The theory of evolution has been widely regarded by biologists as a means of explaining the characteristics of existing forms of life. Since Darwin first proposed his idea, scientists have synthesized it with the theory of Mendelian genetics to form neo-Darwinism; the idea that evolution occurs solely through natural selection.[1] However, many observed phenotypes seem to have very low probabilities of occurring through evolution alone, and so many scientists believe that "natural selection among traits generated at random cannot by itself be the basic principle of evolution."[2] In his book *Darwin's Black Box*, Michael J. Behe asserts that given this dearth of an explanation, intelligent design is the most reasonable explanation. However, Behe gathers support for the theory of Intelligent Design by misunderstanding the concept of natural selection, and wrongly assuming that neo-Darwinism is the only reasonable explanation for the present complexity of life given the relatively short history of the earth.

The theory of evolution as understood by neo-Darwinists is grounded upon a logical fallacy. The observation made of the natural world is that "evolution is a process in which creatures with adaptive traits are selected". The claim that is most widely accepted is that "evolution is a process in which creatures are selected for their adaptive traits".[3] This second statement is possibly true in some situations, but arriving at the latter statement after validation of the first statement is completely fallacious.

Yet Behe finds issue with NS (natural selection), not because of this intensional fallacy, but because he believes evolution requires random changes in the genotype to occur by mutation at a gradual pace, and the probability of any significant change in an organism that would produce an entirely new species is too low. Evolution does not necessarily use natural selection,

[1] Pg. 24; *Darwin's Black Box*, by Michael J. Behe

[2] Pg. 21; *What Darwin Got Wrong*, by Jerry Fodor and Massimo Piattelli-Palmarini

[3] Pg. xv; *What Darwin Got Wrong*, by Jerry Fodor and Massimo Piattelli-Palmarini

as shown in the previous paragraph, and so even if natural selection gives an unlikely explanation for a particular phenotype, evolution as a whole may still give a valid option.

Behe's accusation of natural selection's impotency is similar to that of Fodor's and Piattelli-Palmarini's in *What Darwin Got Wrong*. Fodor and Piattelli-Palmarini concede that natural selection can act as a mechanism that solidifies phenotypes according to ecological constraints (i.e. microevolution) but would probably only "[tune] the piano" rather than "[compose] the melodies".[4] But despite this shortcoming of neo-Darwinism, they claim, there are still other scientific explanations that detail how certain phenotypes have come to be expressed in nature.

Changes in a population's phenotype are not necessarily indicative of an adaptation to an environment. Some small percentage of fruit flies, when exposed to the fumes of ether during the egg stage, develops a second pair of wings. When these fruit flies are selectively bred, the offspring have an even higher chance of reacting to the ether in a similar fashion. Through multiple repetitions of this process, eventually a generation emerges that will develop the second pair of wings without the presence of ether. This "genetic assimilation" is not an example of adaptation, since there was no reason for the growth to happen without the ether as a trigger; adaptation would only explain why a larger percentage of the flies reacted to the ether. Nor could this ever be the result of natural selection, since the variation in phenotype was due to environmental factors, rather than a mutation in genes. The extra small pair of wings could have also resulted from an internal mutation in the master gene (Ubx) (i.e. without the ether given enough time and selective breeding), but the ability of an environment to influence a

[4] Pg. 21; *What Darwin Got Wrong*, by Jerry Fodor and Massimo Piattelli-Palmarini

population's phenotypic expressions directly, rather than cultivating specific genotypes by way of natural selection, is indisputable.[5]

The reaction of the fruit flies to the ether should also seem suspect from the perspective of a neo-Darwinist. There is no observable advantage given to the flies that grew the second pair of wings, especially because they were only exposed to the ether in the egg stage. Another experiment showed that fruit flies exposed to excessive heat when growing up develop peculiarly large eyes. Therefore, the flies were not, throughout the generations, becoming more suited to their environment.[6] They were only reacting to their environment. If the flies were subject to high temperatures during the egg stage in the wild, the same change genetic assimilation would have occurred, albeit after more generations, but the change was not due to natural selection. Unusual environments and selective processes in them "do produce various phenotypes, of which some are not lethal, but not adaptive either".[7] There is no need to explain the existence of phenotypes by proposing an environment through which such a characteristic might be favored.

