Part A
1. List of Program Learning Outcomes (PLOs)
   (PLOs should be appropriate to the degree and consider national disciplinary standards, if they exist.
   Each outcome should describe how students can demonstrate learning.)
   PLO1: Students will demonstrate the ability to formulate hypotheses and design experiments to address a scientific question.
   PLO2: Students will demonstrate an understanding of the relevant content in their concentration as assessed through a discipline-specific assignment and/or exam.
   PLO3: Students will demonstrate laboratory or field skills relevant to their concentration.
   PLO4: Students will demonstrate proficiency in scientific writing skills by effectively writing an advanced scientific paper, like a scientific literature review.
   PLO5: Students will demonstrate proficiency in oral presentation skills by effectively presenting scientific research, like a conference style research presentation.

2. Map of PLOs to University Learning Goals (ULGs)
   (Please indicate how your PLOs map to the University Learning Goals below by listing the PLO under each relevant ULG, or including this map in table form (see examples here). Use the link above for a full description of each ULG.)

<table>
<thead>
<tr>
<th>ULG 1 – Specialized Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULG 2 – Broad Integrative Knowledge</td>
</tr>
<tr>
<td>ULG 3 – Intellectual Skills</td>
</tr>
</tbody>
</table>
The correspondence of the Biology PLOs with SJSU’s ULGs is shown in Table 1. This map was developed by the Biological Sciences Assessment Committee.

**Table 1. Map of Biology PLOs to ULGs with schedule for assessment**

<table>
<thead>
<tr>
<th>Biology PLO</th>
<th>Courses</th>
<th>When Assessed</th>
<th>ULG</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bio 155, 156</td>
<td>AY 20-21</td>
<td>1, 2, 3, 4</td>
</tr>
<tr>
<td>2</td>
<td>Bio 124, 135B, 160; Micr 141</td>
<td>AY 15-16</td>
<td>1, 4</td>
</tr>
<tr>
<td>3</td>
<td>Bio 125, 135L; Bot 165; Micr 141L</td>
<td>AY 16-17</td>
<td>1, 3, 4</td>
</tr>
<tr>
<td>4</td>
<td>Bio 100W</td>
<td>AY 18-19</td>
<td>1, 3, 4</td>
</tr>
<tr>
<td>5</td>
<td>Bio 155, 156</td>
<td>AY 19-20</td>
<td>1, 2, 3, 4</td>
</tr>
</tbody>
</table>

3. **Alignment – Matrix of PLOs to Courses**
(Please show in which courses the PLOs are addressed and assessed. The curriculum map should show increasing levels of proficiency and alignment of curriculum and PLOs. See examples [here](#))

Table 1 shows the courses in which the Biology PLOs are assessed.

4. **Planning – Assessment Schedule**
(Please provide a reasonable, multi-year assessment plan that specifies when a PLO will be assessed (A), when you might plan to implement changes as a result of your assessment (I), and, if applicable, when you might reassess a given PLO (R) to gauge the impact of the change. All PLOs should be assessed at least once during each program planning cycle (usually 5 years). Add rows and columns as necessary.)

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLO 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>PLO 2</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td>I</td>
</tr>
<tr>
<td>PLO 3</td>
<td></td>
<td>A</td>
<td></td>
<td></td>
<td>I</td>
</tr>
<tr>
<td>PLO 4</td>
<td></td>
<td></td>
<td>A</td>
<td></td>
<td>I</td>
</tr>
<tr>
<td>PLO 5</td>
<td></td>
<td></td>
<td></td>
<td>A</td>
<td>I</td>
</tr>
</tbody>
</table>

5. **Student Experience**
   a. How are your PLOs and the ULGs communicated to students, e.g. websites, syllabi, promotional material, etc.? Students may read the Biology PLOs on our website at http://www.sjsu.edu/biology/assessment/program-learning-objectives/index.html. The PLOs and mapping to course activities are included in the syllabi for all courses taught in the Biological Sciences Department.
   b. Do students have an opportunity to provide feedback regarding your PLOs and/or the assessment process? If so, please briefly elaborate.
Feedback on the Program Review submitted in June of 2015 included a valuable suggestion to conduct a focus group with students to discuss assessment. We will make plans for a focus group in AY 2016-17.

Part B
6. During AY 2015-16, we assessed PLO 2: Students will demonstrate an understanding of the relevant content in their concentration as assessed through a discipline-specific assignment and/or exam.

a. BA, Biological Sciences and BS, Biological Sciences, Concentration in Ecology and Evolution.

During Fall, 2015, a concept inventory exam was given to students in Biol 160: Ecology. All students in the BA and in the BS, Ecology and Evolution degrees complete this course. The exam included 33 questions, which were grouped into 14 different topics/subjects (see Appendix 1). The average score for the 32 students who took the exam was 57%.

Table 2. Assessment of PLO 2 for BS, Biological Sciences, Concentration in Ecology and Evolution and for BA Biological Sciences. Values are the average score plus or minus the standard deviation for all questions covering each topic.

<table>
<thead>
<tr>
<th>General subject</th>
<th>Topic</th>
<th>Mean score (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural selection</td>
<td>Adaptation</td>
<td>65.3 ± 16.9</td>
</tr>
<tr>
<td>Population ecology</td>
<td>Population regulation and growth</td>
<td>64.2 ± 11.2</td>
</tr>
<tr>
<td>Life histories</td>
<td>r vs. K selection</td>
<td>47.0[^1]</td>
</tr>
<tr>
<td>Trophic structure</td>
<td>Producers vs. consumers</td>
<td>71.7 ± 23.1</td>
</tr>
<tr>
<td>Species interactions</td>
<td>Predation</td>
<td>42.4[^1]</td>
</tr>
<tr>
<td>Species interactions</td>
<td>Niches and competition</td>
<td>59.1 ± 10.7</td>
</tr>
<tr>
<td>Biogeography</td>
<td>Large-scale patterns of diversity</td>
<td>56.8 ± 34.3</td>
</tr>
<tr>
<td>Ecosystem ecology</td>
<td>Energy flow</td>
<td>27.3[^1]</td>
</tr>
<tr>
<td>Ecosystem ecology</td>
<td>Nutrient cycling</td>
<td>72.7[^1]</td>
</tr>
<tr>
<td>Community ecology</td>
<td>Patterns of species abundance</td>
<td>9.1[^1]</td>
</tr>
<tr>
<td>Disturbance</td>
<td>Disturbance effects</td>
<td>41.4 ± 7.6</td>
</tr>
<tr>
<td>Connectivity</td>
<td>Corridors</td>
<td>54.5[^1]</td>
</tr>
<tr>
<td>Physiological ecology</td>
<td>Allometry</td>
<td>24.2[^1]</td>
</tr>
</tbody>
</table>

[^1]There is no standard deviation shown for topics that had only one question.

b. BS, Biological Sciences, Concentration in Microbiology.

During Fall, 2015, a concept inventory exam was given to students in Micro 141: Pathogenic Microbiology I. The exam included 50 questions, which were grouped into 8 different topics (see Appendix 2). The average score for the 33 students who took the exam was 69%.

Table 3. Assessment of PLO 2 for BS, Biological Sciences, Concentration in Microbiology. Values are the average score plus or minus the standard deviation for all questions covering each topic.

<table>
<thead>
<tr>
<th>General subject</th>
<th>Mean score (%)</th>
</tr>
</thead>
</table>

[^1]
Pathogenesis 77.7 ± 12.1
Taxonomy 67.7 ± 3.5
Environmental 83.3 ± 10.7
Physiology 69.2 ± 19.0
Diagnostics 42.4
Structure 77.8 ± 22.7
Genetics 60.3 ± 25.2
Immunology 65.5 ± 10.7

1 There is no standard deviation shown for topics that had only one question.

c. BS, Biological Sciences, Concentration in Molecular Biology.

During Fall, 2015, a concept inventory exam was given to students in Biol 135B: Eukaryotic Cell and Molecular Biology II, which all students in this concentration are required to take during their final semester. The exam included 36 questions and there were 19 students who took the exam. The average score on the exam was 60%.

d. BS, Biological Sciences, Concentration in Systems Physiology.

During Fall, 2015, a concept inventory exam was given to students in Biol 124: Systems Physiology, which all students in this concentration are required to take. The exam included 20 questions, which were grouped into 8 different topics or organ systems (see Appendix 4). The average score for the 79 students who took the exam was 56%.

