

Principle of Trading Time with Offspring Number for Testing Incidence of Favourable Mutations

Nasser-Eddin Rateb Dweik*

Department of Agricultural Sciences, Faculty of Science and Agriculture, Jerash University, Jordan

*Corresponding author: Nasser-Eddin Rateb Dweik, Department of Agricultural Sciences, Faculty of Science and Agriculture, Jerash University, P.O. Box, 311, Jerash 26110, Jordan, Tel: 00962-799887692; E-mail: dweik500@gmail.com

Received date: September 20, 2016; Accepted date: October 25, 2016; Published date: November 02, 2016

Copyright: © 2016 Dweik NER. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

Abstract

Charles Darwin summarized his theory of evolution in few words, "descent with modification". Evolution means change or more accurately heritable change that affects DNA sequence. Heritable changes depend on occurrence of favorable mutations that Darwin named modifications, so, favorable mutations represent the pillars that support the idea of evolution. As far as no scientist had recognized and tested a specific favorable mutation, then the favorable mutation concept remains speculative and theoretical. Validation of this theoretical concept needs strong, physical and testable evidence.

Biologists rely on time factor when they try to explain evolution theory; evolution occurs through accumulation of favorable mutations and no one can live tens of thousands of years to see it happen, especially long generational time organisms. Thus the time factor remains a mysterious thing or an umbrella under which every biological change is achievable. To make evolution issue more realistic and scientific, it is important to look for an alternative item to replace or substitute the time factor. In this article, an attempt has been made to substitute the time factor with an equivalent or even more accurate item which is the number of offspring. Number of offspring may be the best physical indicator for detecting incidence of favorable mutations and subsequently evolution. It is known that phenotypes of offspring represent a showroom of mutations' effects on individuals. Here a novel principle is presented; Principle of Trading Time with Offspring number, to test incidence of favorable mutations and subsequently its impact on evolution.

Keywords: Evolution; Testing of evolution; Favorable mutation; Favorable mutation rate

Introduction

Evolution is considered a process by which all life on earth has diversified from bacterial cell existed over 3.6 billion years ago [1,2]. Darwin's theory can be clarified as occurrence of minute changes called mutations, these mutations occur in the genetic code of an organism, which might lead to changes in the structures of a genes, resulting in a variant form that may be transmitted to subsequent generations, These mutations are "tested" by nature in which the organism exists.

Geneticists say; most of mutations (which make changes) are harmful to organisms. Most organisms will die before serious harmful genes are passed on to its offspring (neutral mutations do not make changes), however sometimes, a gene combination will arise a favorable mutation that actually improves the adaptation of the organism to its particular environment and these genes are more likely to be passed on. By this process called "Natural Selection", all life has branched. Natural Selection is considered the basic mechanism of evolution" [1,3]. However, this mechanism needs occurrence of favorable mutations to act upon. The question is, are favorable mutations (Darwin's modifications) attainable?

However, little changes in the offspring of certain animal or plant color cannot be considered a modification, because colors are depending on pigments structure*. Many photosynthetic plants or animals have a number of pigments, so any change in pigment structure or any absence of certain pigment component will result in a change of the organism color. As a matter of fact, minor color changes may affect adaptation only. Adaptation cannot be considered as a substantial change that may lead to formation of a new system or organ. For example, transition of amphibians to reptiles or dinosaurs to birds needs substantial changes.

On the other side, some scientists with a high knowledge of fossil records stand for "punctuated equilibrium theory"; it reveals that evolution occurs mainly in sudden bursts, with long periods of little change [4]. However, the theory of punctuated equilibrium lacks a clear convincing mechanism especially when someone tries to explain the theory at the molecular level.

