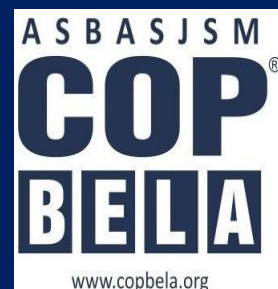




Amar Shaheed Baba Ajit Singh Jujhar Singh Memorial
COLLEGE OF PHARMACY
(An Autonomous College)
BELA (Ropar) Punjab



Name of Unit	Bioinformatics
Course/Subject Name	Computer Application in Pharmacy
Course/Subject Code	BP205T
Semester	II
Course coordinator	Ramanjit Kaur
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Learning Outcome of Module 04

LO	Learning Outcome	Course Outcome Code
LO1	To understand different types of databases, applications of computers and databases in pharmacy.	BP205.4
LO2	To illustrate the concept of Number system in computer.	BP205.4
LO3	To make use of web technologies such as HTML, XML, CSS, Programming languages, web servers and pharmacy drug database.	BP205.4
LO4	To appraise the applications of computers in pharmacy such as drug information services, pharmacokinetics, mathematical model in drug design, hospital and clinical pharmacy.	BP205.4
LO5	To explain about bioinformatics and its impact in vaccine discovery. To elaborate the applications of computers for data analysis in preclinical development.	BP205.4

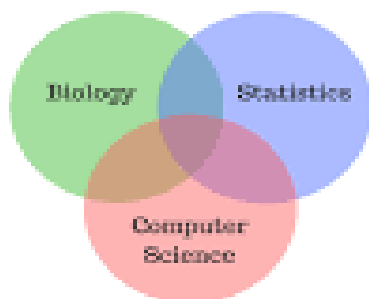
Content Table

Topic
• Bioinformatics. • Bioinformatics Database. • Impact of Bioinformatics in Vaccine Discovery • Concept of Bioinformatics

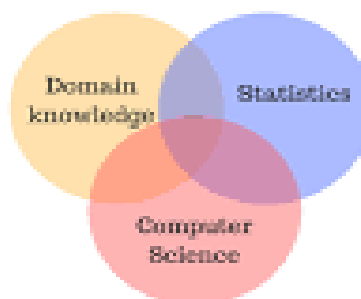
BIOINFORMATICS

Bioinformatics is a science field that is similar to but distinct from biological computation, while it is often considered synonymous to computational biology. Biological computation uses bioengineering and biology to build biological computers, whereas **bioinformatics** uses computation to better understand biology.

