

Neil Shubin – *Your Inner Fish*

Directions: Answer the discussion questions below as you read. Answers may be handwritten or typed. Do not copy answers from others! Work may be submitted in class or emailed to me at jholwell@thomas.k12.ga.us.

Due dates: February 11 (Ch 1 – 3)
 February 25 (Ch 4 – 6)
 March 11 (Ch 7 – 9)
 March 25 (Ch 10, 11, Afterword)

Chapter 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 is the *Inner Fish* the 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**. Hint: see p. 58
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?”
2. What are *conodonts*? What extant species contains them?
3. 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. T or F: *Homeobox* genes are conserved segments of DNA found within the DNA sequence of *Hox genes*. 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? Is *Noggin* an activator or a suppressor?
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?