Geneticists rely on time when they try to explain evolution theory [3,4]. As far as, most mutations are harmful and favorable ones are rare, then substantial changes in organism morphology might need very long period of time. Additionally, they believe that evolution occurs through accumulation of favorable mutations and no one can live tens of thousands of years to see it happen, thus the time factor remains a mysterious thing that can change, through certain

* Pigments are large organic molecules that have unique features. The visible light (white light) exists in a rainbow of colors in the electromagnetic spectrum. Pigments reflect or transmit the wavelengths they cannot absorb, making them appear in the corresponding color. Each type of pigment can be identified by the specific spectrum pattern of wavelengths it absorbs from visible light.

mutations, a huge ugly dinosaur to a marvelous good looking Gold Finch bird. For short generational organisms like fruit fly, no one had traced changes that had led to formation of a new organ or system.

To make evolution issue more realistic and scientific, it is important to look for an alternative item to replace or substitute the time factor. In this article, an attempt has been made to replace or substitute the time with an equivalent or even more accurate thing which is the number of offspring. Thus it is possible to trade time with offspring, because, offspring represents a showroom of the effects of mutations on phenotypes of individuals. Upon making such substitution for most organisms, the resulting figure will be huge (in billions).

Cubas P and his colleagues has published an important article in Nature entitled: "An Epigenetic Mutation Responsible for Natural Variation in Floral Symmetry. The authors in the article characterize the first naturally occurring mutant where the fundamental symmetry of the *Linaria vulgaris* flower is changed from bilateral to radial. This mutation is traced to methylation which indicates that epigenetic mutations may play a more significant role in evolution than has previously been suspected [5].

Individual's Phenotype is a Mirror that Reflect Effects of Mutations

Phenotype of any organism can be considered a mirror that reflects effects of all mutations that affects morphology. It is known that effective or significant mutations are those who could be transferred to offspring. Mostly, effective mutations occur during meiosis that produces gametes. Male and female gametes unite during sexual reproduction to form the zygote [6], i.e., sexual reproduction grants effective mutations to the offspring [1,3]. So, the time is not the important item to show effects of mutations, but the numbers of gametes do, because they have the opportunity to meet, unite and produce the zygote and then produce the offspring that may show measurable novel characters (pleiotropic effects are included).

Suppose that random mutations are able to change the morphology and physiology of any living organism. In order to follow up the possibility of any organism to evolve, we have to follow up all phenotypic changes that could happen to the offspring (lineage) of that organism through its geological age or a considerable part of it. The fossil record scarcity makes this mission impossible. Following up of all phenotypic changes during a plausible time period of the organism's geological age will be satisfactory to determine reality of evolution. Spontaneous mutations are random mutations that could happen any time anywhere [4,7]. Because phenotype of an offspring can be considered a mirror that reflects effects of most mutations, so, it is scientifically logical to follow up the possibility of any organism to evolve by observing and following up phenotypes of a huge number of its offspring. Changes that do not occur at the individual level will not appear at the population level.

Different Organisms Produce Different Numbers of Offspring

No doubt, different organisms produce different numbers of offspring. Some give birth to one individual in one year like; females of Deer, Antelopes, Elephants, Goats, Cows, Wildebeests et cetera, while others like, Red jungle fowl hen (*Gallus gallus*) lay from 16-20 eggs per nest, Because many nests are damaged and the eggs are crushed and eaten by predators so, we may estimate that each pair of Red jungle

fowl hen produce in average 8-12 individuals per year, although this assumption has not been rigorously tested in wild bird population but still we can guess, keeping in mind that egg incubation in the wild is not manageable for all females due to the presence of many natural enemies and the ability to navigate these enemies may also be under selectable pressures..

The current wildebeest (*Connochaetes taurinus*) population in Africa is around 1.3 million animal or more [8,9], however, It is difficult to find an estimation for the red fowl (*Gallus gallus*) populations because they are scattered in the jungles. Red fowl lives in jungles of north India and south-east Asia. It is considered the most recent ancestor of the domesticated farm chickens. Determining population growth pattern for wildebeest and red fowl is not known well; did it rise to some level and then fluctuate widely in response to diseases, predation and changes in environmental conditions? Or did it grow at a constant rate from one period to another? To make calculations easy, we can assume it has a constant growth rate of 3.0% for both wildebeest and chicken populations. Although a wildebeest female give birth to one calve, and a chicken female brood in average 8-12 eggs each year, however, much higher predation rate to red fowl populations suggests equal percentage rates for both organisms. On the other side; the American crocodile (*Crocodylus acutus*) lay between 35-50 eggs, only 5-10% live to reach adulthood. Also, the hawksbill sea turtle (*Eretmochelys imbricata*) may lay between 160-200 eggs and only <5% live to reach maturity.

