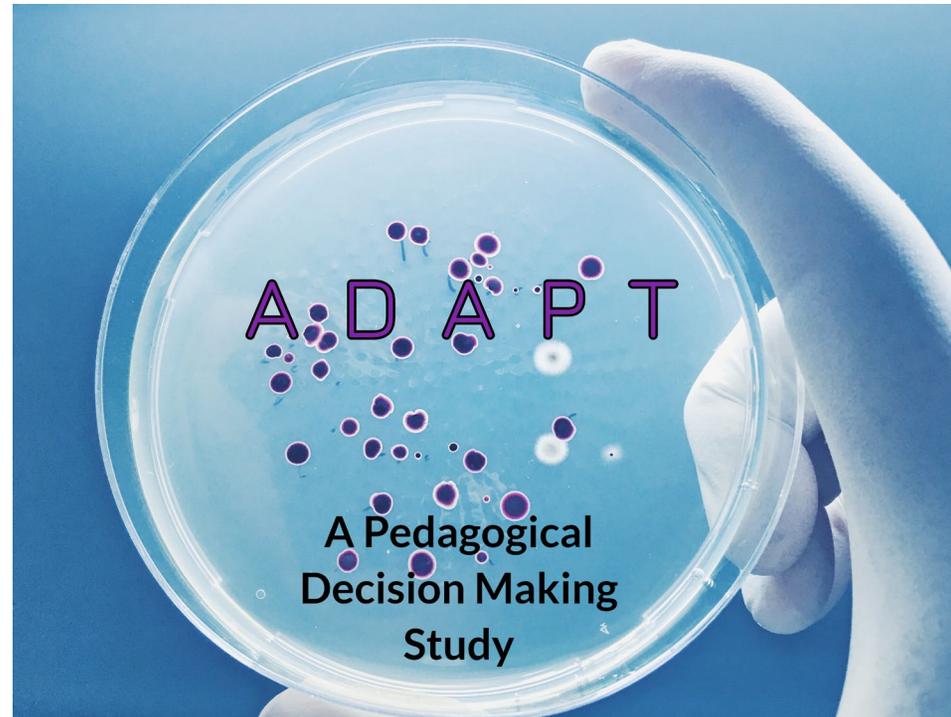


# The Utility-Value Intervention Resource Manual



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## Assignment Templates

**Overview:** In this document, you will find four two-page assignment templates that can be adapted for your courses. Specifically, these assignments are geared toward cell and molecular biology, but can be modified to fit other biology classes as well.

The assignments in this document are the basic version of the utility-value intervention that provides students with the assignment objective, sample questions, sample applications of these concepts to real-world scenarios, and guidance on structuring the written work.

Overall, the task asks the students to 1) devise a question related to course content, 2) answer this question using scientific knowledge, and 3) finally describe how this concept plays a role in their own life.

## Writing Assignment #1

**Objective:** Writing about scientific principles and phenomena is an increasingly important skill in the 21<sup>st</sup> century. This assignment is designed to help you understand a major concept covered in this unit while also helping you develop your science writing skills. One key to effective science writing is explaining how science can be used in everyday life. You'll do this in a 500-600 word paper. You should:

<b>1) Formulate and answer a question</b>	<b>Sample questions</b>
Select a concept that was covered in lecture and formulate a question. Use this question as the title of your essay.	<ul style="list-style-type: none"> <li>• What are isotopes, and what happens during radioactive decay?</li> <li>• What are the properties of amino groups, and why are they biologically important?</li> </ul>
<b>2) Explain how this applies to your life</b>	<b>Examples of applications</b>
Write a 500-600 word essay <b>answering this question</b> , and discuss <b>how the information could be useful to you in your own life</b> . Be sure to include some concrete information that was covered in this unit, explaining <i>why</i> the information is relevant to your life and useful for you. Be sure to explain <i>how</i> the information applies to you personally and give examples.	<ul style="list-style-type: none"> <li>• Radioisotopes are unstable isotopes that emit energy and subatomic particles. Radioisotopes are important <b>in your own life</b> because they are commonly used in household smoke detectors.</li> <li>• Some neurotransmitters, including norepinephrine, histamine, and serotonin, are amines. <b>In your own life</b>, you may benefit from synthetic amines if you take decongestants to relieve cold or allergy symptoms.</li> <li>• Steroids play important roles in membrane structure and cell signaling. <b>In your own life</b>, your doctor may prescribe a steroid treatment to reduce the swelling associated with an injury or other inflammatory ailment.</li> </ul>

### 3) Structure your essay as suggested below

- State your question in the title.
- **1<sup>st</sup> section:** Give an overview of the answer to your question.
- **2<sup>nd</sup> section:** Provide the scientific details of the answer to your question. Be sure to select the relevant information from class notes and the textbook.
- **3<sup>rd</sup> section:** Make it personal. Explain why this information is relevant to your life or useful for you and give examples.

Since you will be writing about science from a personal perspective, you can use personal pronouns (I, we, you, etc.).