Table 4. Assessment of PLO 2 for BS, Biological Sciences, Concentration in Systems Physiology. Values are the average score plus or minus the standard deviation for all questions covering each topic.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Mean score (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feedback mechanisms</td>
<td>54.1 ± 16.5</td>
</tr>
<tr>
<td>Hematology</td>
<td>62.5 ± 23.4</td>
</tr>
<tr>
<td>Cardiorespiratory physiology</td>
<td>35.5 ± 4.0</td>
</tr>
<tr>
<td>Thermoregulation</td>
<td>51.9 ± 22.2</td>
</tr>
<tr>
<td>Endocrinology</td>
<td>66.5 ± 6.3</td>
</tr>
<tr>
<td>Respiratory physiology</td>
<td>55.7</td>
</tr>
<tr>
<td>Sensory physiology</td>
<td>81.0 ± 3.5</td>
</tr>
<tr>
<td>Gastrointestinal physiology</td>
<td>64.6</td>
</tr>
</tbody>
</table>

1 There is no standard deviation shown for topics that had only one question.

7. Analysis
   a. BA, Biological Sciences

The assessment exam used for BA students was originally designed for students in the BS Biology, Ecology & Evolution concentration. Although all BA students are required to take Biol 160, the course in which this exam was administered, they do not take most of the other Ecology & Evolution courses. Therefore, the exam may not be an accurate assessment of the BA program.
During the 2015-16 AY, the Department of Biological Sciences restructured our BA degree into different “tracks” (such as pre-professional, pre-teaching, etc.). Moving forward, the department will need to develop an appropriate assessment plan for these new tracks. The department will need to decide what concepts and skills are relevant to this degree, and agree upon a strategy for assessing these (e.g., in which course(s) should assessment for the BA be implemented for each of the tracks).

b. BS, Biological Sciences, Concentration in Ecology & Evolution

The assessment exam for students in the BS Biology, Ecology & Evolution concentration was administered in Biol 160. This course is not a true capstone course for the concentration, and the poor performance of the students may reflect their lack of preparation for the exam. The E&E concentration does not currently have a true capstone course, and one of the goals for the next year is to create one. Previously, we have not had sufficient faculty to offer a capstone course, but recent hires and the reorganization of teaching assignments enable us to develop this course. Furthermore, the faculty needs to evaluate this exam and determine whether the questions truly reflect what we want our students to learn in the program.

c. BS, Biological Sciences, Concentration in Microbiology

The assessment exam for students in the BS Biology, Microbiology was administered in Micro 141, which most students complete during the fall of their senior year. Student performance on the assessment exam suggests that the students were acquainted with the concepts being assessed. Student performance was greatest for topics relating to pathogenesis, which is logical because the exam was given at the end of the pathogenic microbiology course. After administering the exam, faculty members in this area decided some questions were not good, and eliminated these before the exams were graded. Additional questions were poorly written, and will be rewritten before the next assessment.

d. BS, Biological Sciences, Concentration in Molecular Biology

The assessment exam for students in the BS Biology, Molecular Biology was administered in the capstone course for the concentration. This area has been using this assessment exam for at least four years. However, it was designed to assess material more specific to the course in which it was administered, rather than the entire program. Therefore, faculty members have indicated the exam should be modified for future assessment.

e. BS, Biological Sciences, Concentration in Systems Physiology

The assessment exam for students in the BS Biology, Systems Physiology was administered in Biol 124, which is a pre-requisite for all of the other physiology courses in the department. It is possible that student performance could be improved by administering the exam in the capstone course for the concentration.

8. Proposed changes and goals

Changes:
1. We propose to identify each students’ program (BA or BS) during assessment. We did not
distinguish between the BA and the BS, Ecology & Evolution students who took the same exam. That limited our ability to evaluate each of these programs and the exam, itself.

**Goals:**

1. Assess PLO #3 during AY 2016-17. This PLO will assess students’ learning of lab and field skills within their concentrations. The department has concentration-specific skill assessment exams that will be administered in our capstone courses.

2. Evaluate the results of our content assessment as described in section 7 above. Are the exam questions accurately assessing our programs? If so, what changes are needed in our programs to improve student learning? Are the exams being administered in the appropriate courses (e.g., Ecology & Evolution, Systems Physiology)?

3. Develop a capstone course for the BS, Biological Sciences, Concentration in Ecology and Evolution, and administer assessment exams in that course.

4. Develop an appropriate assessment plan for the new BA Biological Sciences tracks. The department needs to decide what concepts and skills are relevant to this degree, and agree upon a strategy for assessing these (e.g., in which course(s) should assessment for the BA be implemented)

**Part C**

<table>
<thead>
<tr>
<th>Proposed Changes and Goals</th>
<th>Status Update</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assess PLO 3</td>
<td></td>
</tr>
<tr>
<td>Evaluate content assessment</td>
<td></td>
</tr>
<tr>
<td>Develop capstone course for BS, Ecology &amp; Evolution</td>
<td></td>
</tr>
<tr>
<td>Develop assessment plan for BA tracks</td>
<td></td>
</tr>
<tr>
<td>Plan student focus group</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 1. Assessment exam for BA Biological Sciences and for BS Biological Science, Concentration in Ecology & Evolution.

This exam, to test understanding of concepts in evolution/natural selection and in ecology, is modified from exams used to test classroom concepts in evolution and ecology at San Diego State University and Concept Inventories obtained from the Ecological Society of America website. Questions in a true/false format were modified to multiple-choice questions. The concepts tested by individual questions are given below (some questions relate to more than one concept).

<table>
<thead>
<tr>
<th>Questions</th>
<th>General subject</th>
<th>Topic</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,19,22,</td>
<td>Natural selection</td>
<td>Adaptation</td>
<td>understand that evolution acts on variable genetic traits of populations, not individuals</td>
</tr>
<tr>
<td>24,25,27,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28,29,30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,33</td>
<td>Population ecology</td>
<td>Population regulation</td>
<td>understand that density-dependent processes are necessary to regulate populations around a carrying capacity. Understand that invasive exotic species often irrupt because have escaped their native competitors and predators</td>
</tr>
<tr>
<td>3,15,26</td>
<td>Population ecology</td>
<td>Population growth</td>
<td>understand the basic differences between exponential and logistic population growth.</td>
</tr>
<tr>
<td>4,30</td>
<td>Life histories</td>
<td>r vs. K selection</td>
<td>understand that natural selection has resulted in organisms having different characteristics based on fundamental body plans and life expectancies</td>
</tr>
<tr>
<td>5,16,23</td>
<td>Trophic structure</td>
<td>Producers vs. consumers</td>
<td>understand how organisms at different trophic levels acquire energy for life and the effects of energy loss in food chains on species characteristics</td>
</tr>
<tr>
<td>6,18</td>
<td>Species interactions</td>
<td>predation</td>
<td>understand the functional response models and that the key metric for predators to regulate a population includes the proportional prey mortality and the numerical response of predators to prey. Understand effect of predators on ecosystem diversity and food chains</td>
</tr>
<tr>
<td>7,14</td>
<td>Species interactions</td>
<td>niches and competition</td>
<td>understand the concept of the niche and its relationship to biodiversity and also that natural factors alter the concept that “species with completely overlapping niches cannot coexist”</td>
</tr>
<tr>
<td>8,12,17,21</td>
<td>Biogeography</td>
<td>large-scale patterns of</td>
<td>understand global gradients in biodiversity and forces that affect biodiversity at large spatial scales</td>
</tr>
<tr>
<td>9</td>
<td>Ecosystem ecology</td>
<td>Energy flow</td>
<td>understand that food webs have different pathways and the amounts of energy flowing in them differ</td>
</tr>
<tr>
<td>Page</td>
<td>Topic</td>
<td>Content</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>-------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Ecosystem ecology</td>
<td>Nutrient cycling communities: understand that nutrients are cycled and that different nutrients have different reservoirs in the biosphere</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Community ecology</td>
<td>patterns of species abundance understand the fundamental nature of communities as an assemblage of populations, and that most species are intermediate in abundance while fewer are rare or very abundant (log-normal distribution)</td>
<td></td>
</tr>
<tr>
<td>13,18,20</td>
<td>Disturbance</td>
<td>disturbance effects understand effects of disturbance on adaptations and community structure</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Connectivity</td>
<td>corridors understand the role of corridors in allowing plant and animal movement in response to climate change and in linking population demographically and genetically</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>ecophysiology</td>
<td>allometry understand surface area/volume and scaling relationships in affecting physiology</td>
<td></td>
</tr>
</tbody>
</table>
Please answer the following questions where there is only one correct answer per question.

1. Which of the following statements about adaptations is true?
   a. Adaptations evolve within individuals.
   b. “Adaptation” is another word for “acclimatization”
   c. Genetic variation within a population is a requirement for the evolution of adaptations.
   d. Both a and b
   e. None of the above

2. Population regulation occurs when:
   a. the population is in initial phases of growth
   b. density-dependent factors affect processes such as births, deaths, immigration, and emigration
   c. All factors influencing populations operate independent of population density
   d. the population has “crashed” at least once in the past
   e. None of the above

3. Which of the following statements about logistic population growth is true?
   a. The carrying capacity is the maximum population size that can be supported by the environment indefinitely.
   b. At low densities, logistic growth is similar to exponential growth.
   c. At the carrying capacity, there is no population growth in the logistic model.
   d. All of the above
   e. None of the above

4. For which of the following organisms would it be advantageous to allocate more resources to reproduction than to growth?
   a. One with low adult survival rates
   b. One in which fecundity increases with increased body size
   c. One with a long life span
   d. Both a and b
   e. None of the above

5. Which of the following statements about the relationship between consumers and producers is true?
   a. Consumers obtain energy by eating other organisms, whereas producers obtain energy by decomposing dead matter.
   b. Consumers obtain energy from an external source to produce their own food, whereas producers obtain energy by decomposing dead matter.
   c. Consumers obtain energy by eating other organisms, whereas producers use energy from an external source to produce their own food.
   d. Consumers and producers both obtain energy by eating other organisms; the difference lies in what types of organisms they eat.
   e. None of the above
6. You perform an experiment on a predator-prey system and determine that the predator is able to regulate a prey population. Which of the following must be true?
   a. The predator exhibits a functional response to prey density
   b. The predator exhibits a numerical response to prey density (i.e., predators become more numerous where prey densities are high)
   c. As prey density increases, the proportion of the prey population eaten by predators decreases
   d. Either a or b must be true
   e. A, b, and c all must be true

