BIOLOGY

Bioinformatics: Codes of Biology

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The combination of biology and computers has revolutionized the medical field. The decades of research on encrypting DNA codes has been redefined by the introduction of algorithms, molecular biology hardware; the dispute has become solvable which has led to the birth of "Bioinformatics": an interdisciplinary field that develops and improves upon methods for storing, retrieving, organizing and analyzing biological data.

Discovery

Each part of an organism has a foundation: cells, and these foundations are subdivided into DNA, further categorizing as genes. Each gene is unique in its nature but with a common location in an individual called gene location. This unique, yet analyzable property was researched and categorized by Paulien Hogeweg and Ben Hesper in 1970 as "the study of informatic processes in biotic systems". (Alla L Lapidus)

Over the years, the foundations set by Hogeweg and Hesper were developed into bioinformatics. The depth of Bioinformatics encompasses several fields including but not limited to biotechnology, environmental science, and agriculture. The patterns and codes that discern each object hence paved the way for success.

Process of Genetic Coding

The genetic code is the set of rules by which information encoded in genetic material (DNA or RNA sequences) is translated into proteins (amino acid sequences) by living cells. The code is run on the basis of similar variables like nucleotide pairs, phosphate groups and ribose sugar and is decrypted. Moreover, the grouping of nitrogenous nucleotides: Adenine (A) with Thymine (T) and Guanine (G) with Cytosine (C) and Uracil (U) (replaces Thymine in RNA) is formulated as a mathematical set of data and each pair of nucleotides. Their hydrogen bonds and their diverse structure is utilized in finding possible improvements or innovations in multiple fields as such told above. (Kimball, 2014-05-01)

Branches of Biological Informatics:

The broad yet infamous field of bioinformatics is subdivided into four main branches: genomics, proteomics, cheminformatics and transcriptomics. Genomics is the study of the expression of genes and is an integral field in the study of cells and their nature while proteomics is the study of protein structure, function, and interactions produced by a particular cell, tissue, or organism. Cheminformatics (chemical informatics) focuses on storing, indexing, searching, retrieving, and applying information about chemical compounds and lastly, the study of sets of all messenger RNA

molecules in the cell is called transcriptomics. (Kumar A, 2017) These fields share one common trait: they are interdisciplinary in nature. No discovery is refused by at least two of these fields, i.e. in gene therapy; all four branches are utilized.

Applications:

a. Biotechnology:

The field although is an amalgamation of genetic engineering with modern prosthetics and robotics, researchers predict that application of bioinformatics in the production and improvement of dairy products via the *Lactobacillus* bacterium will prove successful and play a role in modernizing the perception of dairy products as a significant part of science.

b. *Medicine:*

The array of drugs, their uses, their effects on individual humans and animals, have been a challenge for pharmacists and chemists but the inclusion of bioinformatics in corresponding specific results of drugs by the presence of genes will present an opportunity to eradicate the problem of allergies. This can further be utilized in cancer treatments to run simulations on cancer cells of individuals and predict the result of each treatment of specific patients and thus paves the way for an increase in the success rate of survival of cancer patients.

c. *Microbial Genome Applications:*

The prospect of microbes solving problems is not a novel aspect in modern science but the potential it contains is still a boundary that has not been explored by scientists. These microbes have provided sufficient evidence in their action as decomposers even to the extent of aiding waste cleanups. The perfect example for such a microbe is *the Deinococcus radiodurans* bacterium that has been given the rank of the toughest bacterium by Guinness Book of World Records due to its ability to repair fragments of damaged DNA and chromosomes. The appliance of bioinformatics can further enhance its use by finding the precise elements that differentiate this bacterium from others and utilizing the information to produce enhanced microbes for waste cleanup. (Priyadarshi, 2014)

d. *Agriculture:*

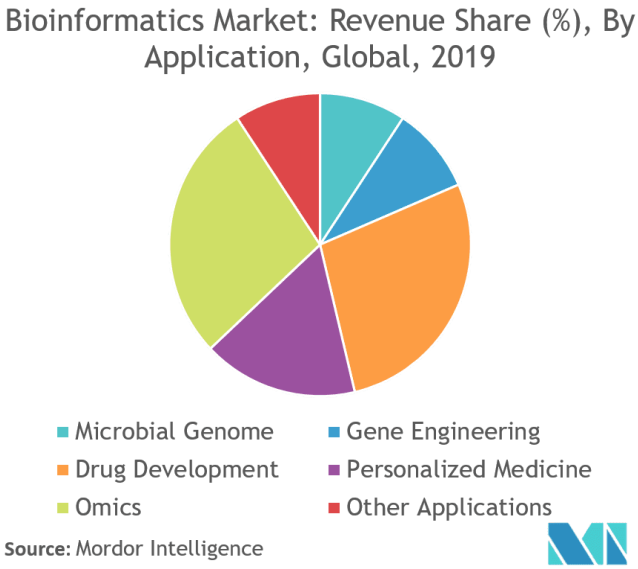
The improvement of crop species, their resistance to diseases, and their yield have been developed since the time of the Green Revolution but the method initiated decades ago can be improved to make it more efficient and precise. The obsolete methods included years of reproduction with varied species and the observation and conclusion of the changes. However, the probability of finding results and the time taken to retrieve those results can be solved by the utilization of bioinformatics which can provide the results of reproducing species and their benefits just by differentiating each gene that gives the successful change and use that key to share results as done for watercress which is known as the first plant to be sequenced and to act as a model for future plant generations and clement sequencing. (Priyadarshi, 2014)

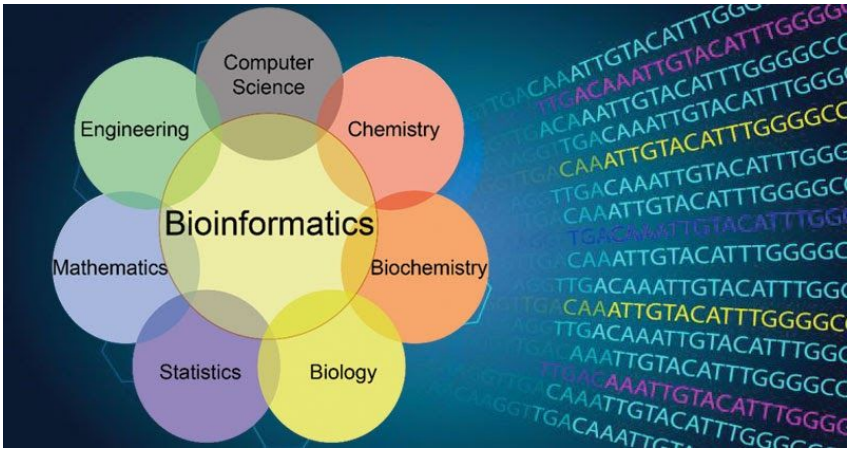
Conclusion:

As the field of Computer Science is extending through the branches of science, the symphony between Biology and Computer Science is cognizable, and the range of applications and future prospects are evident too. Hence, the process of exploring and researching in Bioinformatics will surely present future possibilities of

accomplishments in the fields of medicine, agriculture, and biotechnology.

Tables





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