If we assume the average populations number (through the organism geological age) of wildebeest to be 0.5 million animal and for red fowl to be one million bird, so; in average the annual wildebeest populations increase around $0.5 \text{ million} \times 3.0\% = 15000$ new born individual. Theoretically; every 15000 individuals may replace or equal to one solar year of the geological age of a wildebeest population. The same thing; each year of chicken population may replace or equal to $1 \text{ million} \times 3.0\% = 30000$ bird. It is important to remember; each individual arise from a union of a male and a female gametes that produce the zygote and then produce the whole animal. Moreover, each new born animal represent a case where one or more spontaneous mutation could happen, and each favorable mutation may appear when raising around one billion chicken birds (assuming the rate of favorable mutation is one in a billion).

Principle of Trading Time with Offspring number

Principle of Trading Time with Offspring number states that: "it is possible to trade a reasonable period of time from the geological age (in years) of a certain organism with a huge number of its offspring that appears along its geological age, because each individual represent a case or an opportunity to show the effect of a mutation or mutations that could happen mainly during meiosis. Meiosis; is the process which produce male and female gametes, which after its union can shape and produce offspring [4,6]. If millions of years are exchanged with estimated number of individuals of a certain organism (Trading Time with Offspring number), then we will realize that favorable mutations (Darwin's modifications) are not attainable or it will never appear to make evolution.

Statistics reveals that tens of billions of domestic chicks are produced annually all over the world. The Food and Agriculture Organization of the United Nations (FAO) estimate of global poultry production is more than 58 billion bird in 2013 and suggests that it is expected to grow by 1.6% in 2014. This figure does not include

domestic chickens that are produced at homes. Estimate of total global numbers of red fowls' populations that have lived on earth (at most around 80 million years) may calculate as follows; 80 million \times 30000 individual (annual increase in number of chicks)=2400 billion birds. If we assume the average number of annual chicks production in the last 155 years equal around 15 billion bird, so; what had been produced from domestic farm chicks worldwide in the last 155 years (age of Darwin's theory) may reach around; 155 year \times 15 billion=2325 billion bird. It is clear that the total number of wild chicken that have lived on earth almost equal the number of domestic chicks that have been produced in farms since Darwin puts his theory of evolution. It is important to note that 2325 billion birds may represent or equal to 2325 cases of potential good (favorable) mutation. Yet, no one had recorded a substantial change in any chick organ; in spite of 2325 of potential favorable mutations that supposed to lead to evolution. No doubt; what can be applied on chickens can be applied on all other organisms if it can be raised in huge numbers.

Depending on the previous calculations, it can be seen that a long period of time is not a mysterious, complex or a magic issue where evolution can hide behind; but it can be replaced with organisms' offspring number. If evolution is real, then hundreds of potential favorable mutations are enough to make substantial changes among individuals of chickens' populations. As far as, not a single favorable mutation had appeared in any organ of domestic farm chicks especially in the last 155 years, so, this situation cast a big suspicion; if favorable mutations (Darwin's modifications) are attainable and consequently if evolution theory is correct.

Someone may say what about Natural Selection, genetic drift and geographical isolation (stop exchanging genetic material with other organisms of the same species). Here, it should not be said that evolution is associated with Natural Selection, and evolution can be realized as a result of accumulation of gradual favorable mutations, because not a single favorable mutation has appeared in the offspring in order for Natural Selection to act upon. Nevertheless, changes in environmental conditions, geographical isolation and genetic drift cannot make substantial genetic changes that lead to evolution, because; as we saw, favorable mutations are not attainable, i.e., environmental conditions, genetic drift and geographical isolation per se; do not cause genetic changes; however, genetic changes occur as response to environmental changes that prevail in different geographical regions, i.e., substantial genetic changes do not occur as a result of mutations; but because of presence of internal (built-in) mechanisms and pathways that are designed to respond to different environmental conditions that prevail in different geographical regions. Irrespective of the source of substantial genetic changes, Trading Time with Offspring Number Principle is looking for small genetic changes that lead to noticeable differences (in offspring) before Natural Selection can act upon. For example:

