

國立清華大學 103 學年度碩士班考試入學試題

系所班組別：生命科學院甲組、醫學生物科技學程

考試科目（代碼）：生物學(0402、0702)

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*請在【答案卷】作答

1. Term
 - (a) IgA (2 points)
 - (b) Innate immunity (2 points)
 - (c) Dendritic cells (2 points)
 - (d) Antigenic shift in orthomyxoviruses (2 points)
2. Short answer
 - (a) Describe the influenza virus particle (3 points)
 - (b) Reassortment vaccines (2 points)
 - (c) What do you know about the rabies virus in Taiwan? (3 points)
 - (d) What do you know about H7N9 influenza A? (2 points)
 - (e) Describe the enterovirus 71 vaccine development in Taiwan. (2 points)
3. Describe and give the results of an experiment that shows the role (if any) of GTP hydrolysis in (a) forming the 30S translational initiation complex, and (b) releasing IF2 from the ribosome. (5 points)
4. Compare the poliovirus virus genetic material with a typical mammalian mRNA. How does the virus take advantage of this difference to interfere with the translation? (5 points)
5. What are microsatellites and minisatellites? Which of these two tools is better for linkage mapping? Why? (5 points)
6. Describe a method to detect a specific protein-DNA interaction in a living cell. (5 points)
7. What are the functions of membranes? (10 points)
8. Imagine protein X, destined to go to the plasma membrane. Assume that the mRNA carrying the genetic message for protein X has already been translated by ribosomes in a cell culture. If you fractionate the cell, in which fraction would you find protein X? Explain by describing its transit. (10 points)
9. Describe how a countercurrent heat exchanger may function to retain heat within an animal body. (5 points)

