

## Houston Academy for International Studies AP Biology Summer Assignment

### *Your Inner Fish by Neil Shubin*

You have signed up for a challenging and rewarding course for the 2020-21 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.

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 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 will 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.

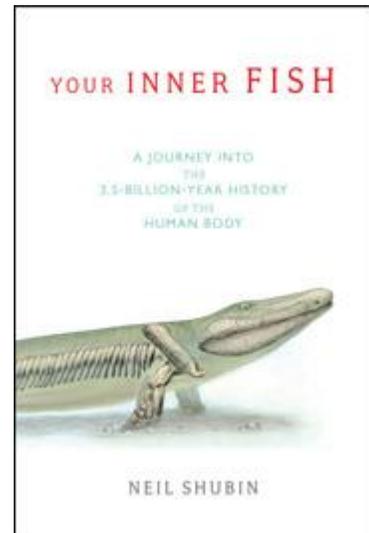
Your summer enrichment will be due the first week of the school. If you choose not to work on the assignment over the summer, you will be missing out on an easy '100' 😊.

### 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.

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 numbers 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.



### **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?