7. Despite early laboratory experiments suggesting that “complete competitors cannot coexist”, many ecological communities contain a large number of similar species. What can account for this?
   a. Competition among the species in the past has resulted in different realized niches for the species
   b. the environment is always changing, and there may not be enough time for competitive exclusion to occur before a disturbance alters the community
   c. natural selection has resulted in divergence in morphological features of the species, reducing competition
   d. all of the above are possible reasons for the coexistence of similar species in a community

8. Which of the following statements most correctly characterizes biogeographic patterns of species diversity?
   a. Diversity is higher near the poles than near the equator, due to more frequent disturbance near the poles
   b. Diversity is higher near the equator than near the poles, due at least in part to a higher degree of energy input near the equator
   c. Global gradients of species diversity do not exist; rather, high species diversity is found only in “hotspots”
   d. Diversity tends to be very low on most islands, due to their isolation from the mainland
   e. On islands, diversity tends to decrease with island size, due to greater amounts of predation

9. Which is true of food webs?
   a. Most of the energy eventually flows through the detrital food chain rather than the grazing food chain
   b. Much, but not all of the energy entering the food web is lost as heat energy due to respiration
   c. Only about 50% of the energy available in an organism is assimilated by the organism that eats it
   d. Most of the animals in a food web are able to eat only one species of prey

10. Which is true of the way in which nutrients are cycled in the biosphere?
    a. Human activities affect the carbon cycle, but have little or no effect on the sulfur cycle
    b. The largest reservoir of carbon is organic carbon bound up in vegetation
    c. Nutrient turnover is more rapid in colder biomes (e.g. coniferous forests) than in warmer biomes (e.g. deciduous forests).
    d. Despite its high content of the atmosphere, nitrogen often is the limiting nutrient for primary production
11. Ecological communities are composed of a variety of populations living in the same area. Which most correctly characterizes ecological communities?
   a. Most communities change little over time, demonstrating a tight integration of interdependent species
   b. Communities typically include many species that are intermediate in abundance, and few species that are rare or very common
   c. A high diversity of species in a community corresponds to broader niches for most of those species
   d. Species richness is a measure of diversity within a community that includes the number of species and their relative abundance
   e. All of the above

12. Question: On a visit to Great Smoky Mountains National Park (GSMNP) in Tennessee, you meet a group of botanists who are among the biologists participating in the All Taxa Inventory (ATI) of organisms in the park. You learn that the goal of the ATI at GSMNP and other locations in the US is to inventory all of the species in the US. Why is the US species inventory important? The best answer is:
   a. Although we have identified and named all but a few of the species that live in the United States, we are doing the inventory because we do not know which ones are present in GSMNP or other places.
   b. The United States is experiencing a mass extinction of animal and plant species with some 30% being in danger of going extinct in the foreseeable future. So the inventory is being done to establish base-line data to establish more precisely what is the status of species in the US
   c. The inventory is designed to determine which species have already been lost from the park.
   d. Since most species have no economic importance (they are not bought or sold), the benefits of the inventory will be scientific, not economic.

13. Question: On the morning of 27 August 1883 a series of huge volcanic eruptions eliminated the island of Krakatau in the Pacific Ocean and left a smoldering island named Rakata with surface temperatures that morning between 300° and 850°C. Nothing alive remained on Rakata. If you went to see Rakata today, you would find an island not very different biologically from Krakatau on 26 August 1883, except in the forest you would find none of the long lived tree species originally found on Krakatau. The recovery of the biodiversity on Rakata is best explained by which of the following?
   a. The rich volcanic ash on Rakata provided the environment in which the organisms that managed to get to Rakata evolved to create a biodiversity similar to that of the original island
   b. The lack of long-lived tree species indicates that, although they can get to the island, the environment is no longer suitable.
   c. Dispersed by air and water to Rakata during the years after the eruptions, species that existed elsewhere re-established the island’s biodiversity to pre-eruption level
   d. If left free from major catastrophes, even totally devastated ecosystems will eventually recover to their previous state.
   e. none of the above
14. Five species of warblers (insect-eating birds) differ with regard to their foraging zones within trees in northern forests. This is a classic example of niche differences amongst a group of similar species that coexist together in the same habitats at the same time.

On certain islands off the coast of Maine that have forests of similar height and insect food as those on the mainland, the myrtle warbler occurs without the four other species. Based on your knowledge of ecological interactions in nature, what do you think are the most likely changes in the abundance and foraging niche of myrtle warblers on these islands compared to populations of the same species on the mainland? Choose one of the following possibilities (Note: ↑ stands for expands or increases, ↓ stands for contracts or decreases — stands for no change.)

a. Niche ↑ Abundance ↓
b. Niche ↓ Abundance ↓
c. Niche ↔ Abundance ↑
d. Niche ↑ Abundance ↑
e. Niche ↔ Abundance ↔

15. When optimal conditions for growth and reproduction persist, all populations of organisms show which of the following growth patterns?
   a. Logistic growth curve with single maximum
   b. Logistic growth curve with oscillation around single maximum
   c. Exponential growth curve
   d. Series of boom-bust exponential growth curve

16. **Question:** Seeing a mountain lion or a jaguar is a thrilling and rare event. Why are such animals rare compared to their prey like deer?

   a. Mountain lions and jaguars are as common as deer, but because they are very reclusive and people are not their natural prey, we just don’t see them very often.

   b. **Because of the necessarily inefficient transfer of energy from prey to predator, it takes a lot of deer to maintain populations of mountain lions and jaguars.**

   c. Top predators like mountain lions and jaguars have high metabolic requirements and must spend huge amounts of energy and time hunting, and often starve to death.

   d. Mountain lions and jaguars are the exception among animals; other top predators (e.g. eagles and hawks) are about as common as their prey.

   e. Top predators like mountain lions and jaguars have large home ranges, but the home ranges are not much larger than herbivores of similar body size.
17. Islands A and B are similar in size, but A is 3 times closer to the mainland. Islands C and D are the same distance from the mainland, but Island D is 3 times larger than C.
   a. Island A would have fewer species than B, because A is subject to predation from mainland species
   b. Island A would have more species than B, because it has a higher immigration rate
   c. Island D would have a higher extinction rate than C
   d. Islands C and D would have similar extinction rates, because they are the same distance from the mainland
   e. none of the above

18. *Littorina* is a small snail that lives in the intertidal zone and grazes for algae in tide pools. Why does species diversity peak at intermediate levels of *Littorina* density and disturbance? (NOTE: Disturbance for the boulder communities is measured as the number and strength of waves, which move the boulders and disrupt the communities that live on them.)
   a. Intermediate levels of disturbance and herbivory allow inferior competitors to invade the community and coexist with dominant space competitors.
   b. At intermediate levels of herbivory in tide pools and intermediate levels of disturbance on intertidal boulders, conditions for resident species will be better than at other disturbance levels and all species will have the highest intrinsic rates of increase.
   c. At intermediate levels of disturbance and herbivory, predation will be at its lowest level both in tidepools and on boulders.
   d. Productivity of both tide pools and boulder communities is highest at intermediate levels of herbivory and disturbance respectively which allows more species to coexist together because there is more food.

19. **Question:** Caterpillars of the monarch butterfly exclusively eat the leaves of the milkweed plant but no other animals eat milkweed leaves because the leaves contain powerful toxins. In fact, if you ate them, you would get very sick. These observations are explained by which of the following
   a. Insects like the monarch have a primitive digestive system compared to animals like humans and the compounds in the milkweed leaves are only toxic to animals with sophisticated digestive systems.
   b. Milkweed plants evolved to produce substances that are toxic to all animals except monarchs.
   c. The energy costs and other disadvantages in eating toxic leaves provide negative selection pressures that mean the monarchs will eventually go extinct.
   d. Milkweed plants evolved to produce substances that are toxic to all animals and over time monarchs evolved resistance to these toxins.
20. **Statement:** In the past several years ecosystems in North America, especially in the western part of the United States, have experienced substantial disturbance because of intense fires and frequent flooding.

   a. The more natural disturbances experienced by an ecosystem the greater the species diversity and the higher the capacity to withstand change.

   b. **Natural disturbances (e.g., fire, drought, flooding, etc.) are required for maintaining diverse ecosystems that are then not substantially changed by these natural disturbances.**

   c. Without natural disturbances the diversity of species is maintained and the abundances of most species that are present increase significantly.

   d. Since natural disturbance is beneficial for preserving species diversity, human activities that disturb ecosystems (e.g., clearing forest for fields and pasture, clear-cutting forests in a pattern similar to severe forest fires, etc.) lead to more diverse ecosystems that are resilient to substantial change.

21. **Statement:** The various terrestrial ecosystems around the world exhibit sufficient similarities that they can be classified into types called biomes: tropical rainforest, deciduous forest, coniferous forest, tundra, desert, etc.

   a. **As we move up high mountains in the tropics from sea level to higher elevations, the sequence of biomes observed is essentially the same as that observed when going from the tropics to the poles of the Earth.**

   b. The key factors that correlate with the kind of biome observed in a particular place are the atmospheric pressure and the length of day (i.e., relative amount of light and dark).

   c. By knowing the amount of rainfall (water availability over the year) or the annual temperature range for a particular area, it is possible to predict the biome that would be present in that area.

   d. Each biome has a unique set of species associated with it (e.g., cacti in deserts, evergreen trees in coniferous forest), but the overall number of species is similar in most biomes regardless of the exact location of the biome.

