



Dr.Omics Labs
The Doctor of your DNA

LONG-TERM INDUSTRIAL

Pharmacogenomics

Internship



Learn how to tailor treatments to patients'
genes with pharmacogenomics

www.dromicslabs.com



DrOmics Research Lab is a distinguished genomics research solution provider offering Custom Research and Bioinformatics services. Located in India, our services extend worldwide.

Led by **Dr. Deepshikha Satish**, (PhD in Translational Bioinformatics from ICgeb-JNU), we comprise a team of dedicated and enthusiastic research professionals. Our mission is to empower the next generation of scientists through specialized training programs, equipping them with the knowledge and practical experience essential for excelling in genomics research.

Our Custom Research services cater to a wide range of genomics research needs, including but not limited to genome sequencing, transcriptomic profiling, and epigenetic analysis. We understand that each research project is unique and requires a tailored approach, which is why we collaborate closely with our clients to develop a customized research plan that meets their specific requirements.

Personalized medicines through use of Pharmacogenomics will soon be an integral part of healthcare. However, approximately 77% of pharmacy schools acknowledge that **pharmacists lack sufficient knowledge** in pharmacogenetics. However, only 31% of these institutions have intentions to incorporate more pharmacogenetics content into their curriculum. So we would like to congratulate you for talking this initiative to enrich students curriculum with Pharmacogenomics and happy to provide you with scientifically referred, carefully crafted course for Pharmacogenomics which is indeed an established but less of academically introduced in various curriculums.

<https://ascpt.onlinelibrary.wiley.com/doi/epdf/10.1002/cpt.2957>

ABOUT US



Table of Contents

1

Introduction to Pharmacogenomics

2

Fundamentals of Bioinformatics

3

Databases & Basics of Linux O.S

4

Python for Pharmacogenomics

5

R for Data Analysis

6

Introduction to GWAS

7

Pharmacogenomic Applications in Drug Discovery

8

Pharmacogenomics in Cancer Treatment

9

Variant Calling Analysis using GATK

10

Clinical implementation of pharmacogenomics & Introduction to Regulatory Guidelines

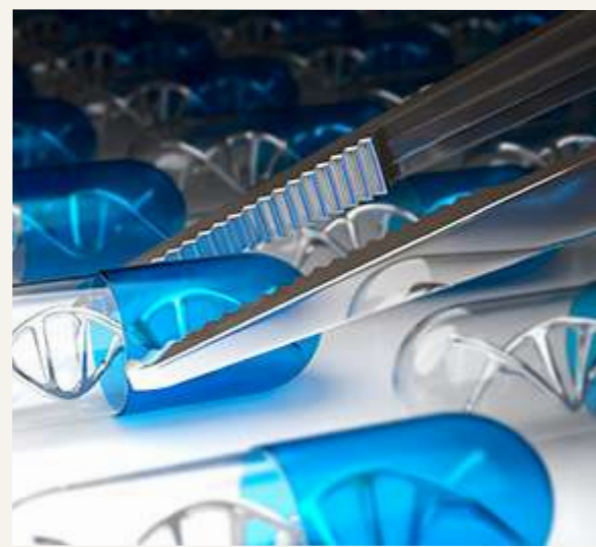
11

Research Project in Computational Pharmacogenomics



MODULE 1

INTRODUCTION TO PHARMACOGENOMICS



DAY	DETAILED SYLLABUS
1	Overview of genomics and pharmacogenomics and Introduction to Genetics, Cell Biology, Molecular Biology, and Biochemistry as relevant to the field of Pharmacogenomics
2	How the genome conveys information to the rest of the body (the central dogma of molecular biology)
3	Basic concepts about genetic diseases and mutations
4	Basic principles of genetics : single gene inheritance, independent assortment, linkage and genetic variation, Epigenetics, non-genetic factors influencing phenotypes
5	Introduction to Genomes, Variation and Population Genetics, Introduction to 1000 Genome project and ENCODE
6	Introduction to bioinformatics databases and resources : NCBI
7	Single Nucleotide Polymorphisms and other genetic variations Theory Introduction to variation databases: DbSNP
8	Introduction to ClinVar, DbVar for variation information
9	Association studies in Pharmacogenomics, Linking NGS/Microarray/ other technologies to bedside, Analyzing gene mutations
10	(A) Role of Pharmacogenomics in Drug development, In silico pharmacokinetics and pharmacodynamics modeling (B) Career Opportunities: Roles in genomic research, precision medicine, and bioinformatics personalized healthcare.