This assignment requires that you formulate your own question and approach, so do not use the sample questions or specific examples provided above for your paper. Great ways to start questions that will help you think deeply in this class include: How do/does \_\_\_\_\_? Why is/are \_\_\_\_\_? What is the difference between \_\_\_\_\_?

For this assignment, work independently and do the best you can; you'll receive feedback on your work after it's turned in.

**Formatting** Your paper should be 500-600 words, double-spaced and saved as a Word document (.doc or docx, no PDFs).

**File Name** To allow for anonymous grading, please only include your student ID number (do not put your name in the document itself).

**Deadline and Grading** Upload your document by the deadline: 11:59 PM, **Thursday, September 6**, to the **Writing Assignment #1** folder. This assignment is worth 10 points and will be graded on the following: the quality of the question related to class content (chapters 2-5), the quality of the scientific reasoning used to answer the question, and organization of the paper.

**NOTE: Failure to successfully upload the correct document will result in a grade of zero for this assignment.**

## Writing Assignment #2

**Objective:** Writing about scientific principles and phenomena is an increasingly important skill in the 21<sup>st</sup> century. This assignment is designed to help you understand a major concept covered in this class while also helping you develop your science writing skills. One key to effective science writing is explaining how science can be used in everyday life. You'll do this in a 500-600 word paper. You should:

<b>1) Formulate and answer a question</b>	<b>Sample questions</b>
Select a concept that was covered in lecture and formulate a question. Use this question as the title of your essay.	<ul style="list-style-type: none"> <li>• What are some of the functions of membrane proteins?</li> <li>• Why is the movement of water across cell membranes crucial to living cells?</li> </ul>
<b>2) Explain how this applies to your life</b>	<b>Examples of applications</b>
Write a 500-600 word essay <b>answering this question</b> , and discuss <b>how the information could be useful to you in your own life</b> . Be sure to include some concrete information that was covered in this unit, explaining why the information is relevant to your life and useful for you. Be sure to explain how the information applies to you personally and give examples.	<ul style="list-style-type: none"> <li>• ABO blood groups are determined by differences in the carbohydrate portion of glycoproteins on the surface of red blood cells. <b>In your own life</b>, knowing your blood type may help you assess your risk of developing certain cancers and other health conditions.</li> <li>• In plants, osmosis facilitates the absorption of water from the soil and contributes to turgidity. <b>In your own life</b>, you can extend the shelf life of your produce by immersing it in water for a few seconds to increase the turgor pressure and reduce wilting.</li> <li>• Some enzymes break down large molecules into smaller components, which is important to the digestive process. <b>In your own life</b>, you can use the lipases found in some laundry detergents to remove greasy stains from your clothing.</li> </ul>

### 3) Structure your essay as suggested below

- State your question in the title.
- **1<sup>st</sup> section:** Give an overview of the answer to your question.
- **2<sup>nd</sup> section:** Provide the scientific details of the answer to your question. Be sure to select the relevant information from class notes and the textbook.
- **3<sup>rd</sup> section:** Make it personal. Explain why this information is relevant to your life or useful for you and give examples.

Since you will be writing about science from a personal perspective, you can use personal pronouns (I, we, you, etc.).

This assignment requires that you formulate your own question and approach, so do not use the sample questions or specific examples provided above for your paper. Great ways to start questions that will help you think deeply in this class include: How do/does \_\_\_\_\_? Why is/are \_\_\_\_\_? What is the difference between \_\_\_\_\_?

For this assignment, work independently and do the best you can; you'll receive feedback on your work after it's turned in.

**Formatting** Your paper should be 500-600 words, double-spaced and saved as a Word document (.doc or docx, no PDFs).

**File Name** To allow for anonymous grading, please only include your student ID number (do not put your name in the document itself).

**Deadline and Grading** Upload your document by the deadline: 11:59 PM, **Thursday, October 6**, to the **Writing Assignment #2** folder. This assignment is worth 10 points and will be graded on the following: the quality of the question related to class content (chapters 6-10, the quality of the scientific reasoning used to answer the question, and organization of the paper.

**NOTE: Failure to successfully upload the correct document will result in a grade of zero for this assignment.**

## Writing Assignment #3

**Objective:** Writing about scientific principles and phenomena is an increasingly important skill in the 21<sup>st</sup> century. This assignment is designed to help you understand a major concept covered in class while also helping you develop your science writing skills. One key to effective science writing is explaining how science can be used in everyday life. You'll do this in a 500-600 word paper. You should:

1) Formulate and answer a question	Sample questions
Select a concept that was covered in lecture and formulate a question. Use this question as the title of your essay.	<ul style="list-style-type: none"> <li>• What are the characteristics of archaea and why were they placed in a separate domain from bacteria?</li> <li>• How do hyphae contribute to nutrient absorption in fungi?</li> </ul>

