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# Genomics and Proteomics: An Overview

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## Introduction

**Genomics:** It can be broadly defined as the field of genetics which attempts to understand the content, organization, function, and evolution of genetic information contained in whole genome of an organism.

**Proteomics:** It is the field of molecular biology that studies the structure and function of proteins, protein complexes, their localization, their interactions, and posttranslational modifications in a cell.

## Differences between Genomics and Proteomics

- Genomics is the study of genes in an organism while proteomics is the study of all the proteins in a cell.
- In genomics main unit is study of function of genomes while in proteomics main unit is study of function of proteomes
- The genome has constant nature; every cell has the same set of genes in an organism. While the proteome has dynamic nature and varies.
- The set of proteins produced in different tissues varies as per the gene expression.
- Genomics use high throughput techniques to map, sequence, and analyse genomes. While proteomics, use high throughput methods for characterization of the 3D structure and the function of proteins.
- The techniques associated with genomics include quality sequencing strategies, like development of communicated grouping labels (ESTs), coordinated quality sequencing, ID of single nucleotide polymorphisms (SNPs), entire genome shotgun sequencing, and the investigation and understanding of sequenced information utilizing distinctive programming and databases.

While techniques associated with proteomics include extraction and electrophoretic partition of proteins, digestion of proteins with the utilization of trypsin into small fragments, determination of amino acid sequence via mass spectrometry, and identification of proteins utilizing information of protein databases.

Besides, the 3D structure of protein can be predicted using software-based strategies. Protein expression can be studied by protein microarrays. Protein-network maps can be created to determine protein-protein associations.

- There are mainly 2 types of genomics i.e. structural genomics and functional genomics. While proteomics are of 3 types namely structural, functional, and expression proteomics
- Genomics study is important to understand the structure, function, location, regulation of the genes in an organism.

While study of entire protein set produced by a cell type is done so as to understand its structure and function.

- Genomics studies are less beneficial as genes in the nucleus can't exactly depict the conditions in the cell due to regulation at the RNA and protein level which can't be viewed.

While Proteomics studies are found to be more beneficial because proteins are the functional molecules in cells and they can easily depict the actual conditions.

## Clinical Applications of Genomics and Proteomics

### Applications of Genomics

- Molecular medicine
- microbial genomics
- Risk assessment
- Bio-archaeology, Anthropology, Evolution and human migration.
- DNA identification, forensic
- Agriculture, livestock breeding, and bioprocessing
- Increase rate of genetic improvement
- Detect abnormalities
- Animal cloning
- Transgenic animal

## Applications of Proteomics

- Common application in drug discovery induced target identification and validation.
- Proteins may serve as potential therapeutic targets.
- Screening compound in pre-clinical studies.
- Involves identifying proteins whose expression level or expression changes in disease state.
- Biomarkers are used to access the effect and mechanism of action of specific drug.