A phenotype is not necessarily indicative of an adaptation to an environment either. Behe cites examples of physical characteristics that seem to have irreducible complexity as evidence against the scope of evolution. An irreducibly complex characteristic would serve no function were only part of the mechanism present, and according to neo-Darwinism, any trait that gives no benefit to the organism would be eliminated through natural selection. This notion ignores the fact that there are constraints on selectability.

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[5] Pg. 58; *What Darwin Got Wrong*, by Jerry Fodor and Massimo Piattelli-Palmarini
[6] Pg. 59; *What Darwin Got Wrong*, by Jerry Fodor and Massimo Piattelli-Palmarini
[7] Pg. 60; *What Darwin Got Wrong*, by Jerry Fodor and Massimo Piattelli-Palmarini

The bacteria *E. coli* can naturally break down the sugar lactose, but cannot digest similar variants such as lactulose and lactobionate. Through direct laboratory selection, a strain of *E. coli* that was capable of digesting lactose as well as lactulose was acquired, but this population, even with further direction, was unable to eventually digest lactobionate. Even though some strains of *E. coli* produced through laboratory conditions were capable of digesting lactobionate, no bacteria that could digest lactulose were able to do the same. But a normal, undirected population of *E. coli*, when put in an environment *without any lactulose*, was still observed to produce bacteria that could digest both lactose and lactulose. Given a population of said bacteria, natural selection would be unable to cultivate those that could digest lactobionate since no variation of that sort could arise given this trait. Yet this disadvantage still manifests itself.[8]

External constraints on selectability also exist in conjunction with internal constraints. The potency of a phenotype can be dependent, though not entirely, on the size of the population, which has very little to do with the genotype of the organisms of said population save the rate of reproduction (however in this case natural selection would be unable to select the members from within that population who had greater rates of reproduction). For example, the striped patterns on the sides of zebras are most effective at confusing predators only when there are many zebras in a population. The striped pattern is also an example of "'the ascent of the abundant' – that is, when abundant phenotypes may acquire evolutionary advantage regardless of their fitness", and this as well eludes natural selection (the pattern would be ineffective until other members of the population expressed the same phenotype).[9] Constraints on selectability permit an evolutionary explanation in situations where natural selection fails, but evolution, through natural selection or otherwise, is not the only scientific explanation for the complexity of life.

[8] Pg. 61; *What Darwin Got Wrong*, by Jerry Fodor and Massimo Piattelli-Palmarini

[9] Pg. 60; *What Darwin Got Wrong*, by Jerry Fodor and Massimo Piattelli-Palmarini

There is evidence that some seemingly complex characteristics may be the result of physical or chemical laws that are constraining the behavior or development of the organism. The disposition of seeds in a sunflower follow a pattern of recursive addition (1, 1, 2, 3, 5, 8) appropriately named the Fibonacci spiral. But the pattern is too specific and too ubiquitous (from the spirals of conch shells to nebulae) to be the work of genetics or evolution. Despite the benefit of such a distribution, such a rule that regulates physical changes on a macroscopic scale implies that the mechanism is not even biological, much less the product of natural selection. The coordination of "many hormones and networks of metabolites, proteins and so on that are under the control of genes and their regulatory networks" to produce this effect would require precision beyond the scope of gradual, minute changes caused by mutation. The "vastly more plausible" option is that the shapes are a result of "elaborate self-organizing interactions between several components that are [coded] for by genes… …and the strictures dictated by chemical and physical forces," not evolution.[10]

Behe makes a case for intelligent design as an explanation for the complexity of organisms by first exhausting the alternative scientific possibilities and then concluding that his own position, as the last remaining, is the most probable. His conclusion seems justified only with a misunderstanding of the true scope of the theory of evolution as a mechanism beyond the reach of natural selection, and the denial of scientific theories other than evolution that attempt to answer the question of complexity. Given the numerous lapses in Behe's attempt at inclusiveness, his line of reasoning becomes ineffective, and the theory of intelligent design seems substantially less valid.

[10] Pg 74; *What Darwin Got Wrong*, by Jerry Fodor and Massimo Piattelli-Palmarini