- At the birds head level, no one had recorded that he had seen a chick that got an owl's round face or an owl's eyes or even its eyes location had changed.
- At the bird's beak level, no one had claimed or recorded that he had seen a chick evolve a beak or a bill that resembles an eagle, parrot, ostrich, or a duck beak. Additionally, not a single tooth has appeared in any beak or bill. Paleontologists presume that birds are decent from Archaeopteryx which has teeth in their beaks [1,2], however. If this is true, then some teeth should appear from time to time as back mutations. It is known that mutations that inactivate a gene are called forward mutations, while their effects are reversed

by back mutations, i.e., back mutations are not attainable. Geneticists estimated the incidence of back mutation equals to one in ten million (1×10^7) event per locus [7].

- At the bird's voice level, no one had recorded that he had observed a change in any chickens' voice. For example, a chicken voice had converted to a Sage Grouse, Black Grouse, Quail, Chucker or even to Crow or Turkey voice.
- At the bird's breast bones level, no one had claimed that he had seen a chick having several breast bones like that of dinosaurs instead of furcula and sternum bones of birds.
- At the bird's leg level, no one had claimed that he had seen a chick having a webbed- toed leg. Moreover, no one had claimed that he saw a chick toe that has fused bones, extra bones or has long toes like that of purple swamp hen (*Porphyrio porphyria*) toes.
- At the bird's coat level, no one had claimed that he had seen a chick that has got horny scales like that of dinosaurs instead of feathers.
- Moreover, no one had claimed that he had seen a transitional chick; for example, one that has half a duck beak and half a chicken beak. Also in wildebeest and cattle, no one had seen a bull horns had changed to an Deer's branched antlers, or had seen a sheep that has replaced its wool coat with hairs like that of goats. None of these modifications has appeared, then where are Darwin's modifications and when they will appear?

Can Chickens Retain the Ability to Grow Teeth?

Harris et al. noticed that the beak of a mutant chicken embryo (dubbed talpid2) has a tiny bumps and protuberances along its edge that looked like alligator teeth. Talpid2 is a recessive lethal trait, meaning that such mutants are never born, but some persist in eggs as long as 18 days. Presumably, death occurs as a result of disruption of gene expression regulation [10].

In vertebrates, a gene known as sonic hedgehog (shh) is essential for tooth production. In normal chickens, this gene is found and expressed along the sides of the gums, but in mutant chicks (talpid2 mutants) shh gene is expressed in the middle of the gums. Scientist's explanation for this phenomenon is; the mutant version of talpid2 appears to turn shh gene on in the right place for growing teeth and this leads to nascent teeth.

Harris's [10] discovery does not necessarily mean that chickens retain the ability to grow teeth. First of all changing location of gene expression in the birds' ancestors would disrupt proper gene regulation and produce disabled mutants. Presumably, disabled individuals would die or at least would possess low fitness, then, how evolution would pass through individuals possessing low fitness?

From the very beginning, how changing location of gene expression in birds' ancestors would be beneficial, because some flesh eating birds still need those teeth. What had happened to birds that experienced sudden loss of their teeth as a result of alteration in the location of gene expression? How they make it and survive while they are designed to eat flesh. Science does not accept saying; they were obliged to change their diet habits and turned to eat plant seeds. This shift is impossible, because it needs synchronized cooperation of tens of genes in order to change a beak shape, bird behavior and the related digestive enzymes. We see lions die of hunger in areas full of grass and trees because they cannot change their diets. Here, there is no time for tens of favorable mutations to fulfill necessary changes.

