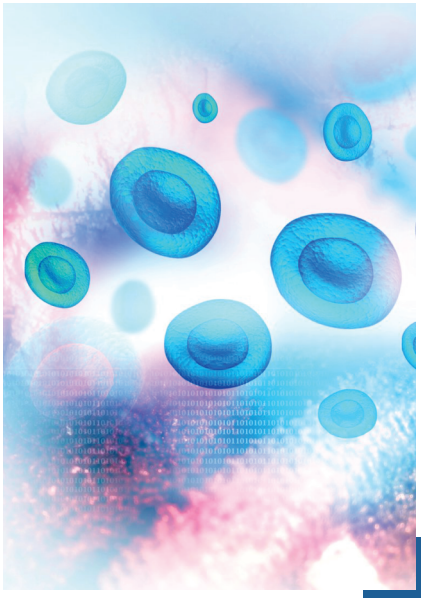
ILM

GENOMICS, BIOTECHNOLOGY & HEALTH SCIENCES
RESEARCH LAB

discoverSTEM
Innovation Quotient is the *new* IQ

For more details, visit: **www.discoverSTEM.info**

CURRICULUM



DSGBH01 :: Organization of Life

- Cellular Organization
- Organismal Organization
- Population Organization

Exercise: Hands-on exercise to co-relate human Cells and world around us | 75 minutes.

DSGBH02 :: Introduction to DNA

Inspired from: **XGEN101 – Fundamentals of Genetics**
Stanford School of Medicine Genetics and Genomics Program

- Fundamentals of human cell
- What is a DNA?
- Introduction to DNA
- DNA & RNA: DNA vs RNA
- mRNA, rRNA and tRNA: Functions | Types of RNA
- Protein Synthesis, DNA Transcription and DNA Translation
- DNA Methylation
- Introduction to mRNA Vaccines

Exercise: Understand DNA coding and simulate DNA Code | 75 minutes.

DSGBH03 :: Introduction to Genetics

Inspired from: **XGEN101 – Fundamentals of Genetics**
Stanford School of Medicine Genetics and Genomics Program

- DNA, Gene, and Genome
- Alleles, Genotype, and Phenotype
- Punnett Square
- Epigenetics

Exercise: Understand Epigenetics and impact of certain genes on human body | 75 minutes.

DSGBH04 :: Mutation

- Gene Mutation
- Types of Mutation
- Spontaneous Mutation
- Induced Mutation
- Mutagens
- Repair Mechanism of Mutation
- Your Probability to get Superpower through some Rarest Mutations

Exercise: Simulate vaccine design for a mutating virus | 75 minutes.

DSGBH05 :: Genomics

Inspired from: **XGEN102 – Genomics**. Stanford School of Medicine Genetics and Genomics Program

- What is Genomics?
- A Short History of Genomics
- Why Genomics?
- Model Organism for Genomic Study
- Major Branches of Genomics

Exercise: Develop Co-relation between Animal Gene and Human Gene | 75 minutes.

DSGBH06 :: Introduction to Genome Sequencing

Inspired from: **XGEN102 – Genomics**. Stanford School of Medicine Genetics and Genomics Program

- What is Genome Sequencing?
  - Some Early DNA Sequencing Methods
  - Second Generation Sequencing
  - Third Generation Sequencing
- Genetics vs Genomics
- Explaining DNA Sequencing Method

Exercise: Extract Human DNA from Saliva | 75 minutes.

DSGBH07 :: Applications & Limitations of DNA Sequencing

- Solving Crime
- Personalized Healthcare
- Cancer Genomics
- Studying eDNA (Environmental DNA) using DNA metabarcoding
- Detecting Mutations
- Parental Verification
- Identifying and developing GMO Plants in agriculture
- Microbial Identification and study of new species of bacteria and Virus

Exercise: Perform Gene Sequencing of Unknown DNA | 75 minutes.

DSGBH08 :: The Human Genome Project

- Introduction, Principle and Goals of HGP
- A race to sequence the human genome
- Phases of HGP
- Technical Aspects of HGP
- Focus of the HGP
- Applications of the HGP
- Ethical, Legal and Social Implications (ELSI)
- Whole Genome Sequencing and You

Exercise: Brainstorm and Develop Future Use of Human Genome Information | 90 minutes.

DSGBH09 :: The Future of Genomics

- Ten Bold Predictions

Exercise: Predict the Future Impact of Genomes in Our Lives | 90 minutes.

DSGBH10 :: Genetic Engineering & Biotechnology

Inspired from: **XGEN203 – Genetics Engineering & Biotechnology** Stanford School of Medicine Genetics and Genomics Program

- Introduction to Gene Editing
- Gene Editing tools (CRISPR/Cas9 Technology)
- Gene Editing and CRISPR/Cas9 Technology – How far should we go?
- Complications and Risks of Gene Editing:
- Ethical Issues in Gene Editing

Exercise: Hands-on Gene Editing using CRISPR/Cas9 Technology | 90 minutes.

DSGBH11 :: Genetic Engineering - Applications and Bioethics

- Genetic Engineering Explained:
- Why Genetic Engineering?
  - Genetic engineering and its future impact:
  - 15 Things You Didn't Know About the Genomics Industry
  - 10 Reasons Why Biotech is Booming -
  - Impact of Genetic Engineering in Medicine.
  - Genetic Engineering Application in Agriculture.
  - Gene Drives to Lower Disease transmission
  - CRISPR Mediated Biofuels:
  - Genomics in Organ Transplant
  - Genetically Modified Organism (GMO)
  - Genetically Modified Crops

Exercise: Bioethics Research Project | 75 minutes.

DSGBH12 :: Fundamentals of Gene Therapy

Inspired from: **XGEN201 – Principles & Practices of Gene Therapy** Stanford School of Medicine Genetics and Genomics Program

- Gene Mutation & Genetic Diseases
- Introduction to Gene Therapy
- Some examples of Gene Therapy

Exercise: Understand and Simulate an Attempt to Develop Cure for Cancer using TP53 Gene | 75 minutes.

DSGBH13 :: Personalized Medicine through Genomics

Inspired from: **XGEN205 – Personal Genomics & Your Health** Stanford School of Medicine Genetics and Genomics Program

- How Personal Genomics impacts Healthcare
- Diagnosing and Treating Diseases with the help of Genomics (Example of Diabetes, Heart Dieases, Allergies etc)

Exercise: Research and Report Writing on Gene Therapy of a Genetic Disease | 75 minutes.