference between the daily pattern of activity under L12:D12 conditions (Figure 2) and under DD conditions (Figure 3), and use the data to **support** the researchers' claim.
- (d) To investigate the claim that exposure to light overrides the genetically controlled circadian rhythm, the researchers plan to repeat the experiment with mutant mice lacking a gene that controls the circadian rhythm. **Predict** the observed activity pattern of the mutant mice under L12:D12 conditions and under DD conditions that would support the claim that light overrides the genetically controlled circadian rhythm.
- (e) In nature, mice are potential prey for some predatory birds that hunt during the day. **Describe** TWO features of a model that represents how the predator-prey relationship between the birds and the mice may have resulted in the evolution of the observed activity pattern of the mice.

2015 AP® BIOLOGY FREE-RESPONSE QUESTIONS

4. Both mitosis and meiosis are forms of cell division that produce daughter cells containing genetic information from the parent cell.
- Describe** TWO events that are common to both mitosis and meiosis that ensure the resulting daughter cells inherit the appropriate number of chromosomes.
 - The genetic composition of daughter cells produced by mitosis differs from that of the daughter cells produced by meiosis. **Describe** TWO features of the cell division processes that lead to these differences.
-



5. Phototropism in plants is a response in which a plant shoot grows toward a light source. The results of five different experimental treatments from classic investigations of phototropism are shown above.
- Give support** for the claim that the cells located in the tip of the plant shoot detect the light by comparing the results from treatment group I with the results from treatment group II and treatment group III.
 - In treatment groups IV and V, the tips of the plants are removed and placed back onto the shoot on either a permeable or impermeable barrier. Using the results from treatment groups IV and V, **describe** TWO additional characteristics of the phototropism response.

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Question 4

Both mitosis and meiosis are forms of cell division that produce daughter cells containing genetic information from the parent cell.

- (a) **Describe** TWO events that are common to both mitosis and meiosis that ensure the resulting daughter cells inherit the appropriate number of chromosomes.

Description (1 point each; 2 points maximum)

- Spindle elements (microtubules) form/attach to chromosomes
- Chromatin condenses
- Alignment of chromosomes across center of cell prior to chromosome separation
- Separation of chromatids/centromeres to daughter cells
- G2/M checkpoint occurs in both processes
- Replication or synthesis of DNA precedes mitosis/meiosis
- Cytokinesis separates daughter cells after mitosis/meiosis

- (b) The genetic composition of daughter cells produced by mitosis differs from that of the daughter cells produced by meiosis. **Describe** TWO features of the cell division processes that lead to these differences.

| Feature | Description (1 point each row; 2 points maximum) | |
|--|--|---|
| | Mitosis | Meiosis |
| Number of divisions/number of resulting cells | 1 division/ 2 cells result | 2 divisions/ 4 cells result |
| Ploidy of daughter cells | <ul style="list-style-type: none">• Same as parent cell• Diploid• ($2n \rightarrow 2n$ or $n \rightarrow n$) | <ul style="list-style-type: none">• Half of parent cell• Haploid• ($4n \rightarrow 2n$; $2n \rightarrow n$) |
| Chromatids separate | Occurs | Not in meiosis I/only in meiosis II |
| Crossing over | Does not occur | Occurs |
| Homologous chromosomes separate/independently assort | Does not occur | Occurs |