Using one or more examples, demonstrate how the theories can help *and* hinder the search for knowledge in science.

June 9, 2013

Word Count: 1,545

In this essay, I will examine how theories can help and hinder the search for knowledge in science. According to Zimmerman (2012), a scientific theory summarizes one or group of hypotheses that have been supported with repeated testing and later become accepted as a valid explanation of phenomenon. No theory is ever regarded as an absolute truth, but it is regarded as a well supported testable interpretation that provides explanation for natural phenomenon. As it attempts to explain the world's most fundamental aspects, it not only aids but also hinders us in the search for knowledge. To illustrate how the theory both helps and prevents the development of knowledge, I will use the examples of evolution theory, especially natural selection by Charles Darwin. Through language and perception, we can acquire knowledge from the scientific theory. The knowledge issues are the following: How and why is knowledge renewed or reshaped? How do theories shape knowledge and become accepted? What uncertainties, biases in approach, or limitations do we encounter? How do competing versions of a theory affect the theory's validity?

How the theories help the search for knowledge can be demonstrated with the example of the early evolutionary theories such as Lamarckism and the development of natural selection from them. Nowadays, Darwin's natural selection is considered to be one of the basic mechanisms of evolution. However, it had been developed from early theories of the early 1800's. Lamarck (1809) suggested that the traits that are acquired due to the physiological needs of organisms in interacting with the environment could be inherited. Although Lamarck's proposal for adaptive evolution with the acquired traits was regarded wrong because acquired characteristics do not have a genetic basis, Darwin's natural selection in 1859 incorporated the hypotheses of Lamarckism. For example, Lamarck's idea that use or disuse of certain structure causes it to enlarge or shrink was accepted by Darwin until the development of modern genetics (Ben Waggoner 1996). According to Lamarck, giraffes developed an elongated neck as they tried to reach the high branches. Similarly, because penguins did not use their wings to fly, the wings became smaller. However, he did not know how the inheritance of acquired traits happened. Early theories of evolution were wrong and incomplete due to the lack of knowledge

and evidences, but Darwin's idea was not completely different from them. This could answer the knowledge issue: How and why is knowledge renewed or reshaped? As a scientific theory is supported with repeated testing and confirmed as a valid explanation of a phenomenon (Zimmerman 2012), knowledge is renewed or reshaped by the development of thoughts. No or little knowledge can be established by a single theory. Most of the knowledge is changed over time to be more accurate based on different scientists. As time passes, scientists' better understanding in subject enables them to come up with more developed hypotheses that are well supported by an ample amount of evidence, reshaping the existing hypotheses by rejecting some and accepting others. However, the reshaped hypotheses does not make the theory and our scientific knowledge an absolute truth. It directs us closer to the truth and better understanding by filling the gap in the theory.

How the scientific theories help the search for knowledge can also be demonstrated with the example of Darwin's natural selection and subsequent discoveries in molecular genetics. Natural selection, defined as "any consistent difference in fitness among phenotypically different classes of biological entities" (Futuyma 2009), is the process in which variation among organisms is inherited to the offsprings and causes suitable ability to survive and reproduce. However, the central thought of natural selection was originally developed in the absence of a valid explanation of heredity. For example, after observation of fourteen different Galapagos finches with different beaks, Darwin concluded that each was modified from the same ancestor to have a suitable phenotypic characteristic for the environmental niche each had. This hypothesis was based on assumptions that individuals had variations in their traits due to genetic mutation and that traits were consistently inherited even though Darwin did not know anything about genetics. Our knowledge about genetics was undiscovered until almost 50 years after the publication of Darwin's *On the Origin of Species*. Another knowledge issue can be taken into consideration: How do theories shape knowledge and become accepted? Related to the hypotheses that humans came from the same ancestor of the apes, there had been questions about the different number of chromosomes that humans and apes had. Scientists' discovery of the fused genetical information that decreased the number of chromosomes confirmed Darwin's theory and made it more acceptable. The combination of Darwin's theory and discovery of molecular genetics enable the scientists to advance for better acquisition of knowledge. In addition, the discovery of hereditary genetics disproves Lamarck's idea that organisms can inherit acquired traits to the offsprings. Further developed theory of evolution

with the presence of a valid theory for heredity of genetic information leads us to better search for knowledge in science.

