The Theory of Evolution Made Simple

Evolution seems to get a bad rap sometimes. I believe a lack of understanding of the theory may be to blame. This column is my understanding of what the theory is all about.

PRACTICAL SCIENCE WITH PHIL FREDA

Whenever I bring up the theory of Evolution to fellow students or acquaintances, I often receive flack from a number of them.

I usually get, "I didn't come from a monkey" or "So, are you an atheist?"

Full Disclosure

First, I would like to clarify that the theory of evolution and the belief in a higher power are not, by any means, mutually exclusive. In my opinion, evolution actually adds to the awe and beauty of the Universe, or God for that matter.

I do realize that the descent of man from the great apes is a hard pill to swallow for some individuals, but evolution does not happen in leaps and bounds, it takes millennia for a parent species to evolve into another.

My education and research as a Biology student has brought me to a simplistic and accessible understanding o f the theory.

Evolution isn't as hokey, convoluted and intimidating as some may set it out to be. Whether stemming from skepticism or belief in creationism, the actual theory of evolution seems to be the target of misunderstood accusations and even quote-mining at times.

I believe that most skeptics really don't have a very good understanding of the theory or don't realize its simplicity and elegance.

A Brief History Lesson

Charles Darwin, the proclaimed founder and initial advocate of evolution was actually a naturalist and geologist aboard the English ship HMS Beagle for five years. While on his voyage, he took fossil evidence and animal observations. His most notable observations were on the Galapagos Islands, where he noticed that on different islands, there were noticeable variations in both the behaviors and physical characteristics of finches [little birds] and giant tortoises.

He noticed that the finches had different shaped beaks, depending from which island they hailed, that better adapted them to feed on different types of food, ranging from nuts to insects. The nut-eating finches had large beaks that could crack hard shells, while the insect-eating finches had long, pincer-like beaks.

The tortoises he encountered on each island had different shaped shells. Some tortoises had raised portions on the tops of their shells to allow them to extend their neck to reach higher vegetation, while individuals on another island lacked this "collar". He deduced that since only higher vegetation was available in the areas where the tortoises with collared shells were found and lower

vegetation was ample where the tortoises with normal shells lived, that some natural force was selecting these individuals to better fill their respective niches.

Additionally, the fossil evidence Darwin uncovered illustrated species that he had never seen before and were obviously no longer found in the area. Darwin wrote that, for some reason, species seem to have disappeared from the biological sphere of life. This was in huge contraction to popular religious beliefs that all life was created by God at one time. No one thought that species changed over time.

So, Why the History Lesson?
The theory of evolution can be summed up in the last three paragraphs, it is essentially that simple. Evolution requires really only one thing: reproductive isolation.

Natural selection actually comes later.

If I were to split up two halves of a population of mice to the point where they could no longer mate and exchange genes, and placed one group in a very cold climate and one group in a very hot climate; within a few generations, a noticeable change in the frequencies of phenotypes (physical appearances and modes of behavior) would start to accumulate.

This is where natural selection comes in to play. In the colder environments, mice with higher metabolic needs and thinner coats would eventually be selected against and die; lowering the accessibility and chance of mating. The exact opposite would occur in the warmer environments. This essentially is evolution at a micro-level.

If extrapolated over many generations, changes in gene frequencies add up and may even lead to a divergence into two distinct breeding species. This is called speciation or macroevolution. Evidence of this can be seen with horses and donkeys which share a common ancestor.

These two species can still breed - but with difficulty. The resulting offspring is a sterile mule. Over the course of more and more generations, evolution tells us that these species would no longer be able to breed at all, because their genetic make-ups will continue to diverge.

Teaching the theory
Last summer, I had the privilege and responsibility to teach students as an intern in the School District of Philadelphia's Summer Bridge Program.

My job was to teach science (Biology in particular).

A fellow intern and I were brainstorming on how to effectively teach the theory of evolution to students transitioning to high school from elementary school, and came up with an idea.

We told all of the students that they were grazing herbivores. We also told them that all of the low-lying vegetation was becoming more and more scarce because of a drought coupled with a population explosion of fellow herbivores.

We then taped a beach ball to the wall of the classroom at about 5 feet from the ground.

Any student that could not reach the ball by either standing or jumping, were told to sit down. These students (or the animals they represented) had essentially "died." After each round we placed the beach ball higher and higher and at the end of each round, more students began to sit down.

At the last round, only 4 students remained. We then asked the class, if these four individuals bred what kinds of resulting animals you would expect to see? The students agreed that it was likely that the offspring would be good jumpers and would be able to reach higher vegetation.

The theory is not only simple to understand, but it is accessible to people of any age or education level. As a side note, the students really enjoyed the exercise.

Common misconceptions concerning the theory

Evolution can be defined as the changes in inherited traits of organisms through many generations.

Notice that evolution does not at any time try to examine or explain the origins of life on this planet – the most common misconception.

It deals with life after it arises.

Another common attack on evolution is that it is just a theory. In order for a theory to actually be established and accepted into the scientific community, it must be tested over and over again and peer reviewed. A theory is actually the highest accolade an idea can achieve in science, proofs only happen in the realm of mathematics.

After all, gravity is just a theory, and I would not recommend testing that one out!

The last skepticism I would like to tackle is that evolution shows us no proof that it actually works. Breakthroughs happen in studying evolution almost on a daily basis, especially in the realms of microbiology and virology. The fossil record also gives us insight on how evolution works over time in giving us transitional species to study, like in whale evolution.

Soon, I will try to post an article on this matter exclusively.

A final thought

The theory of evolution is a very important and major part of understanding Biology and even ourselves as humans. I understand that some people may have their reservations about the theory, but perhaps, this article has shed some light on it. I really don't expect anyone to accept the theory based on what I have presented, all I ask that you think about it.

Want to see evolution take place before your eyes? Try this fun interactive exercise found on the PBS website.

Philip Freda is a graduate student candidate for the Biology master's program at St. Joseph's University in Philadelphia, where he is also a teacher's assistant in several biology classes and labs.

Philip spent last summer as an intern science teacher through the Philadelphia Summer Bridge Program.