

MSc Microbiology Sem IV MIC 403c

**MICROBIAL GENOMICS &
PROTEOMICS**

Lecture 2 | Types of Genomics

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Types of Genomics/Transcriptomics/Proteomics

- **Genomics** -interdisciplinary field of biology focussing on structure, function, evolution, mapping and editing of the genome
- **Branches/types of Genomics**
- *Structural Genomics*: Physical nature of entire genome (Sequence, genomic maps, 3D structures)
- *Functional Genomics*: Functions, regulation and interactions within genome- gene annotation
- *Epigenomics*: Complete set of epigenetic modifications (DNA methylation and histone modifications)
- *Epitranscriptomics*: Complete set of RNA editing and modification (6 methyl adenine)

- *Comparative Genomics*: Compare genome of different organisms, Phenotypic and genotypic associations, population analysis
- *Mutational Genomics*: study of all mutations that occur in genome of an organism and its impact (SNPs, genomics, epigenomic and transcript changes in disease such as cancer)
- *Evolutionary Genomics/ Phylogenomics*: Phylogenetic relationships (relationship between different groups of organisms and their evolution) understanding from divergence and order using genomics (homologous genes- ortholog [speciation from common ancestor] or paralogs [gene duplication], phylogenetic trees that determine time line chronograms
- *Pharmacogenomics*: Drug interactions with genome, new drug discovery
- *Pathogenomics*: genome analysis of pathogens

Applied Genomics

- *Translational Genomics*: Organism improvement using information about genome
- *Clinical /Medical Genomics*: Application and integration of genomics for diagnosis and treatment of diseases
- *Agricultural Genomics Or Agrigenomics*: Application of genomics in agriculture (trait screening, parentage crossing, transgenics) to drive sustainable soil and plant production/ live stock breeding
- *Environmental Genomics* : Application of genomics (eDNA sequencing) in understanding the environment.
 - *How environment results in genomics changes: epigenetics*
 - *Biodiversity and Interaction amongst nature*
 - *Monitoring ecosystem changes and functional variations in nature*

- *Industrial Genomics*: Study of genomics for development of industrial strains with higher and efficient product production
- *Nutritional Genomics/Nutrigenomics*: Study of relationship between nutrients in food/diet and gene expression
- *Space Genomics*: Sequencing life in Space
- *Systems Biology*: Applications of biological Omics in understanding structure-function relationships in systems (cell, tissue, organ, biosystem)
- *Synthetic Biology*: Genome editing for creating cellular structure using synthetic or man made molecules

Types of Proteomics

- *Structural Proteomics*: Mapping of 3D structure of protein and protein complexes using high throughput technology (wet and virtual)
- *Functional Proteomics*: Study protein-protein, protein-DNA, protein-carbohydrate, protein-lipid interactions, cellular localizations to understand physiological role of whole set of proteome
- *Expressional Proteomics*: Analysis of organisms wide protein expression

Application of Genomics & Proteomics

- Database of organisms/genes/transcriptomes/proteomes/epigenomes etc etc
- Identify new genes
- Gene expression analysis
- Genome Wide Association Studies (GWAS)
- Identify disease associated gene
- Identify disease resistant varieties
- Gene analysis of environment
- Gene Therapy
- Genome Editing
- And many more...