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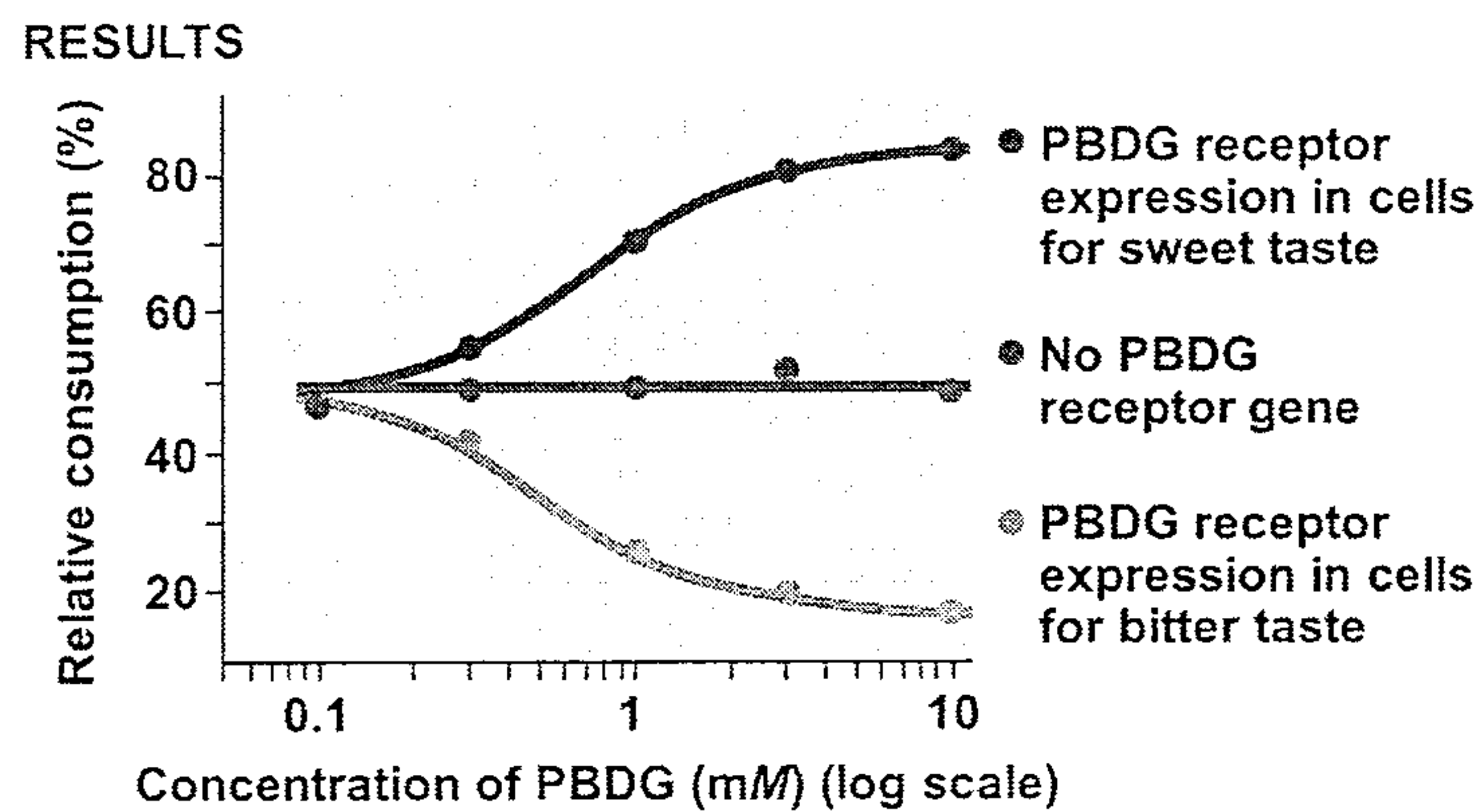
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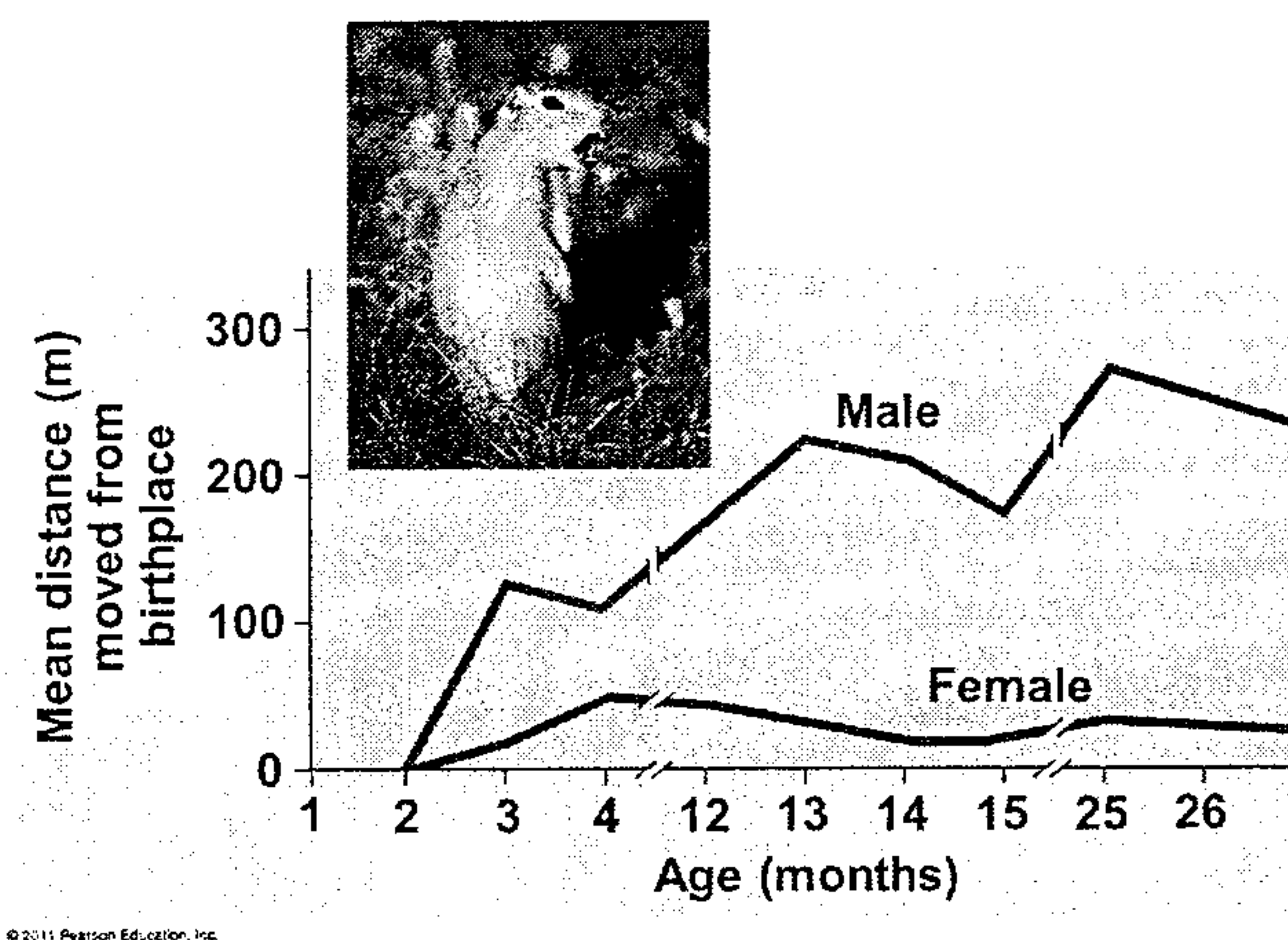
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10. What is menopause? What is its potential function? (5 points)
11. Why is the membrane potential negative? Using channels and pumps to explain it. (5 points)
12. Briefly explain this experiment, and draw a conclusion based on this result. (5 points)