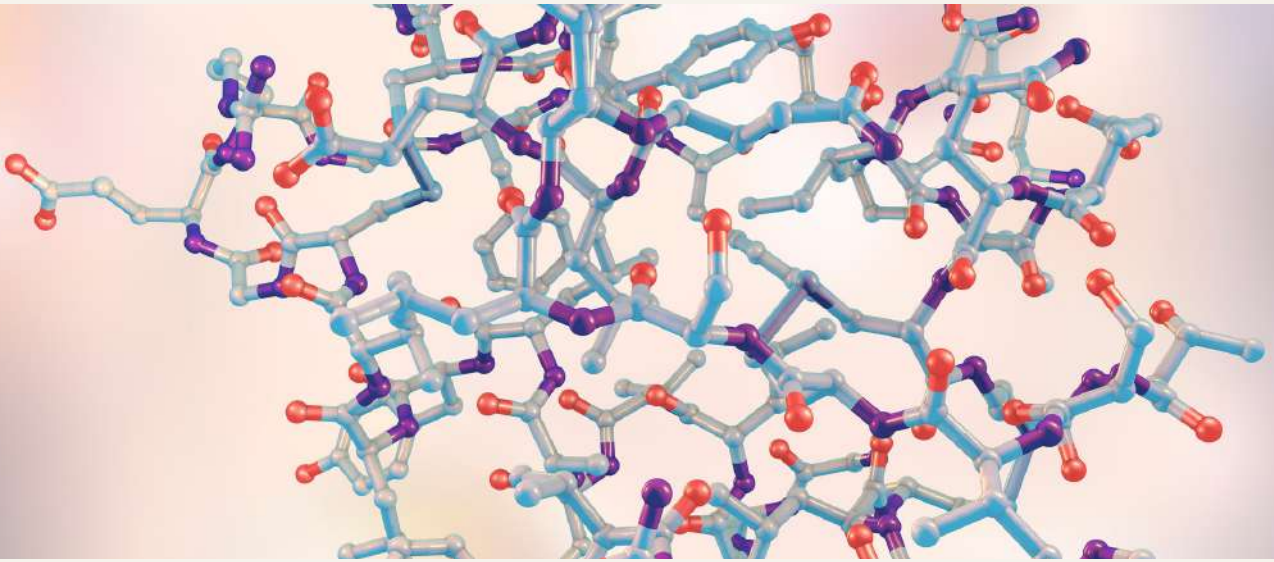


MODULE 2

FUNDAMENTALS OF BIOINFORMATICS

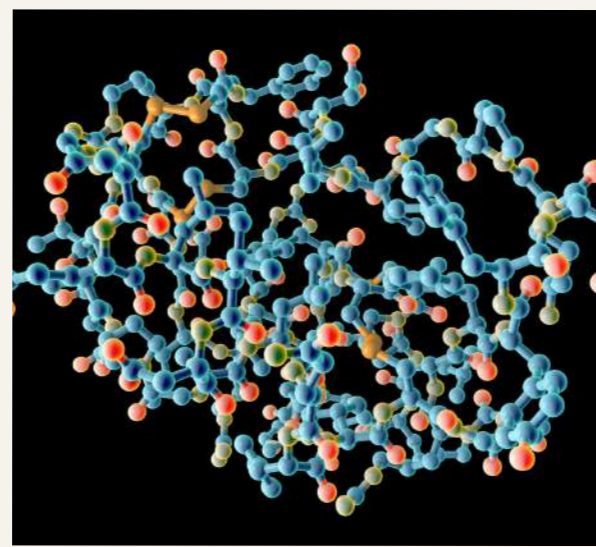
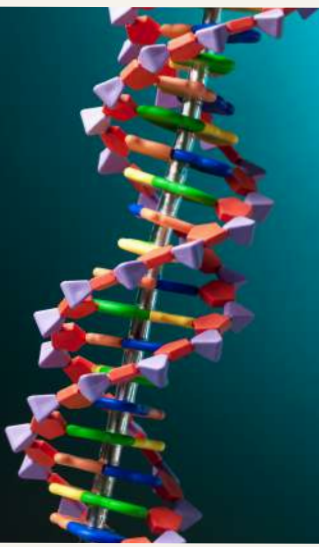