22. **Question:** Human synthesized herbicides and insecticides have been used for more than fifty years to control plants and insects in agricultural settings and in the places where we live. In most cases which of the following happens

   a. Herbicides and insecticides help maintain ecological balance in human designed ecosystems because they reduce the populations of organisms that have gotten out of control.

   b. Herbicides and insecticides move in food webs and are, by design, not toxic to non-target organisms like beneficial insects, birds, and humans.

   c. **After years of use, herbicides and insecticides that were initially effective in killing pest organisms became less effective until they no longer killed pest organisms.**

   d. Because of dilution in the soil and in the water, herbicides and insecticides become so low in concentration that they have little influence on non-target organisms.
23. **Statement:** The following diagram shows the pyramid of energy for a four trophic level river ecosystem.

```
Top predator
---------Secondary Consumers------
-------------Primary Consumers-------------
-------------Primary Producers-------------
```

What do you think might be the effects on the abundance of organisms in the lower three trophic levels if we removed the top predator (bass)?

a. Secondary consumers would decrease, without the bass to remove the diseased individuals

b. All three trophic levels would increase without a top predator in the system

c. Only primary and secondary consumers would increase

d. **Primary producers and secondary consumers would increase**

24. **Question:** In the Galapagos islands there is a group of 14 finch species, all closely related, that are found nowhere else. Similarly, in the Hawaiian islands there are over 20 endemic species of honeycreepers that are very similar and share a common ancestor. In Africa, certain lakes have over 1000 species of cichlid fish, most of which do not occur in other lakes in Africa. About 120 million years ago, the number of beetle species began to increase rapidly and tens of thousands of new species arose in a relatively short period of time. What do all of these phenomena have in common

a. When conditions are right, the DNA of any species—plant, animal, or microbe—can mutate very rapidly leading to the proliferation of new types. This must have occurred in all of the above mentioned groups.

b. All of the above phenomena are driven by convergent natural selection.

c. The proliferations of species in all of these groups undoubtedly involved genetic drift which the dominant evolutionary force that led to rapid reproductive isolation and diversification

d. **All of the examples involved evolutionary changes that produced different phenotypes and allowed closely related species to exploit different niches.**

![Venezuelan guppies](image)

**Venezuelan guppies**

Guppies are small fish found in streams in Venezuela. Male guppies are brightly colored, with black, red, blue and iridescent (reflective) spots. Males cannot be too brightly colored or they will be seen and consumed by predators, but if they are too plain, females will choose other males. Natural selection and sexual selection push in opposite directions. When a guppy population lives in a stream in the absence of predators, the proportion of males that are bright and flashy increases in the population. If a few aggressive predators are added to the same stream, the proportion of bright-colored males decreases within about five months (3-4 generations). The effects of predators on guppy coloration have been studied in artificial ponds with mild, aggressive, and no predators, and by similar manipulations of natural stream environments (Endler, 1980).

25. **Fitness** is a term often used by biologists to explain the evolutionary success of certain
organisms. Which feature would a biologist consider to be most important in determining which guppies were the “most fit”? 

a. large body size and ability to swim quickly away from predators 
b. excellent ability to compete for food 
c. high number of offspring that survived to reproductive age 
d. high number of matings with many different females.

26. Assuming ideal conditions with abundant food and space and no predators, what would happen if a mating pair of guppies were placed in a large pond? 

a. The guppy population would grow slowly, as guppies would have only the number of babies that are needed to replenish the population. 
b. The guppy population would grow slowly at first, then would grow rapidly, and thousands of guppies would fill the pond. 
c. The guppy population would never become very large, because only organisms such as insects and bacteria reproduce in that manner. 
d. The guppy population would continue to grow slowly over time.

27. In guppy populations, what are the primary changes that occur gradually over time? 

a. The traits of each individual guppy within a population gradually change. 
b. The proportions of guppies having different traits within a population change. 
c. Successful behaviors learned by certain guppies are passed on to offspring. 
d. Mutations occur to meet the needs of the guppies as the environment changes. 

28. Statement: The guppy species found in streams in Venezuela, has males that exhibit a genetically determined range of coloration from brightly colored to dull gray. Brightly colored males are seen easily and consumed by predators, but plain males are not chosen by females for mating. In a stream with no predators, the proportion of brightly colored males is high. If a few predators are added to the same stream, the proportion of brightly colored males decreases within five months (3-4 generations). 

What accounts for the changes in male coloration after predators are added? 

a. The traits of some guppies gradually changed as they encountered predators, so that they became less brightly colored. The offspring of these individuals inherited these changes. 
b. When predators were introduced into the stream, females stopped choosing brightly colored males and chose dull males since dull males had traits that would now benefit the females’ offspring. 
c. The presence of predators led to mutations in the genes responsible for coloration, and, as a result, the proportion of brightly colored males gradually decreased. 
d. The proportion of guppies with genes that cause bright coloration decreased due to strong selection by predators, even though females still preferred brightly colored mates.
29. A field has annual pea plants in it and no other fields in the area have pea plants. Fifty percent of the plants have purple flowers and 50% have white flowers. Flower color is determined by a single gene in each of the plants’ two sets of chromosomes and this means each plant has two copies of a gene for flower color. If a plant has one white and one purple copy, or two purple copies, its flowers are purple. If it has two white copies, its flowers are white.
A rabbit family, that eats just purple pea flowers, moves into the field. When a rabbit finds a purple-flowered plant, it eats all the flowers on that plant.
Although the plant survives, it produces no seeds. After many years,.... (Choose the letter of the correct outcome)

   a. **only white-flowered pea plants remain in the field.**
   b. **only purple-flowered pea plants remain in the field.**
   c. **about 50% of the pea plants have purple flowers and about 50% have white flowers.**
   d. **it is not possible to predict exactly what happens.**

30. **Task:** Among the following scenarios, choose the one where bird population “a” would, in theory, have a greater capacity to respond to intense selection pressures and better adapt to major climatic changes over the next 50,000 years (25,000 generations).

   a. All members of population “a” have an enzyme that corrects any change to their DNA. Population “b” does not have this ultra-efficient repair enzyme and continues experiencing changes in its genes due to mutations.
   b. Population “a” experiences 10 times the immigration rate of individuals from surrounding populations than population “b”. Population “b” remains fairly isolated and experiences a constant, very low influx of genes from other populations.
   c. Due to periodic plagues, population “a” exhibits large fluctuations in number of birds with total population size often plummeting to 5-10 individuals before slowly climbing back to higher levels.
   Population “b” maintains a steady abundance of moderate size.
   d. Due to its proximity to the ocean, population “a” has evolved in a very stable climate with constant rainfall and temperature. Population “b” lives further inland and has evolved in a very seasonal and unpredictable climate.

31. Suitable habitat corridors between otherwise isolated habitats ...

   a. **will allow species to shift their range in response to climate changes**
   b. **will allow increased functional population size for maintaining genetic diversity and a lower extinction rate**
   c. **are especially important for large carnivores**
   d. **can adversely affect biodiversity by allowing the spread of exotic invasive species**
   e. **all of the above**
32. There are large variations in organism sizes among the different taxonomic groups. An effect of this size variation is
   a. small mammals retain heat better than large mammals and have a lower metabolic rate
   b. the gills of small fish are better than those of large fish in meeting oxygen needs in low oxygen habitats.
   c. mammals, birds, and frogs of similar sizes have similar metabolic rates
   d. larger trees have an easier time conducting water to upper tissues, because they have more leaves
   e. all of the above

33. Exotic species are regularly intentionally or accidently introduced to new regions. Which of the following is true.
   a. by increasing the number of species the effect is almost always ecologically beneficial
   b. fortunately, we understand ecological traits well enough to predict which species might become a problem
   c. because they have left their predators and competitors behind in their native range, some exotic species irrupt as highly invasive species
   d. most of the problems with exotic species arise from rapid evolution of the genetically diverse invaders
   e. all of the above
Appendix 2. Assessment exam for BS Biological Sciences, Concentration in Microbiology

1. Which one of the following statements is NOT part of Koch’s postulates?
   A. The microorganism must be isolated from a dead animal and pure cultured.
   B. The microorganism and disease can be identified from a mixed culture.
   C. The pure cultured organism is inoculated into a healthy, susceptible animal.
   D. The same microorganism must be present in every case of the disease.

2. What group of microorganisms has a variety of internal cell compartments and acts as decomposers?
   A. Bacteria
   B. Viruses
   C. Archaea
   D. Fungi

3. Which group of microbial agents is eukaryotic?
   A. Bacteria
   B. Viruses
   C. Archaea
   D. Algae

4. A ______ is a mixture of ______ that form as a complex community.
   A. genome; genes
   B. biofilm; microbes
   C. biofilm; chemicals
   D. miasma; microbes

5. What is the term that describes the ability of organisms to maintain a stable internal state?
   A. Metabolism
   B. Homeostasis
   C. Biosphere
   D. Ecotype

6. An important method used in the rapid identification of a pathogen is ______.
   A. rRNA gene sequencing
   B. polymerase chain reaction
   C. molecular taxonomy
   D. biochemical tests

7. Most bacterial cells are measured using what metric system of length?
   A. Millimeters (mm)
   B. Micrometers (um)
   C. Nanometers (nm)
   D. Centimeters (cm)
8. Intracellular organization in bacterial and archaeal species is centered around
   A. compartmentation of metabolism.
   B. growth and reproduction.
   C. sensing and responding to environment.
   D. All the above (A-C) are correct.

