

Compare and contrast mechanism for evolutionary change essay sample



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“ Evolution is the most profound and powerful idea to have been conceived in the last two centuries” (Mayr E 2002)

The concept of evolution has been debated throughout time. “ Evolution is change in the properties of populations of organisms over time”. Based on evidence available the theories of evolution have themselves evolved. As theories on evolution expanded it created a divide within the scientific communities. Palaeontologists and Evolutionary biologists study evolution as two divisions Microevolution and Macroevolution. “ Microevolution refers to varieties within a given type. Change happens within a group, but the descendant is clearly of the same type as the ancestor. This might better be called variation, or adaptation, but the changes are “ horizontal” in effect, not “ vertical””(Morris, J DR, 2012). Typical theories to explain the genetic variation is natural selection, gene flow and genetic drift. “ Macroevolution refers to major evolutionary changes over time, the origin of new types of organisms from previously existing, but different, ancestral types” (Morris, J DR, 2012). Macro evolution uses the mechanisms common descent and speciation to depict long periods of little change (stasis) then sudden short periods of change (punctuation). Micro evolution can also be influential historical trends if given enough time. Fossils, radiometric dating and molecular clocks are all used to provide evidence of evolutionary trends. (University of California Museum of Palaeontology. 2004)

Since Aristotle’s statement of “ infinite duration” (Mayr E) the idea was widely accepted that Earth had always existed and simply revolved through cycles or periods of state. The world encountered Creationism during the 18th century (Mayer E) through religion and the teachings of Genesis in the <https://assignbuster.com/compare-and-contrast-mechanism-for-evolutionary-change-essay-sample/>

Bible. People turned to the belief that there was one Creator that made the universe and all the individual organisms to live in perfect harmony. The lack of scientific knowledge and this reliance on religious preaching meant we dated the world at around 6000 years old and the power religion held over society made this the predominant theory for many years. It wasn't until the discovery of fossils and contradictory scientific evidence in the 17th and 18th centuries that dated the Earth as 4500 million years old and outlined the evolution of different organisms. This supported the idea that the world was actually an ever-changing entity as suggested by Charles Darwin in the 19th century. This shook creationism to the core. It led all members of society to question how the world has become the form it is today.

Common Descent describes a steady and naturalistic change over time from one form of species into the current version we observe today. Although fossil records demonstrate variation in species there is substantial links missing from the fossil record. " most palaeontologists found themselves facing a situation in which there were only gaps in the fossil record, with no evidence of transformational evolutionary intermediates between documented fossil species" (Schwartz, Jeffrey H., 1999). These large gaps in knowledge and evidence create difficulties in classification of organisms and tracing the evolutionary path. Scientists today rely on a series of parameters to record the 1. 8million species presently uncovered, this can also allow us to draw parallels and recognise relationships between organisms. We can use this as a tool to measure evolutionary distances and create " phylogenetic trees" (Class handouts, 2012).

The taxonomy of life is something that has evolved over time to the standard we have today. This began in the 18th century. “ In 1735, Linnaeus published an influential book entitled *Systema Naturae* and is still the basic framework for all taxonomy in the biological sciences today” (O’Neil, D. (2012). Life is classified in levels, starting with Life itself and then proceeding to the following divisions of Domain, Kingdom, Phylum, Class, Order, Family, Genus and finally Species. The Five kingdoms are Plantae, Animalia, Fungi, Protocists and Prokaryotes. Plantae organisms use chlorophyll in the process of photosynthesis, use cellulose and have cell walls. Animalia are the classification in which we belong and organisms are heterotrophic, multicellular with organs or tissues. Animalia can be invertebrates (no backbone) or vertebrates (with backbone). Fungi are multicellular, parasitic or saprophytic, and have cell walls made of chitin, Protocists are unicellular and parasitic and their digestion is mainly intracellular. Finally the kingdom Prokaryotes are organisms that lack nuclei and are simple single celled organisms (Laguna Hills High School. 1999).