DAY	DETAILED SYLLABUS
11	Introduction to Bioinformatics
12	Introduction to Genomics data resources : Gene,protein database
13	Ensembl genome database
14	UCSC database
15	Genome Browser
16	Bioinformatics Tools for Sequence Analysis: Introduction to tools and techniques used for analyzing DNA and protein sequences BLAST
17	Standalone BLAST
18	MSA-ClustalW
19	MEGA for Phylogenetic Analysis
20	(A) Primer Designing using PRIMER3 tool and validation using blast (B) Career Opportunities: Role as Bioinformatics Researcher, Biological Data Analyst, Genomic Data Scientist, Bioinformatics Consultant, Bioinformatics Project Manager etc



MODULE 3

PART 1 DATABASES



DAY	DETAILED SYLLABUS
21	PubMed Database
22	KEGG database
23	UniProt Database
24	Pharmacogenomic databases (e.g., PharmGKB, DrugBank)
25	(A) Bioinformatics Tools for Drug Response Prediction(PolyPhen-2, SIFT) (B) Career Opportunities: Role include Database Curator, Bioinformatics Analyst, Database Administrator, and Data Scientist.



MODULE 3

PART 2

BASICS OF LINUX O.S



DAY	DETAILED SYLLABUS
26	Overview of Linux, Advantages of Linux in scientific computing Installation of Linux
27	Package Management: Installing, updating, and removing software packages
28	1) Navigating the file system 2) Working with directories and files 3) Basic file operations (create, copy, move, delete) 4) File permissions and ownership
29	Advanced Linux commands: 1) Introduction to command-line tools (grep, sed, awk) 2) Handling CSV and text files
30	(A) Introduction to Bash Scripting: 1) Writing and executing simple scripts 2) Variables and conditionals (B) Career Opportunities: Increased employability across various IT domains, system management, software development, and infrastructure maintenance

DAY	DETAILED SYLLABUS
31	Introduction to Python language, Need of programming as a Bioinformatician, Installation of Python on various platforms, Installation of IDE, Print function, Comments
32	User input, Data types, Variables and rules to create a variable, In-built functions of python, Slicing and indexing in String, String and data formatting
33	Control statements: if -else, If-elif-else, for loop, while loop
34	Python data structure : List, Set, Tuple, Dictionary
35	Methods of List, Slicing and indexing in List and Tuple
36	Functions : Function introduction and its requirement, Defining a function, Calling a function
37	File handling : CRUD operation in file handling, OS module
38	Pandas library: Reading different file formats such as csv, tsv and excel files, Filtering data, Creating excel, csv and tsv files using pandas library
39	Biopython (Seq object): Introduction to Biopython, Installation of Biopython, Conversion of a string into biological sequence, Obtaining complement, reverse complement, transcribe, reverse transcribe and translation from a sequence, Finding GC content from a sequence
40	<p>(A) SeqIO object : Reading various biological file formats such as fasta and genbank, Analysis of fasta sequences, Finding GC content of a fasta file, Finding GC content of a fasta file containing multiple sequences and storing the data in a file, Converting a genbank file into fasta format</p> <p>(B) Career Opportunities: Consideration for role as Pharmacogenomic Data Scientist, or Software Developer in pharmaceutical companies, research institutions, and healthcare.</p>

