Genetic Diversity: Mutations, Sexual Reproduction, Migration, and Population Size

Genetic diversity is the total number of genetic natures in the genetic makeup of a particular species. It is the natural technique in which populations acquaint with the changing environments. Survival and adaptability of various species depend greatly on their genetic diversity. Mutations, migration, sexual reproduction and population size are four important issues associated with genetic diversity. This paper is discussing genetic diversity and the important issues associated with genetic diversity.

The genetic diversity varies in a natural range for each and every specific species. Furthermore, the genetic diversity is altered through numerous generations of the species. There are several natural processes that are continuously performed in such a way to have impacts on the genetic diversity. Among the various factors that have effect on genetic diversity, mutations are those that impact genetic diversity both in positive and negative ways. Sometimes, there are abnormal faults in the replication of DNA or other components of the production and arrangements of genetic information in the cells. Mutations are occurred in such conditions. Though mutations are occurred in a very slow manner they are continuous. Mutations are expressed in varied levels. A change in a DNA nucleotide matters in the production of a different protein in point mutation. Genes are restructured in chromosomal mutations. Through point mutations and chromosomal mutations, new alleles are produced and genetic diversity is increased. The rate of mutation can be valuable information for better understanding of evolutionary relationships. There are many issues concerning mutations in genetic diversity. The possibility of genetic disorders in offspring is one of the most important issues among them.

Another important issue concerning genetic diversity is migration. It is the movement of genetic diversity within a species. As migration occurs, alleles are either added to or subtracted from a local population. The reason is the migration of species from a genetically different population to another. For example, migration results in genetic diversity of plant species through pollen dispersal or seed dispersal. In this case, the rate of migration is determined by the factors such as the level of reproduction rates and the distances over which the seeds or pollen were disseminated. Movement of somatic propagules like suckers or rhizomes is a reason for genetic diversity in asexually reproducing species. Migration is an issue concerning genetic diversity as it has mostly negative impacts on the genetic diversity of species.

Another important factor that increases the genetic diversity within species is sexual reproduction. New species are developed through sexual reproduction. Mutation and the genetic recombination through meiosis and fertilization are two important factors for genetic diversity in sexually reproducing species. More surviving offspring are produced through sexual reproduction. The importance of sexual reproduction in genetic diversity is obvious from the exceptionally diverse animal world and plant world. The risk of genetically transmitted diseases is associated with sexual reproduction. It can be considered as one of the important issues linked with sexual reproduction which impacts genetic diversity.

Population size is a very important factor that impacts the genetic diversity of a biome. The different components produce genetic diversity within a gene pool depending on the population size. As a result, a smaller population corresponds to a smaller genetic diversity while a larger population represents a greater genetic diversity. In other words, other decisive factors including migration, mutation, or sexual reproduction have greater influences on the genetic character of a smaller population. Some specific species become extinct in smaller populations. They are not able to survive due to changing environments or health problems. The inability of survival or extinction of species is one of the issues concerning genetic diversity associated with population size.

The most important advantage of having higher genetic diversity is the wider variety of offspring. Species with lesser genetic diversity will generate offspring that are genetically comparable to them. These newer generations also are more vulnerable to diseases or problems just like their parents. For maintaining and improving genetic diversity, all the above mentioned factors are significantly important. The chances of extinction of various species are increased when any of these factors produce negative impacts on genetic diversity.

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Origin of Life on Earth

Since the known history of human race, scientists and theorists of different periods tried to answer the fascinating question ‘How life originated on earth’. As a result, a number of different theories are there to explain the origin of life on earth. Because of the very reason that none of them could establish a theory which is acceptable to all or which could prove as flawless, newer theories continued to be proposed. None of the theories suggested on the origin of earth could convincingly illustrate the actual experiment that could have resulted in the origin of life on earth. Among the various theories, some are considered as more substantial than others in illustrating how the first living thing originated on earth. This paper is discussing three such conflicting theories that attempted to explain the origin of life on earth. They are Panspermia theory, Heterotroph theory and Autotroph theory.

During the early years of 1900s, the Swedish scientist Svante Arrhenius popularized the concept of Panspermia. According to Panspermia theory, the life on earth was originated with an extraterrestrial reason. The life was originated somewhere outside the earth and the seeds of life were carried to earth. Obviously, the theory could not explain how the first living thing originated. The scientists of that period did not pay much attention to this theory as it lacked any scientific evidence. Later, when the evidences were collected from studying meteorites and space explorations, the theory could get some support from the scientific world. However, the basic concept of Panspermia was modified and revised by then. Scientific examinations of meteorites proved the presence of organic molecules in them. Thus the probability of life existing somewhere else in the solar system became more evident. Scientific evidences suggested that liquid water in large quantities in the forms of lakes, rivers or even as saline oceans existed in the past. The assumptions based on these evidences were later established with the recent Mars explorations. Though the Mars explorations could not support any evidence for presence of life in the past, the presence of water is believed to be a supporting evidence for the concept that life could have sustained on Mars. The supporters of Panspermia theory thinks the life on earth was originated from the seeds of life carried by meteorites to earth from any extraterrestrial location possibly Mars.

Heterotroph hypothesis and Autotroph hypothesis tried to explain the origin of life on earth based on the metabolic aspects. With the help of fossil evidences, scientists suggested that about 3.5 billion years ago, prehistoric forms of life were present on earth. When the existing organic molecules were lost or damaged, the first primitive cells would have attempted to add new organic molecules into their arrangements. Heterotroph hypothesis and Autotroph hypotheses are two theories explaining the ways the cells could have succeeded in doing so.

As per the Heterotroph theory, the first living things on earth were heterotrophs. Organic molecules are captured from their environs and made use to produce new molecules by heterotrophs. These organic molecules are also required to provide energy for heterotrophs. The theory suggests that they would have lived off organic molecules in the oceans. The evidence for the presence of innumerable compounds in the early oceans supports this concept. One of the scientific evidence supporting the Heterotroph hypothesis is the records that indicate the presence of earliest cells in fossils which are supposed to be older than the period of exposure of oxygen on atmosphere. Early heterotrophs were not getting sufficient energy from organic molecules as they were anaerobic organisms. They could not have been able to find resource materials to satisfy their energy requirements as their population increased through reproduction. The theory holds that these heterotrophic cells could have endured mutations that enabled them to convert the unusable materials to usable resources. Mutations could have helped some cells to survive while others in which mutations did not occur could have extinct. Through a sequence of mutations, more complex series of biochemical reactions would have initiated within the heterotrophic cells. Further addition of procedures to their metabolic process could have caused the new metabolic pathways to develop.

According to the Autotroph hypothesis, the early living things were autotrophs. Autotrophs used exterior energy sources such as sunlight or inorganic chemical reactions to combine simple inorganic molecules such as water and carbon dioxide to produce new organic molecules. Such organic molecules would have been worked as resources for new cells. These cells could have provided energy for autotrophs. Recently, some evidences were collected in support of Autotroph hypothesis. For example, it was evidenced that Domain Archaea is autotrophic and they lived in extremely unfriendly environments. Scientists believe that such extreme conditions are similar to the settings of the early earth. According to the theory, the first organisms could have autotrophs and gradually they would have evolved into both autotrophic and heterotrophic cells. Thus various newer cells could have developed. The process of evolution could have then continued over the years.

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