



# UFS-NGS Unit 5<sup>th</sup> Data to Discovery Bioinformatics Workshop for Beginners (07-09 July 2025)

#### Introduction

NGS data analysis training workshops are essential. This demand has been addressed in the previously organized bioinformatics workshops by the UFS-NGS Unit. However, despite the growing significance of bioinformatics in research and healthcare, there remains a persistent gap in the foundational training available for beginners in this discipline of sequence data handling. In the last months the UFS-NGS Unit has received several notable requests from students and researchers for foundational bioinformatics training tailored towards early beginners and absolute novices. For many of these researchers and students, the barriers to entry in bioinformatics such as unfamiliarity with programming languages, data analysis tools, and computational workflows is overwhelming and complicated with the rapid evolution of bioinformatics tools and methods.

#### Aim

To bridge this gap, the UFS-NGS Unit is committed to providing foundational bioinformatics training designed specifically for beginners, equipping them with the essential skills to navigate bioinformatics tools, data analysis workflows, and computational methods effectively. The workshop is designed to equip the researchers with the necessary bioinformatic skills required to analyse NGS data focusing on three aspects: whole genome data, 16S metagenomics and viral metagenomics data. The workshop will combine both theoretical and practical sessions.

#### Intended audience

The course is aimed at individuals from a molecular biology background, interested in bioinformatics, and who work (or are planning to work) on genomic datasets.

## Participants will be introduced to

- Basic Linux command lines for NGS data analysis
- 16S/Shotgun metagenomics data analysis aspects
- Whole genome data analysis aspects including phylogenetic analysis
- Proteomics and molecular modelling

#### Host

The UFS-NGS Unit

## Venues

- Metro 4
- Computer labs
- Faculty of Health Sciences Foyer

#### **Guest Speakers**

## Prof. Olihile Sebolai (Department of Microbiology and Biochemistry, University of the Free State)

Prof. Olihile M. Sebolai is a professor of microbiology at the University of the Free State, South Africa. He leads a research laboratory with an established programme on Cryptococcus neoformans, particularly focusing on antifungal resistance and host-pathogen interactions. In recent years, Prof. Sebolai has incorporated molecular docking and in silico screening into his research to elucidate pathogen-to-pathogen interactions. Notably, he co-authored a few studies that explored the structural alignment and docking of fungal Kex2-like proteases with the SARS-CoV-2 spike protein, providing new insights into cross-kingdom protease interactions and potential therapeutic implications.

Prof. Sebolai has published widely in the fields of medical mycology and infectious disease, and his work spans both laboratory-based and computational approaches. He is also a dedicated mentor, having supervised numerous MSc and PhD students, and plays an active role in promoting interdisciplinary collaborations that address fungal disease burden in African settings. His research contributes to expanding the toolkit for antifungal drug discovery through repurposing and enhancing our understanding of fungal virulence and persistence.











## Mrs. Mandy Jampies (Research Development, University of the Free State)

Mandy Jampies is a Senior Officer in the Directorate: Research Development at the University of the Free State (UFS). She holds a National Diploma in Commercial Administration and a B.Tech in Office Management and Technology from the Central University of Technology.

With a career spanning over 15 years in higher education, Mandy coordinates the postdoctoral fellowship programme across UFS campuses and manages internal bursaries for master's and PhD students. She provides vital support in research administration, data reporting and funding processes.

She was also part of the team that led UFS to achieve the prestigious Platinum Status for Good Financial Grant Practice (GFGP) accreditation, reflecting her contribution to strengthening research governance and operational excellence.

