AP Biology Reading Assignment

Survival of the Sickest

By Dr. Sharon Moalem

The AP Biology curriculum has gone through a complete overhaul. The course is now focused around 4 Big Ideas:

> Big Idea 1: The process of evolution drives the diversity and unity of life.
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> Big Idea 2: Biological systems utilize free energy and molecular building blocks to grow, to reproduce, and to maintain dynamic homeostasis.
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> Big Idea 3: Living systems store, retrieve, transmit, and respond to information essential to life processes.
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> Big Idea 4: Biological systems interact, and these systems and their interactions possess complex properties.

Within each Big Idea are several *Enduring Understandings* which are delineated further into numerous Essential Knowledge concepts. The new organization of the curriculum provides students explicit benchmarks in the understanding of biology as a systematic science. This book addresses the 4 Big Ideas in a personal and intriguing nonfiction platform. It will get you excited about biology!

Directions:

1. Read the book Survival of the Sickest by Dr. Sharon Moalem. As you are reading each chapter, complete the guided reading questions.

2. Choose passages from the book that demonstrate TWO (2) different Enduring Understandings per Big Idea. Since there are 4 Big Ideas, you must choose 8 different passages (2 per Big Idea) for 8 different Enduring Understandings. Please see the charts below for an explanation of the 4 Big Ideas, 17 Enduring Understandings, and 55 Essential Knowledges.

3. Explain how each passage relates to a specific Enduring Understanding and Big Idea. Use specific Essential Knowledge statements for support. You cannot use the same passage for a different Big Idea.

4. This assignment will be collected and graded on October 2nd.

Reading Guide - Survival of the Sickest

Introduction

1. What is the "big" question the book will attempt to answer?

Chapter I - " Ironing It Out"

2. Identify and describe at least five ways in which iron impacts life.

3. In the context of this chapter, explain the author's reference to Bruce Lee and to the barber pole.

Chapter II - "A Spoonful of Sugar Helps the Temperature Go Down"

4. Distinguish between each of the three types of diabetes.

5. What did the ice cores of 1989 reveal about the Younger Dryas?

6. Describe the body's "arsenal of natural defenses" against cold.

7. Describe the connection between Rana sylvatica and diabetes.

8. In Chapters 1 and 2 several inherited disorders were discussed. Create and complete a chart with the following information: Disease/Disorder, Symptoms, Evolutionary Advantage

Chapter III - "The Cholesterol Also Rises"

9. Why do we need Vitamin D? Cholesterol? Folic acid?

10. Briefly describe the connection between each of the following pairs of concepts:
    a. tanning beds/ birth defects

    b. sunglasses/ sunburn

    c. hypertenson/ slave trade

    d. Asian flush/drinking water

    e. skull shape/ climate

    f. body hair/ malaria

11. What's so fishy about the Inuits' skin color?

12. Explain the good and the bad of ApoE4.

Chapter IV - "Hey, Bud, Can You do Me a Fava?"

13. What is G6PO? Explain the role of G6PO.

14. Briefly describe the connection between each of the following pairs of concepts:
    a. European clover/Australian sheep breeding crisis of the 1940s

    b. Capsaisin/ birds and mammals

    c. Malaria/ air conditioning

    d. Favism/ fava beans

15. Explain the following statement found on page 87: "Life is such a compromise."

Chapter V - "Of Microbes and Men"

16. Identify 3 ways in which microbes/parasites move from host to host.

17. For each pathway listed in question #2, explain the relationship of the mode of transmission to the virulence of the invader.

18. What is our advantage in the survive-and -produce race?

Chapter VI - "Jump Into the Pool"

19. Briefly discuss the following terms/scientists:
    a. Jenner
    b. vaccine
    c. Antibodies
    d. B-cells
    e. "junk DNA"
    f. Lamarck
    g. McClintock
    h. Retroviruses

20. What is the Weissman barrier?

21. Make connections between the following sets of terms:
    a. transposons/viruses/evolution

    b. sunspots/flu epidemics

22. Humans have about 25, 000 genes and more than a million different antibodies. How is this possible?

23. What is a persisting virus?

Chapter VII - "Methyl Madness: Road to the Final Phenotype"

24. Make connections between the following sets of terms:
    a. vitamin supplement/ agouti mice

    b. snakes/ long-tailed lizards

    c. Barker Hypothesis/ fathers who smoke

    d. Smoking grandmothers/ asthmatic children

    e. Betel nut chewing/ cancer

25. Epigenesis may be partially responsible for the childhood epidemic of obesity. Explain.

26. "Good times mean more boys. Tough times mean more girls." Explain.