2) Explain how this applies to your life	Examples of applications
Write a 500-600 word essay <b>answering this question</b> , and discuss <b>how the information could be useful to you in your own life</b> . Be sure to include some concrete information that was covered in this unit, explaining <i>why</i> the information is relevant to your life and useful for you. Be sure to explain <i>how</i> the information applies to you personally and give examples.	<ul style="list-style-type: none"> <li>• Methanogens are microscopic archaea that produce methane as a byproduct of their metabolism. The methanogens that live in your gut are beneficial <b>in your own life</b> because they assist with the digestion of polysaccharides.</li> <li>• Many fungi produce valuable compounds that are used to make antibiotics and other medications. <b>In your own life</b>, you can use antibiotics to recover from a bacterial infection like strep throat or an impacted tooth.</li> <li>• Ecologists and policy makers use population dynamics for setting catch limits and preventing overfishing of vulnerable aquatic species. You can use this information <b>in your own life</b> to make informed choices about the seafood that you buy.</li> </ul>

### 3) Structure your essay as suggested below

- State your question in the title.
- **1<sup>st</sup> section:** Give an overview of the answer to your question.
- **2<sup>nd</sup> section:** Provide the scientific details of the answer to your question. Be sure to select the relevant information from class notes and the textbook.
- **3<sup>rd</sup> section:** Make it personal. Explain why this information is relevant to your life or useful for you and give examples.

Since you will be writing about science from a personal perspective, you can use personal pronouns (I, we, you, etc.).

This assignment requires that you formulate your own question and approach, so do not use the sample questions or specific examples provided above for your paper. Great ways to start questions that will help you think deeply in this class include: How do/does \_\_\_\_\_? Why is/are \_\_\_\_\_? What is the difference between \_\_\_\_\_?

For this assignment, work independently and do the best you can; you'll receive feedback on your work after it's turned in.

**Formatting** Your paper should be 500-600 words, double-spaced and saved as a Word document (.doc or docx, no PDFs).

**File Name** To allow for anonymous grading, please only include your student ID number (do not put your name in the document itself).

**Deadline and Grading** Upload your document by the deadline: 11:59 PM, **Monday, November 1**, to the **Writing Assignment #3** folder This assignment is worth 10 points and will be graded on the following: the quality of the question related to class content (chapters 28, 29, and 31), the quality of the scientific reasoning used to answer the question, and organization of the paper.

**NOTE: Failure to successfully upload the correct document will result in a grade of zero for this assignment.**

Writing Assignment #4

**Objective:** Writing about scientific principles and phenomena is an increasingly important skill in the 21<sup>st</sup> century. This assignment is designed to help you understand a major concept covered in this class while also helping you develop your science writing skills. One key to effective science writing is explaining how science can be used in everyday life. You'll do this in a 500-600 word paper. You should:

<p><b>1) Formulate and answer a question</b></p>	<p><b>Sample questions</b></p>
<p>Select a concept that was covered in lecture and formulate a question. Use this question as the title of your essay.</p>	<ul style="list-style-type: none"> <li>• What are the general characteristics of annelids and how have they adapted for different lifestyles?</li> <li>• What are the structural differences between sponges and cnidarians?</li> </ul>
<p><b>2) Explain how this applies to your life</b></p>	<p><b>Examples of applications</b></p>
<p>Write a 500-600 word essay <b>answering this question</b>, and discuss <b>how the information could be useful to you in your own life</b>. Be sure to include some concrete information that was covered in this unit, explaining why the information is relevant to your life and useful for you. Be sure to explain how the information applies to you personally and give examples.</p>	<ul style="list-style-type: none"> <li>• Earthworms improve the quality of soil by speeding up the decomposition of organic matter. <b>In your own life</b>, you can use earthworms in composting to recycle your food scraps.</li> <li>• Sponges and cnidarians both produce defensive compounds that can be used in medical and cosmetic applications. You benefit from the anti-inflammatory compounds of corals <b>in your own life</b> if you use certain beauty products or asthma medications.</li> <li>• Insects pollinate many angiosperm species that humans depend on for food. <b>In your own life</b>, you benefit from the work of pollinators each time you consume coffee or chocolate.</li> </ul>

### 3) Structure your essay as suggested below

- State your question in the title.
- **1<sup>st</sup> section:** Give an overview of the answer to your question.
- **2<sup>nd</sup> section:** Provide the scientific details of the answer to your question. Be sure to select the relevant information from class notes and the textbook.
- **3<sup>rd</sup> section:** Make it personal. Explain why this information is relevant to your life or useful for you and give examples.

Since you will be writing about science from a personal perspective, you can use personal pronouns (I, we, you, etc.).

This assignment requires that you formulate your own question and approach, so do not use the sample questions or specific examples provided above for your paper. Great ways to start questions that will help you think deeply in this class include: How do/does \_\_\_\_\_? Why is/are \_\_\_\_\_? What is the difference between \_\_\_\_\_?

For this assignment, work independently and do the best you can; you'll receive feedback on your work after it's turned in.

**Formatting** Your paper should be 500-600 words, double-spaced and saved as a Word document (.doc or docx, no PDFs).

**File Name** To allow for anonymous grading, please only include your student ID number (do not put your name in the document itself).