Harris [10] found that expressing the *shh* gene in a new location initiate teeth-like structures for several days and then reabsorbed. This means true-teeth growth needs additional gene or genes contributions which are not there. Archaeopteryx fossils reveal that it was having teeth, but this sounds necessary for its life in that time. Claiming that Archaeopteryx was the oldest ancestor to birds is not proven yet, because teeth-less birds like; Protoavis and Confuciusornis sanctus was found earlier or concurrent to Archaeopteryx [11,12]. Chatterjee, a paleontologist at Texas University, who found the Protoavis fossils, says: they have advanced avian features that place them closer to the ancestor of modern birds than Archaeopteryx.

If Harris [11] discovery means that chickens retain the ability to grow teeth, then the teeth-like structures should not reabsorbed, and most genes necessary for teeth production should be available. It is not acceptable to say; Natural selection had eliminated all necessary genes, because Natural selection could not discard individuals that still carry pseudogenes and/or copy gene number for hundreds of millions of years. In the chicken world, the *shh* gene is expressed in different tissue. Bringing together the two tissues in the jaw of the mutant embryo may had led to teeth-like structures, so, no one is pretty sure that expression of *shh* gene in *talpid2* mutants leads to nascent teeth because, no chick survived to show real teeth, however, it may lead to formation of a torus, which is a bulging projection or swellings caused by bone or muscle like; torus palatinus disorder. Scientists do not know what causes torus palatinus yet.

Grant Study of Darwin's Finches [13]

Apparently, this study contradicts with what Grant and his wife had found in Galápagos' islands when they studied Darwin's finches, as a matter of fact, the Grants observed that drought conditions led to larger average weight and beak size within populations of the medium ground finch (*Geospiza fortis*) and the cactus finch (*Geospiza scandens*), while flooding experienced a few years later resulted in reduced measurements. They also found that when the environment changes, some of the variants in each population survive while others die. The Grants consider this as a proof how interspecific competition and natural selection can act strongly enough on contemporary populations to produce observable and measurable evolutionary changes [13].

As a matter of fact, Darwin's finches are mingled together at Galápagos' islands, some were larger and have thick beaks and others were small and have slender ones. Grant [13] did not make measurements of beaks to the finches' offspring alone, but he measured birds' beaks of all ages of certain species. Because of drought conditions and limited seed resources, it is expected that natural selection will be in favor of those who have thicker beaks. Birds that have thick beaks will produce chicks that have thick beaks, and vice versa. So, the percentage of birds that have thick beaks will increase on the island, because they have an extra advantage to break big and solid seeds, while the percentage of smaller birds that have not the extra advantage will decrease. So, Grant had calculated percentages not effects of favorable mutations, given that number of studied birds may not exceeded several hundreds. Grant did not give any evidence that medium ground finches have got thicker beaks as a result of favorable mutation, i.e., favorable mutations are not involved in Grant's study. Thus, Grant study is different than this study.

On the other side, In search for genes that control beak size, the study of Lamichhaney et al. in Science magazine implies that the two

HMGA2 beak gene forms are not alleles but they are gene variants or alternatives; where one gene gets induced in response to drought condition and the other stays standby or mute [14]. Let us assume that one of the two gene copy variants was original and the other appeared as a result of favorable mutation then three questions arise: how natural selection was able to fix the second gene variant while the first is fit and active? Secondly, how a signaling pathway that is able to respond to changes in environmental conditions gets established? However, it may involve several synchronizing genes? Nevertheless, the probability of establishing a signalling pathway from cooperation of several mutating genes is almost zero due to the high number of nucleotides in each gene. Thirdly, how the two gene variants are linked to the signaling pathway?

From previous discussion and due to low number of Darwin finches in the island and the short time period for changes, most probably, changes in the beak size is not a matter of evolution rather it is plasticity in the birds' genomes. This plasticity appears as a result of built-in (pre designed) mechanisms that can respond to environmental conditions through activation of an alternative gene variant or an epigenetic modification.

