Main Points Of Natural Selection Theories

Discovering the Theories of Darwin, Watson, and Crick

The scientific community is never stagnant. Constantly collecting data, searching for knowledge, and competing for grants and discoveries has lead to revolutionary breakthroughs at breathtaking speed. Two such revolutionary theories are Charles Darwin’s origin of species and Watson and Crick’s helical structure of DNA. Darwin believed that species were not unchangeable and that organisms that belonged to the same genera were in fact lineal descendants of other generally extinct species. He also argued that natural selections is the most important means of modification, although it is not the only means of modification. James and Watson and Francis Crick discovered that DNA was a double helix polymer, and that each strand contained a long chain of monomer nucleotides wound around each other. They also found that DNA replicated itself by separating into two individual strands, which each became a template for the new strand of DNA. In this essay, I will demonstrate the complicated process of scientific discovery in the biological sciences. I will argue that scientific breakthroughs are reached by a necessity for an explanation of some process. However, these discoveries often inspired by observations, require extended periods of time to be developed, and are not isolated events, but are instead influenced by other individuals and competition between colleagues by comparing Charles Darwin’s The Origin of Species: By Means of Natural Selection of the Preservation of Favoured Races in the Struggle for Life and James Watson’s The Double Helix: A Personal Account of the Discovery of the Structure of DNA.

Charles Darwin opens his book by describing his inspiration for his theory of the origin of species, or “the mystery of mysteries” of his time. When positioned as the naturalist on the H.M.S. “Beagle,” he “was much struck with certain facts in the distribution of the organic beings inhabiting South America, and in the geological relations of the present to the past inhabitants of that continent.” The catalyst for Darwin’s theory was his observations – his observations of histories, differences, and distributions of animals. Although the “Beagle” began its journey in 1831, Darwin did not begin organizing and “patiently accumulating and reflecting” any information that could contribute to the formulation of his theory until he returned home in 1837. He states that only after working on the subject for five years did he finally allow himself to begin theorizing. Only in 1844 did he finally outline conclusions that he deemed likely, but he uses his years of contemplation to explain the gravity of his theory, which contradicted the accepted view of the time, that each species was created by God to be unchanging. Charles Darwin’s revolutionary theory of the origin of species was not a spark without inspiration that developed in a void: instead, it grew from years of careful observations from the world around him, and took even more years to become developed. In fact, Watson and Crick’s discovery of the double helix of DNA was reached in much the same way.

Although Watson’s book is written from his perspective and is biased in his favor, it nevertheless provides insight into his mind and his version of the discovery of the structure of DNA. He introduces his book by commenting on the process of discovery in the biological sciences. According to Watson, “science seldom proceeds in the straightforward logical manner imagined by outsiders. Instead, its steps forward (and sometimes backward) are often very human events in which personalities and cultural traditions play major roles.” James Watson’s method of discovery mirrors Darwin's in that it was not an isolated event; instead, it was influenced by the context and events of his time. Both Watson and Darwin's modes of discovery were neither simple nor straightforward, but required much thought, energy, time, and luck. Just as Darwin regarded the origin of species as the "mystery of mysteries," DNA was still viewed as a mystery in 1955. At the time, no one knew who would be the one to discover its secrets, or even if the secret of DNA would be as revolutionary as imagined. The breakthrough in DNA cannot be adequately explicated in a paragraph in a biology textbook and "was not simple and certainly not as the newspapers reported."

As previously established, biological discoveries are seldom, if ever, made in isolation. Although a theory is oftentimes attributed to one, or at most, two or three people (evidenced by the theories addressed by this essay: Charles Darwin's origin of species and Watson and Crick's helical structure of DNA), many individuals can influence and shape a theory, either directly or inadvertently. In addition, because discovery is neither a linear nor clean process, these individuals are frequently competitors. For example, at least five people (that Watson mentions) were involved with the breakthroughs in DNA: Maurice Wilkins, Rosalind Franklin, Linus Pauling, Francis Crick, and James Watson. Although Watson cites Crick as the dominant force, each name mentioned, even in passing, made some contribution. Watson mentions Max Perutz, who was a chemist born in Austria but came to England in 1936. Perutz and Sir Lawrence Bragg, the director of the Cavendish, had collected X-ray diffraction for more than a decade. Maurice Wilkins, the first name mentioned by Watson, worked and studied at the King's College in London. He was a physicist who used X-ray diffraction, and according to Watson, the "molecular work on DNA in England was, for all practical purposes, the personal property of Maurice Wilkins." Because of Maurice Wilkins' stake in DNA and the English cultural concept of fair play, Crick could not have started working on the problem that Wilkins had focused on for years. Watson then describes Rosalind Franklin, who was a trained crystallographer and was meant to help with Wilkins' research. In addition to stating that Franklin claimed that DNA was her problem and that she was not Wilkins' assistant, he dedicates paragraphs to sexist comments, such as "Though her features were strong, she was not unattractive and might have been quite stunning had she taken even a mild interest in clothes. This she did not. There was never lipstick to contrast with her straight black hair, while at the age of thirty-one her dresses showed all the imagination of English bluestocking adolescents. So it was quite easy to imagine her the product of an unsatisfied mother who unduly stressed the desirability of professional careers that it could save bright girls from marriages to dull men," and the needed to be put in her place. Watson also describes Linus Pauling, a chemist at Cal Tech, who was interested in one of the most important scientific prizes, an understanding of DNA and the recognition that came with it. In fact, he sent a letter to Maurice to request a copy of the crystalline DNA X-ray photographs, which Maurice refused because he wanted to review the data before releasing it. The influence on Watson and Crick's discovery of the structure is further demonstrated by Watson's attendance of a meeting in Naples on the structures of biological macromolecules. One of the lectures was given by Wilkins, in which he presented an X-ray diffraction image of DNA, which showed more detail than previous images and was considered as arising from a crystalline substance. Watson explicitly says that he forgot Wilkins, but not the image of DNA, which he could not understand. He says, "It was certainly better to imagine myself becoming famous than maturing into a stifled academic who had never risked a thought." Propelled by this thought and the knowledge that Pauling had partly solved the structure of proteins, Watson continued down the path of discovering the structure of DNA.

