Introduction to Neutrosophic Genetics

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Abstract

Neutrosophic Genetics is the study of genetics using neutrosophic logic, set, probability, statistics, measure and other neutrosophic tools and procedures.

In this paper, based on the Neutrosophic Theory of Evolution (that includes degrees of *Evolution, Neutrality (or Indeterminacy),* and *Involution*) – as extension of Darwin's Theory of Evolution, we show the applicability of neutrosophy in genetics, and we present within the frame of neutrosophic genetics the following concepts: neutrosophic mutation, neutrosophic speciation, and neutrosophic coevolution.

Keywords: Genetics, Mutation, Speciation, Coevolution, Neutrosophic Genetics, Neutrosophic Theory of Evolution, Degrees of Evolution / Neutrality or Indeterminacy / Involution, neutrosophic mutation, neutrosophic speciation, neutrosophic coevolution

1. Introduction to Mutation

The common definition is that a *Mutation* is a change (a permanent alteration) in the genetic (DNA) sequence. During the cell division, if a mistake is made in DNA copying, we have a mutation.

The mutation can result from random mistake of DNA copying, or due to environmental factors (such as exposure to chemicals that are called mutagens, to ionizing radiation, or infection by viruses) [1].

If the mutation occurs in the body cells, it is called *Somatic Mutation*, and it is not passed on to the offspring. But if the mutation occurs in the female eggs and male sperm, it is called *Germ-Line Mutation*, and it is passed on [1].

The mutation is part of Darwin's Evolution and thanks to mutation we have much biodiversity of species on Earth.

2. Neutrosophic Theory of Evolution

As an extension of Darwin's Evolution, Neutrosophic Theory of Evolution [9] comprises three types of degrees:

a) Degree of *Evolution* (as Darwin's).

b) Degree of *Neutrality* (neither evolution, nor involution) or *Indeterminacy* (not sure if the change is towards evolution or involution).

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c) Degree of *Involution.*

Mutations alterate genes, or create new genes.

3. Neutrosophic Mutation

As in neutrosophy, we meet three types of mutations:

a) *Positive Mutations*, or mutation that produces benefic (positive) effect in the sense of evolution (adaptation) of the individual to the environment.

b) *Neutral Mutations*, or mutation that have no effect on evolution or on involution (adaptation or inadaptation) of the individual to the environment.

The overwhelming number of mutations are neutral.

This is also due to the mechanisms that many organisms have for repairing the DNA initial changes and for removing somatic cells that were mutated.

c) *Negative Mutations*, or mutation that produces malefic (acrimonious, negative) effect in the sense of involution (inadaptation) of the individual to the environment.

Since mutation may weaken the immune system and produces genetic disorder, negative mosaicism, birth defects, infections, cancer, abnormal biological processes, etc.

4. Species

In the frame of a species, with respect to its individuals all together, there occur:

degrees of positive mutation, neutral mutation, and negative mutation – denoted by T (truth), I (neutral or indeterminate), and F (falsehood) respectively, where $T, I, F \in [0, 1]$.

Let $\alpha_T, \beta_T, \alpha_I, \beta_I, \alpha_F, \beta_F \in [0, 1]$, with:

$\alpha_T > \beta_T, \alpha_I > \beta_I, \alpha_F > \beta_F,$

where α_T is the upper treshold of T,

and β_T is the lower treshold of T,

and similarly for α_I, β_I, and respectively α_F, β_F.

Of course, the thresholds depend on each species and on its environment.

5. Neutrosophic Speciation

Each Species has a degree of speciation (T), a degree of continuation (I), and degree of extinction (F), where $T, I, F \in [0, 1]$. We use the neutrosophic notation: *Species(T, I, F).*

Each Species(*T, I, F*) neutrosophically tends towards:

a) *Speciation*, or formation of a new species, if $T \geq \alpha_T$, and $I \leq \beta_I$, $F \leq \beta_F$;

b) *Continuation*, as the same species, if $I \geq \alpha_I$, and $T \leq \beta_T$, $F \leq \beta_F$;

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c) *Extinction*, if $F \geq \alpha_F$, and $T \leq \beta_F$, $I \leq \beta_I$.

6. Neutrosophic Coevolution

Two species in the same environment may be in some:

a) Degree of cooperation (T);

b) Degree of neutrality (I);

c) Degree of conflict (F).

Of course these degrees $T, I, F \in [0, 1]$ are dynamic, and continuously change according to the environment and the species that live and interact with each other.

Conclusion

The Neutrosophy [1998], as a new branch of philosophy [9], is based on triads of the form *(<A>, <neutA>, <antiA>),* where *<A>* and *<antiA>* are opposites of each other, while *<neutA>* is the neutral (or indeterminate) between them. In general *<A>* may be an item (concept, idea, notion, theory, etc.).

We have introduced for the first time the Neutrosophic Genetics, which is the study of genetics using neutrosophic logic, set, probability, statistics, measure and other neutrosophic tools and procedures.

Within the frame of neutrosophic genetics, we have extended the classical concepts of mutation, speciation, and coevolution, to respectively neutrosophic mutation, neutrosophic speciation, and neutrosophic coevolution in order to better describe our real world.

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Addendum (Definitions)

Since this paper is intended for the general public, in order for the paper to be self-contained, we provide below dictionary definitions of principal genetic terms.

Allele: any of the alternative forms of a gene that may occur at a given locus; "allele," Merriam-Webster.com Dictionary, https://www.merriam-webster.com/dictionary/allele. Accessed 12/7/2020.

Chromosome: any of the rod-shaped or threadlike DNA-containing structures of cellular organisms that are located in the nucleus of eukaryotes, are usually ring-shaped in prokaryotes (such as bacteria), and contain all or most of the genes of the organism; "chromosome," Merriam-Webster.com Dictionary, https://www.merriam-webster.com/dictionary/chromosome. Accessed 12/7/2020.

DNA: any of various nucleic acids that are usually the molecular basis of heredity, are constructed of a double helix held together by hydrogen bonds between purine and pyrimidine bases which project inward from two chains containing alternate links of deoxyribose and phosphate, and that in eukaryotes are localized chiefly in cell nuclei; "DNA," Merriam-Webster.com Dictionary, https://www.merriam-webster.com/dictionary/DNA. Accessed 12/7/2020.

Gene: a specific sequence of nucleotides in DNA or RNA that is located usually on a chromosome and that is the functional unit of inheritance controlling the transmission and expression of one or more traits by specifying the structure of a particular polypeptide and especially a protein or controlling the function of other genetic material; "gene," Merriam-Webster.com Dictionary, https://www.merriam-webster.com/dictionary/gene. Accessed 12/7/2020.

Genome: one haploid set of chromosomes with the genes they contain; "genome," Merriam-Webster.com Dictionary, https://www.merriam-webster.com/dictionary/genome. Accessed 12/7/2020.

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Germ: a small mass of living substance capable of developing into an organism or one of its parts; "germ," Merriam-Webster.com Dictionary, https://www.merriam-webster.com/dictionary/germ. Accessed 12/7/2020.

Phenotype: the observable characteristics or traits of an organism that are produced by the interaction of the genotype and the environment; "phenotype," Merriam-Webster.com Dictionary, https://www.merriam-webster.com/dictionary/phenotype. Accessed 12/7/2020.

Somatic: of, relating to, or affecting the body especially as distinguished from the germplasm (germ cells and their precursors serving as the bearers of heredity); "somatic," Merriam-Webster.com Dictionary, https://www.merriam-webster.com/dictionary/somatic. Accessed 12/7/2020.

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