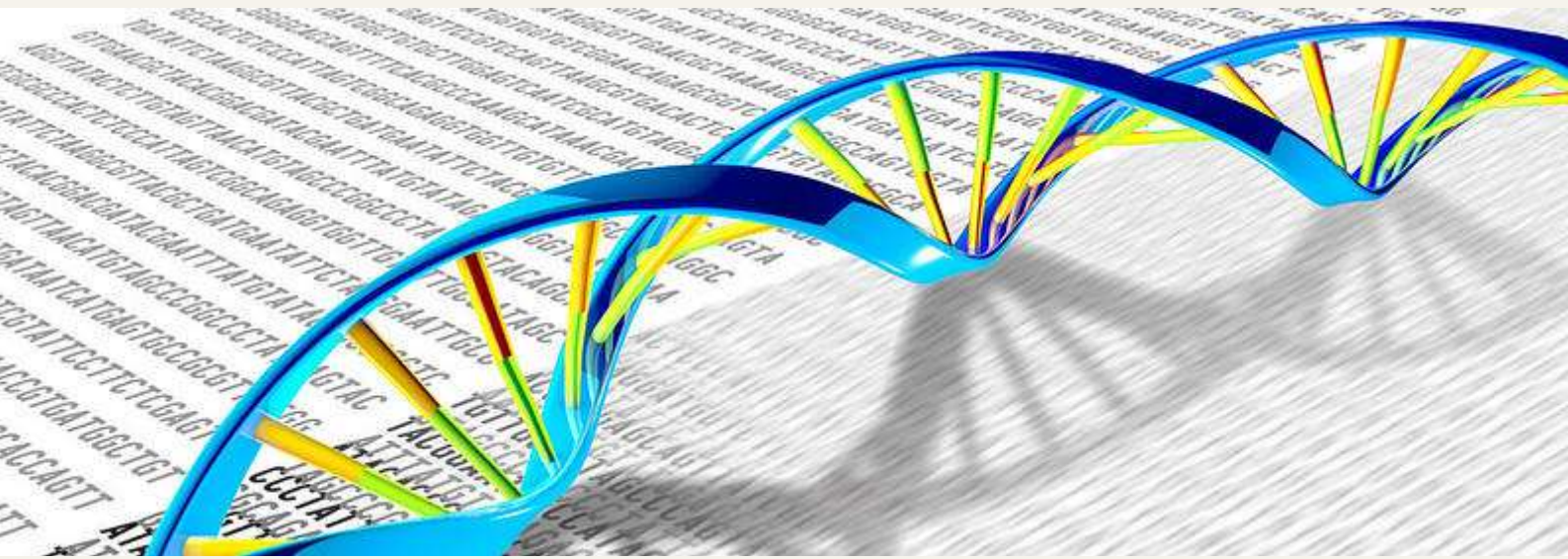


MODULE 5

R FOR DATA ANALYSIS

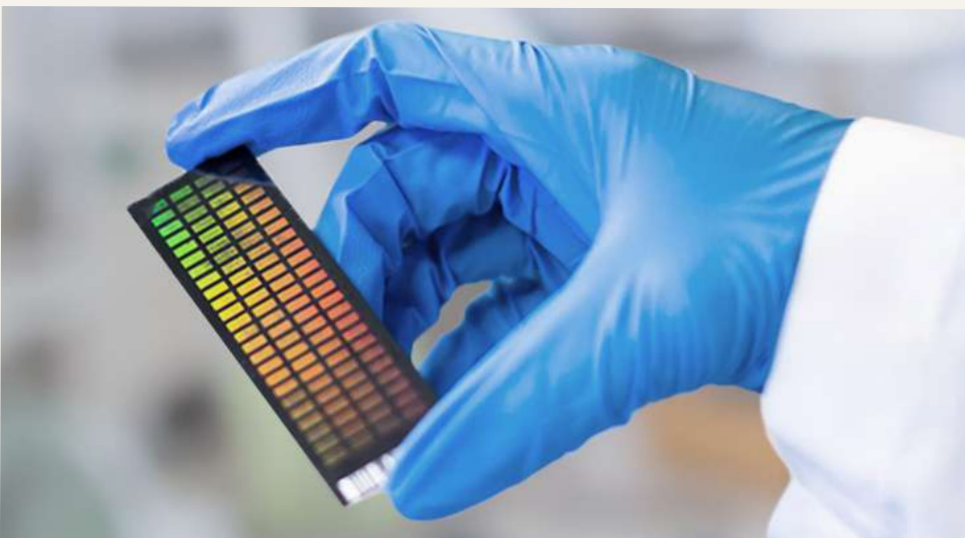


DAY	DETAILED SYLLABUS
41	Introduction to R Programming Language · Importance of R, RStudio, Installation
42	Objects/Data structures · Data types, Operators
43	Data import export
44	Functions · Built-in functions. · User-defined functions
45	Conditional statements (If, Else, If-else) Loops (While, For)
46	Packages · CRAN/Bioconductor, · Installation
47	Data analysis with R package · Dplyr