On the other hand, the theory may hinder the search for knowledge in science. This can be demonstrated with the examples of ambiguity involved in the language of the theory. The word ‘evolution’ may have different definitions by different scientists. According to Curtis and Barnes (1989), evolution is any change in the frequency of alleles within a gene pool from one generation to the next. The definition includes the inheritance of genotypic traits. However, according to Futuyma (1986), evolution is a change in the properties of populations of organisms that transcend the lifetime of a single individual. This definition is rather vague and unclear compared to the first definition, arousing uncertainties regarding the theory of evolution. The degree of change indicated by ‘evolution’ is differently defined by scientists, which then brings us to answer the knowledge issue: What uncertainties, biases in approach, or limitations do we encounter? Definition of the theory explains what the theory deals with and what it proposes. However, if different definitions exist among scientists, it is uncertain whether the theory helps the search for knowledge. Different definitions imply different understanding and arguments, which eventually hinders the search for knowledge. Furthermore, there could be discrepancy of the language between the scientific and non-scientific communities. Outside of science, one might say a ‘theory,’ indicating that it is a guess that may or may not be true. On the contrary, in science, theory is “an explanation that generally is accepted to be true” (Helmenstine). A scientific theory must be testable, falsifiable, and substantiated by adequate evidence unlike just theory. Like the word ‘evolution,’ different definitions of ‘theory’ may create uncertainty regarding the theory of evolution. Because ‘theory’ is considered to be possibly false in its common meaning, people may consider the theory of evolution as possibly false while it should be considered to be relatively true scientifically.

Furthermore, the conflict of the evolution theory with the original system of belief, Creationism, shows how the theory hinders the search for knowledge. Creationism is “the belief that the universe and living organisms originate from specific acts of divine creation, as in the biblical account” (Oxford University). Considering Darwin’s theory that variations are purely random, this theory arouses many conflicts between the religious and scientific views about the world. The conflict between Creationism and Darwin’s Natural Selection can answer the following knowledge issues: What uncertainties, biases in approach, or limitations do we

encounter? and How do competing versions of a theory affect the theory's validity? As there has been existing view about the creation of the organisms that prevailed among even the most educated scientists, Darwin's new theory could not be easily accepted. Especially, at the time when Darwin published his idea, most of the educational institutions were owned by the church, so the theory of evolution was strongly opposed by people. Therefore, since then, there are biases in approach when searching for knowledge from the theory of evolution. There could be religious bias where public that is religiously faithful and more familiar to the Creationism is more biased against the new theory that disputes the existence of God. It creates the limits of perception as perception can be influenced by the expectations. The creationism is also called "creation science", which further arouses uncertainty in thinking. Because it is called "science", although it offers the Bible as the substantiated theory, it stirs up public controversy whether the creationism is the 'correct' theory as John F. Haught (1995) suggests. The religious bias can further prevent from distinguishing between a scientific theory and just theory as they believe what the Bible says regardless of its lack of logic with strong correlation and evidences. As people are uncertain and more biased against the theory because of the existing system of belief, it hinders the search for knowledge.

To conclude, scientific theories can both help and hinder the search for knowledge. The theory can develop over a period of time based on new observations, discovery of new science, and the past incorrect theories. Its improvement and development further aids and enables easier and better approach to knowledge, thus helping its search. On the other hand, it can also prevent the search for knowledge with the uncertainties the theory brings about and biases associated with the existing system of belief.

The analysis of language and Creationism is convincing and thorough. You made clear connections to language, but you were not writing about sense perception, you were actually writing about interpretation and understanding. Your definition of theory was extensive and served the purposes of your essay well. The discussions of Lamarck and Darwin were interesting, but were somewhat heavy on explanation.