**Proteomics and their application in crop improvement**

Bioinformatics is the study of biological data using information tools. Bioinformatics is a combination of computer, mathematics algorithm and statistics with concept in life science to solve biological problem. The main task of bioinformatics is to manage and analyze the biological data. Bioinformatics has a number of applications in animal as well as in plant biology.

Now-a-days CADD (Computer-Aided Drug Design) is very much helpful in discovering new drug. In plant biology, these tools are helpful in improving crop, improving nutrition quality. It also helps in studying medicinal plants with the help of proteomics, genomics, transcriptomics, and helps in improving the quality of traditional medicinal material. Genomics helps in providing massive information to improve the crop phenotype. Bioinformatics have tools to analyze biological sequences like DNA, RNA and protein sequences. ‘Multiple alignment’ provides a method to estimate the number of genes in the gene families and also in the identification of the undescribed genes. The multiple alignment information helps in studying the gene expression pattern in plants. Computational tools are very much helpful in identification of ergonomically important gene by comparative analysis between crop plant and model species. Bioinformatics mainly deals with – 1) DNA, RNA and protein sequence 2) Molecular structure 3) Expression data.

[Note : *A* ***gene family*** *is a set of several similar* ***genes****, formed by duplication of a single original* ***gene****, and generally with similar biochemical functions. One such* ***family*** *are the* ***genes*** *for human haemoglobin subunits; the ten* ***genes*** *are in two clusters on different chromosomes, called the α-globin and β-globin loci.*]

**Bioinformatics have number of applications in plants crop improvement**, such as-

1. *Single gene analysis* - Single gene analysis include DNA, RNA and protein sequences. These are the most fundamental at the molecular level.
2. *Biochemical pathways* - KEGG (Kyoto Encyclopedia of Genes and Genomes) is a database that contains all the metabolic pathways which help in understanding the high level function and utilities of the biological system.
3. *Molecular techniques* - There are some online tools for the designing of primer. Eg: primer premier, Primer3(***Primer Premier*** *is a software that combines the designs of various* [*PCR applications*](http://en.wikipedia.org/wiki/Applications_of_PCR)*, polymer chain reaction, under one common platform.*), GenScript.

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1. *Sequence similarity* -NCBI (National Centre for Biotechnology Information) tool and BLAST (Basic Local Alignment Search Tool) use dynamic programming algorithm which helps in searching of similarity between two different species. The dynamic programming finds the similarity between two species sequences by the use of substitution matrix and gaps.
2. *Modeling of protein*: Protein structure can be easily determined by the use of various tools of bioinformatics like Swiss Model from the sequence. There are number of tools available for the modeling of the protein.

**Role of Bioinformatics in crop improvement.**

1. *Crop improvement*:  The storage and accession of data has become an expanding challenge after the introduction of next generation sequencing techniques. The most important database EST (expressed sequence tag) database consists of ESTs drawn from the multiple cDNA. EST has an application in the discovery of new genes, genomes and identification of the coding regions in the genomic sequences. Genotype identification, analysis of genetic diversity, phenotype mapping can be modify by the different software tools and can bring improvement in crop.

2. *Insect resistance*:  Plants are made resistant to insects by incorporating desire gene to the plant. The first resistant plant was made by incorporating the cry gene from *Bacillus thuringiensis* (Bt). It is bacterial species which increases the soil fertility and protect the plant from pests. The genes of the Bt can be incorporated into the plant gene.

3. *Plant breeding*:  Plant genomics helps in understanding the genetic and molecular basis of all biological process. By understanding the genetic and molecular structure, it helps in developing new cultivars with improved quality and reduced economic and environmental cost. Now-a-days the Genome program is an important tool for the plant improvement. This genome programme helps in identifying the key genes and their function.

4. *Improve nutritional quality*:  There are various ways of improving nutrition quality. It can be improved by the redirection of the cellular activity, by the modification of the enzymatic transport and by regulating the function of the cell. Various tools are available to identify the genes. With the advances in the proteomics and glycomics, there are various tools for the analysis of primary and secondary metabolic pathways.

5. *Development of drought resistant varieties*:  Drought resistant varieties can be developed by identifying the drought tolerance genes and alleles. Various tools have been developed to study the physiology, expression profiling, comparative genomics. The KEGG database (*Kyoto Encyclopedia of Genes and Genomes database*) contains all the metabolic pathways like the pathway for the carbohydrate production. Genes in the ABA production pathway are important for the development of drought resistant varieties. KEGG databases can be important in identifying the pathway for carbohydrate production and ABA production. After the identification of the pathway the genes involved in the same pathway are studied for the development.

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