**Deadline and Grading** Upload your document by the deadline: 11:59 PM, **Wednesday, December 12**, to the **Writing Assignment #4** folder This assignment is worth 10 points and will be graded on the following: the quality of the question related to class content, the quality of the scientific reasoning used to answer the question, and organization of the paper.

**NOTE: Failure to successfully upload the correct document will result in a grade of zero for this assignment.**

## Grading Rubric

**Overview:** Below are two one-page grading rubric options that can be used to quickly assess student performance on each writing assignment. The first rubric is designed for a 10-point assignment graded for content, writing quality, proper formatting, and relevance of the connections they make to their own life, but it can be modified for any point scheme or grading for biology content only. The second rubric shows another option to grade on a check, minus, plus system. Some faculty may also choose to modify this grading scheme to be a pass/fail format instead.

Assignment 1	Use these categories to reduce points			“Default” Category	Use to increase points
	Unacceptable Quality	Poor - Incomplete or multiple significant mistakes	Needs improvement - One significant or multiple minor mistakes	Good – assignment completed appropriately. Only a small number of minor mistakes.	Excellent Quality
Formulate a question	<b>0 points</b> No clear question.		<b>0.5 points</b> Question not stated in title, but it is pretty clear that student is answering an implied clear and specific question.	<b>1 point</b> Student explicitly states a question as the title of the essay.	
Correct biology content	<b>0 points</b> No correct biology content.	<b>1.5 points</b> Multiple instances of incorrect biology content.	<b>2-2.5 points</b> One significant error or missing significant relevant details.	<b>3-3.5 points</b> Solid essay. Generally correct biology content. May be missing small details or contain slightly incorrect details.	<b>4 points</b> Essay illustrates excellent knowledge of complex biology content.
Structure and quality of writing	<b>0 points</b> Unreadable due to major composition errors.	<b>1 point</b> 3+ significant composition errors that make the essay difficult to understand.	<b>1.5 points</b> The essay contains 1 or 2 significant errors in composition that make the essay difficult to understand.	<b>2-2.5 points</b> Composition is generally well executed. May contain minor errors that don't interfere with readability.	
Formatting	<b>0 points</b> Essay is not .doc/.docx and <500 words.		<b>0.5 points</b> Student missed either .doc/.docx or 500+ word requirement.	<b>1 point</b> Essay is .doc/.docx and 500+ words.	
Relevance and overall impression	<b>0 points</b> Student doesn't connect material to anybody.		<b>0.5 points</b> Student attempts to connect material to somebody (e.g., people in general)	<b>1 point</b> Student connects material to the self or someone they know.	<b>1.5 points</b> Above and beyond a “Good” response. Either (a) made detailed connection or (b) made more than one relevance connection.

## Check, Plus, Minus Grading Rubric

*Overview:* This simplified version of the one-page grading rubric can be used to quickly assess student performance on each writing assignment. This particular rubric is designed to gauge student work on all essay components, but faculty may choose to grade only for biology content for instance.

Students are assessed on not just on the biology content of their paper, but also on their writing quality, proper formatting, and relevance of the connections they make to their own life.

	Unacceptable Quality (-)	Needs improvement - One significant or multiple minor mistakes (√)	Excellent Quality (+)
Assignment 1	<p><b>0 points</b> No submission or submission was entirely off-topic</p>	<p><b>1 point</b> Essay meets the minimum expectations of 1) word-count, 2) student-posed question about a biological topic, 3) clarity and accuracy of content presented, and 4) relevance of personal application.</p>	<p><b>2 points</b> Essay meets expectations of 1) word-count, 2) student-posed question about a biological topic, 3) clarity and accuracy of content presented, and 4) relevance of personal application.</p>

## **Grading Tips and Tricks for the Utility-Value writing Assignment**

**Overview:** While grading can be time consuming, it is an important activity that helps your students understand their performance in class and for you to gauge how well students are grasping content. You likely already have exams and quizzes that evaluate student learning, so the UVI does not need to account for a major portion of student grades (suggested 1%-3%). With this in mind, below are several options faculty have devised to ease the burden of grading a new assignment like the UVI. Students will still get the benefit of delving deeper into biological content and finding personal relevance to sometimes abstract concepts; while you and/or your teaching assistants won't be overwhelmed with grading writing assignments. These options will help to speed up the grading process while still giving students enough feedback and motivation to continue turning in the assignment (Walvoord, B. & V. Anderson, 1998).

### **Grading for Science Content Only**

You are likely most concerned with whether your students are grasping the scientific content you cover in the course. Based on this, you can choose to grade the UVI solely on the first portion of the assignment.

How to do it:

- Students complete the assignment in its entirety posing a question about a biological topic, correctly answering their question, and describing the personal significance of this content to their own lives.
- Evaluation of the student's work is done only on 1) did they pose a relevant question and 2) did they answer it using proper biological content.
- You do not need to grade for proper formatting, grammar, or the personal relevance section so this cuts the amount of grading in half.

