

Dear Student:

You have signed up for a challenging and rewarding course for the 2021-22 school year. In order to make sure that you are thinking about AP Biology once school is out, I want you to do a little preparation work over the summer.

First, you will read Your Inner Fish by Neil Shubin and complete the assignment found in this packet. This is a good read, and we will refer back to the book as the year progresses. Be sure to think about how you can relate the reading to biology topics we might study next year, as you enjoy the text. You will have to buy a copy of the book or borrow it from the local library. In addition, you will complete a biology scavenger hunt and a vocabulary assignment. This will be fun and allow you to review/learn some biology vocabulary, while also giving you the chance to be creative! See the next few pages for the complete assignment.

I may be contacting you this summer through email. **So, I am asking you to send me an email by June 30, 2020.** In the email, please do the following:

- Use an email that you will be checking over the summer
- In the subject line, put “[**your name**]-AP Biology”
(ex. Bina Singh -AP Biology)
- In the body of the email, answer the following questions in numerical order. They do not have to be in complete sentences unless requested.

1. Your name – first and last. Name you preferred to be called.
2. Will you be a Sophomore, Junior or Senior in the 2021-22 academic year?
3. AP classes you have previously taken and your final grade for those courses.
4. Have you already taken Anatomy & Physiology, or will you be taking that course this year?
5. List of AP Classes you will be taking during the 2021-2022 academic year.
6. All-time favorite hobby or activity?
7. List your favorite candy or snack.
8. Summarize your family in one sentence.
9. Will you have a job during the school year? If so, where?
10. In what clubs and/or extracurricular activities will you participate this coming school year?
11. Explain, in a sentence or two, why have you chose to take AP Biology.
12. Do you have any concerns and/or curiosities about taking AP Biology?
13. What are your plans after graduation?
14. If you had one million dollars that you had to give away, what would you do with it?

Your summer enrichment will be due by Monday, August 23, 2021. If you choose not to work on the assignment over the summer, you will be behind during the rest of the class. I promise you, this will not ruin your summer and it will not be an overload of work (I am on summer break, too!) This will be the **FIRST GRADE FOR THIS CLASS.**

If you have any questions, please email me. I will be checking my email frequently over summer break.

Thank you for being a dedicated science student!

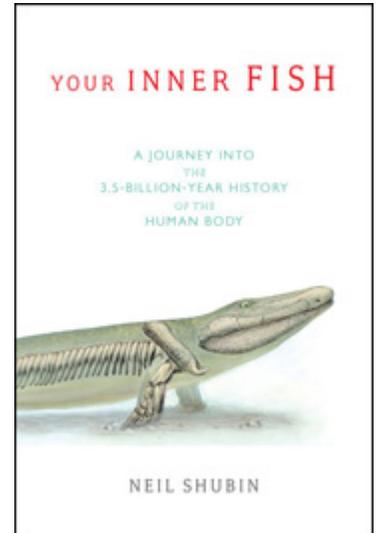
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Part 1: Your Inner Fish

Evolution is one of the major themes in any general biology course. In Your Inner Fish, Neil Shubin writes about the evolutionary relationship between fish and tetrapods (You are a tetrapod.) by discussing development of major body systems. This is not a dry biology textbook. Everything is presented through exciting new scientific research and discoveries. In addition to seeing many connections to biology, you will find great applications to anatomy and physiology.

With this in mind, I am asking you to read Your Inner Fish over the summer. As you read the book, please keep a reading journal. For each chapter:

1. Take notes as you read the text that might be helpful to “jog” your memory when we discuss the different chapters at different points during the school year. You should also think about what topics we might cover in class and information mentioned in the text.
2. Answer the discussion questions below.



DISCUSSION QUESTIONS

Chapter 1 - Finding Your Inner Fish

1. Explain why the author and his colleagues chose to focus on 375 million year old rocks in their search for fossils. Be sure to include the types of rocks and their location during their paleontology work in 2004.
2. Describe the fossil Tiktaalik. Why does this fossil confirm a major prediction of paleontology?
3. Explain why Neil Shubin thinks Tiktaalik says something about our own bodies? (in other words – why the “Inner Fish: title for the book?)

Chapter 2 - Getting a Grip

1. Describe the “pattern” to the skeleton of the human arm that was discovered by Sir Richard Owen in the mid-1800s. Relate this pattern to his idea of exceptional similarities.
2. How did Charles Darwin’s theory explain these similarities that were observed by Owen?
3. What did further examination of Tiktaalik’s fins reveal about the creature and its’ lifestyle?

