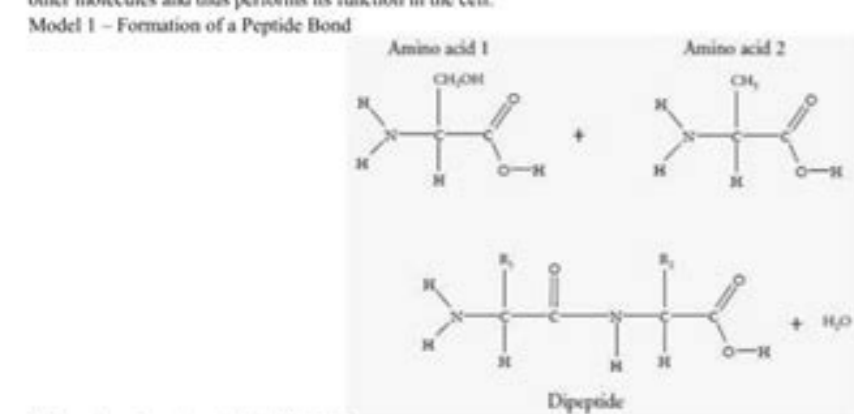


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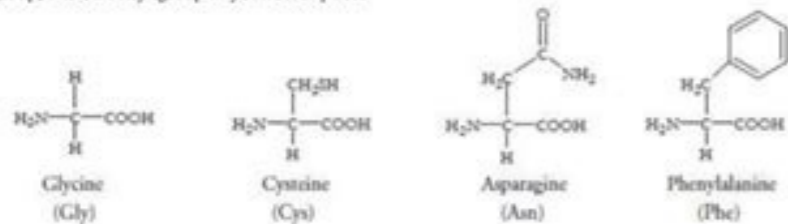
POGIL™ Activities for AP® Biology
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Protein Structure
 POGIL™ Activities for AP® Biology
 What are the levels of protein structure and what role do functional groups play?

Why?
 Proteins accomplish many cellular tasks such as facilitating chemical reactions, providing structure, and carrying information from one cell to another. How a protein chain coils up and folds determines its three-dimensional shape. Its shape will, in turn, determine how it interacts with other molecules and thus performs its function in the cell.



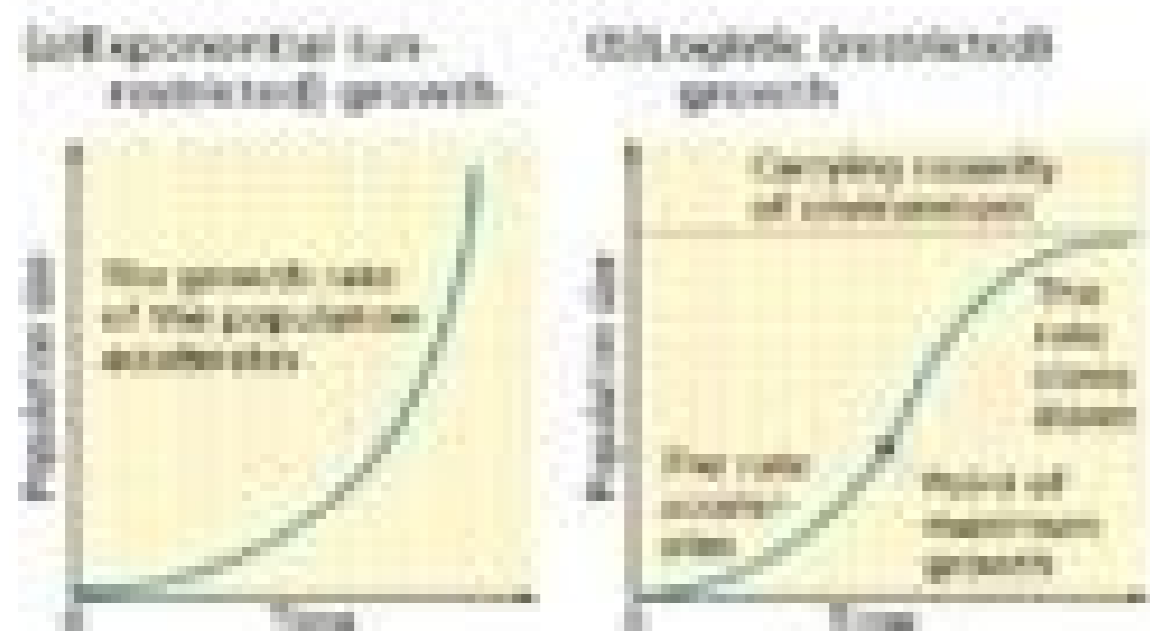
- Examine the amino acids in Model 1.
 - Circle an amine group in the diagram.
 - Draw a triangle around a carboxylic acid (carboxyl) group.
- How are the amino acids similar to one another?
- How are the amino acids different from one another?
- How many amino acids are involved in the reaction to make a dipeptide?
- In Model 1 the original amino acids are combined through a **condensation reaction** to make the dipeptide.
 - What does R1 represent in the dipeptide?
 - What does R2 represent in the dipeptide?
- Put a box around the atoms in the amino acids that become the H₂O molecule produced by the reaction in Model 1.
 - A peptide bond is a covalent bond linking two amino acids together in a peptide. Circle the peptide bond in Model 1.
 - Between which two atoms in the dipeptide is the peptide bond located?
- Between what two functional groups is the peptide bond located?
- There are 22 different amino acids found in nature. Two were shown in Model 1. Additional examples are shown below. With your group, write one or two grammatically correct sentences to describe how these amino acids are similar and how they are different. Use the terms R-group, amine group, and carboxyl group in your description.