### **Minus, Check, Plus Grading**

This is a method for grading for completeness of a UVI assignment. Using this method, you only need to quickly skim each assignment to gauge whether the major components are included.

How to do it:

- you will use the (-) symbol to signify unsatisfactory work or a score of 0,
- you will use the (✓) mark to denote satisfactory work or a score of 1,
- finally, use the (+) symbol to signify exemplary work or a score of 2.

### **Pass/Fail Grading**

The grading rubric shared with you can also be modified to follow a pass/fail or satisfactory/unsatisfactory grading scheme. This is useful in large classes or if you do not have teaching assistants.

### **Random Sample Grading**

For very large classes, you might consider selecting at-random a set number of essays to grade. This makes implementing the UVI even in the largest of lectures manageable for you and/or your TAs. This strategy is particularly likely to be combined with pass/fail minus, check, plus grading schemes.

How to do it:

- Inform students that for each of the three UVI assignments, you will be randomly drawing a pool of essays that you will grade. Aim for 33% of your class size.
- Use the grading rubric to score just these assignments.
- What do I do for those students whose assignment is not drawn? You have options here, and make sure to be transparent with students. One option is to leave their grade empty until an assignment they turn in is sampled. The grade on the sampled assignment becomes their overall writing grade. Alternatively, you can issue a grade of credit (if using credit/no credit) for those not sampled. With this later strategy, you may consider skimming through all essays at face value to ensure they at least look to be on topic, but without further reading.

### **Peer-Review Grading Option**

In mid-sized classes, having students review each other's work can cut down considerably on your time commitment for grading and had the added benefit of allowing students to explore other perspectives.

How to do it:

- For each of the three assignments, have students exchange their completed essay with another student.
- You can help ensure this is a little more random (so friends don't grade each other's work) by having them exchange across rows. If doing this online, most LMSs have peer grading options that create random assignment or blind reviews.
- Provide them a grading rubric and allow 10-15 minutes of class time for them to grade.
- Alternatively, this can easily be reformatted for online implementation where students upload their completed rubric to your LMS.

## Sample Student Essays

**Overview:** Below are four sample student essays from recent introductory biology classes. These essays provide examples of the type of work students are expected to submit when using the essay format template for the assignment. In these examples, students:

1. title their essay using the question they intend to answer,
2. describe the biological content related to their question, and
3. connect this information to some aspect of their personal life.

You might also use these essays as examples for your students to set clear expectations of the work they will submit for the scientific writing assignments during the semester.

## Sample 1

### **What is the importance of having 46 chromosomes in a human being?**

Chromosomes are structures made up of DNA and small proteins called histones. These chromosomes hold the genetic information for all organism in the form of genes and they reside in the nuclei of all our cells. These, along with a process called methylation, play a vital role in the developmental trajectory of an organism. Chromosomes and their function were uncovered by a series of researchers beginning with Gregor Mendel. In 1856, Mendel began a series of experiments using primarily pea plants to understand the transmission of seven core traits (i.e. plant height, seed tint, flower location, etc.). Though his work is now viewed as seminal in the foundation of genetics today, his work on the inheritance of traits was largely ignored in 1865. However, in the early 1900s, Walter Sutton and Theodor Boveri separately used the laws of Mendelian Inheritance to understand the fundamentals of what exactly was transmitting inherited traits through generations. Sutton's contribution, using his work with grasshoppers, was that these chromosomes must come in pairs from the maternal and paternal sides. Boveri's contribution, using his work on sea urchins, was that the genetic information from both parents must come in equal amounts. Their work, along with the countless contributions of others using different model organisms, concluded in the development of the Boveri-Sutton Chromosome Theory in 1915 which became a unifying theory to help explain Mendel's principles from 50 years before. This theory states that, "Mendelian genes have specific loci (positions) along chromosomes, and it is the chromosomes that undergo segregation and independent assortment" (Campbell Biology 296). Before diving into the importance of each of these chromosomes carrying traits through the generations, it is important to discuss the aspects we have come to understand regarding these structures over the decades since Sutton and Boveri's work.

Chromosomes have three specific aspects that all play a crucial role in understanding the function of a chromosome with an organism. They are the: gene, locus, and genome. To begin

with, a gene contains the information that codes for often very specific traits that can be passed to offspring. The exact location of this gene on the chromosome is called the locus. Looking at the bigger picture now, a genome is the collection of all these genes, in their specific loci on a chromosome contained within our cell's DNA. While the vast majority of our cells carry with them 46 chromosomes within their DNA, our gametes or egg and sperm cells, have only 23 chromosomes. This occurs through the process of meiosis. When an egg is fertilized by a sperm cell, each of these 23 chromosomes within the egg and sperm must be present and properly align with their matching pair to achieve proper embryonic development as well as development stretching long past the prenatal environment. This is how humans arrive at the full count of 46 chromosomes