Chapter 3 - Handy Genes

1. Many experiments were conducted during the 1950s and 1960s with chick embryos and they showed that two patches of tissue essentially controlled the development of the pattern of bones inside limbs. Describe at least one of these experiments and explain the significance of the findings.
2. Describe the hedgehog gene using several animal examples. Be sure to explain its’ function and its’ region of activity in the body.

Chapter 4 - Teeth Everywhere

1. Teeth make great fossils - why are they “as hard as rocks?” What are conodonts?
2. Shubin writes that “we would never have scales, feathers, and breasts if we didn’t have teeth in the first place.” (p. 79) Explain what he means by this statement.

Chapter 5 - Getting Ahead

1. Why are the trigeminal and facial cranial nerves both complicated and strange in the human body?
2. List the structures that are formed from the four embryonic arches (gill arches) during human development.
3. What are Hox genes and why are they so important?

4. Amphioxus is a small invertebrate yet is an important specimen for study – why? Be sure to include characteristics that you share with this critter!

Chapter 6 - The Best Laid (Body) Plans

1. Early embryonic experiments in the 1800s led to the discovery of three germ layers. List their names and the organs that form from each.
2. Describe the blastocyst stage in embryonic development.
3. What is meant by “ontogeny recapitulates phylogeny?”
4. What type of gene is Noggin and what is its function in bodies?
5. Sea anemones have radial symmetry while humans have bilateral symmetry but they still have “similar” body plans – explain...

Chapter 7 - Adventures in Bodybuilding

1. Refer to the timeline on p.121 in Your Inner Fish – what is most surprising to you about the timescale? Explain your choice.
2. What is the most common protein found in the human body? Name it and describe it.
3. Explain how cells “stick” to one another; give at least one example.
4. How do cells (generally) communicate with one another?
5. What are choanoflagellates and why have they been studied by biologists?
6. What are some of the reasons that “bodies” might have developed in the first place? Include any environmental conditions that might have favored their evolution.

Chapter 8 - Making Scents

1. Briefly explain how we perceive a smell.
2. Jawless fish have a very few number of odor genes while mammals have a much larger number. Why does this make sense and how is it possible?

Chapter 9 - Vision

1. Humans and Old World monkeys have similar vision – explain the similarity and reasons for it.
2. What do eyeless and Pax 6 genes do and where can they be found?

Chapter 10 - Ears

1. List the three parts of the ear; what part of the ear is unique to mammals?
2. An early anatomist proposed the hypothesis that parts of the ears of mammals are the same thing as parts of the jaws of reptiles. Explain any fossil evidence that supports this idea.
3. What is the function of the Pax 2 gene?

Chapter 11 - The Meaning of It All

1. What is Shubin’s biological “law of everything” and why is it so important?
2. What is the author trying to show with his “Bozo” example?
3. This chapter includes many examples of disease that show how humans are products of a lengthy and convoluted evolutionary history. Choose three (3) of the problems listed below and briefly explain how ancient ancestors’ traits still “haunt” us:

- Obesity
- Heart disease
- Hemorrhoids
- Sleep apnea
- Hiccups
- Hernias
- Mitochondrial diseases



Afterword (new findings re: Tiktaalik)

1. Tiktaalik was a fish that lacked an operculum – what does this tell us about the animal?
2. Tiktaalik had a true neck – what did this allow the animal to do (advantages?)
3. How was Tiktaalik able to survive in the cold Arctic environment?

Part 2: Biology Term Scavenger Hunt

For this part of your summer assignment, you will be familiarizing yourself with science terms that we will be using at different points throughout the year.

On the next page is the list of terms.

➤ **Select and “collect” 40 words/terms**

When I say “collect”, I mean you should collect that item by finding it and taking a **photograph** (digital or paper printed) or making a **sketch** of that item. You should create a unique way to present your “collection”, along with corresponding explanations. You can do this in a number of different ways: PowerPoint, Microsoft Word, and Prezi or by creating an actual photo album. Have another idea for presenting? Just email me!

You do not need to find the exact item on the list, say for example, if it is an internal part to an organism, but you must apply the term to the specimen you find and explain in your finished project how this specimen represents the term.

- **EXAMPLE:** If you choose the term “phloem”, you could submit a photograph you have taken of a plant leaf or a plant stem and then explain in your project what phloem is and specifically where phloem is in your specimen.

➤ **ORIGINAL PHOTOS/SKETCHES ONLY:**

You cannot use an image from any publication or the Web. You must have taken the photograph (or made the sketch) yourself. The best way to prove that is to place an item (stuffed animal, a button, toy car, etc.) in all of your photographs that only you could have added each time. You could make a small sign of your name that will be in each photo/drawing.