Population Biology

Population size - # of organisms belonging to a particular species living in a certain area

Population growth - increase in size of a population



exponential (unrestricted) growth - occurs in areas a population occupying stable, ideal conditions (unlimited food, absence of disease, favorable temperatures, etc.) of organisms

logistic - occurs in a population growing under limiting factors

Two types with limiting factors: density-dependent and density-independent

Density-Dependent

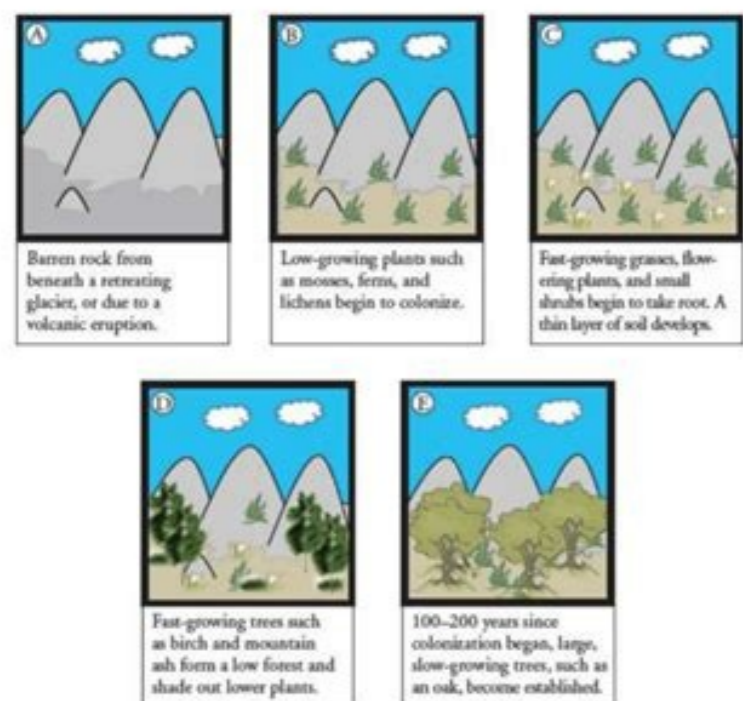
- affected by physical aspects of environment
- concerned to population density (size of population that organisms grow best at and grow point reached)
- the more dense a population is:
 1. competition
 - population will increase in fighting and resources from decrease when resources become too scarce
 - competition over food, space, and other resources
 2. disease/straggle
 - organisms require resources

