**Hands-on workshop in bacterial genomics and antimicrobial resistance**

Date:

June 11-15, 2023

Location:

Child Health Research Foundation (Head Quarters)

Khilji Road, Shyamoli, Mohammadpur,

Dhaka, Bangladesh.

Course Summary:

This five-day workshop provides participants with a comprehensive overview of bacterial genomics and its applications in antimicrobial resistance research. Through a series of lectures and hands-on sessions, participants will learn how to analyze bacterial genomes for antimicrobial resistance and virulence factors, conduct comparative genomic analysis, and apply bacterial genomics to investigate clinical and scientific problems. The workshop will focus on bioinformatic tools and software commonly used in bacterial genomic analysis. The workshop will also include setting up Linux operating system (on personal laptops), and training on basic shell commands within the Anaconda environment. The attendees are requested to bring their own laptops, so that once the training is complete, they will leave with a standard setup of bioinformatics pipelines for their own genomic investigations. The attendees are welcome to bring their own datasets as well and instructors will guide them through the analysis.

Learning Objectives:

By the end of this workshop, participants will be able to:

* Gain basic working knowledge of Linux operating system
* Understand the sequencing techniques and file formats
* Assemble bacterial genomes from raw reads obtained from different sequencing platforms
* Analyze bacterial genomes using bioinformatics tools and software
* Understand the common mechanisms of antimicrobial resistance
* Identify and annotate antimicrobial resistance genes and virulence
* Undertake multi-locus sequence typing (MLST) and genotyping analysis
* Explore the genomic diversity among a set of bacterial strains using phylogenetic analysis
* Perform comparative genomic analysis to identify differences in antimicrobial resistance and virulence among a set of bacterial strains
* Apply bacterial genomics in scientific problems including diagnosis and treatment of infectious diseases
* Evaluate the challenges and opportunities in bacterial genomics research

Workshop overview:

**Day 1: Introduction to bacterial genomics and bioinformatics**

* Overview of bacterial genomics and its applications (Senjuti)
* Introduction to bioinformatics tools for bacterial genomics analysis (e.g., NCBI/EBI databases, common file formats) (Tanmoy)
* Hands-on session: setting up Linux OS, basic Bash commands and Anaconda environment.
  + Linux (Esha)
  + Anaconda (Anise)
  + Bash (Esha)

**Day 2: Bacterial genome analysis: from sequence data to genomes**

* Introduction to different sequencing methods (Tanmoy)
* Quality control of sequencing data
* De-novo genome assembly and annotation
* Submission of genomic data
* Hands-on session: Bacterial genome assembly and annotation
  + FastQC (Esha)
  + Trimmomatic (Esha)
  + Unicycler (Anise)
  + Prokka (Anise)
  + Submission (Preonath)

# Day 3: Bacterial genome analysis for antimicrobial resistance

* Introduction to antimicrobial resistance and its molecular mechanisms (Yogesh)
* Identification of resistance genes and mutations using bioinformatics tools (e.g., ResFinder, AMRfinder, CARD)
* Identification of virulence genes using different tools
* Introduction to multi-locus sequence typing (MLST) and its importance
* Hands-on session: Antimicrobial resistance and virulence gene identification, and conduct MLST-typing
  + ResFinder (Tanmoy)
  + VirulenceDB (Tanmoy)
  + MLST (Preonath)

**Day 4: Comparative genomics and phylogenetics**

* Introduction to comparative genomics and phylogenetic analysis (Yogesh)
* Comparative analysis of bacterial genomes for identifying differences in virulence and antimicrobial resistance (Tanmoy)
* Hands-on session: Phylogenetic analysis using bacterial genomes, visualization, and annotation of phylogenetic tree:
  + Mapping (Anise)
  + Variant calling (Preonath)
  + Consensus building (Preonath)
  + RAxML (Tanmoy)
  + iTOL (Tanmoy)

**Day 5: Application of bacterial genomics**

* Pathogenwatch (Tanmoy)
* Overview of current scientific and clinical applications of bacterial genomics and antimicrobial resistance testing (Senjuti)
* Discussion of future directions and advancements in the field (Senjuti)
* Presentations by different groups

Additional information:

The course will include lectures from Senjuti Saha, PhD, Molecular Genetics, University of Toronto, Yogesh Hooda, PhD, Biochemistry, University of Toronto, Canada and Arif M. Tanmoy, PhD candidate, MMIZ, Erasmus MC, The Netherlands.

Limited number seats are available, and selection will done on a first come first served basis.

The cost of this course is BDT 15,000 and a limited number of need-based scholarships will be provided.

All participants need to register on the following link -> XXXXX.