

# A.P. Biology Summer Assignment

## 2019

Welcome to AP Biology. I look forward to an exciting year with you!

Your summer assignment is to read *The Serengeti Rules* by Sean B. Carroll [available at local bookstore, your library, or amazon.com] and answer the questions listed below. This amazing book covers a lot of ground, drawing connections between distant areas of science and human experience. Regardless of your particular interest(s) in biology, you are likely to find at least parts of this book fascinating.

As you read each chapter in the book, copy and paste the corresponding prompt (see below) into a document, then respond in a paragraph or two. Follow the Prep Style Guide when formatting your document.

**Email to me your typed responses by August 23rd.**  
**[adotolo@fairfieldprep.org](mailto:adotolo@fairfieldprep.org)**

I will grade your thoughtful, well developed responses for your first test grade of the course. Don't submit your work late! Email me early if you run into trouble.

Enjoy your summer,  
Mr. Dotolo

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### **Introduction: Miracles and Wonder**

1. Describe how advances in medicine and food production have affected the natural regulation of the global human population.

### **Part I: Everything Is Regulated**

#### **CHAPTER 1: THE WISDOM OF THE BODY**

2. Near the end of Chapter 1, Sean Carroll writes, "Combined with his knowledge of the control of digestion, respiration, heart rate, and the responses to stress in animals, Cannon was provoked to think about the body's ability to react to disturbances and yet to maintain critical functions within fairly narrow ranges."

- a. Describe one of Cannon's discoveries that helped lead him to conclude that the body is able to "maintain critical functions within fairly narrow ranges."
- b. What term was coined by Walter Cannon to "describe the steady states maintained in the body"?

## **CHAPTER 2: THE ECONOMY OF NATURE**

3. Study Figure 2.4 on page 42 of *The Serengeti Rules*. This figure shows the number of rabbit and lynx furs (pelts) sold by trappers to the Hudson Bay Trading Company of Canada. Now go to Google Images and search “lynx hare population cycle.” The graphs that you will see are from textbooks used in biology courses. Compare these graphs to the original Charles Elton graph.

- a. Comment on how well the patterns in the textbook graphs match the original graph.
- b. How do you explain the differences you see?
- c. What was Charles Elton trying to infer from the lynx-hare data? What are the limitations of the inference?

### **Part II: The Logic of Life**

## **CHAPTER 3: GENERAL RULES OF REGULATION**

4. Study Figure 3.2 on page 56 of *The Serengeti Rules*. In the figure caption, Sean Carroll writes, “That pause and second growth curve became the basis of Monod’s thesis and eventual Nobel Prize.” Here Carroll refers to the 1965 Nobel Prize in Physiology or Medicine awarded to Jacques Monod and François Jacob. How did this one discovery by Monod lay the foundation for a Nobel Prize 25 years later?

## **CHAPTER 4: FAT, FEEDBACK, AND A MIRACLE FUNGUS**

5. A recent study by Tufts University and published in the *Journal of Health Economics* (2016) estimates that the average cost of developing a new drug and bringing it to market exceeds \$2.5 billion. The probability that a new drug makes it through all phases of testing and is approved for medical use is less than 10%. These high costs tend to keep most drug development in the hands of for-profit companies like Merck, the company that developed the first statin drugs for lowering blood cholesterol levels. Discuss the medical and individual costs and benefits of this drug development model.

## **CHAPTER 5: STUCK ACCELERATORS AND BROKEN BRAKES**

6. Sean Carroll explains that two common events in the genesis of cancer are stuck “accelerators” and broken “brakes.” For many of a person’s genes there are two copies, one inherited from a person’s father, and one from a person’s mother. For types of cancer that involve broken brakes and stuck accelerators, which case requires both genes to be malfunctioning? Which requires just one malfunctioning gene? Explain.

### **Part III. The Serengeti Rules**

## **CHAPTER 6: SOME ANIMALS ARE MORE EQUAL THAN OTHERS**

7. Consider the results Robert Paine’s *Pisaster* starfish experiment. Compare the results of his starfish removal experiment to how many cancers work.

## **CHAPTER 7: SERENGETI LOGIC**

8. Construct a table that combines the rules of regulation followed by enzymes with the General Rules of Regulation and the Serengeti Rules shown on page 153. How are the rules similar? How are they different?

## **CHAPTER 8: ANOTHER KIND OF CANCER**

9. Sean Carroll closes Chapter 8 with the claim that “the ultimate causes of these cancers are not the missing predators, they are a matter of humans doing too much.” Indeed, for human societies to exist, we must grow food, lots of it, and keep insects, fungi, and herbivores from eating the food we grow and predators from eating the animals we raise. What recommendation(s) do you have that could bring natural regulation back to the ecological systems on which we depend?

## **CHAPTER 9: TAKE 60 MILLION WALLEYE AND CALL US IN TEN YEARS**

10. On pages 171–172, Sean Carroll describes an experiment conducted on some Wisconsin lakes by aquatic ecologists Stephan Carpenter and James Kitchell. Reread these two pages, and outline the ecologists’ experiment using the guidance below.

- a. Write a potential research question that guided Carpenter and Kitchell in their research on lake trophic cascades.
- b. Write the hypothesis Carpenter and Kitchell proposed to answer their research question.
- c. Briefly outline the method Carpenter and Kitchell designed to test their hypothesis.
- d. Write the prediction Carpenter and Kitchell made for what they expected to see if their hypothesis was supported.
- e. Describe the results of their experiment. How well did their results support their hypothesis?

## **CHAPTER 10: RESURRECTION**

11. The constant presence of tourists at national parks like Yellowstone inevitably has an effect on the animals that live there and their behaviors. A plan for the restoration and conservation of Gorongosa includes tourism. Discuss the costs and benefits of allowing tourism in natural places like Gorongosa and Yellowstone.

## **Afterword: Rules to Live By**

12. In a 1973 essay with the same name, geneticist Theodosius Dobzhansky made famous the idea that nothing in biology makes sense except in the light of evolution. From a careful reading of The Serengeti Rules, one could also argue that nothing in biology makes sense except in the light of regulation. Do you agree or disagree with this claim? Why or why not?