Chapter VIII - "That's Life: Why You and Your iPod Must Die"

27. Make connections between the following terms:
    a. Progeria/ lamina A

    b. Hayflick limit/ telomeres

    c. Cancer cells/ stem cells

d. Size/ life expectancy

e. Risky child birth/ big brains and bipedalism

28. Explain the author's iPod and aging analogy.

29. Identify the 5 lines of cancer defense.

30. What are the two accomplishments of biogenic obsolescence?

31. Compare and contrast the Savanna and aquatic ape hypotheses.

Conclusion

32. The author hopes that you will come away from this book with an appreciation of three things:

a. Life is in a constant state of creation
b. Nothing in our world exists in isolation
c. Our relationship with disease is often much more complex than we may have previously realized.

Is there anything that you would add?

33. "Nothing in biology makes sense except in the light of evolution." How does this book, Survival of the Sickest, support this quote by Theodosius Dobzhansky, a noted evolutionary biologist?

Big Idea 1: The process of evolution drives the diversity and unity of life.

Passage 1: _____

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Enduring Understanding (Number and Letter): _____

Explanation: _____

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Passage 2: _____

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Enduring Understanding (Number and Letter): _____

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Big Idea 2: Biological systems utilize free energy and molecular building blocks to grow, to reproduce, and to maintain dynamic homeostasis.

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Enduring Understanding (Number and Letter): _____

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Passage 2: _____

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Enduring Understanding (Number and Letter): _____

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Big Idea 3: Living systems store, retrieve, transmit, and respond to information essential to life processes.

Passage 1: _____

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Enduring Understanding (Number and Letter): _____

Explanation: _____

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Passage 2: _____

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Enduring Understanding (Number and Letter): _____

Explanation: _____

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Big Idea 4: Biological systems interact, and these systems and their interactions possess complex properties.

Passage 1: _____

Enduring Understanding (Number and Letter): _____
Explanation: _____

Passage 2: _____

Enduring Understanding (Number and Letter): _____
Explanation: _____

Appendix to the Curriculum Framework: AP Biology Concepts at a Glance

Big Idea 1: The process of evolution drives the diversity and unity of life.

Enduring understanding 1.A: Change in the genetic makeup of a population over time is evolution.	**Essential knowledge 1.A.1:** Natural selection is a major mechanism of evolution.
	Essential knowledge 1.A.2: Natural selection acts on phenotypic variations in populations.
	Essential knowledge 1.A.3: Evolutionary change is also driven by random processes.
	Essential knowledge 1.A.4: Biological evolution is supported by scientific evidence from many disciplines, including mathematics.
Enduring understanding 1.B: Organisms are linked by lines of descent from common ancestry.	**Essential knowledge 1.B.1:** Organisms share many conserved core processes and features that evolved and are widely distributed among organisms today.
	Essential knowledge 1.B.2: Phylogenetic trees and cladograms are graphical representations (models) of evolutionary history that can be tested.
Enduring understanding 1.C: Life continues to evolve within a changing environment.	**Essential knowledge 1.C.1:** Speciation and extinction have occurred throughout the Earth's history.
	Essential knowledge 1.C.2: Speciation may occur when two populations become reproductively isolated from each other.
	Essential knowledge 1.C.3: Populations of organisms continue to evolve.
Enduring understanding 1.D: The origin of living systems is explained by natural processes.	**Essential knowledge 1.D.1:** There are several hypotheses about the natural origin of life on Earth, each with supporting scientific evidence.
	Essential knowledge 1.D.2: Scientific evidence from many different disciplines supports models of the origin of life.

Big Idea 2: Biological systems utilize free energy and molecular building blocks to grow, to reproduce, and to maintain dynamic homeostasis.

Enduring understanding 2.A: Growth, reproduction and maintenance of the organization of living systems require free energy and matter.	**Essential knowledge 2.A.1:** All living systems require constant input of free energy.
	Essential knowledge 2.A.2: Organisms capture and store free energy for use in biological processes.
	Essential knowledge 2.A.3: Organisms must exchange matter with the environment to grow, reproduce and maintain organization.
Enduring understanding 2.B: Growth, reproduction and dynamic homeostasis require that cells create and maintain internal environments that are different from their external environments.	**Essential knowledge 2.B.1:** Cell membranes are selectively permeable due to their structure.
	Essential knowledge 2.B.2: Growth and dynamic homeostasis are maintained by the constant movement of molecules across membranes.
	Essential knowledge 2.B.3: Eukaryotic cells maintain internal membranes that partition the cell into specialized regions.
Enduring understanding 2.C: Organisms use feedback mechanisms to regulate growth and reproduction, and to maintain dynamic homeostasis.	**Essential knowledge 2.C.1:** Organisms use feedback mechanisms to maintain their internal environments and respond to external environmental changes.
	Essential knowledge 2.C.2: Organisms respond to changes in their external environments.
Enduring understanding 2.D: Growth and dynamic homeostasis of a biological system are influenced by changes in the system's environment.	**Essential knowledge 2.D.1:** All biological systems from cells and organisms to populations, communities and ecosystems are affected by complex biotic and abiotic interactions involving exchange of matter and free energy.
	Essential knowledge 2.D.2: Homeostatic mechanisms reflect both common ancestry and divergence due to adaptation in different environments.
	Essential knowledge 2.D.3: Biological systems are affected by disruptions to their dynamic homeostasis.
	Essential knowledge 2.D.4: Plants and animals have a variety of chemical defenses against infections that affect dynamic homeostasis.
Enduring understanding 2.E: Many biological processes involved in growth, reproduction and dynamic homeostasis include temporal regulation and coordination.	**Essential knowledge 2.E.1:**Timing and coordination of specific events are necessary for the normal development of an organism, and these events are regulated by a variety of mechanisms.
	Essential knowledge 2.E.2: Timing and coordination of physiological events are regulated by multiple mechanisms.
	Essential knowledge 2.E.3: Timing and coordination of behavior are regulated by various mechanisms and are important in natural selection.