9. Plasmids
   A. replicate with the bacterial chromosome.
   B. contain essential growth information.
   C. may contain antibiotic resistance genes.
   D. are as large as the bacterial chromosome.

10. The bacterial cell is capable of
    A. spatial separation of metabolic processes.
    B. carrying out complex metabolic processes.
    C. subcompartmentalizing biochemical processes.
    D. All the above (A-C) are correct.

11. Which of the following statements does NOT apply to bacterial reproduction?
    A. A fission ring apparatus is present.
    B. Septum formation occurs.
    C. A spindle apparatus is used.
    D. Symmetrical cell division occurs.

12. If a bacterial cell in a broth tube has a generation time of 40 minutes, how many cells will there be after 6 hours of optimal growth?
    A. 18
    B. 64
    C. 128
    D. 512

13. A microbe that is a microaerophilic mesophile would grow optimally at _____ and ______.
    A. high O₂; 30C
    B. low O₂; 20C
    C. no O₂; 30C
    D. low O₂; 37C

14. Enzymes combine with a ____ at the ____ site to lower the activation energy.
    A. substrate; active
    B. product; noncompetitive
    C. product; active
    D. coenzyme; active

15. Which one of the following is NOT produced during glycolysis?
    A. ATP
    B. NADH
    C. Pyruvate
D. Glucose

16. Which one of the following macromolecules would NOT normally be used for microbial energy metabolism?
   A. DNA
   B. Proteins
   C. Carbohydrates
   D. Fats

17. Which one of the following is the correct sequence of flow of electrons in the energy-fixing reactions of photosynthesis?
   A. Water— photosystem I— photosystem II— NADPH
   B. Photosystem I— NADPH— water— photosystem II
   C. Water— photosystem II— photosystem I— NADPH
   D. NADPH— photosystem II— photosystem I— water

18. Microorganisms that use organic compounds as energy and carbon sources are
   A. chemoheterotrophs.
   B. chemoautotrophs.
   C. photoautotrophs.
   D. photoheterotrophs.

19. Which of the following statements is NOT true of the bacterial chromosome?
   A. It is located in the nucleoid.
   B. It usually is a single, circular molecule.
   C. Some genes are dominant to others.
   D. It usually is haploid.

20. Plasmids are
   A. another name for transposons.
   B. accessory genetic information.
   C. domains within a chromosome.
   D. daughter chromosomes.

21. At a chromosome replication fork, the lagging strand consists of _____ that are joined by _____
   A. RNA sequences; DNA ligase
   B. Okazaki fragments; RNA polymerase
   C. RNA sequences; ribosomes
   D. Okazaki fragments; DNA ligase

22. In a eukaryotic microbe, those sections of a primary RNA transcript that will NOT be translated are called
   A. introns.
   B. anticodons.
   C. “jumping genes.”
   D. exons.
23. If an antibiotic binds to a 50S subunit, what cellular process will be inhibited?
   A. DNA replication
   B. Intron excision
   C. Translation
   D. Transcription

24. Which one of the following is not part of the operon?
   A. Regulatory gene
   B. Operator
   C. Promoter
   D. Structural genes

25. Nutritional mutants are referred to as
   A. prototrophs.
   B. wild type.
   C. revertants.
   D. auxotrophs.

26. Which one of the following is NOT an example of genetic recombination?
   A. Conjugation
   B. Binary fission
   C. Transduction
   D. Transformation

27. Transformation refers to
   A. using a virus to transfer DNA fragments.
   B. DNA fragments transferred between live donor and recipient cells.
   C. the formation of an F recombinant cell.
   D. the transfer of naked fragments of DNA.

28. A metagenome refers to
   A. a large genome in an organism.
   B. the collective genomes of many organisms.
   C. the genome of a metazoan.
   D. two identical genomes in different species.

29. All the following terms apply to microbial killing except:
   A. sterilization.
   B. microbicidal.
   C. bactericidal.
   D. fungistatic.

30. Viral genomes consist of
   A. DNA only.
   B. RNA only.
   C. DNA or RNA.
   D. DNA and RNA.
31. Cytopathic effects would include all the following except
   A. changes in cell structure.
   B. provirus formation.
   C. vacuolated cytoplasm.
   D. syncytia formation.

32. A plaque is
   A. change in cell structure due to viral infection.
   B. viral cell inclusion.
   C. clear zone within a lawn of bacteria.
   D. cellular aggregation of phage heads.

33. Newly emerging viruses causing human disease can arise from
   A. species jumping.
   B. mutations.
   C. genetic recombination.
   D. All of the above (A-C) are correct.

34. Which one of the following statements about fungi is NOT true?
   A. Some fungi are dimorphic.
   B. Fungi have cell walls made of chitin.
   C. Fungi are photosynthetic organisms.
   D. Fungi consist of the yeasts and molds.

35. Factors affecting virulence may include
   A. the presence of pathogenicity islands.
   B. their ability to penetrate the host.
   C. the infectious dose.
   D. All the above (A-C) are correct.

36. Possible target sites of activity of antibacterial drugs include
   A. the cell wall
   B. nucleic acids
   C. ribosomes
   D. all of these are possible

37. If a person has recovered from a disease but continues to shed disease agents, that person is a
   A. vector.
   B. fomite.
   C. vehicle.
   D. carrier.

38. A zoonosis is a disease
   A. transmitted from humans to animals.
   B. spread from animals to humans.
   C. transmitted between wild and domestic animals.
   D. spread between wild animals.
39. Which pair of cells represents granulocytes?
   A. Neutrophils and eosinophils
   B. Eosinophils and monocytes
   C. Lymphocytes and monocytes

40. The secondary lymphoid tissues include the _____ and _____.
   A. thymus; bone marrow
   B. bone marrow; tonsils
   C. spleen; thymus
   D. spleen; lymph nodes

41. Which of the following statements is NOT true of innate immunity?
   A. It is an early-warning system against pathogens.
   B. It is a form of immunity found only in vertebrates.
   C. It is a nonspecific response.
   D. It responds within minutes to many infections.

42. _____ cells are associated with _____ immunity while _____ cells are part of _____ immunity
   A. B; cell-mediated; T; innate
   B. T; humoral; B; cellular
   C. T; cell-mediated; B; humoral
   D. T; humoral; B; nonspecific

43. The presence of IgM antibodies in the blood indicates
   A. an early stage of an infection.
   B. a chronic infection.
   C. an allergic reaction is occurring.
   D. humoral immunity has yet to start.

44. MHC class I proteins would be found on _____ whereas MHC class II proteins would be found on _____
   A. nucleated cells; plasma cells
   B. nucleated cells; macrophages
   C. dendritic cells; neutrophils
   D. only white blood cells; red blood cells

45. Exposure to the flu virus, contracting the flu, and recovering from the disease would be an example of
   A. artificially acquired passive immunity.
   B. naturally acquired active immunity.
   C. artificially acquired active immunity.
   D. naturally acquired passive immunity.

46. Herd immunity is affected by
   A. the percentage of a population that is vaccinated.
   B. the strength of an individual’s immune system.
   C. the number of susceptible individuals.
D. All the above (A-C) are correct.

47. Immunological tolerance to “self” is established by
   A. destruction of self-reactive lymphoid cells.
   B. clonal anergy.
   C. clonal deletion.
   D. All the above (A-C) are correct.

48. In the soil, antibiotics are produced by some
   A. fungal species and viruses.
   B. bacterial species and viruses.
   C. viruses and helminthic species.
   D. fungal and bacterial species.

49. A vaccine made from an inactivated bacterial toxin is properly called a(n)
   A. gamma globulin
   B. attenuated vaccine
   C. toxoid
   D. recombinant vaccine

50. The correct sequence of phases in the typical bacterial growth curve is
   A. stationary, logarithmic, lag, decline
   B. lag, logarithmic, decline, stationary
   C. lag, logarithmic, stationary, decline
   D. adaptation, lag, logarithmic, decline
   E. lag, destadial, logarithmic, decline
Appendix 3. Assessment exam for BS Biological Sciences, Concentration in Molecular Biology
1) There are many DNA polymerase enzymes in both bacterial and eukaryotic cells, with varying functions. One limitation of ALL DNA polymerases, however, is that they can only add bases to the 3' end of an existing polynucleotide molecule. Which of the following enzymes is required to bypass this limitation during S phase?
   A) Single-strand binding protein
   B) Helicase
   B) Primase
   B) DNA gyrase

2) What is the evidence that different DNA polymerases carry out leading and lagging strand synthesis?
   A) Two DNA polymerases are present at the replication fork
   B) Error-prone DNA polymerase mutants all lead to similar mutation rates.
   C) Pol δ “idles” during replication, while Pol ε does not.
   D) a and b
   E) a and c

3) Although highly repetitive DNA is common in eukaryotic chromosomes, it does not code for proteins; in fact, most of it is never transcribed into RNA. Which of these is a function of highly repetitive DNA?
   a. Binding of kinetochore proteins, which allow chromosomes to attach to spindle microtubules.
   b. Buffering the ends of linear chromosomes to prevent the loss of protein-coding sequences during replication
   c. Enhancing transcriptional activity
   d. a and b
   e. None of these

4) True or false: The eukaryotic centromere is defined by a consensus sequence that varies very little from species to species.
   a. True
   b. False

5) Which of the following structures are required to prevent exonuclease degradation and fusion of chromosomes, as well as promote meiotic pairing?
   a. Telomeres
   b. Centromeres
   c. Origin of Replication

6) Homologous DNA recombination is known to be required for the repair of:
   a. single nucleotide mutations
   b. double-strand breaks in DNA
   c. erroneous DNA methylation
   d. replication errors

7) Which of the following is most likely to be an EARLY event in the process of cancer development?
   a. Loss of cell-cell contact
b. Angiogenesis
c. Mutation of DNA repair genes
d. Resistance to apoptotic signals

8) True or false: Homologous DNA recombination happens only during meiosis.
   a. true
   b. false

9) Which of the following statements is incorrect?
   a. In meiosis, synapsis of homologous chromosomes is always required for the initiation of recombination.
   b. In many organisms, both telomeres and centromeres are required for correct pairing during meiosis.
   c. In most diploid species, meiotic recombination is essential for proper chromosome segregation
   d. None of these statements is correct.