3.1 SUCCESSION-POGIL (PART 1) NAME _____ HR _____

OBJECTIVE: Distinguish how communities develop differently over time

On May 18, 1980, Mount St. Helens in the state of Washington erupted with the force of a hydrogen bomb. The volcano had been dormant for over 120 years, but now 57 people were dead and forests and lakes were totally destroyed, including nearby Spirit Lake, which became a mud hole. The blast leveled trees in areas over 10 miles from the crater and ash deposits suffocated life on the mountain. However, within weeks, mammals that had taken shelter underground started to reappear in the area, and now, over thirty years later, many areas of the mountain are colonized with a large variety of plant and animal life. How does an area move from a sterile, barren wilderness to one full of life?

MODEL 1 - PRIMARY SUCCESSION



POGIL™ Activities for High School Biology

- Refer to Model 1:
 - On what type of land does primary succession first begin to occur?
 - Does there appear to be any life on the land when primary succession begins?
 - Why would most plants such as shrubs and trees find it difficult to grow here?
- Refer to diagram B in Model 1:
 - What are the first organisms (colonizers) on this land?
 - Suggest the mechanisms by which the first colonizers arrived on the land.

Phase	DNA	Chromosomes
G1	2n	2n
S	4n	2n
G2	4n	4n
M	4n	4n
Prophase	4n	4n
Metaphase	4n	4n
Anaphase	4n	4n
Telophase	4n	4n
Cytokinesis	4n	4n
Two daughter cells	2n	2n