➤ **NATURAL ITEMS ONLY:**

Specimens may be used for only one item/word, and all must be from something that you have found in nature. Take a walk around your yard, neighborhood, and town. **DON'T SPEND ANY MONEY!** Research what the term means and in what organisms it can be found... and then go out and find one.

➤ **TEAM WORK:**

You may work with other students in the class to complete this project, but **each student must turn in his or her own project** with a unique set of terms chosen.

TERMS

1. adaptation of an animal
2. adaptation of a plant
3. abscisic acid
4. actin
5. amniotic egg
6. amylase
7. angiosperm
8. animal that has a segmented body
9. annelid
10. anther & filament of stamen
11. arthropod
12. archaebacteria
13. autotroph
14. auxin producing area of a plant
15. basidiomycete
16. Batesian mimicry
17. biological magnification
18. bryophyte
19. C 4 plant
20. Calvin cycle
21. carbohydrate -fibrous
22. cambium
23. cellulose
24. chitin
25. chlorophyta
26. cnidarian
27. coelomate
28. conifer leaf
29. commensalism
30. connective tissue
31. cuticle layer of a plant
32. deciduous leaf
33. deuterostome
34. dicot plant with flower & leaf
35. diploid chromosome number
36. echinoderm
37. ectotherm
38. endosperm
39. endotherm
40. enzyme
41. epithelial tissue
42. ethylene
43. eubacteria
44. eukaryote
45. exoskeleton
46. fermentation
47. flower ovary
48. frond
49. fruit – dry with seed
50. fruit – fleshy with seed
51. gametophyte
52. gastropod
53. genetically modified organism
54. gibberellins
55. glycogen
56. gymnosperm cone
57. haploid chromosome number
58. heartwood
59. hermaphrodite
60. insect
61. K-strategist
62. keratin
63. leaf – gymnosperm
64. lepidoptera
65. lichen
66. lignin
67. lipid used for energy storage
68. littoral zone organism
69. long-day plant
70. meristem
71. modified leaf of a plant
72. modified root of a plant
73. modified stem of a plant
74. monocot plant with flower & leaf
75. muscle fiber – striated
76. mutualism
77. mycelium
78. mycorrhizae
79. myosin
80. nematode
81. niche
82. nymph stage of an insect
83. parasite
84. parenchyma cells
85. phloem
86. pine cone – female
87. platyhelminthes
88. pollen
89. pollinator
90. porifera
91. prokaryote
92. protein – fibrous
93. protein – globular
94. protostome
95. pteridophyte
96. r-strategist
97. radial symmetry
98. rhizome
99. scale from animal with two-chambered heart
100. spore
101. sporophyte
102. stem – herbaceous
103. stem – woody
104. stigma & style of carpel
105. tendril of a plant
106. thorn of a plant
107. unicellular organism
108. vascular plant tissue
109. xerophyte
110. xylem

Biology Prefixes and Suffixes-The Language of Science

The main reason students find it difficult to understand science is because of all the hard to write, spell and read words. Actually, scientific vocabulary is a mix of small words that are linked together to have different meanings. If you learn the meanings of the little words, you'll find scientific vocabulary much easier to understand. Find the mean to the following Greek/Latin root words.

Word	Meaning
a / an	
meso	
leuco	
aero	
anti	
amphi	
aqua / hydro	
arthro	
auto	
bi / di	
bio	
cephal	
chloro	
chromo	
cide	
cyto	
derm	
haplo	
ecto (exo)	
endo	
epi	
gastro	
genesis	
herba	
hetero	
homo	
ov	
kary	
neuro	
soma	
saccharo	
primi / archea	
phyll	
hemo	

Word	Meaning
hyper	
hypo	
intra	
-itis	
lateral	
-logy	
-lysis	
-meter	
mono	
morph	
micro	
macro	
multi / poly	
pod	
-phobia	
-philia	
proto	
photo	
pseudo	
synthesis	
sub	
troph	
therm	
tri	
zoo, zoa	
-tropism	
-taxis	
-stasis	
zyg / zygous	
phago	
path / pathy	
sym / syn	

Once you have completed the above table, use it to develop a definition, in your own words, for each of the following terms.

1. Hydrology _____

2. Cytolysis _____

3. Protozoa _____

4. Epidermis _____

5. Spermatogenesis _____

6. exoskeleton _____

7. Abiotic _____

8. Pathogen _____

9. pseudopod _____

10. Hemophilia _____

11. Endocytosis _____

12. herbicide _____

13. Anaerobic _____

14. Bilateral _____

15. autotroph _____

16. Monosaccharide _____

17. Arthropod _____

18. polymorphic _____

19. Hypothermia _____

20. Biogenesis _____