Student Survey

We are asking that you express your own beliefs. **Your answers will not affect your grade.** Your instructor will never see your individual answers, only whether you participated and the class results as a whole. This information will be very helpful to us in an effort to design more effective biology courses.

Below are number of statements that may or may not describe your beliefs about learning biology. Choose the rating that **best expresses your feeling** about the statement.

If you don't understand a statement, leave it blank. If you have no strong opinion, choose "Neutral."

I. **Attitudes about the Study of Biology**

1. My curiosity about the living world led me to study biology.
   
   Strongly agree  Agree  Neutral  Disagree  Strongly disagree

2. I think about the biology I experience in everyday life.
   
   Strongly agree  Agree  Neutral  Disagree  Strongly disagree

3. After I study a topic in biology and feel that I understand it, I have difficulty applying that information to answer questions on the same topic.
   
   Strongly agree  Agree  Neutral  Disagree  Strongly disagree

4. Knowledge in biology consists of many disconnected topics.
   
   Strongly agree  Agree  Neutral  Disagree  Strongly disagree

5. When I am answering a biology question, I find it difficult to put what I know into my own words.
   
   Strongly agree  Agree  Neutral  Disagree  Strongly disagree

6. I do not expect the rules of biological principles to help my understanding of the ideas.
   
   Strongly agree  Agree  Neutral  Disagree  Strongly disagree

7. To understand biology, I sometimes think about my personal experiences and relate them to the topic being analyzed.
   
   Strongly agree  Agree  Neutral  Disagree  Strongly disagree

8. If I get stuck on answering a biology question on my first try, I usually try to figure out a different way that works.
   
   Strongly agree  Agree  Neutral  Disagree  Strongly disagree

9. I want to study biology because I want to make a contribution to society.
   
   Strongly agree  Agree  Neutral  Disagree  Strongly disagree
10. If I don’t remember a particular approach needed for a question on an exam, there’s nothing much I can do (legally!) to come up with it.

   Strongly agree    Agree    Neutral    Disagree    Strongly disagree

11. If I want to apply a method or idea used for understanding one biological problem to another problem, the problems must involve very similar situations.

   Strongly agree    Agree    Neutral    Disagree    Strongly disagree

12. I enjoy figuring out answers to biology questions.

   Strongly agree    Agree    Neutral    Disagree    Strongly disagree

13. It is important for the government to approve new scientific ideas before they can be widely accepted.

   Strongly agree    Agree    Neutral    Disagree    Strongly disagree

14. Learning biology changes my ideas about how the natural world works.

   Strongly agree    Agree    Neutral    Disagree    Strongly disagree

15. To learn biology, I only need to memorize facts and definitions.

   Strongly agree    Agree    Neutral    Disagree    Strongly disagree

16. Reasoning skills used to understand biology can be helpful to my everyday life.

   Strongly agree    Agree    Neutral    Disagree    Strongly disagree

17. It is a valuable use of my time to study the fundamental experiments behind biological ideas.

   Strongly agree    Agree    Neutral    Disagree    Strongly disagree

18. If I had plenty of time and money, I would take a biology class outside of my major requirements just for fun.

   Strongly agree    Agree    Neutral    Disagree    Strongly disagree

19. The subject of biology has little relation to what I experience in the real world.

   Strongly agree    Agree    Neutral    Disagree    Strongly disagree

20. There are times I think about or solve a biology question in more than one way to help my understanding.

   Strongly agree    Agree    Neutral    Disagree    Strongly disagree

21. If I get stuck on a biology question, there is no chance I'll figure it out on my own.

   Strongly agree    Agree    Neutral    Disagree    Strongly disagree

22. When studying biology, I relate the important information to what I already know rather than just memorizing it the way it is presented.
23. There is usually only one correct approach to solving a biology problem.

24. When I am not pressed for time, I will continue to work on a biology problem until I understand why something works the way it does.

25. Learning biology that is not directly relevant to or applicable to human health is not worth my time.

26. Mathematical skills are important for understanding biology.

27. I enjoy explaining biological ideas that I learn about to my friends.

28. We use this statement to discard the survey of people who are not reading the questions. Please select "agree" (not "strongly agree") for this question to preserve your answers.

29. The general public misunderstands many biological ideas.

30. I do not spend more than a few minutes stuck on a biology question before giving up or seeking help from someone else.

31. Biological principles are just to be memorized.

32. For me, biology is primarily about learning known facts as opposed to investigating the unknown.

II. Knowledge of the Nature of Science

33. Science is limited to investigating topics for which evidence can be gained through experiments and/or observation.
34. Evidence is necessary to support all conclusions in science.

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<thead>
<tr>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly disagree</th>
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35. Scientific theories explain scientific laws.

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<tr>
<th>Strongly agree</th>
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<th>Disagree</th>
<th>Strongly disagree</th>
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36. Theories and laws are quite different kinds of scientific knowledge.

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37. Valid scientific laws are more valuable than valid scientific theories.

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</table>
38. Scientific hypotheses become theories and finally, with more evidence become laws.

<table>
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<tr>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly disagree</th>
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III. Knowledge of the Process of Evolution

Canary Island Lizards

The Canary Islands are seven islands just west of the African continent. The islands gradually became colonized with life: plants, lizards, birds, etc. Three different species of lizards found on the islands are similar to one species found on the African continent (Thorpe & Brown, 1989). Different species live on different islands. For example, the fruit eating lizards live on some of the islands while the insect eating lizards live on other islands. Some of the major differences in the lizards are their claw size and body length.