It is important to note, that there are copious ways in which this process can go wrong; for instance, if there are for some reason too many or too few chromosomes being carried by the egg or sperm cells or they do not properly combine at fertilization. If a zygote is missing one of its autosomal chromosomes, this generally results in an inviable embryo that does not continue to develop. This usually occurs because of a mistake during meiosis that created one of the gametes. On the other side of issues that can arise in our chromosomes is when we have too many. While there are a variety of instances where fertilization results in more than two copies of a chromosome, I will talk about a specific example here. A common chromosomal abnormality results from an extra copy of a chromosome being added (again, usually through an error in meiosis) and is called trisomy. Depending on which chromosome is affected, the embryo will either be non-viable or it may persist to birth and beyond with varying degrees of phenotypic disruption. The most common form of trisomy that results in viable embryos is when a third copy of chromosome 21 is added (Trisomy 21) which results in Down Syndrome.

Down syndrome is extremely important to me, not only because it is the most common chromosomal abnormality in humans, but because my mother works with special needs children,

many of whom have Down Syndrome. My mother frequently talks about the many struggles these children face but also about how, in so many ways, they are just like other children. Many of their struggles sadly come from social interactions with peers and even adults in their lives that treat them as though there is something wrong about them because of their differences. I find it extraordinarily unfair that they are treated so poorly because of something they have no control over.

According to the Centers for Disease Control and Prevention, Down syndrome occurs in approximately 1 in every 700 births and results in several prominent characteristics such as a flattened facial profile, almond-shaped eyes, smaller head with smaller features (ears, nose), and often shorter stature (CDC.org). These physical characteristics cause individuals with Down Syndrome often stand out in their peer groups which can lead to the unfair treatment and bullying my mother often reports they face. Not only are there noticeable physical differences in those with Down Syndrome, but many also have cognitive difficulties such as delayed language/speech, learning difficulties, and impulsivity problems. It takes patience and special care, but as my mother can attest to, these individuals can thrive when those around them have the knowledge and understanding to act with care. A testament to this is that in 1960 the average lifespan for those with Down Syndrome was only 10 years of age. By 2007, their life expectancy skyrocketed to 47 (CDC.org). Recognizing a mis-copied chromosome can result in so many different characteristics that open a person up to a host of social and personal struggles is heartbreaking. However, with greater understanding comes greater ability to care and make sure these individuals have the resources they need to thrive.

#### Works Cited

Centers for Disease Control and Prevention Data and Statistics on Down Syndrome | CDC 2019  
Reece, Jane B., et al. Campbell Biology. Eleventh edition. Boston: Pearson, 2017.

## Sample 2

### **What is natural selection and how does it affect the modern homo sapiens?**

In 1859, Charles Darwin published *On the Origin of Species* which became the foundational work laying out his principles for understanding the process of Natural Selection. In essence, this theory states that in a given population of a species, there are an enormous variety of traits and characteristics in each of the individuals making up that population. If an individual possesses a particular trait that is somehow advantageous for their survival, for example, a thicker fur coat in the Arctic, then that individual is more likely to survive. If that individual is more likely to survive then it reasons it is also more likely to have the chance at successful reproduction, thus passing this advantageous trait to the next generation. The opposite is true for unfavorable traits, for example a fur coat that is slow to grow in in the Arctic. Over time and many generations, these unfavorable traits that do not benefit survival of individuals, are weeded out of the population. The development of these traits can occur randomly through genetic mutations, the influence of environmental shifts, or genetic recombination through reproduction. No species is exempt from natural selection and modern humans are the result of countless generations adaptation.

A remarkable example of natural selection occurring on a much shorter timespan compared to humans is the story of the Peppered Moth of Britain and Ireland. This moth is most commonly a pale white color covered with a ‘peppering’ of black spots. This is excellent camouflage for them during the day when they rest on lighter colored tree trunks. Within this species however, there is a genetic variation that sometimes results in an almost entirely dark colored moth termed ‘melanic’. When resting during the day on light colored tree trunks, these melanic moths stand out clearly to passing birds, thus this genetic variation is not at all favorable to their survival. As Darwin would predict, these dark colored moths are quite infrequent. However, an interesting thing happened in urban centers in Britain during the mid-1800s. Coal fired heating in homes and the rise of industrialization in city centers left soot covering many of the surfaces in town including trees,

walls, and rocks. The once well-camouflaged light Peppered Moth now stood out and made easy targets for predators, while the melanic-variant moths hid safely against the darkened surfaces. By 1895, the melanic moths now made up 98% of the Peppered Moth population in the city of Manchester indicating this genetic variant was now very favorable for survival, at least in urban centers. Once regulations were put in place to help reduce the amount of pollution in cities, natural selection once again led to the decline of the melanic-variant moths as the surfaces they hide on became cleaner and lighter in color. The example provides such a great demonstration of natural selection at work that the Peppered Moth is sometimes called Darwin's Moth,

A greater understanding of natural selection has benefitted me personally, aside from the millions of years of this process that have led to the traits I carry today. I enjoy gardening and each year I like to save seeds from the plants I grew all season to have for next year. What natural selection has taught me is that it is very important to harvest seeds only from the plants that were most successful during the growing season; which ones produced the most fruit, which ones tolerated cold snaps, which had the most colorful blooms, etc. In this way, I can 'help along' natural selection by weeding out the plants that did not fair well in the environment and encourage the strongest ones. Over consecutive years, I should have seeds that are well adapted to the microclimate of my backyard! On the flip side of this of course is natural selection has also been hard at work on the weeds that inhabit my garden and they have to their advantage many, many more decades of adaptation under their belts. I have found that they are incredibly resilient to all that nature (or I) throw at them.