The circumstances of Darwin's publication of his theory match Watson and Crick's in that both theories were made in a context that influenced them, as well as in competition with other individuals. Both theories seem to result from a race to discovery and recognition. For example, Darwin believed that his work was nearly completed in 1859, but it would still take years to officially complete it. Nevertheless, he was enticed to publish the abstract because of Alfred Russell Wallace. Wallace studied the natural history of the Malay Archipelago and made the same conclusions as Darwin on the origin of species. He even sent Darwin a memoir in 1858 to be forwarded to Charles Lyell. Wallace's conclusions were sent to the Linnean Society and published in the third volume of the Journal of that society. However, because Lyell and Dr. Hooker, who read Darwin's outlines in 1844, knew Darwin's ideas, advised him to publish a few abstracts from his manuscripts. If it weren't for Wallace rapidly approaching conclusions that were similar to Darwin's, Darwin may have even further delayed the publication of his ideas. Therefore, Darwin's publication of his theory on the origin of species is a direct result of competition with colleagues, specifically Alfred Russell Wallace. In addition to Wallace's impending discoveries, like Watson, Darwin's theories were influenced by the discovery of others, although he provides them with proper credit. Darwin applied Malthus' doctrines to the animal and vegetable kingdoms: more individuals in each species are born than can survive. Because of this, there this is a constant struggle for existence, and any organism that has a varying condition that provides it with a better chance of survival will be naturally selected for. Darwin's recognition of Malthus and the use of his economic doctrine is another aspect of the process of biological discovery shared with Watson, Crick, and other scientists: breakthroughs are not created in vacuums, but are influenced by fellow individuals and the ideas of the intellectual society of the period.

Although Charles Darwin's theory was revolutionary, he was hesitant to shake the Christian belief of the origin of species. He asserted "all the procedure is represented primarily and pre-eminently as flowing from commands and expressions of will, not from direct acts. Let there be light – let there be a firmament – let the dry land appear – let the earth bring forth grass, the herb, the tree – let the waters bring forth the moving creature that hath life – let the earth bring forth the living creature after his kind – these are the terms in which the principal acts are described." Darwin quotes the Bible and attempts to present his theory in concordance with the dominant Christian view of creation of the time. He uses sacred words and ideas to contextualize his own. Although his theory has been harkened as an earth-shattering understanding, he attempted to present it in a way that would be palatable by his colleagues. Nevertheless, he sticks by his theory by clearly stating that "the scriptural objection quickly vanishes, and the prevalent ideas about the organic creation appear only as a mistaken inference from the text." Darwin argues that the Bible can even be reinterpreted to support his theory. He rhetorically asks, "How can we suppose an immediate exertion of this creative power at one time to produce zoophytes, another time to add a few marine mollusks…This would surely be to take a very mean view of the Creative Power." Darwin even argues within the Christian context itself. To believe that God could not continuously inspire and create different species, which agrees with Darwin's theory of evolution, is limiting of God Himself. Darwin argues that there is no reason to dismiss God, or his theories, fully. Watson and Crick's paper, with their revolutionary ideas, was published in Nature with an introduction by Lawrence. When typing the final version, Watson told his sister "she was participating in perhaps the most famous event in biology since Darwin's book." Because of the number of years and amount of time spent in the formulation of the idea, as well as the similar conclusions almost reached by their contemporaries, their ideas quickly became acknowledged and accepted.

By comparing Charles Darwin's The Origin of Species: By Means of Natural Selection of the

Preservation of Favoured Races in the Struggle for Life and James Watson’s The Double Helix: A Personal Account of the Discovery of the Structure of DNA, I was able to successfully demonstrate the complicated process of scientific discovery in the biological sciences. I successfully argued that scientific breakthroughs are achieved because of a necessity for an explanation of some process, often inspired by observations, require extended periods of time to be developed, are not isolated events, and are instead influenced by other individuals and competition between colleagues. The necessity for an explanation of some process was demonstrated by the Darwin’s need to explain speciation and Watson and Crick’s need to explain the structure of DNA. Observations played a key role for both Darwin, who was inspired by his observations of the variety of animals on his voyage with the “Beagle” and Watson and Crick, who notes the crystalline structure from the X-ray crystallography structures. Both theories arose due to competition and the influence of other individuals as well: Darwin’s from Wallace and Malthus, Watson and Crick’s from Wilkins, Franklin, and Pauling. The similarities between the process of realizing a scientific breakthrough in both Darwin and Watson and Crick’s work demonstrate that the scientific process is never simple or clean, but like scientific principles, can follow a predictable pattern.