Gradual Changes or Punctuated Equilibrium

In this context, we cannot say evolution involves unnoticeable gradual (fine-tuning) changes, because such changes would be lost and cannot be fixed due to its null effect on fitness. However, Punctuated Equilibrium Theory refutes gradual changes. The Punctuated Equilibrium Theory stated, that mutations are not gradual, but new species evolve suddenly over relatively short periods of time (this state is called cladogenesis), followed by longer periods in which little genetic change occurs (this state is called stasis), however, no sudden bursts of any evolved birds noticed.

Let us suppose that favorable mutations are amenable and transformation of a chicken beak is possible through occurrence of four successive favorable mutations. Also, let us suppose that the first good (noticeable) mutation has appeared and fixed by Natural Selection, now; there is no guarantee that the second mutation will occur to continue what the first mutation had established, a third or fourth mutation might occur before the second mutation, or the second mutation may appear after a long period of time after the first mutation had mutated and spoiled the whole program.

In reality, random mutations could not make substantial changes in chicks' beaks or toes shapes and or in voice in order for Natural Selection to act upon. Mechanism of Natural Selection cannot perform if mutations have no positive effect on the organism's life or his fitness. A little change in a beak or toes shape has no effect on fitness nor is lethal to birds. On the other hand, the Punctuated Equilibrium Theory, which rejects the mechanism of gradual changes, is built on examination of real fossils and not on expectations or speculations. Additionally, no one had seen one chick which has got wider beak or webbed-toed leg that appeared suddenly and not gradually.

Conclusion

Raising and watching hundreds of billions of domestic chickens show that the probability of favorable mutation occurrence is around zero or it does not exist. If favorable mutations are amenable, then upon raising certain organism in huge numbers, we have to see or detect some positive modifications in certain organ or system.

Principle of Trading Time with Offspring number is looking for simple and small modifications before natural selection starts to act upon.

In conclusion, time may be replaced with or substituted by offspring number, and failure of detecting any favorable mutation when raising billions of chicken birds imposes a challenge to the evolution theory. Epigenetic alterations may play a major role in speciation of organisms than has previously been suspected. However; some adaptations that might be encountered in life of organisms may be attributed to built-in mechanisms (out of the scope of this article) rather to mutations.

References

1. Ridley M (1996) Evolution, 2nd edition. By Blackwell Science, Inc, USA.
2. Futuyma D (2005) Evolution. Sunderland: Sinauer Associate Inc.
3. Stearns SC, Hoekstra RF (2000) Evolution. OXFORD University press.
4. Campbell NA, Reece JB, Mitchell LG (2012) Biology, Benjamin/Cummings, USA.
5. Cubas P, Vincent C and Coen E (1999) An Epigenetic Mutation Responsible for Natural Variation in Floral Symmetry. Nature 401: 157-61.
6. Brooker RJ (1999) Genetics: Analysis and principles, Addition-wesley longman Inc. Cal. USA.
7. Lewin B (2004) Genes VIII, Pearson Prentice Hall, NJ.
8. UCN SSC Antelope Specialist Group (2008) *Connochaetes taurinus*. The IUCN Red List of Threatened Species 2008: e.T5229A11120316.
9. Hopcraft J, Sinclair A, Holdo R, Mwangomo E, Mduma S, et al. (2013) Why are wildebeest the most abundant herbivore in the Serengeti ecosystem? Serengeti IV: Sustaining Biodiversity in a Coupled Human-Natural System, University of Chicago Press, Chicago.
10. Harris M, Hasso S, Ferguson M, Fallon J (2006) The development of archosaurian first-generation teeth in a chicken mutant. Curr Biol 16: 371-7.
11. Beardsley T (1986) Fossil bird shakes evolutionary hypotheses. Nature 322: 677.
12. Martin LD, Hou L, Zhou Z, Feduccia A (1998) *Confuciusornis sanctus* compared to archaeopteryx lithographica. Naturwissenschaften 85: 286-289.
13. Grant PR, Grant RB (2003) What Darwin's finches can teach us about the evolutionary origin and regulation of biodiversity. Bioscience 53: 965-975.
14. Lamichhaney S (2016) A beak size locus in Darwin's finches facilitated character displacement during drought. Science 325: 470-474.