“ Natural selection is a process in nature in which organisms possessing certain genotypic characteristics that make them better adjusted to an environment tend to survive, reproduce, increase in number or frequency, and therefore, are able to transmit and perpetuate their essential genotypic qualities to succeeding generations” (Biology Dictionary. 2009). Charles Darwin published his theory of natural selection and evolution in 1859, it “ became one of the most influential books in history.” (McNamara, R. (2012). Unlike mechanisms such as genetic drift it is thought natural selection is beneficial. “ Remembering that many more individuals are born than can

possibly survive, that individuals having any advantage however slight, over others, would have the best chance of surviving and of their procreating their kind... This preservation of favourable variations and the rejection of injurious variations, I call Natural Selection." (Darwin, C (1859). The adaptations created within organisms are seen to take advantage of environmental factors in order to survive and reproduce, rather than it being a random event as perceived in Genetic Drift and Mutation. It is from this theory of natural selection that the concept of " survival of the fittest" (Collins English Dictionary - Complete and Unabridged. 2003) has formed. Fitness is not necessarily classified as the strongest or best defensive adaptation within a population. " In reality the word " fittest" seldom means the strongest or the most aggressive. On the contrary, it can mean anything from the best camouflaged or the most fecund to the cleverest or the most cooperative." (Le Page, M. 2009)

Darwin outlines the theory that the evolutionary success of natural selection depends not just on the successful variation of the organism but the organisms' success at reproducing that variation in future generations. We can also observe artificial selection or evolution through selective breeding that works to the same principles as natural selection only " the selective agent is man and not nature" (Dawkins, R 2009). This is also a beneficial adaptation as seen in domestication of wolves to dogs and then the biodiversity of dog as a species. Other principles of selection are; sexual selection. " Selection makes many organisms go to extreme lengths for sex: peacocks maintain elaborate tails, elephant seals fight over territories, fruit flies perform dances, and some species deliver persuasive gifts" (University

of California Museum of Palaeontology (2004). When organisms evolve it can be in relation to another organism within the ecosystem. “ There is a constant arms race going on between predator and prey, parasite and host. Many species have to evolve continuously just to maintain their current level of relative fitness, let alone get fitter” This process is known as co-evolution. All of these mechanisms seen to provide some benefit play a vital role within evolution but can only claim some credit for the biodiversity of organisms today, we must also take into consideration the unbeneficial effects of evolution such as mutation.

When looking at other Micro evolutionary mechanisms such as genetic mutations and genetic drift, the adaptations are not necessarily beneficial. “ Genes don’t blend; they shuffle. You could say they are shuffled badly, with groups of cards sticking together for several generations of shuffling before chance happens to split them” (Dawkins, R 1999). These are random changes within the genome of the organism. “ Mutations can be beneficial, neutral, or harmful for the organism, but mutations do not “ try” to supply what the organism “ needs.” In this respect, mutations are random—whether a particular mutation happens or not is unrelated to how useful that mutation would be” (University of California Museum of Palaeontology 2004). There are several theories on how these gene mutations come about. Some of the main ideas are that in DNA replication there is an error in the copying of the genetic code. These result in the genetic code reading differently and also the expression of the phenotype of the organism can vary and create discrepancies. Another theory is that environmental factors affect the genetic code such as radiation and UV light. These chemicals cause the DNA

to break down. The body responds by repairing the damage but may leave errors or inaccurate reparation. An example of these mutations can be seen in Bacteria's resistance of penicillin through "The Ledenberg Experiment" (Ruse, M Travis, J (2009) we can see that some colonies of the bacteria contained the gene mutation for immunity prior to the penicillin exposure. Therefore the bacteria survival is through reproductive success similar to that of natural selection than adaptations caused by environmental catastrophe.

However, if an environmental catastrophe reduced the number of a species the genome would be simplified thus causing adaptation within that species through mutation. Due to limiting the gene variation within that population, offspring can receive two copies of the same gene. "The more widely the duplicated genes spread in a population, the faster they will acquire mutations...In this way, a species can go from having one gene with two functions to two genes that each carry out one function." (Le Page, M. 2009) The environment can be considered a completely random event that is less likely to be beneficial in this instance than when taken into consideration with natural selection. Genetic Drift is also the entirely random mechanism of evolution. As natural selection suggests genes or traits are passed on the future generations through reproductive success and this in turn produces adaptations. With genetic drift it is purely chance that the organism passes on its gene therefore unlikely to produce beneficial adaptations.

