**Extended Data Table 3-1. Multiple-choice knowledge questions presented in pre- and post-module Google forms.** To assess content knowledge before and after each module, students completed a Google form. The percentage of students who answered each question correctly are presented by topic in Figure 3.

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| **Topic** | **Modulea** | **Question** | **Possible responsesb** |
| **Importance of the nervous system** | Flies on Ice | Why is it important to understand how the nervous system works? | *Diseases of the nervous system are treatable once we understand how they are caused* |
| Our nervous system is not important for processing of our senses |
| The nervous system is the only organ system in humans essential to life |
| Dysfunctions of the nervous system do not cause disease |
| Roundabout We Go! | Why is it important to understand how the nervous system works? | Many diseases result from nervous system dysfunction |
| Our senses are processed through the nervous system |
| We can develop therapies for neurological deficits |
| *All of the above* |
| **How neurons communicate** | Flies on Ice | The nervous system is composed of many neurons, which are specialized cells that can communicate through \_\_\_\_\_\_ signals | *Electric and chemical* |
| Light |
| Radioactive |
| Magnetic |

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| **Fruit flies as model organisms** | Flies on Ice | Why do scientists use fruit flies as a model organism for research? | Fruit flies have a long life cycle like humans |
| *Fruit flies are inexpensive and easy to maintain in large numbers* |
| Humans and fruit flies have the exact same number of chromosomes |
| Humans and fruit flies do not share similar genes and diseases |
| **Identifying variables** | Roundabout We Go! | A group of scientists are testing how a specific DNA mutation might affect an organism’s crawling phenotype. What is the independent variable in this experiment? | The crawling patterns of the organisms. |
| The temperature of the room. |
| *The genotypes of the organisms.* |
| The time the organism spends crawling. |
| Flies on Ice (pre-module survey) | The independent variable is an experiment is defined as: | The time it takes to design an experiment |
| The variable whose variation does depend on another |
| *The variable whose variation does not depend on another* |
| The variable whose variation is held constant |
| Flies on Ice (post-module survey) | You just conducted an experiment to see if the amount of time flies spend on ice affects their recovery response. The \_\_\_\_\_\_ is the independent variable in this experiment. | *Amount of time flies spend on ice* |
| Amount of time the flies stay immobilized |
| Number of flies that die |
| Number of flies you put on ice |

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| **Experimental Design** | Flies on Ice | Which of the following is a correct statement about designing an experiment? | All experiments require expensive laboratory equipment |
| Data from one trial is enough to draw a conclusion |
| Experiments can only be designed by someone with a Ph.D. |
| *Identifying your variables before starting an experiment is important* |
| **Interpreting graphs** | Flies on Ice | Describe the relationship between the time a fly spends on ice and its recovery time as depicted by the graphc. | *As time on ice increases, recovery time continues to increase constantly* |
| As time on ice increases, recovery time decreases |
| *As time on ice increases, recovery time increases constantly at first but then remains constant* |
| Time spent on ice and recovery time are not correlated |
| **Mendelian inheritance** | Roundabout We Go! | If two heterozygous flies with the same recessive mutation mate, what percentage of the offspring will display a mutant phenotype? | 10% |
| *25%* |
| 50% |
| 100% |
| **Molecular biology** | Roundabout We Go! | Which correctly describes the events of protein production in the cell? | The gene is translated into mRNA, then transcribed into protein. Finally, the protein carries out its function in the cell |
| The gene for a signal receptor protein gets translated into protein, then transcribed into mRNA. Finally, the protein carries out its function in the cell. |
| *The gene is transcribed into mRNA, and then translated into protein. Finally, the protein carries out its function in the cell.* |

aKnowledge questions asked on surveys varied depending on the module instructed, but sometimes shared knowledge areas.

bCorrect responses are indicated in italics

cThe graph that students are asked to interpret differs in the pre- and post-module survey. The first graph depicts a linear relationship, and the second graph depicts expected results for Flies on Ice (i.e., a relationship that is initially linear, but begins to plateau as the X axis values increase).