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Defense Worksheet

Part A. Inquiry and Research

Go to the Learn Genetics website at http://learn.genetics.utah.edu/content/basics/proteintypes/ and click on "defense proteins." Then answer the following questions.

1. What is the function of a defense protein?

2. List three defense proteins and what they do:

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Part B. Engineering Challenge

A couple has given birth to a child with a damaged immune system. The baby has SCID—severe combined immunodeficiency, informally called the "boy in a bubble" disease. As engineers, your challenge is to "cure" this child by creating an antibody that the child's body is not making. You will be given amino acids (building materials) to build the antibody needed to keep the child free of bacteria. Then you will test to see if you have made a healthy *defense protein* or a mutated one.

Step 1: Brainstorm. Write down ways "things" can be captured, attacked or removed in the space below.

Step 2: Design. Your *challenge* is to use the amino acids (materials) listed below to design a model defense antibody protein. The design *requirements and constraints*: Your protein model will be tested on a 2 x 5-foot floor area covered with shredded paper. Your model must pick up the bacteria (shredded paper) off the floor where they lie. You may not "sweep" the bacteria into a pile and pick it up from the pile. You may not use your hands to pick up any bacteria off of the floor. Clearly draw and label the planning diagram for your design so that someone else could recreate it. Available materials:

- 1 roll of masking tape
- twine/string
- paper
- aluminum foil
- saran wrap
- 1 paper bag
- balloons
- Popsicle sticks

labeled drawing from a notebook

Step 3: Before you start building, have the teacher approve your design. **teacher initials:** _____

Amount of bacteria you hypothesize that your protein will capture: _______

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Step 4. Build. Next, use the amino acids (materials) to build a protein. *Remember*: The function of this protein is to keep the child free of bacteria.

Step 5: Test and evaluate. *Did your model pick up as much bacteria (paper) as you thought it would?* Circle: yes or no *How much did it pick up?* _______________

Explain why it did/did not meet your expectations. *How effective was your protein model? How much paper did it pick up? Did it drop any paper? Did you encounter other problems?*

Step 6: Redesign. *How will you change your design?* In the space below, write/draw your adjustments.

Have the teacher approve your revised design. **teacher initials:** _______

Amount of bacteria you hypothesize that your revised protein will capture: ______

labeled drawing from a notebook

Step 7: Test and re-evaluate. *Did your design pick up as much bacteria (paper) as you thought it would?* Circle: yes or no *How much did it pick up?* _______________

Explain why it did/did not meet your expectations. *How effective was your protein model? How much paper did it pick up? Did it drop any paper? Did you encounter any other problems?*

Data collection: Record the amount of bacteria (paper) collected by each group.

Group #	Trial 1	Trial 2

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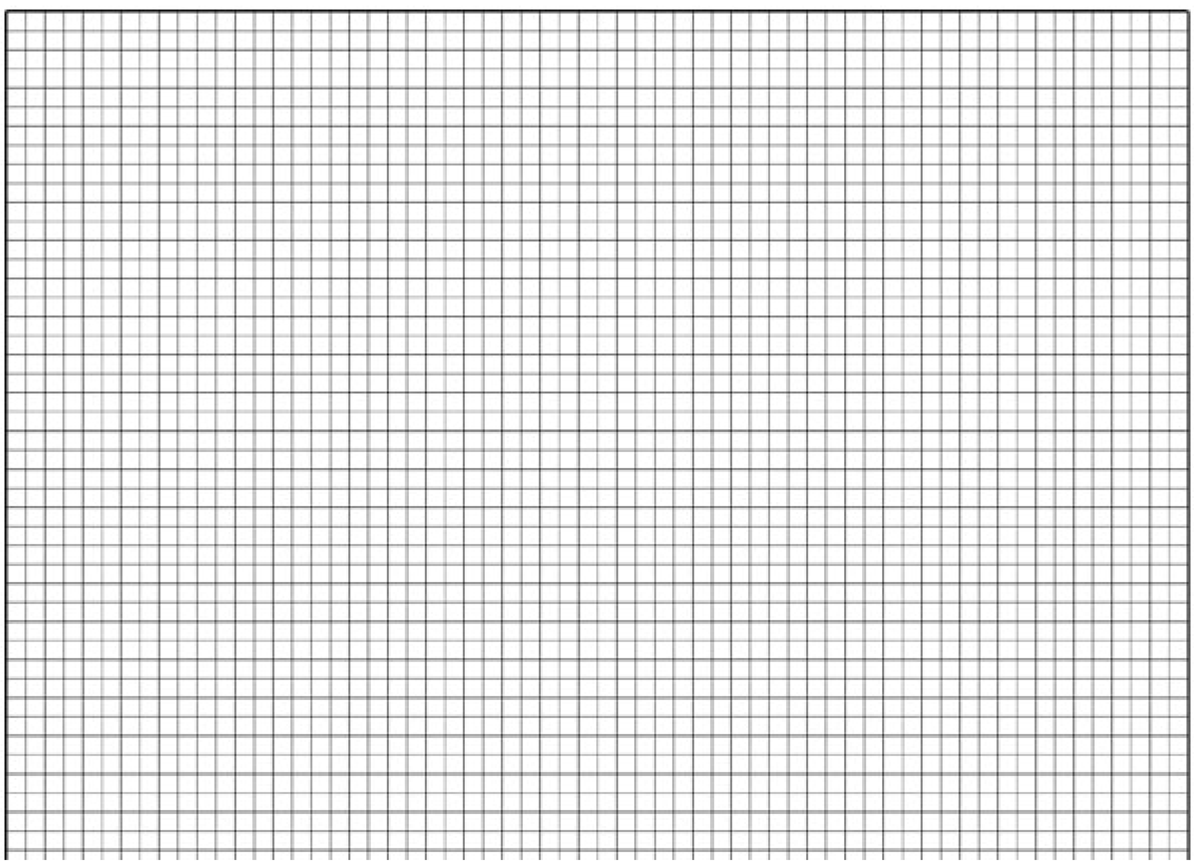
Step 8: Compare. Examine the data for all teams. Graph the data. *What does the data tell you?*

What was the class average amount of bacteria collected?

How did your antibody perform compared to the other antibodies that were built? What is an idea from a different antibody that you could have incorporated into yours, and why would you use it? What is something another group did that you would not have done, and why?

Amount of Bacteria Collected

Amount of Bacteria



Group Number

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Step 9: Conclusion. When DNA has errors in it (mutations that cause disease), it produces faulty proteins or no proteins. *If your structure was a real antibody capturing bacteria so that you wouldn't get sick, would it do a good-enough job that it would keep you healthy? Or, if you had to use the antibody you created to keep you healthy, would you die because it is a mutated antibody?*