Micro evolution creates the variance within a genus there are other variables within Macro evolution, such as migration and gene flow that also create long term effects for evolutionary trends. "Gene flow occurs when genes are <https://assignbuster.com/compare-and-contrast-mechanism-for-evolutionary-change-essay-sample/>

carried from one population to another. An example of gene is when pollen gets blown to a region where it previously did not exist, transporting new genetic material to that population" (Live Science Staff. (2007). Looking at Macro-evolution and what we depict as speciation, geographical isolation plays an important role. This concept states that " a species is a group of actually or potentially interbreeding individuals who are reproductively isolated from other such groups". As demonstrated from our own ancestry. " It is only in Africa that fossil hominids older than 2million years have been found. There is now no longer any doubt that Africa was the cradle of mankind." (Mayr, E 2002) This was a biological breakthrough of its time. Being aware that we were geographically isolated in Africa sets us as a separate species from the Neanderthals that were present at the same time but only located in the continent we know now as Europe. (Class handouts, 2012) " Scientists believe that the effects of climate on food sources and habitat played a major part in the migration" Hays J. (2011).

Whilst we were genetically very similar to the Neanderthals other variances took place that caused their extinction whilst we continued to flourish as a species. Extinction can form a part of natural selection where the species are no longer suitably adapted to survive, this does not reflect on the simplicity of the organism. This could also be brought about by severe environmental changes such as the Ice Age. " Extinction occurs when species are diminished because of environmental forces (habitat fragmentation, global change, overexploitation of species for human use) or because of evolutionary changes in their members (genetic inbreeding, poor reproduction, decline in population numbers)" Encyclopaedia Britannia.

(2012). Scientists have been fascinated with the tracing of our ancestors and the knowledge we have today shows a shared ancestry with Apes that dates back to 40million years ago (class handouts 2012). Fossils demonstrate the Prosimians and Old world Monkeys of this time share key characteristics and behavioural traits and our species evolved along the phylogenetic tree until we finally divided from chimpanzees 10million years ago. Reasons for this evolutionary split are uncertain although we can trace from fossil records key changes in physiology which could have adapted the way in which we lived. The main contributing factor for this was the evolution to bipedalism.

This could have come about through any number of factors from natural selection to environmental effects. " Australopithecines belong to the same family as modern day humans, Australopithecine afarensis was adapted to bipedalism, appear apelike above the neck and humanlike below the neck and dated 2. 9 to 3. 5 million years ago. The oldest A. afarensis was dated 5. 6 years ago from northern Kenya" (Brown M, 2012). This convergence is thought to have created huge behavioural shift in eating habits and physiological structure. The positioning of the spine evolved from a postural positioning to directly underneath the skull where it is present today. " Homo habilis existed between 2. 4 and 1. 5 million years ago. The brain size in earlier fossil specimens was about 500cc to 800cc. The species brain shape shows evidence that some speech had developed." (Stanford University. 2000). The effect of language and speech on the evolution of the Hominid species has shaped the environment we live in today. " Homo erectus lived between 1. 8 million and 300, 000 years ago. Brain size was between 900cc to 1200cc. Homo sapiens sapiens first appeared about 120, 000 years ago.

Modern humans have an average brain size of about 1350” (Stanford University. 2000). The evolution of the homo sapien sapien could be considered artificial selection as ourselves as a species created tools and technology that has ensured our survival, biologists and evolutionists will continue to debate whether this is the main contributing factor to our ongoing success or whether other mechanisms were involved.

In conclusion we cannot reasonably state there is any one mechanism of evolution that is solely responsible for the evolution of the world into the state we know it today. “ I think one of the greatest mysteries in biology at the moment is whether natural selection is the only process capable of generating organismal complexity,” said Massimo Pigliucci of the Department of Ecology and Evolution at Stony Brook University in New York, “ or whether there are other properties of matter that also come into play. I suspect the latter will turn out to be true.” Each mechanism plays its part in the development of species within a population. We cannot argue that these adaptations continue to improve the organism or population. Neither can we claim complete understanding of evolution as a biological process. Until such a time as we understand why evolution occurs and gather the ‘ missing links’ in our hereditary knowledge, the accepted theory that macro evolution is a by product of microevolution will continue and one cannot occur without the other. Our knowledge will continue to expand and as one of the newest species to have developed in evolutionary history we must realise that we are still learning all the complexities. “ While scientists are shedding light on natural mechanisms that work to shape species, many questions in the field are brewing on the lab-bench. And the original question examined by Charles

Darwin—what is the mechanism that causes new species to evolve—has yet to be fully explained” (Live Science Staff. (2007)

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