48	Sequence Analysis in R · seqinR · Biostrings
49	Data Visualization (plots) · Barplot · Boxplot · Heatmap
50	(A) Basic statistical analysis (Biological Data) · Chi Square test · T-Test · Z-Test (B) Career Opportunities: Role of analyzing large genomic datasets, perform statistical analyses, develop visualization tools, and contribute to the advancement of personalized medicine by understanding genetic influences on drug response.



MODULE 6

INTRODUCTION TO GWAS

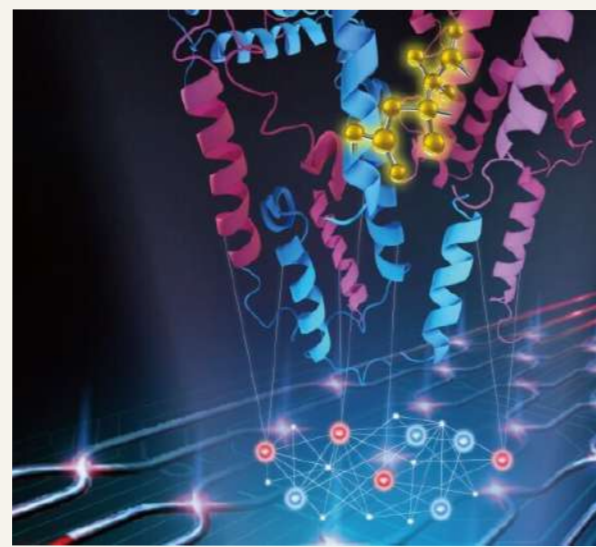
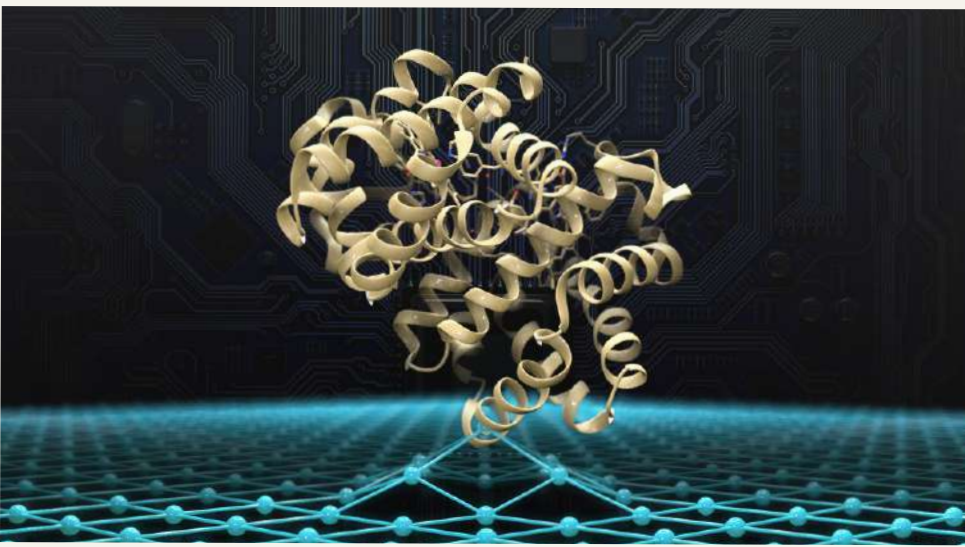