Big Idea 3: Living systems store, retrieve, transmit, and respond to information essential to life processes.

Enduring understanding 3.A: Heritable information provides for continuity of life.	**Essential knowledge 3.A.1:** DNA, and in some cases RNA, is the primary source of heritable information.
	Essential knowledge 3.A.2: In eukaryotes, heritable information is passed to the next generation via processes that include the cell cycle and mitosis or meiosis plus fertilization.
	Essential knowledge 3.A.3: The chromosomal basis of inheritance provides an understanding of the pattern of passage (transmission) of genes from parent to offspring.
	Essential knowledge 3.A.4: The inheritance pattern of many traits cannot be explained by simple Mendelian genetics.
Enduring understanding 3.B: Expression of genetic information involves cellular and molecular mechanisms.	**Essential knowledge 3.B.1:** Gene regulation results in differential gene expression, leading to cell specialization.
	Essential knowledge 3.B.2: A variety of intercellular and intracellular signal transmissions mediate gene expression.
Enduring understanding 3.C: The processing of genetic information is imperfect and is a source of genetic variation.	**Essential knowledge 3.C.1:** Changes in genotype can result in changes in phenotype.
	Essential knowledge 3.C.2: Biological systems have multiple processes that increase genetic variation.
	Essential knowledge 3.C.3: Viral replication results in genetic variation, and viral infection can introduce genetic variation into the hosts.
Enduring understanding 3.D: Cells communicate by generating, transmitting and receiving chemical signals.	**Essential knowledge 3.D.1:** Cell communication processes share common features that reflect a shared evolutionary history.
	Essential knowledge 3.D.2: Cells communicate with each other through direct contact with other cells or from a distance via chemical signaling.
	Essential knowledge 3.D.3: Signal transduction pathways link signal reception with cellular response.
	Essential knowledge 3.D.4: Changes in signal transduction pathways can alter cellular response.
Enduring understanding 3.E: Transmission of information results in changes within and between biological systems.	**Essential knowledge 3.E.1:** Individuals can act on information and communicate it to others.
	Essential knowledge 3.E.2: Animals have nervous systems that detect external and internal signals, transmit and integrate information, and produce responses.

Big Idea 4: Biological systems interact, and these systems and their interactions possess complex properties.

Enduring understanding 4.A: Interactions within biological systems lead to complex properties.	**Essential knowledge 4.A.1:** The subcomponents of biological molecules and their sequence determine the properties of that molecule.
	Essential knowledge 4.A.2: The structure and function of subcellular components, and their interactions, provide essential cellular processes.
	Essential knowledge 4.A.3: Interactions between external stimuli and regulated gene expression result in specialization of cells, tissues and organs.
	Essential knowledge 4.A.4: Organisms exhibit complex properties due to interactions between their constituent parts.
	Essential knowledge 4.A.5: Communities are composed of populations of organisms that interact in complex ways.
	Essential knowledge 4.A.6: Interactions among living systems and with their environment result in the movement of matter and energy.
Enduring understanding 4.B: Competition and cooperation are important aspects of biological systems.	**Essential knowledge 4.B.1:** Interactions between molecules affect their structure and function.
	Essential knowledge 4.B.2: Cooperative interactions within organisms promote efficiency in the use of energy and matter.
	Essential knowledge 4.B.3: Interactions between and within populations influence patterns of species distribution and abundance.
	Essential knowledge 4.B.4: Distribution of local and global ecosystems changes over time.
Enduring understanding 4.C: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.	**Essential knowledge 4.C.1:** Variation in molecular units provides cells with a wider range of functions.
	Essential knowledge 4.C.2: Environmental factors influence the expression of the genotype in an organism.
	Essential knowledge 4.C.3: The level of variation in a population affects population dynamics.
	Essential knowledge 4.C.4: The diversity of species within an ecosystem may influence the stability of the ecosystem.