39. What would happen if a breeding pair of lizards was placed on an island under ideal conditions with no predators and unlimited food so that all individuals survived? Given enough time:

   1. The lizard population would double and then stay relatively stable.
   2. The lizard population would grow slowly and then level off.
   3. The lizard population would stay small because birds only have enough babies to replace themselves.
   4. The lizard population would increase dramatically.

40. What could cause one species to change into three species over time?

   1. Groups of lizards must have been geographically isolated from other groups and random genetic changes must have accumulated in these lizard populations over time.
   2. There may be minor variations, but all lizards are essentially alike and all are members of a single species.
   3. In order to survive, different groups of lizards needed to adapt to the different islands, and so all organisms in each group gradually evolved to become a new lizard species.
Groups of lizards encountered different island environments so the lizards needed to become new species with different traits in order to survive.

41. Fitness is a term often used by biologists to explain the evolutionary success of certain organisms. Below are descriptions of four fictional female lizards. Which lizard might a biologist consider to be the “most fit”?

<table>
<thead>
<tr>
<th>Lizard</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Length (cm)</td>
<td>20</td>
<td>12</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Offspring surviving to adulthood</td>
<td>19</td>
<td>28</td>
<td>22</td>
<td>26</td>
</tr>
<tr>
<td>Age at death (years)</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Claw length</td>
<td>long</td>
<td>short</td>
<td>medium</td>
<td>long</td>
</tr>
<tr>
<td>Comments</td>
<td>Healthy, strong, clever</td>
<td>Light colored, eats fruit</td>
<td>Dark colored, eats both fruit and insects, quick</td>
<td>Largest territory compared to other lizards on island</td>
</tr>
</tbody>
</table>

- A
- B
- D
- C

42. What do you think happens among the lizards of a certain species when the food supply is limited?

- The lizards fight for the available food and the strongest lizards kill the weaker ones.
- The lizards least successful in the competition for food are likely to die of starvation and malnutrition.
- Genetic changes that would allow lizards to eat new food sources are likely to be induced.
- The lizards cooperate to find food and share what they find.

43. According to the theory of natural selection, where did the variations in claw size in the three types of lizards most likely come from?

- The lizards needed to change in order to survive so beneficial new traits developed over their lifetime.
- The lizards wanted to have different skills, so beneficial new traits gradually appeared in the population.
- Random genetic changes and sexual recombination both created new variations and variations that were associated with survival were passed onto new offspring.
- The island environment caused genetic changes in the lizards.
44. Populations of lizards are made up of hundreds of individual lizards. Which statement describes how similar they are likely to be to each other if they all lived on a particular island?

☐ All lizards in the populations have many similarities, but there are differences in many features as well.
☐ All lizards in the population are identical to each other on the outside, but there are differences in their internal organs such as how they digest food.
☐ All lizards in the population are completely unique and share no features with other lizards.
☐ All lizards in the population are likely to be nearly identical.

45. Which statement could describe how traits in lizards pass from one generation of lizards to the next generation?

☐ Lizards that are able to hear, but have no survival advantage because of hearing will eventually stop passing on the “hearing” trait.
☐ Lizards with stronger claws that allow for catching certain insects have offspring whose claws gradually get even stronger during their lifetime.
☐ Lizards with a particular claw size and body length are likely to pass similar traits on to offspring.
☐ Lizards that learn to catch a particular type of insect will pass the new ability to offspring.

IV. Ability to Design and Carry Out Experiments

Human saliva is 99.5% water and .5% enzymes, glycoproteins, electrolytes, mucus, and other compounds. A biologist interested in the effect of salivary enzymes (such as amylase) on starch set up an experiment with the following test tubes.

Test tube 1: potato starch in water
Test tube 2: potato starch in amylase and water
Test tube 3: potato starch in amylase, electrolytes, and water

46. Which of the following test tubes should also be included in this study?

☐ Potato starch in electrolytes and water
☐ Potato starch in human saliva
☐ Potato starch in amylase, electrolytes, glycoproteins, and water
☐ Potato starch alone
☐ Potato starch in amylase alone

47. When population sizes of amphibians began declining, scientists came up with the hypothesis that increased exposure to ultraviolet (UV) light was hindering development in amphibian eggs. A biologist decides to test this hypothesis by collecting amphibian eggs and putting them in enclosures that let in different amounts of UV light. Some enclosures had plastic covers that blocked UV rays, others had plastic covers that did not block
UV rays, and others had no plastic cover. Why was it necessary to have both enclosures with no plastic cover and enclosures with a plastic cover that did not block UV rays?

48. You are doing experiments to test whether a specific type of acupuncture works. This type of acupuncture holds that specific needle insertion points influence specific parts of the body. As part of your experimental design, you randomize your treatments so that some people get acupuncture needles inserted into the "correct" sites and others into "incorrect" sites. As part of your experiments on the scientific validity of this particular type of acupuncture, it would be important to:

- have the study performed by researchers who believe in this form of acupuncture.
- test only people without opinions, pro or con, about acupuncture.
- test only people who believe in acupuncture.
- determine whether placing needles in different places produces different results.

49. Solar thermal systems use heat generated by concentrating and absorbing the sun’s energy to drive a generator and produce electrical power. A biotechnology company has developed a new solar panel treatment to increase energy production. There are two different types of glass (A and B) that this treatment can be used with. The company has 12 test sites in the Mojave Desert in the southwestern United States. Each site has eight generators. The sites might differ slightly in the amount of sunlight they receive. How would you design an experiment to examine the effectiveness of this new treatment?