DAY	DETAILED SYLLABUS
51	Introduction to GWAS
52	Impact of genetic diversity on individual drug responses.
53	Methods and Technologies in GWAS
54	Clinical Implications
55	GWAS analysis using real data
56	Installation of HAIL package
57	Plots before quality check
58	Quality control based on Sample level, genotype quality and Variants level
59	GWAS analysis
60	<p>(A) Annotations of GWAS output</p> <p>(B) Career Opportunities: Roles such as GWAS Analyst, Pharmacogenomic Researcher, Statistical Geneticist, or Bioinformatics Scientist in pharmaceutical companies, research institutions, and healthcare organizations.</p>



MODULE 7

PHARMACOGENOMIC APPLICATIONS IN DRUG DISCOVERY



DAY	DETAILED SYLLABUS
61	Module 1: Introduction to Drug Development <ul style="list-style-type: none"> • Overview of Drug Development Process • Introduction to Computer-Aided Drug Design (CADD)
62	Module 2: Compound Databases in Drug Discovery <ul style="list-style-type: none"> • PubChem, DrugBank, ChEMBL • Features and functionality • Data retrieval and analysis
63	Module 3: Principles of Pharmacokinetics <ul style="list-style-type: none"> • Absorption, Distribution, Metabolism, and Excretion (ADME) • Biotransformation and Excretion
64	Module 4: Pharmacodynamics and Drug Action <ul style="list-style-type: none"> • Principles of Pharmacodynamics • Cellular and Molecular Mechanisms
65	Module 5: Drug Metabolism and Pharmacokinetic Modeling <ul style="list-style-type: none"> • Drug Metabolism Pathways • Pharmacokinetic Modeling and Analysis
66	Module 6: Pharmacovigilance and Drug Safety <ul style="list-style-type: none"> • Pharmacovigilance Principles • Drug Interactions and Safety
67	Module 7: Pharmacogenomics and Drug Target Selection, Computational approaches to drug target identification and validation
68	Module 8: Pharmacogenomics in Clinical Trials <ul style="list-style-type: none"> • Overview of Phase I to Phase IV clinical trials • Considerations for pharmacogenomic study design

DAY	DETAILED SYLLABUS
69	<p>Module 9: Pharmacogenomics for Predicting Drug Efficacy and Safety</p> <ul style="list-style-type: none">•Use of genetic biomarkers in clinical trial endpoints•Challenges and opportunities in pharmacogenomics-guided clinical trials
70	<p>(A) Module 10: Application of NOMAD in Pharmacogenomics</p> <ul style="list-style-type: none">•Features and capabilities of the database•Use cases in pharmacogenomics research and drug development <p>(B) Career Opportunities: Opportunities exist in pharmaceutical companies, biotech firms, and research institutions to contribute to drug development and personalized medicine</p>



MODULE 8

PHARMACOGENOMICS IN CANCER TREATMENT



DAY	DETAILED SYLLABUS
71	Genetic Basis of Cancer
72	Genetic Variations Impacting Cancer Drug Response
73	Targeted Therapies and Biomarkers
74	Genomic Profiling Techniques
75	Cancer Genomics Databases(The Cancer Genome Atlas - TCGA)
76	Genomic Alterations in Drug Response
77	Functional Genomics in Cancer Research(CRISPR/Cas9 technology)
78	Development of biological drugs and cell/animal models.
79	Clinical trial implications of Pharmacogenomics in Oncology:
80	<p>(A) Case studies illustrating how genetic variations impact treatment outcomes in specific cancer types</p> <p>(B) Career Opportunities: Oncogenomic Researcher, Clinical Pharmacogeneticist, Cancer Genomic Data Scientist, or Molecular Pathologist. Work in cancer research institutions, pharmaceutical companies, and healthcare settings.</p>