10) Which of the following is a mechanism for maintaining a pool of stem cells in a differentiating tissue?
    a. programmed cell death
    b. asymmetric cell division
    c. mitotic recombination
    d. angiogenesis

11) Which of the following is a trigger for cellular senescence?
    a. activation of telomerase
    b. low expression of “mitogenic stimulation” genes
    c. elevated levels of DNA damage

12) True or false: apoptotic cell death is genetically regulated, while necrotic cell death is an unregulated response to tissue damage.
    a. true
    b. false

13) Caspases are involved in the regulation of which of the following processes?
    a. apoptosis
    b. necrosis
    c. autophagy

14) You have identified a gene that, when mutated, results in an increased risk of cancer in humans. When you make a complete loss-of-function mutation in this gene in cultured cells, the cells begin to divide uncontrollably. What type of gene have you probably identified?
    a. An oncogene
    b. A tumor-suppressor gene
    c. Telomerase
    d. A cell-death gene

15) Why do familial cancers (that is, cancers due to an inherited predisposing mutation) tend to occur earlier in life and be more severe than similar, but sporadic (nonfamilial) cancers?
    a. Mutation rates are always higher in individuals with cancer-causing mutations.
b. Individuals with familial cancers tend to be less healthy, with less effective immune systems.
c. The person with familial cancer had a “head start” - they already have a carcinogenic mutation in every cell, which means they needed fewer mutations to accumulate before developing cancer.

(16) Proteins destined to enter the endoplasmic reticulum (a) are transported across the membrane after their synthesis is complete. (b) are synthesized on free ribosomes in the cytosol. (c) cross the membrane in a folded state. (d) all remain within the endoplasmic reticulum.

(17) After isolating the rough endoplasmic reticulum from the rest of the cytoplasm, you purify the RNAs attached to it. Which of the following proteins do you expect the RNA from the rough endoplasmic reticulum to encode?
(a) Soluble secreted proteins  (b) ER membrane proteins  (c) Mitochondrial membrane proteins  (d) Plasma membrane proteins  (e) Ribosomal proteins

(18) An individual transport vesicle (a) contains only one type of protein in its lumen. (b) will fuse with only one type of membrane. (c) is endocytic if it is traveling toward the plasma membrane. (d) is enclosed by a membrane with the same lipid and protein composition as the membrane of the donor organelle.

(19) Programmed cell death occurs (a) rarely and selectively where survival factors are not present. (b) to eliminate unneeded cells. (c) only in unhealthy or abnormal cells. (d) only during embryonic development.

(20) Apoptosis differs from necrosis in that necrosis (a) happens more frequently. (b) does not cause DNA to fragment. (c) causes cells to swell and burst while apoptotic cells shrink and condense. (d) uses a caspase pathway.

(21) Imagine that you could microinject cytochrome c into the cytosol of both wild-type cells and cells that were doubly defective for Bax and Bak, which are death-promoting members of the Bcl-2 family. What would you expect?
(a) I would expect wild type cells to undergo apoptosis. (b) I would the Bax−/Bak− to undergo apoptosis. (c) I would expect both cell lines to undergo apoptosis. (d) I would expect neither cell lines to undergo apoptosis.

(22) When a trimeric G protein is activated by a cell-surface receptor (a) the β subunit exchanges its bound GDP for GTP. (b) the GDP bound to the α subunit is phosphorylated to form bound GTP. (c) it dissociates into a free β subunit and an αγ subunit. (d) the α subunit exchanges its bound GDP for GTP.

(23) Which of the following is NOT a function of the ECM?
(a) cell division  (b) cell attachment  (c) tissue formation  (d) cell cushioning

(24) The __________ is a complex network of interconnected filaments and proteins, secreted by all cells, that extends from the outside of the cell and is bound to the cell surface proteins.
(a) microtubule apparatus  (b) cytoskeleton  (c) cell scaffold  (d) extracellular matrix
(25) Which of the following pairings is NOT correct?
(a) adenylate cyclase-GTP  (b) phospholipase C-inositol triphosphate  (c) phospholipase C-diacylglycerol (DAG)

(26) The death receptor pathway leads to the direct activation of:
(a) caspase 8/10  (b) caspase 3  (c) caspase 4  (d) caspase 5

(27) Caspase 8/10 can directly activate:
(a) caspase 9  (b) caspase 3  (c) caspase 4  (d) caspase 5

(28) The concentration of mitotic cyclin
(a) rises dramatically during M phase.  (b) changes as Cdk concentration changes.  (c) falls toward the end of M phase due to ubiquitination.  (d) is highest in G1 phase.

(29) The stage of the cell cycle where biosynthesis of cellular components, in preparation for cell division occurs is:
(a) G1  (b) S  (c) G2  (d) M

(30) Membrane proteins function in:
(a) transport  (b) Amphipatic modification  (c) Temperature control  (d) Protein synthesis

(31) Steroid hormones receptors can activate transcription:
(a) In the absence of steroid hormones  (b) upon binding to a steroid hormone and via amplification of the signal by cAMP.  (c) upon binding to a steroid hormone and via amplification of the signal by Ca^{2+}.  (d) upon binding to a steroid hormone and nuclear translocation

(32) What strategies are used to avoid anoikis?
(a) inhibit survival signals  (b) inhibit anti-apoptotic signals  (c) increase survival signals  (d) increase anti-apoptotic signals

(33) Normal cells in tissues avoid anoikis by:
(a) maintaining ECM attachment  (b) preventing cell-cell contact  (c) preventing ECM attachment  (d) none of the above

(34) Normal transient migratory cell avoid anoikis by:
(a) releasing VEGF  (b) activating the ROS pathway  (c) inactivating the ROS pathway  (d) releasing IL-1

(35) Crisis is activated by the:
(a) loss of growth factor receptors  (b) release of death signals  (d) loss of telomeres  (d) release of growth factors

(36) Angiogenesis is activated by the release of__________ by__________________.
(a) VEGF, endothelial and cancer cells  (b) VEGF, cancer cells only  (c) VEGF, stromal cells only  (d) VEGF, cancer and stromal cells
Appendix 4. Assessment exam for BS Biological Sciences, Concentration in Systems Physiology
**Homeostasis Cargill1SJSCAut14**

**Summary**

**Build**

**Results**  

**Preview**

---

**View Statistics**

**Back to results**

**Total submissions:** 79

---

### Question

**In organisms, like humans, homeostatic negative feedback mechanisms result in**

*Total responses (N): 79  Did not respond: 0*

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>an unfavorable, or damaging affect on the body.</td>
<td>2</td>
<td>2.53%</td>
</tr>
<tr>
<td>2</td>
<td>a constant decrease in the regulated variable.</td>
<td>11</td>
<td>13.92%</td>
</tr>
<tr>
<td>3</td>
<td>equilibrium among body cells and fluids.</td>
<td>7</td>
<td>8.86%</td>
</tr>
<tr>
<td>4</td>
<td>✔ maintenance of an internal variable within a 'normal' range of values.</td>
<td>59</td>
<td>74.68%</td>
</tr>
</tbody>
</table>

---

### Question

**A new species of deer is found in North America. Researchers establish that the concentration of X in the blood is maintained at a relatively constant level over time, even when the animal's external or internal environment changes. When any disturbance causes the value of X to decrease there will be a physiological response that causes X to**

*Total responses (N): 79  Did not respond: 0*

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>increase back towards its normal value.</td>
<td>65</td>
<td>82.28%</td>
</tr>
<tr>
<td>2</td>
<td>decrease still further.</td>
<td>5</td>
<td>6.33%</td>
</tr>
<tr>
<td>3</td>
<td>stay constant at its new value.</td>
<td>9</td>
<td>11.39%</td>
</tr>
</tbody>
</table>

---

### Question

**A new species of deer is found in North America. Researchers establish that the concentration of X in the blood is maintained at a relatively constant level over time, even when the animal's external or internal environment changes. Some disturbance causes the concentration of X to increase. What change will occur in the activity of a sensor that detects X? The sensor receptor will**

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>increase its firing rate from zero to the maximum possible firing rate.</td>
<td>10</td>
<td>12.66%</td>
</tr>
<tr>
<td>2</td>
<td>✔ fire at a rate proportional to the magnitude of X.</td>
<td>54</td>
<td>68.35%</td>
</tr>
<tr>
<td>3</td>
<td>not change its firing rate.</td>
<td>15</td>
<td>18.99%</td>
</tr>
</tbody>
</table>
A new species of deer is found in North America. Researchers establish that the concentration of X in the blood is maintained at a relatively constant level over time, even when the animal's external or internal environment changes. A homeostatic control mechanism functions to maintain the concentration of X at a relatively constant level. This mechanism is functioning.