## LOCAL ORGANIZING COMMITTEE AND CO-FACILITATORS

#### Coordinator of the sub-committees

• Prof. Martin Nyaga (UFS-NGS Unit)

## Planning/content sub-committee

- Dr. Ayodeji Ogunbayo (UFS-NGS Unit)
- Dr. Milton Mogotsi (UFS-NGS Unit)

#### Logistics sub-committee

- Ms. Hlengiwe Sondlane (UFS-NGS Unit)
- Ms. Mamello Maku (UFS-NGS Unit)
- Ms. Somila Nazo (UFS-NGS Unit)
- Ms. Nkosazana Shange (UFS-NGS Unit)
- Ms. Suprise Baloyi (UFS-NGS Unit)

## Marketing sub-committee

- Ms. Manyi Eyong (UFS-NGS Unit)
- Ms. Sesiyanda Maseko (UFS-NGS Unit)
- Ms. Angela Mbele (UFS-NGS Unit)
- Ms. Nkosazana Shange (UFS-NGS Unit)
- Ms. Thabisa Mpaxa (UFS-NGS Unit)
- Ms. Mbali Ncube (UFS-NGS Unit)
- Ms. Palesa Tsunke (UFS-NGS Unit)

## ICT sub-committee

• Mr. Stephanus Riekert (ICT, UFS)

## FACILITATORS/TRAINERS/ASSISTANT TRAINERS

- Dr. Morne Du Plessis (Genetics, UFS)
- Dr. Frank Maleka (Genetics, UFS)
- Dr. Setshaba Taukobong (SAMRC, Cape Town)
- Ms. Rehema Mukami (Rhodes University)
- Ms. Tori Williams (Microbiology and Biochemistry, UFS)
- Mr. Adedayo Lanrewaju (Durban University of Technology)
- Dr. Emmanuel Ogunbayo (UFS-NGS Unit)
- Dr. Milton Mogotsi (UFS-NGS Unit)
- Ms. Nkosazana Shange (UFS-NGS Unit)
- Ms. Surprise Baloyi (UFS-NGS Unit)









# FUNDING ORGANIZATIONS

• Distribution Platform in Omics (DIPLOMICS)

## PARTICIPATING ORGANIZATIONS

- University of the Free State, Bloemfontein campus, South Africa
- National Health Laboratory Services, Bloemfontein, South Africa
- Central University of Technology, Bloemfontein, South Africa
- Vaal University of Technology, Vanderbijlpark, South Africa
- Africa Health Research Institute, Durban, South Africa

NUMBER OF PARTICIPANTS FOR PRACTICAL TRAINING: 25









# PROGRAMME SCHEDULE AND OUTLINE

## Day 1: Monday, 07 July 2025

## Introduction to NGS data analysis

TIME	DESCRIPTION	VENUE	RESPONSIBLE PERSON(S)			
Rapporteur: Dr. Emmanuel Ogunbayo						
08:00-09:00	Registration	Foyer	All facilitators			
09:00-09:15	Welcome Address (Overview of the UFS-NGS Unit)	Metro 4	Prof. Martin Nyaga			
09:15-09:45	Guest Speaker: Kex2 proteases as potential biological bridges: A molecular docking study linking fungal pathogenesis and SARS- CoV-2	Metro 4	Prof. Olihile Sebolai			
09:45-10:00	Institutional Talk: Empowering research excellence: Enhancing impact through strategic support	Metro 4	Mrs. Mandy Jampies			
10:00-10:30	Tea/Coffee break					
10:30-13:00	Theoretical talk: Introduction to NGS and Bioinformatics data analysis. Introduction to Linux environment and basic commands for file management: Is, cd, mkdir, cp, mv, rm, grep, head, tail, man, pwd, etc	Lab A	Dr. Morne Du Plessis and Dr. Maleka, supported by the rest of the trainers			
13:00-14:00	Lunch break					
14:00-16:30	Hands-on training: Quality assessment of NGS data using FastQC and MultiQC and Trimming of genomes using Trimmomatic, Geneious, and genome assembly using SPAdes	Lab A	Dr. Morne Du Plessis and Dr. Maleka, supported by the rest of the trainers			
18:00 -20:00	Welcoming dinner	Health Sciences Foyer	All			