### **Sample 3**

#### **What are sponges and why are they so important?**

In the kingdom Animalia, sponges are perhaps the simplest of animals. They are classified in the phylum Porifera (meaning pore-filled) and contains three classes: Hexactinellida, Demospongia, and the Calcarea. Sponges have an incredibly long fossil record of 600-700 million years and it indicates they diverged from other animals very early on, making them a basal animal. There are approximately 5,500 living species on sponge today of which only 150 are freshwater.

Sponges contain a few different types of cells, but these cells don't organize themselves into tissues or functional units of the same types of cells (like muscles or skin). Sponges also do not have a nervous system for this same reason. Even though they are considered animals, sponges are sessile or immobile and this is one reason many people don't recognized them as belonging to the animal kingdom. Because they cannot move to track down their food, sponges rely on the surrounding water currents to bring food to them. Their pore-filled bodies allow water to pass through them like a filter and cells lining the inner chamber of their body called the spongocel collect tiny food particles using flagella. The structure of a sponge is provided by a skeleton made up of collagen and spicules. Spicules are in turn made of either calcium carbonate, silica, or spongin (collagen). This skeleton is usually separated into two layers with an area between the layers called the mesohyl. This area has a jelly-like substance in it made mostly of collagen. Because both the inner and outer portions of the sponge body are in contact with water, this is where oxygen and carbon dioxide are exchanges and was removal also occurs through the process of diffusion.

Although they are one of the stranger animals in the world, sponges are surprisingly relevant to my own life and others' lives as well. My skin is very sensitive and many body washes and exfoliators are too harsh. For thousands of years humans have been harvesting sponges to use for bathing and they are still used for this purpose today! I have purchased these sponges even at a

regular grocery store before and they are much gentler than the plastic body scrubbers that are also sold. Through my research I also found out that sponges contain certain enzymes and minerals that make them hypoallergenic, and also stop bacteria and mold from growing on them!

Besides just skin care, there is also research showing that sea sponges contain many different compounds that have antibiotic, anti-inflammatory and antiviral properties. There are even some sponges that contain cribrastatin which is shown to be able to kill cancer cells. Other animals have also been seen to use sponges to their advantage. In 1997, dolphins in Shark Bay in Australia were reported attaching sea sponges to their bottle-noses and using the sponge as a glove to safely dig in the sand on the sea floor. This must be an effective technique because in 2007, mother dolphins were recorded teaching this behavior to their babies!

As you can see, sponges have a huge number of different uses for humans and other animals. Many people think that sponges are like a coral or a sea plant, but really they are part of the animal kingdom and have far-reaching benefits for other species. Because they are immobile and rely on the surrounding water to bring them nutrient, it is important that ocean pollution be cleaned up as this can have devastating impacts on these animals.

### Sample 4 Essay

#### **What are fungi and how do they benefit humans?**

Some people view fungi as just another pizza topping while others are disgusted by the idea that anyone would choose to eat such a thing. Fungi are sometimes mistaken as plants also by their fans and their critics, however, fungi actually have their own kingdom beside the animal and plant kingdoms. Fungi are extremely important in our environment and are beneficial to humans on a daily basis. A few of these important roles that fungi fill include recycling organic material, food consumption, and even medicine.

The fungi kingdom is made up of eukaryotic organisms that range in size from microscopic molds to those mushrooms we might eat. This is an incredibly large kingdom and has over 120,000 identifies species, but some mycologist (people who study fungi) estimate there might be well over 2 million species. There are not many exhibits of fungi in the fossil record because the tissues they are made of just do not hold up well and degrade quickly. Despite this, there are a few examples of prehistoric fungi including one of the oldest dating back 2.4 billion years. Needless to say, fungi have been around awhile. With their long history and huge diversity, fungi come in many shapes and sizes such as single-celled organisms (some yeasts), slime molds (myxomycetes), and mushrooms which are the fruiting bodies of some fungi. In our everyday lives, this kingdom is incredibly important to humans I several ways. I will detail a few examples here to show how influential fungi are for us.