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The Cell Cycle What controls the life and development of a cell? Why? An old piece of poetry says "to everything there is a season... a time to be born, a time to die." For cells, the line might say "a time to divide and a time to grow." In multicellular organisms, different types of cells have different roles and need to complete specific tasks. For example, a cell that isn't large enough is not useful for storing nutrients for later, but a cell that is too large will not be useful for transportation through a tiny capillary. In this activity, you will learn about the seasons of a cell's life, and in turn better understand how organisms function. Model 1 – The Cell Cycle G1 * M (including cytokinesis) G2 S 1. How many phases are in the cell cycle as shown in the diagram in Model 1? 2. Starting at the starred cell, what is the order of the stages of a cell's life? 3. During which phase does the size of the cell increase? 4. During which phase does the number of cells increase? The Cell Cycle 1 5. Considering your answer to Questions 3 and 4, identify two ways that the growth of an organism can be accomplished through the events of the cell cycle. 6. Cancer, the uncontrolled growth of cells, often results in a tumor, or mass of abnormal cells. Some cancerous tumors consist of many cells that are much smaller than normal. According to Model 1, what part(s) of the cell cycle is (are) most likely being affected? 7. In Model 1, if the length of the arrow represents time, then for those cancerous cells, what happens to the time that is necessary for the cell cycle? What implication might this have for doctors who are treating cancer patients? Model 2 – Cell Cycle Data Phase Key Process Time Interval (hours) Number of Sets of DNA present in each cell organelles in each at end of phase cell at end of phase Gap1 11 1 560 Synthesis 8 2 570 Gap2 Protein and organelle synthesis 4 2 600 Mitosis Cell and nuclear splitting 1 1 300 Total time: 24 8. Model 2 presents cell cycle data for a typical human cell in culture. Use the phase names in Model 2 to label the G, M, and S phases in Model 1. 9. Looking at the third column of Model 2, compare the time spent in mitosis with the time spent in gap1 in human cells and describe any difference. 2 POGIL™ Activities for High School Biology 10. Imagine 100 cells were chosen randomly from a tissue sample and examined under a microscope. In which phase of the cell cycle would you expect to find the largest number of cells? Explain. 11. Look again at Model 2. Compare the amount of DNA at the beginning and end of synthesis. Why did the amount of DNA change? 12. Fill in the "Key Process" column for synthesis phase in Model 2. 13. Cyto = cell, kinesis = cutting. What do you think takes place during cytokinesis? 14. Other than cytokinesis, what else occurs during the mitosis phase? Hint: Consider the sets of DNA in each cell. 15. Look carefully at information given to you in Model 1 and Model 2. Fill in the key process column in the table for gap1. 16. If a culture in the lab starts with one human cell, how many cells will there be after 24 hours? 17. The total time for the phases listed in Model 2 is 24 hours. How many human cells will be in the culture after another 24 hours? Explain. 18. Is the original cell "dead" or does it disappear after mitosis? Explain your answer. 19. If a starfish sustains damage to a limb, it often grows a new one. If a human adult sustains damage to his or her spinal cord, mobility is often impaired. If a gecko loses its tail, it may grow a new one. Which type of cell is less likely to go through the cell cycle after being damaged— starfish limb, human spinal cord, or gecko tail? Support your answer. 20. Occasionally cells stop dividing and enter another phase, G0. If you damage your liver, new liver cells can be produced to replace up to 75% of the liver. However, if you sustain brain damage, your body does not produce new brain cells. Explain this observation using what you have learned about the cell cycle. The Cell Cycle 3 21. Keeping in mind the events of each part of the cell cycle, mark with a double arrow on Model 1 where those cells might (either temporarily or permanently) exit the cell cycle to G0. Label this as G0. Why did you choose this location for G0? Hint: Think of a place in the cell cycle where the cell is functioning normally, but not preparing to divide. 22. Consider a cell in G0. Use the information in both Models 1 and 2 to answer the following questions. a. In order for this cell to divide normally, what would need to occur? b. What if the phase(s) you identified in part a of this question did not occur? What would be the outcome for the cell in that case? 4 POGIL™ Activities for High School Biology Model 3 – Radiation Ultraviolet light G1 * M (including cytokinesis) G2 S 23. According to Model 3, ultraviolet light is affecting a cell in which phase of the cell cycle? 24. Ultraviolet light may cause DNA damage, which is known as a mutation. How might such damage affect events taking place during the synthesis phase? Hint: Use information from Model 2. Read This! The cell cycle has a regular system of checks and balances that prevents damaged or mutated cells from proceeding to the next phase. One way an organism deals with the problems is to kill the damaged cell before it passes on the problem to its daughter cells. This is a normal process called apoptosis. (Some normal cells also go through this process.) 25. How might the DNA damage go on to affect the rest of the cell cycle if apoptosis did not occur? 26. Why might it be beneficial to an organism for damaged cells to enter G0 instead of dividing once they exist? 27. What could happen, after several cell cycles, to an organism whose damaged cells did not go through apoptosis? In other words, what if a damaged cell that is supposed to die does not? The Cell Cycle 5 Extension Questions 28. For each phase, describe at least one way mistakes during the cell cycle could result in problems. G1 S G2 M G0 29. Some types of cancers are treated with radiation, similar to ultraviolet light. Why might it be beneficial to irradiate cancer cells? 30. Plasmodial slime mold is an example of a multinucleated cell. It can be referred to as "one huge cytoplasmic mass with many nuclei" as seen to the right. What part of Model 1 is skipped in the formation of such a cell? Explain your answer. 31. Chemotherapy utilizes chemicals that disrupt various parts of the cell cycle, targeting rapidly growing cells. Paclitaxel (Taxol®) is one such drug that prevents the mitosis phase from taking place. a. Explain how this drug is useful as a cancer treatment. b. How might targeting rapidly growing cells explain common chemotherapy side effects such as hair loss and nausea? 6 POGIL™ Activities for High School Biology These are the countries currently available for verification, with more to come! United States Canada Mexico American Samoa Guam Northern Mariana Islands Moldova Guernsey South Africa China Israel Japan South Korea Taiwan Australia New Zealand Argentina Brazil Chile Venezuela

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