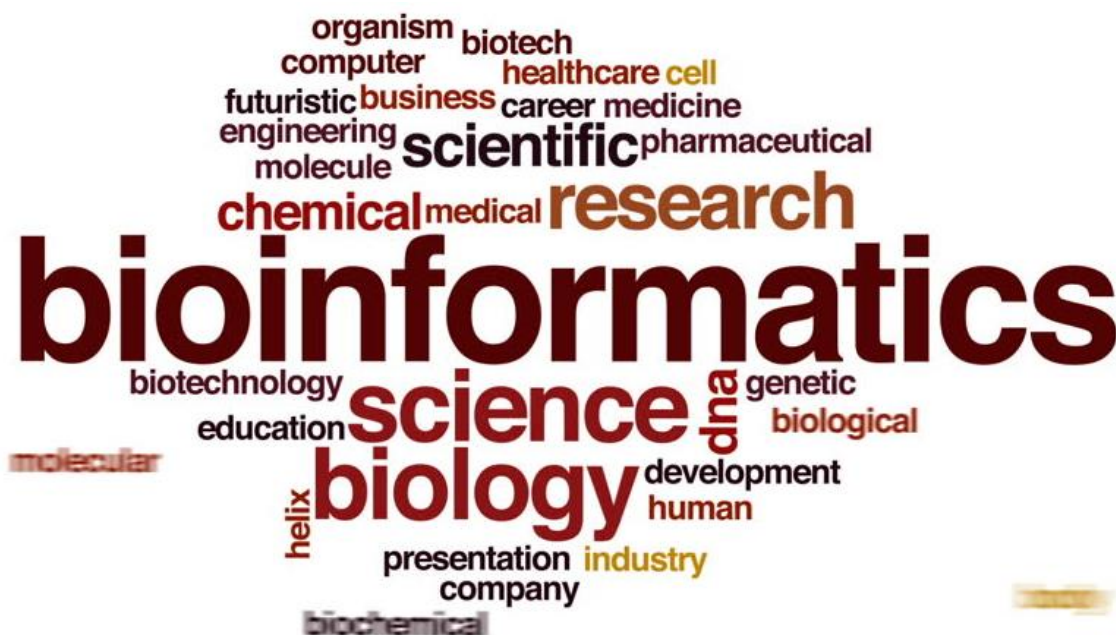
Bioinformatics



Data Science

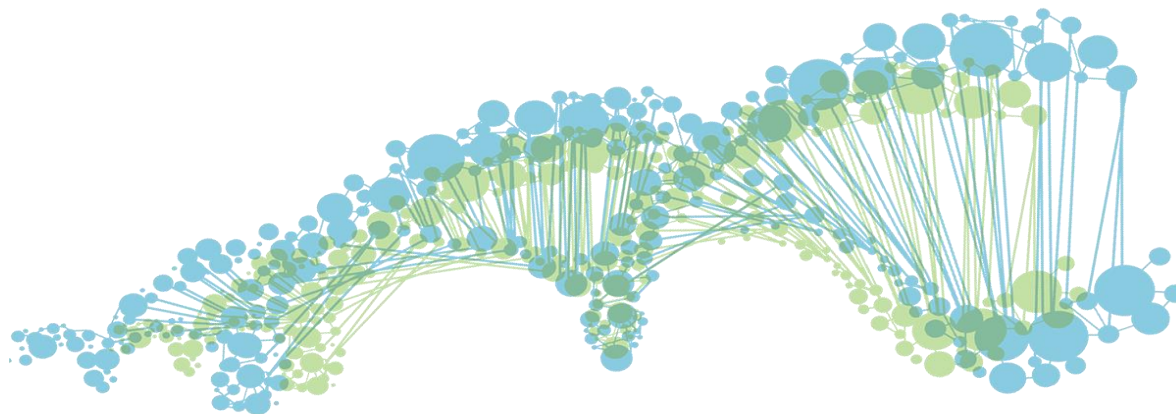


Bioinformatics is an interdisciplinary field that develops methods and software tools for understanding biological data. As an interdisciplinary field of science, bioinformatics combines biology, computer science, information engineering, mathematics and statistics to analyze and interpret biological data. Bioinformatics has been used for in silico (performed on computer or via computer simulation) analyses of biological queries using mathematical and statistical techniques.



Applications of Bioinformatics:

- ✓ Analyze the biological processes.
- ✓ Aids in improving drug discovery.
- ✓ Help in developing new target drug.
- ✓ Study and research.



Objectives of Bioinformatics:

The field of bioinformatics has three main objectives

1. To organize vast reams of molecular biology data in an efficient manner
2. To develop tools that aid in the analysis of such data
3. To interpret the results accurately and meaningfully
4. Study normal biological processes
5. Analyze various approaches to improve biological processes.
6. Aids in improving drug discovery techniques.
7. Helps in developing new target drugs for fatal disesses.
8. Enable study and research on development of preventive medicines for life threatening diseases like cancer.

Need for Bioinformatics:

- 📖 The need for Bioinformatics has arisen from the recent explosion of publicly available genomic information, such as that resulting from the Human Genome Project.
- 📖 Gain a better understanding of gene analysis, taxonomy, and evolution.
- 📖 To work efficiently on rational drug design and reduce drug development duration/time.

Databases

Databases are essential for bioinformatics research and applications. Many databases exist, covering various information types: for example, DNA and protein sequences, molecular structures, phenotype and biodiversity. Databases may contain empirical data (obtained directly from experiments), predicted data (obtained from analysis), or, most commonly, both. They may be specific to a particular organism, pathway or molecule of interest. Alternatively, they can incorporate data compiled from multiple other databases. These databases vary in their format, access mechanism, and whether they are public or not.

Some of the most commonly used databases are listed below:

- ✓ Used in biological sequence analysis: Genbank, UniProt
- ✓ Used in structure analysis: Protein Data Bank (PDB)
- ✓ Used in finding Protein Families and Motif Finding: InterPro, Pfam
- ✓ Used for Next Generation Sequencing: Sequence Read Archive
- ✓ Used in Network Analysis: Metabolic Pathway Databases (KEGG, BioCyc), Interaction Analysis Databases, Functional Networks
- ✓ Used in design of synthetic genetic circuits: GenoCAD
- ✓ Used in calculation of drug DNA interaction: PREDDICTA

Biological Database	
Types of Databases	Information
Bibliographic database	Literature
Taxonomic database	Classification
Nucleic acid database	DNA Information
Genomic database	Gene information
Protein database	Protein information
Enzyme/Metabolic Pathway	Metabolic information