**Total responses (N): 79  Did not respond: 0**

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>when the concentration of X gets too high.</td>
<td>3</td>
<td>3.80%</td>
</tr>
<tr>
<td>2</td>
<td>when the concentration of X gets too low.</td>
<td>5</td>
<td>6.33%</td>
</tr>
<tr>
<td>3</td>
<td>when the concentration of X gets too high or too low.</td>
<td>42</td>
<td>53.16%</td>
</tr>
<tr>
<td>4</td>
<td>✓ at all concentrations of X.</td>
<td>29</td>
<td>36.71%</td>
</tr>
</tbody>
</table>

**Question**
The body has a sensor that detects blood pressure, but does not have a sensor that detects heart rate. Which of the following variables remains relatively constant when the internal or external environment changes?

**Total responses (N): 79  Did not respond: 0**

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>heart rate</td>
<td>10</td>
<td>12.66%</td>
</tr>
<tr>
<td>2</td>
<td>✓ blood pressure</td>
<td>32</td>
<td>40.51%</td>
</tr>
<tr>
<td>3</td>
<td>both</td>
<td>9</td>
<td>11.39%</td>
</tr>
<tr>
<td>4</td>
<td>neither</td>
<td>28</td>
<td>35.44%</td>
</tr>
</tbody>
</table>

**Question**
Normal body temperature of a healthy adult is about 37°C. A fever occurs when the temperature set point is elevated. Jasmine feels cold as she develops a fever because her body temperature at that time is

**Total responses (N): 79  Did not respond: 0**

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>less than 37°C.</td>
<td>8</td>
<td>10.13%</td>
</tr>
<tr>
<td>2</td>
<td>increasing above 37°C.</td>
<td>47</td>
<td>59.49%</td>
</tr>
<tr>
<td>3</td>
<td>✓ less than the new set point temperature.</td>
<td>24</td>
<td>30.38%</td>
</tr>
</tbody>
</table>

**Question**
A homeostatic mechanism in the human body has a control center, also called an intergrator, that is part of which organ system or systems?

**Total responses (N): 79  Did not respond: 0**

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>the endocrine system</td>
<td>14</td>
<td>17.72%</td>
</tr>
<tr>
<td>2</td>
<td>the nervous system</td>
<td>38</td>
<td>48.10%</td>
</tr>
<tr>
<td>3</td>
<td>✓ the endocrine or the nervous system or both systems</td>
<td>27</td>
<td>34.18%</td>
</tr>
</tbody>
</table>
Plasma calcium concentration is maintained relatively constant even when calcium intake increases. Based on this information, one can conclude that

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>plasma calcium must be needed for the normal function of many cells.</td>
<td>19</td>
<td>24.05%</td>
</tr>
<tr>
<td>2</td>
<td>the plasma calcium concentration must be controlled by the nervous system.</td>
<td>11</td>
<td>13.92%</td>
</tr>
<tr>
<td>3</td>
<td>✓ there must be a mechanism to detect the concentration of calcium in the plasma.</td>
<td>49</td>
<td>62.03%</td>
</tr>
</tbody>
</table>

Baroreceptors detect blood pressure. Blood pressure is maintained relatively constant even when the internal or external environment changes. Under what conditions do the baroreceptors send signals to the brain?

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>when blood pressure is not at its normal value</td>
<td>40</td>
<td>50.63%</td>
</tr>
<tr>
<td>2</td>
<td>when blood pressure is increasing</td>
<td>11</td>
<td>13.92%</td>
</tr>
<tr>
<td>3</td>
<td>when blood pressure is constant</td>
<td>2</td>
<td>2.53%</td>
</tr>
<tr>
<td>4</td>
<td>✓ at all levels of blood pressure</td>
<td>26</td>
<td>32.91%</td>
</tr>
</tbody>
</table>

An animal lives in a habitat where oxygen levels in the environment vary over time as shown in the graph below. [IMAGE] If oxygen level in the blood of the animal is regulated by a homeostatic mechanism, which figure below correctly shows oxygen levels in the blood of the animal over time?[IMAGE]

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>✓ A</td>
<td>44</td>
<td>55.70%</td>
</tr>
<tr>
<td>2</td>
<td>B</td>
<td>21</td>
<td>26.58%</td>
</tr>
<tr>
<td>3</td>
<td>C</td>
<td>14</td>
<td>17.72%</td>
</tr>
</tbody>
</table>

Blood glucose is homeostatically maintained. While watching TV, Sam eats 6 frosted sugar cookies. As glucose is absorbed from Sam’s digestive tract, there is a rise in his blood glucose concentration. Which of the following will occur FIRST?

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>✓ Sensors that monitor blood glucose change their activity.</td>
<td>56</td>
<td>70.89%</td>
</tr>
<tr>
<td>2</td>
<td>Effectors that decrease blood glucose change their activity.</td>
<td>3</td>
<td>3.80%</td>
</tr>
<tr>
<td>3</td>
<td>The level of hormones that control blood glucose changes.</td>
<td>20</td>
<td>25.32%</td>
</tr>
</tbody>
</table>
Question
Dora walks home on a freezing winter night and starts to shiver. What determines how much she will shiver?

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>her body temperature</td>
<td>14</td>
<td>17.72%</td>
</tr>
<tr>
<td>2</td>
<td>the outside air temperature</td>
<td>1</td>
<td>1.27%</td>
</tr>
<tr>
<td>3</td>
<td>her set point temperature</td>
<td>2</td>
<td>2.53%</td>
</tr>
<tr>
<td>4</td>
<td>the difference between the set point temperature and her body temperature</td>
<td>40</td>
<td>50.63%</td>
</tr>
<tr>
<td>5</td>
<td>the difference between outside air temperature and her body temperature</td>
<td>22</td>
<td>27.85%</td>
</tr>
</tbody>
</table>

**Total responses (N): 79 Did not respond: 0**

---

Question
Homeostatic systems require a sensor, control center, also called an integrator, and an effector. The role of the effector is to directly change the

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>value of the homeostatically regulated variable.</td>
<td>43</td>
<td>54.43%</td>
</tr>
<tr>
<td>2</td>
<td>value of set point.</td>
<td>10</td>
<td>12.66%</td>
</tr>
<tr>
<td>3</td>
<td>magnitude of the signal from the sensor.</td>
<td>10</td>
<td>12.66%</td>
</tr>
<tr>
<td>4</td>
<td>activity of the control center or integrator.</td>
<td>16</td>
<td>20.25%</td>
</tr>
</tbody>
</table>

**Total responses (N): 79 Did not respond: 0**

---

Question
In temperature regulation, the sweat gland is an effector that most directly causes a change in

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>body temperature.</td>
<td>59</td>
<td>74.68%</td>
</tr>
<tr>
<td>2</td>
<td>the body’s temperature set point.</td>
<td>3</td>
<td>3.80%</td>
</tr>
<tr>
<td>3</td>
<td>signals from sensory receptors in the skin.</td>
<td>6</td>
<td>7.59%</td>
</tr>
<tr>
<td>4</td>
<td>the temperature controlling center, also called integrator, in the brain.</td>
<td>11</td>
<td>13.92%</td>
</tr>
</tbody>
</table>

**Total responses (N): 79 Did not respond: 0**

---

Question
Blood pressure is maintained relatively constant even when the internal or external environment changes. Effectors are parts of the body that receive signals from a control center. Which of the following could be an effector in the system that maintains blood pressure?

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>blood volume</td>
<td>13</td>
<td>16.46%</td>
</tr>
<tr>
<td>2</td>
<td>sensory receptors for blood pressure</td>
<td>16</td>
<td>20.25%</td>
</tr>
<tr>
<td>3</td>
<td>cardiac muscle</td>
<td>25</td>
<td>31.65%</td>
</tr>
<tr>
<td>4</td>
<td>the resistance that must be overcome for blood to flow</td>
<td>25</td>
<td>31.65%</td>
</tr>
</tbody>
</table>

**Total responses (N): 79 Did not respond: 0**
Multiple choice - one answer (button)

**Question**

The control center, also called the integrator, receives signals from the sensors that are part of the homeostatic mechanism and a set point signal. Which of the following represents how the control center processes these two signals?