# Day 1 topics

- Introduction to Linux and command lines for NGS data analysis
- Basic commands: ls, cd, pwd, mkdir, rm, cp, mv, cat, less, head, tail
- File manipulation: touch, nano, chmod, chown
- Searching and retrieving data: grep, find, curl, wget
- Retrieving biological databases: NCBI, UniProt, Ensembl, etc.
- Quality Control and Pre-processing: Hands-on exercises in quality control of whole-genome sequencing data using different tools









## Day 2: Tuesday, 08 July 2025

## 16S/Shotgun Metagenomic Analysis

TIME	DESCRIPTION	VENUE	RESPONSIBLE PERSON(S)			
Rapporteur: Ms. Sesiyanda Maseko						
08:00-10:00	Hands on training on 16S/shotgun metagenomic analysis: Overview of tools and databases, QC, Pre-processing, Assembly	Lab A	Ms. Tori and Dr. Setshaba, supported by the rest of the trainers			
10:00-10:30	Tea/Coffee break					
10:30-12:30	Hands on training on 16S/shotgun metagenomic analysis: Taxonomic classification, diversity analysis	Lab A	Ms. Tori and Dr. Setshaba, supported by the rest of the trainers			
12:30-13:30	Lunch break					
13:30 -15:00	Hands on training on 16S/shotgun metagenomic analysis continues	Lab A	Ms. Tori and Dr. Setshaba, supported by the rest of the trainers			
15:00 - 17:00	Excursion to the Planetarium	Naval Hill	All			

## Day 2 topics

- Tools and Databases: Overview of commonly used bioinformatics tools and databases for shotgun Quality Control and Pre-processing of Shotgun Metagenomics Data: Hands-on exercises in quality control of shotgun metagenomics sequencing data using different tools.
- Sequence assembly of shotgun metagenomics data using applicable tools.
- metagenomics analysis and hands-on exercises in accessing and using these resources.
- Hands-on exercises in taxonomic classification of shotgun metagenomics data
- Hands-on exercises in diversity and community analysis of metagenomics data









# Day 3: Wednesday, 09 July 2025

## Whole Genome Analysis

TIME	DESCRIPTION	VENUE	RESPONSIBLE PERSON(S)			
Rapporteur: Dr. Mhlekazi Molatoli/Ms Angela Mbele						
08:00 -10:00	Hands-on training on whole genome analysis: Multiple sequence alignments and phylogenetic analysis	Lab A	Dr. Maleka and Dr. Setshaba, supported by the rest of the trainers			
10:00 -10:30	Tea/Coffee break					
10:30: -13:00	Hands-on training on whole genome analysis: Multiple sequence alignments and phylogenetic analysis	Lab A	Dr. Maleka and Dr. Setshaba, supported by the rest of the trainers			
13:00 -14:00	Lunch break					
14:00 -15:30	Hands-on training: Proteomic analysis and Molecular Modelling	Lab A	Mr. Adedayo and Ms. Rehema, supported by the rest of the trainers			
15:30-16:30	Hands-on training: Proteomic analysis Proteomic analysis and Molecular Modelling continues		Mr. Adedayo and Ms. Rehema, supported by the rest of the trainers			
16:30 -16:40	Closing remarks and vote of thanks	Lab A	Prof. Martin Nyaga			
18:00 -20:00	Closing dinner for the guests and trainers	Longhorn Grill	Trainers/facilitators/guests			

# Day 3 topics

- Sequence Alignment for Phylogenetics: Hands-on exercises in sequence alignment for phylogenetic analysis, including multiple sequence alignment and the use of software such as MUSCLE and MAFFT.
- Model Selection: Overview of model selection for phylogenetic analysis, including the use of likelihoodbased methods and model comparison tools such as jModelTest and ModelTest.
- Phylogenetic Tree Construction: Hands-on exercises in phylogenetic tree construction using software such as IQTree and MEGA
- Proteomic analysis and molecular modelling