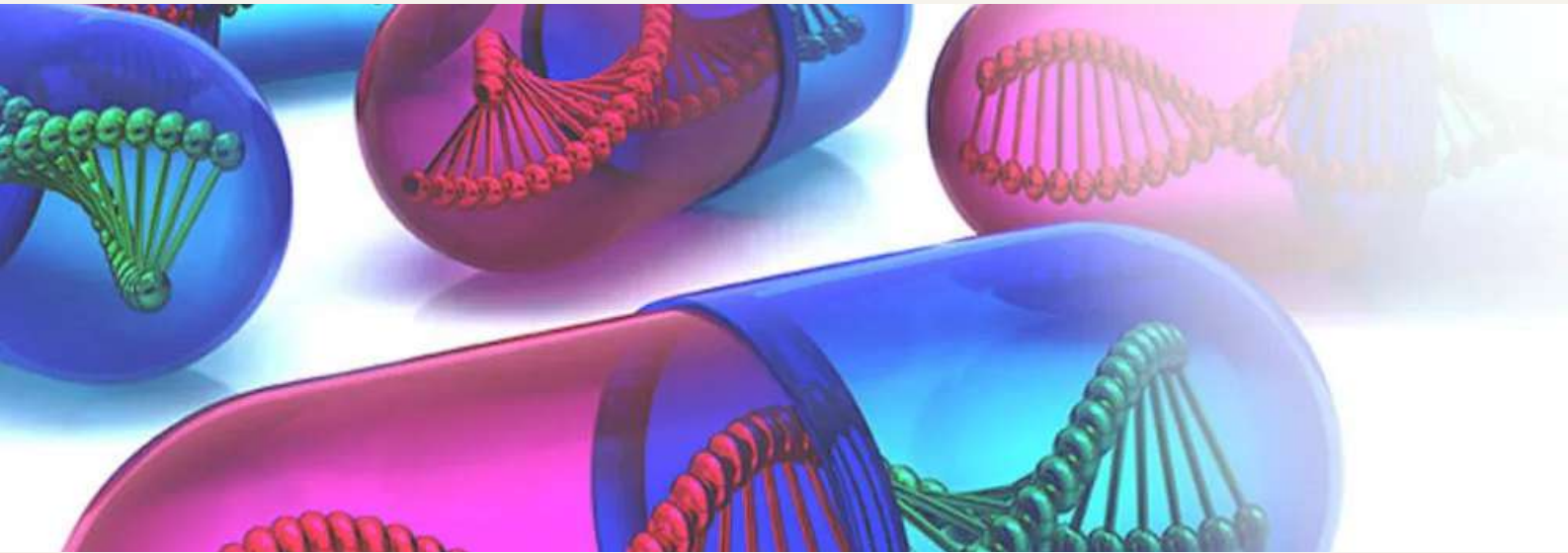


MODULE 9

VARIANT CALLING ANALYSIS USING GATK



DAY	DETAILED SYLLABUS
81	Sequencing Technologies its applications,Introduction to NGS and DNAseq,
82	Basic Terminologies in NGS
83	Understanding of SRA database
84	Tools installation in Linux for Variation Calling
85	Quality control (FastQC)
86	Trimming of Reads (Trimmomatic)
87	Indexing of Genome (BWA) and Alignment of Reads (BWA)
88	Variation calling using GATK
89	Variant Effect Prediction(VEP)
90	(A) Variation Visualization (IGV) (B) Career Opportunities: Role in personalized medicine, and pharmacogenomics.