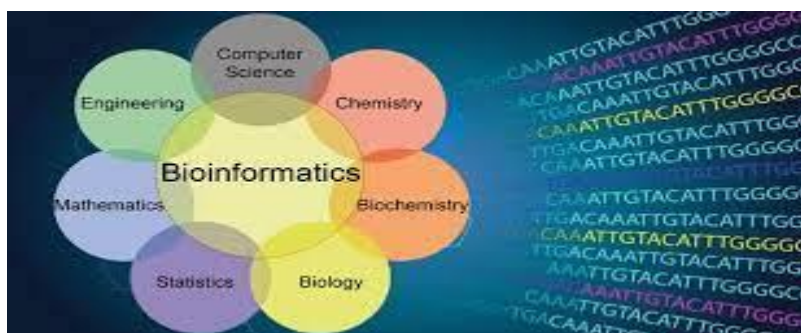
Classification of Bioinformatics Databases:

Databases can be classified on the basis of:

- a) Data type
- b) Data source
- c) Database design
- d) Special category.

Concept of Bioinformatics:

Bioinformatics or life science informatics has emerged as a new branch of biotechnology, offering a fundamental tool to the biologist to accelerate commercialization of biotechnology. Bioinformatics is the classic example of convergence of biotechnology and information technology. Bioinformatics has been the most powerful tools for data mining in life science, analysis, data searching, integration and simulation of molecular biological data.



However, its main priority has been implicated in data storage and genome sequence analysis. The unprecedented growth of information technology and extraordinary growth in molecular biology and recombinant DNA technologies and their interrelated studies culminated into cutting edge technology like bioinformatics. Thus, bioinformatics is also termed as bio-computing or computational biology. Recently, genomics occupies central role in bioinformatics i.e., understanding the basic life process.

IMPACT OF BIOINFORMATICS IN VACCINE DISCOVERY

Bioinformatics help in discovery of vaccines in a more effective way and in shorter span of time. This is because it combines biology with pharmacology. Bioinformatics reduce the time and cost required to develop high drugs with fewer side effects.

Science of genomics plays a vital role in improving human health globally. it has been found that if genome sequence of pathogen is available ,a vaccine can be easily created to destroy that sequence and hence, occurrence of disease can be prevented. Genomic data are processed by a variety of software programs help identify individual genes and their outcomes.

Designing an ideal vaccine largely depends on targeted pathogens and their interactions with existing drugs. study of genome sequence of various pathogens along with rapid advancements in biotechnology allows us to collect large amount of useful information about hosts and pathogens that play an important role in discovery of vaccines.

Multiple Choice Questions(2marks)

1. Bioinformatics combines the use of .
 - a. A collection of hardware components
 - b. Multiple sequence alignment
 - c. Mathematical, statistical and computational method.
 - d. Networking

Ans c

2. Bioinformatics is a science of collection of -----data
 - a. Physical
 - b. Biological
 - c. Metabolic
 - d. General

Ans b

3. Bioinformatics analyze various types of biological -----and genetic data.
 - a. Basic
 - b. Atomic
 - c. Molecular
 - d. Physical

Ans c

4. When of the following database is used to design genetic circuits?
 - a. Gen Bank
 - b. Sanjeevani
 - c. GenoCAD
 - d. InterPro

Ans c

5. Which is the following database is used for next generation sequencing?
- a. InterPro
 - b. Sequence Read Archive
 - c. Sanjeevani
 - d. PreDDICTA

Ans b

6. Which of the following database is used to calculate DNA interaction?
- a. Gen Bank
 - b. Sanjeevani
 - c. PreDDICTA
 - d. InterPro

Ans b

7. Genomic database refers to-----
- a. Metabolic activity
 - b. Protein Information
 - c. DNA Information
 - d. Gene information

Ans d

8. Bioinformatics help in discovery of -----in a more effective way.
- a. Drugs
 - b. Medicines
 - c. Vaccines
 - d. Diagnosis

Ans c

9. Bioinformatics combines biology with-----
- a. Pharmacy
 - b. Chemistry
 - c. Pharmacology
 - d. Medical science

Ans c

10. Nucleic acid database is related to -----
- a. Classification of drugs
 - b. Protein Information
 - c. DNA Information

Ans c

Short Answer Questions (5 marks)

1. What are the features of biological databases?
2. What do you understand by term “Bioinformatics”?
3. List the two major divisions of bioinformatics.
4. Name a few bioinformatics database along with their usage.

Long Answer Questions (10 Marks)

1. Briefly describe Bioinformatics and its Objectives.
2. Discuss classification of biological databases in detail.
3. Briefly explain the impact of bioinformatics in discovery of vaccines.