To begin with, fungi are very good at decomposing and recycling things in the environment. Fungi are heterotrophs like animals meaning they need to get their energy from absorbing nutrients around them instead of through the sun like plants. Fungi often feed on carbon and nitrogen-based materials and break them down into compounds that plants and animals can now reuse. By decomposing plant and animal tissues, fungi help recycle nutrients back into the environment. If it weren't for this action, dead plants and animals would just continue to pile up and with them, all the nutrients they contain. Some types of fungi also form a mutualistic symbiotic

relationship with algae or cyanobacteria to create a lichen. Lichens are able to break down inorganic materials like stones makes even more minerals and nutrients available to the other kingdoms. We as humans, and the whole world more generally, need fungi to help turn materials back into forms we can use.

For food consumption in humans, fungi again are very important even if you don't eat mushrooms. For one, humans use a fungus in the form of yeast to make all kinds of foods from breads to beer. Yeast, during fermentation, consumes sugar from its surroundings and produces alcohol and carbon dioxide as a bi-product. The carbon dioxide is what makes bread rise and become fluffy. In my own life, I used to back sourdough bread with my father. While many bread recipes require that you add baker's yeast (still a fungus), sourdough is made by mixing flour and water together and basically waiting for the yeast that exists in the air around us to colonize the flour and water mixture and begin reproducing. This is why sourdough can taste different depending on where it is made! Another type of fungus in the form of a mold is used to brew soy sauce. Still another is used to give blue cheese its noticeable blue patches. Mushrooms are probably the most recognizable of the fungi kingdom, and are eaten around the world though some are deadly and other cause sever hallucinations.

Probably the most important function the fungi kingdom serves, though is the production of different medicines. Fungi produce the strong antibiotic penicillin. The fungi *penicillium notatum* works by causing surrounding water to rush into the cells of some kinds of bacteria and results in the cell walls bursting. Penicillin inhibits the linkage of bacteria and peptidoglycan. Overall, penicillin and other antibiotics made from fungi have saved countless human lives and are partly credited with the great increase in life expectancy of humans in the 1900s. Fungi have also been used pharmaceutically to lower cholesterol and suppress the immune system after an organ transplant has occurred. Other types of fungi have also been used to reduce high blood pressure, high cholesterol, and to stop bleeding during childbirth. More recently, some researchers have even

looked at using a type of fungus that causes strong hallucinations (psilocybin) to treat mental disorders like depression and OCD. As you can see, even now researchers are discovering new ways to use fungi to improve human lives!

In conclusion, the kingdom of fungi is widely diverse and includes many eukaryotic organisms from single-celled yeast and slime molds all the way to large mushrooms and huge systems of interconnected 'roots' or mycelium that help a fungus feed and break down materials for the rest of us. This kingdom has important benefits to humans that seems to touch on every part of our lives.

## Sample Biology Syllabus Description and Grading Scheme

**Overview:** Below is a sample syllabus integration demonstrating how the UVI can be included in a course schedule. You can select the percentage the assignment is worth for your course, but it is important that it is worth course credit and not just extra credit. This helps ensure students are motivated to complete them. We suggest anywhere between 1%-3% though it can be worth more as in the example below.

## Biology 204 Fall 202 Syllabus

**Exams (80%):** There will be four in-class exams with approximately 40 questions each emphasizing material most recently covered in class. Some questions may also test cumulative knowledge of key concepts that were included on previous exams.

**Homework (14%):** Homework assignments are designed to help you prepare for class. You will read an article or watch a video and answer a few questions about the content (with unlimited attempts) prior to class where this material will be covered. The system does not allow late submissions so be sure to complete these ahead of time.

**Writing Assignments (6%):** There will be 3 writing assignments. The writing assignments will be due before class starts on the dates described in the course schedule. These writing assignments are designed to deepen your understanding and comprehension of some of the major concepts in the course while also developing your ability to communicate scientific ideas to broad audiences in your own words.

### Grading:

<b>Exam I material</b>	<b>100 points</b>
<b>Exam II material</b>	<b>100 points</b>
<b>Exam III material</b>	<b>100 points</b>
<b>Exam IV material</b>	<b>100 points</b>
<b>Homework - 7 Assignments</b>	<b>70 points</b>
<b>Writing Assignments – 3 Assignments</b>	<b>30 points</b>

Your grade will be based on a percentage basis calculated by adding Exams Scores + Homework Assignment + Writing Assignment Scores / 500 points. Any Extra Credit given during the course will be "extra credit". For example, if you receive perfect scores on all Exams, Homework and Writing Assignments, and extra credit opportunities - your grade can be calculated in the following way: 400 points (four Exams) + 70 points (7 Homework Assignments) + 30 points (Writing Assignments) + 40 points (approximate Extra Credit assignments) / 500 Points = 540 points / 500 points = 108% = "A" grade (assuming 40 Extra Credit points will be provided during the semester).

## UVI Implementation Checklist



Must be integrated in the syllabus as a writing assignment



Must be at least three assignments spread out over the term



Must count for course credit (between 1%-3%), not just extra credit to ensure students complete it



Must use the utility-value intervention design with students posing their own question, answering it with proper biological information, and drawing connections to their personal lives.



Must use qualified graders, peer grading, or online grading software to assess quality of scientific content, personal connection, or assign credit on a pass/fail basis.