MODULE 10

PART 1

CLINICAL IMPLEMENTATION OF PHARMACOGENOMICS



DAY	DETAILED SYLLABUS
91	Foundations of Clinical Pharmacogenomics, Strategies, Interpretation of Data
92	Pharmacogenomic Testing Technologies(genotyping)
93	Challenges and opportunities in Clinical Implementation



MODULE 10

PART 2

INTRODUCTION TO REGULATORY GUIDELINES



DAY	DETAILED SYLLABUS
94	Overview of regulatory bodies governing pharmacogenomics, FDA (U.S. Food and Drug Administration), EMA (European Medicines Agency),
95	CPIC (Clinical Pharmacogenetics Implementation Consortium) for drug-gene pairs and dosing recommendations.
96	Global Harmonization Efforts
97	Ethical and Legal Considerations in Pharmacogenomics.(Legal aspects, patient consent etc)
98	Patient and Healthcare Provider Education strategies for effective communication of genetic-based recommendations.
99	(A) Future Perspectives and Emerging Regulatory Issues (B) Career Opportunities: Roles such as Regulatory Affairs Specialist, Pharmacovigilance Scientist, Clinical Research Associate, or Drug Safety Officer in pharmaceutical companies, biotech firms, research institutions, and regulatory bodies.
100	Career Counselling



MODULE 11

RESEARCH PROJECT IN COMPUTATIONAL PHARMACOGENOMICS



DAY	DETAILED SYLLABUS
Research project applying computational methods to pharmacogenomic data analysis	<p>Identification of Novel Pharmacogenomic Markers:Use advanced bioinformatics tools to analyze large-scale pharmacogenomic datasets.Identify novel genetic markers associated with drug response or adverse reactions</p>
	<p>Machine Learning Predictive Models:Develop machine learning models to predict drug response based on genetic variations.Evaluate the performance of these models using cross-validation and external datasets.</p>
	<p>Integration of Multi-Omics Data:Integrate genomics, transcriptomics, and epigenomics data to provide a comprehensive understanding of pharmacogenomic mechanisms.Explore the relationships between different omics layers in the context of drug response.</p>
	<p>Pharmacogenomic Network Analysis:Construct biological networks based on pharmacogenomic data.Identify key genes or pathways that play a crucial role in drug response or toxicity.</p>
	<p>Population-specific Pharmacogenomic Variations:Investigate population-specific pharmacogenomic variations using datasets from diverse ethnic groups.Analyze how genetic variations differ across populations and their implications for personalized medicine.</p>
	<p>Pharmacogenomic Biomarker Discovery:Explore computational methods for identifying robust pharmacogenomic biomarkers.Assess the clinical significance and potential application of discovered biomarkers.</p>
	<p>Pharmacogenomic Data Visualization:Develop interactive data visualization tools for pharmacogenomic datasets.Enhance accessibility and interpretation of complex pharmacogenomic information.</p>
	<p>Identification of Novel Pharmacogenomic Markers:Use advanced bioinformatics tools to analyze large-scale pharmacogenomic datasets.Identify novel genetic markers associated with drug response or adverse reactions</p>

DAY	DETAILED SYLLABUS
Research project applying computational methods to pharmacogenomic data analysis	<p>Machine Learning Predictive Models: Develop machine learning models to predict drug response based on genetic variations. Evaluate the performance of these models using cross-validation and external datasets.</p> <hr/> <p>(A) Integration of Multi-Omics Data: Integrate genomics, transcriptomics, and epigenomics data to provide a comprehensive understanding of pharmacogenomic mechanisms. Explore the relationships between different omics layers in the context of drug response.</p> <p>(B) Career Opportunities: Role as Pharmacogenomic Research Scientist, Bioinformatics Analyst, Clinical Research Coordinator, or Genomic Data Scientist.</p>



CONTACT

US



+91 9310870544, 7888118030, 7843088966



info@dromicslabs.com



www.dromicslabs.com



602/e, W No 3, G/f, L/side, Seqno-m, H
3/727 Gadaipur, New Delhi , South-West
Delhi-110030

Thank you!

OUR CERTIFICATIONS & GRANTS