<table>
<thead>
<tr>
<th>Total responses (N): 79</th>
<th>Did not respond: 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numeric value</td>
<td>Answer</td>
</tr>
<tr>
<td>1</td>
<td>✓ (set point signal) – (sensor signal)</td>
</tr>
<tr>
<td>2</td>
<td>(set point signal) + (sensor signal)</td>
</tr>
<tr>
<td>3</td>
<td>(set point signal) x (sensor signal)</td>
</tr>
<tr>
<td>4</td>
<td>(set point signal) ÷ (sensor signal)</td>
</tr>
</tbody>
</table>

**Response statistics**

- Point value: 1.00
- Mean: 1.67
- Median: 1.00
- Mode: 1
- Min/Max: 1/4
- Standard deviation: 0.87

**Question**

Baroreceptors sense blood pressure. The baroreceptors nerves are cut so the signal from the baroreceptors is unable to reach the cardiovascular control center in the brain. After cutting the nerves, blood pressure will

<table>
<thead>
<tr>
<th>Total responses (N): 79</th>
<th>Did not respond: 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numeric value</td>
<td>Answer</td>
</tr>
<tr>
<td>1</td>
<td>remain constant.</td>
</tr>
<tr>
<td>2</td>
<td>decrease.</td>
</tr>
<tr>
<td>3</td>
<td>✓ increase.</td>
</tr>
<tr>
<td>4</td>
<td>become equal to the set point value.</td>
</tr>
</tbody>
</table>

**Response statistics**

- Point value: 1.00
- Mean: 2.37
- Median: 2.00
- Mode: 3
- Min/Max: 1/4
- Standard deviation: 1.00

**Question**

Information from sensory receptors in homeostatic systems

<table>
<thead>
<tr>
<th>Total responses (N): 79</th>
<th>Did not respond: 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numeric value</td>
<td>Answer</td>
</tr>
<tr>
<td>1</td>
<td>determines the set point.</td>
</tr>
<tr>
<td>2</td>
<td>is sent directly to effectors.</td>
</tr>
<tr>
<td>3</td>
<td>✓ is sent directly to the control centers, also called integrators.</td>
</tr>
<tr>
<td>4</td>
<td>stays in the receptors until the regulated variable changes back to normal.</td>
</tr>
</tbody>
</table>

**Response statistics**

- Point value: 1.00
- Mean: 2.84
- Median: 3.00
- Mode: 3
- Min/Max: 1/4
- Standard deviation: 0.61

**Question**

In a homeostatic system the control center, also called an integrator, receives sensory information from receptors and then the control center will

<table>
<thead>
<tr>
<th>Total responses (N): 79</th>
<th>Did not respond: 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numeric value</td>
<td>Answer</td>
</tr>
<tr>
<td>1</td>
<td>determine what the body wants.</td>
</tr>
<tr>
<td>2</td>
<td>determine the set point.</td>
</tr>
<tr>
<td>3</td>
<td>✓ process the information and control the actions of the effectors.</td>
</tr>
<tr>
<td>4</td>
<td>transmit the sensory information unchanged to the effectors.</td>
</tr>
<tr>
<td>5</td>
<td>control the activity of the sensory receptors.</td>
</tr>
</tbody>
</table>

**Response statistics**

- Point value: 1.00
- Mean: 2.89
- Median: 3.00
- Mode: 3
- Min/Max: 1/5
- Standard deviation: 0.82
Samira is watching a movie and eats 3 chocolate bars. As Samira’s digestive tract absorbs the sugar, there is an initial increase in her blood glucose. When are blood glucose sensors active?

**Multiple choice - one answer (button)**

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>before eating</td>
<td>7</td>
<td>8.86%</td>
</tr>
<tr>
<td>2</td>
<td>during eating</td>
<td>4</td>
<td>5.06%</td>
</tr>
<tr>
<td>3</td>
<td>during eating and after eating</td>
<td>17</td>
<td>21.52%</td>
</tr>
<tr>
<td>4</td>
<td>✓ all the time</td>
<td>51</td>
<td>64.56%</td>
</tr>
</tbody>
</table>

Total responses (N): 79   Did not respond: 0

**In what year of school are you?**

**Multiple choice - one answer (button)**

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>freshman (in your first year of college)</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>2</td>
<td>sophomore (completed one year of college)</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>3</td>
<td>junior</td>
<td>9</td>
<td>11.39%</td>
</tr>
<tr>
<td>4</td>
<td>senior</td>
<td>61</td>
<td>77.22%</td>
</tr>
<tr>
<td>5</td>
<td>post-bac (a bachelor’s degree as your highest degree)</td>
<td>6</td>
<td>7.59%</td>
</tr>
<tr>
<td>6</td>
<td>graduate student</td>
<td>3</td>
<td>3.80%</td>
</tr>
<tr>
<td>7</td>
<td>professional school student (MD, ND, DDS, etc.)</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>8</td>
<td>post-doc</td>
<td>0</td>
<td>0.00%</td>
</tr>
</tbody>
</table>

Total responses (N): 79   Did not respond: 0

**What is your gender?**

**Multiple choice - one answer (button)**

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>female</td>
<td>55</td>
<td>69.62%</td>
</tr>
<tr>
<td>2</td>
<td>male</td>
<td>21</td>
<td>26.58%</td>
</tr>
<tr>
<td>3</td>
<td>prefer not to answer</td>
<td>3</td>
<td>3.80%</td>
</tr>
<tr>
<td>4</td>
<td>Other:</td>
<td>0</td>
<td>0.00%</td>
</tr>
</tbody>
</table>

Total responses (N): 79   Did not respond: 0

**Do you plan on majoring in the life sciences (Biology, Biochemistry, Ecology/Evolution, Genetics, Physiology, etc.) or do you already have a degree in the life sciences?**

**Multiple choice - one answer (button)**

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>yes</td>
<td>74</td>
<td>93.67%</td>
</tr>
<tr>
<td>2</td>
<td>no</td>
<td>5</td>
<td>6.33%</td>
</tr>
</tbody>
</table>

Total responses (N): 79   Did not respond: 0

https://catalyst.uw.edu/webq/results/mpw/254653
Question:
Do you plan on applying to a professional school in medicine (MD, OD, ND, DPM), nursing (RN, BSN), pharmacy, or physical or occupational therapy?

Total responses (N): 79  Did not respond: 0

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>yes</td>
<td>54</td>
<td>68.35%</td>
</tr>
<tr>
<td>2</td>
<td>no</td>
<td>25</td>
<td>31.65%</td>
</tr>
</tbody>
</table>

Response statistics:
- Mean: 1.32
- Median: 1.00
- Mode: 1
- Min/Max: 1/2
- Standard deviation: 0.47

Question:
What is your ethnicity (race)?

Total responses (N): 79  Did not respond: 0

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Asian American or Pacific Islander</td>
<td>40</td>
<td>50.63%</td>
</tr>
<tr>
<td>2</td>
<td>Black or African American</td>
<td>2</td>
<td>2.53%</td>
</tr>
<tr>
<td>3</td>
<td>Hispanic or Latino/Latina</td>
<td>10</td>
<td>12.66%</td>
</tr>
<tr>
<td>4</td>
<td>Native American</td>
<td>1</td>
<td>1.27%</td>
</tr>
<tr>
<td>5</td>
<td>White or Caucasian</td>
<td>19</td>
<td>24.05%</td>
</tr>
<tr>
<td>6</td>
<td>Mixed Race or HAPA</td>
<td>5</td>
<td>6.33%</td>
</tr>
<tr>
<td>7</td>
<td>prefer not to answer</td>
<td>8</td>
<td>10.13%</td>
</tr>
<tr>
<td>8</td>
<td>Other:</td>
<td>3</td>
<td>3.80%</td>
</tr>
</tbody>
</table>

Response statistics:
- Mean: 3.22
- Median: 3.00
- Mode: 1
- Min/Max: 1/8
- Standard deviation: 2.36

Question:
What is your age?

Total responses (N): 79  Did not respond: 0

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>under 18</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>2</td>
<td>18-24</td>
<td>61</td>
<td>77.22%</td>
</tr>
<tr>
<td>3</td>
<td>25-29</td>
<td>10</td>
<td>12.66%</td>
</tr>
<tr>
<td>4</td>
<td>30-39</td>
<td>6</td>
<td>7.59%</td>
</tr>
<tr>
<td>5</td>
<td>older than 40</td>
<td>2</td>
<td>2.53%</td>
</tr>
</tbody>
</table>

Response statistics:
- Mean: 2.35
- Median: 2.00
- Mode: 2
- Min/Max: 2/5
- Standard deviation: 0.73

Question:
Is English your first language?

Total responses (N): 79  Did not respond: 0

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>yes</td>
<td>50</td>
<td>63.29%</td>
</tr>
<tr>
<td>2</td>
<td>no</td>
<td>29</td>
<td>36.71%</td>
</tr>
</tbody>
</table>

Response statistics:
- Mean: 1.37
- Median: 1.00
- Mode: 1
- Min/Max: 1/2
- Standard deviation: 0.49

Question:
Was English the primary language of instruction in your high school?

Response statistics:
- Mean: 1.37
- Median: 1.00
- Mode: 1
- Min/Max: 1/2
- Standard deviation: 0.49

https://catalyst.uw.edu/webq/results/mpw/254653
<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>yes</td>
<td>71</td>
<td>89.87%</td>
</tr>
<tr>
<td>2</td>
<td>no</td>
<td>8</td>
<td>10.13%</td>
</tr>
</tbody>
</table>

**Mean:** 1.10  
**Median:** 1.00  
**Mode:** 1  
**Min/Max:** 1/2  
**Standard deviation:** 0.30

**Question:** What is your student number, name, or the unique identifier your instructor gave you?

**Short response statistics:**

- **Mean:** --  
- **Median:** --  
- **Mode:** --  
- **Min/Max:** --  
- **Standard deviation:** --

**Score statistics:**

- **Point value:** --  
- **Mean:** 0.00  
- **Median:** 0.00  
- **Mode:** 0  
- **Min/Max:** 0/0  
- **Standard deviation:** 0.00

Questions or comments? Contact us or email catalysthelp@uw.edu

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University of Washington

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https://catalyst.uw.edu/webq/results/mpw/254653