13. Describe this experiment, and explain kin selection and altruism in Belding's ground squirrels. (5 points)



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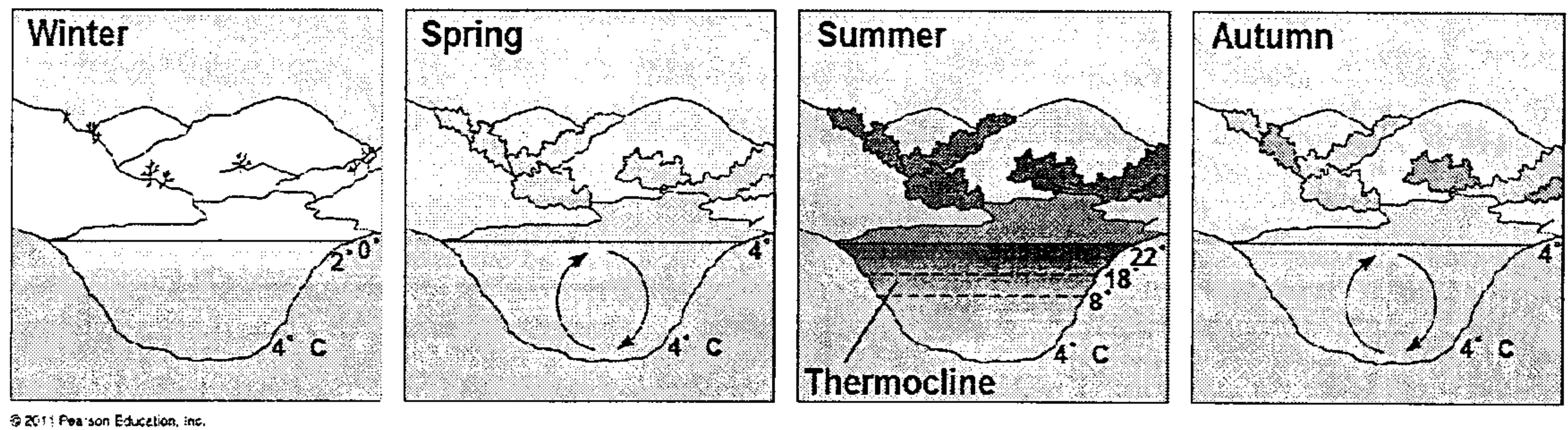
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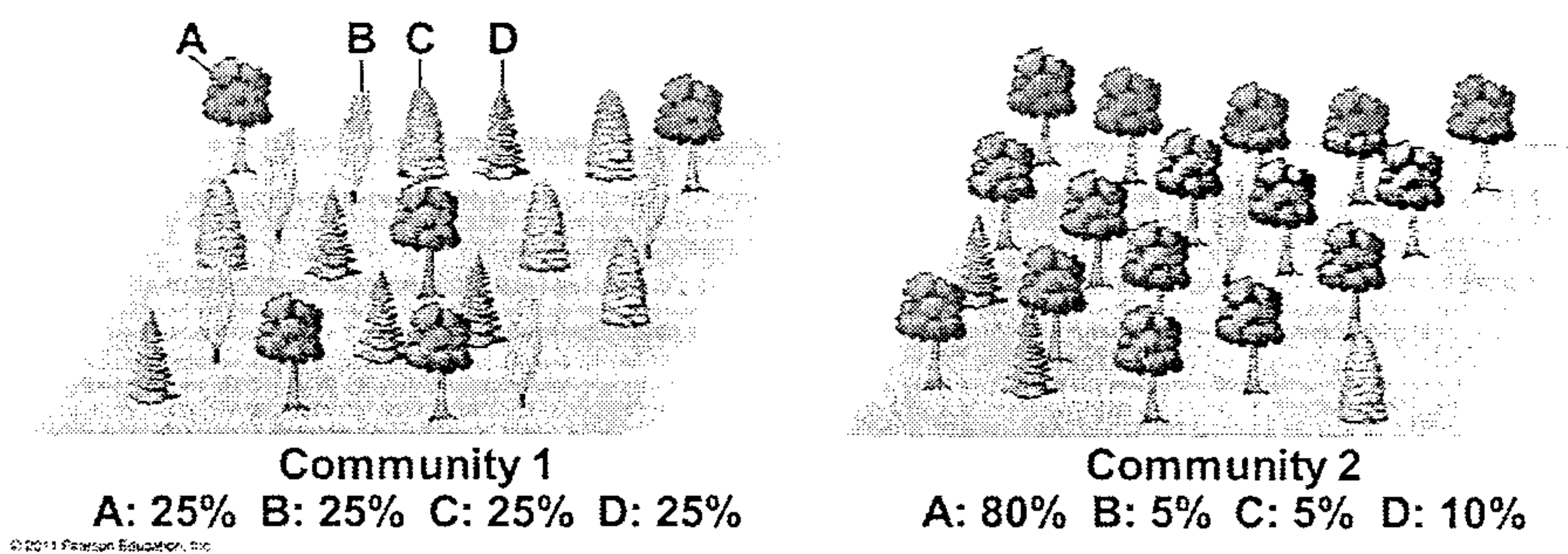
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14. Please explain the seasonal effect of water temperature in lakes. (5 points)



15. What is Batesian mimicry? What is Müllerian mimicry? Why do these types of mimicry work in nature? (5 points)

16. Why is Community 1 more diverse than Community 2? Using Shannon theory (below) to explain it. Note that you do not need to calculate H for two communities, but you do need to show how to use the formula in supporting your explanation. (5 points)



$$\text{Shannon diversity index } (H) = -(p_A \ln p_A + p_B \ln p_B + p_C \ln p_C + \dots)$$