Next-Generation Sequencing (NGS) Analysis Training Course

Professional Development Training Course Outline

Category	Research and Data Analysis	**Duration**	5 Days
Base Fee	$1,500 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

Next-Generation Sequencing (NGS) has revolutionized genomics, enabling unprecedented insights into genetic information, disease mechanisms, and personalized medicine. This intensive training course provides hands-on experience with cutting-edge NGS technologies, bioinformatics pipelines, and data interpretation. Participants will gain expertise in genomic data analysis, variant calling, RNA-Seq profiling, and advanced visualization techniques using industry-standard tools. With the rapid evolution of NGS applications in clinical diagnostics, cancer genomics, microbiome analysis, and precision medicine, this program equips professionals with practical skills to stay ahead in the genomics landscape.

Next-Generation Sequencing (NGS) Analysis Training Course is designed for researchers, clinicians, bioinformaticians, and laboratory professionals seeking to master the full spectrum of NGS workflows. Through interactive lectures, real-world case studies, and guided exercises, participants will develop proficiency in experimental design, data quality assessment, alignment strategies, functional annotation, and downstream analysis. Emphasis is placed on integrating computational tools with experimental insights, ensuring participants can confidently interpret complex datasets, accelerate research discoveries, and implement NGS in clinical or translational research environments.

Programme Curriculum

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Course Duration

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Course Objectives

1. Understand the principles and technologies behind Next-Generation Sequencing (NGS).
2. Master NGS experimental design for genomics, transcriptomics, and epigenomics studies.
3. Perform high-quality NGS data preprocessing, including quality control and trimming.
4. Execute accurate sequence alignment and mapping using modern bioinformatics tools.
5. Detect genomic variants including SNPs, indels, CNVs, and structural variations.
6. Conduct RNA-Seq analysis for differential gene expression and functional profiling.
7. Analyze epigenetic modifications using ChIP-Seq and methylation sequencing techniques.
8. Apply metagenomics workflows for microbiome and pathogen detection.
9. Integrate multi-omics data for comprehensive systems biology insights.
10. Utilize visualization tools for genome browsers, heatmaps, and interactive plots.
11. Interpret results in clinical genomics, personalized medicine, and disease research.
12. Implement reproducible NGS workflows using workflow managers and cloud solutions.
13. Stay updated with emerging trends, AI-driven analytics, and NGS automation technologies.

Target Audience

1. Bioinformaticians seeking advanced NGS analysis skills
2. Genomic researchers in academic or clinical labs
3. Molecular biologists transitioning to computational genomics
4. Clinical laboratory scientists and technicians
5. Data scientists in healthcare and genomics fields
6. Graduate students in genomics, biotechnology, or bioinformatics
7. Healthcare professionals involved in precision medicine
8. Pharmaceutical and biotechnology R&D specialists

Course Modules

Module 1: Introduction to NGS Technologies

- Overview of NGS platforms
- Comparative advantages
- Workflow from sample prep to sequencing output

- Quality control metrics and troubleshooting common issues
- Case Study: Choosing the right NGS platform for cancer genomics

Module 2: Experimental Design and Library Preparation

- Targeted sequencing vs whole-genome sequencing
- RNA-Seq, ChIP-Seq, and single-cell sequencing library prep
- Multiplexing strategies and barcode design
- Sample quality assessment and quantification methods
- Case Study: Optimizing library prep for low-input clinical samples

Module 3: NGS Data Preprocessing

- Quality assessment using FastQC and MultiQC
- Adapter trimming and filtering low-quality reads
- Removal of contamination and duplicates
- Read normalization techniques
- Case Study: Preprocessing RNA-Seq data for differential expression

Module 4: Sequence Alignment and Mapping

- Reference genome selection and indexing
- Alignment tools
- Handling multi-mapping reads and low-quality regions
- Post-alignment processing
- Case Study: Aligning whole-genome sequencing data for variant detection

Module 5: Variant Calling and Annotation

- SNP, indel, and CNV detection pipelines
- Variant annotation using ANNOVAR, SnpEff
- Filtering and prioritizing variants for clinical relevance
- ClinVar, gnomAD, COSMIC
- Case Study: Identifying actionable mutations in cancer genomes

Module 6: RNA-Seq and Transcriptomics Analysis

- Quantification of gene expression using HTSeq and featureCounts
- Differential expression analysis with DESeq2 and edgeR
- Functional enrichment and pathway analysis
- Transcript isoform detection and alternative splicing
- Case Study: RNA-Seq profiling in disease vs healthy tissue

Module 7: Epigenomics and Metagenomics Analysis

- ChIP-Seq peak calling and motif analysis
- DNA methylation profiling and bisulfite sequencing
- Microbiome diversity analysis using Kraken2 and QIIME2
- Integrating epigenetic and microbial datasets
- Case Study: Epigenetic modifications in drug-resistant bacterial strains

Module 8: NGS Workflow Integration and Data Interpretation

- Reproducible workflows using Snakemake and Nextflow
- Cloud computing and high-performance computing pipelines
- Visualization with IGV, UCSC Genome Browser, and R packages
- Multi-omics integration for personalized medicine applications
- Case Study: Building a clinical NGS pipeline for rare disease diagnostics

Training Methodology

This course employs a participatory and hands-on approach to ensure practical learning, including:

- Interactive lectures and presentations.
- Group discussions and brainstorming sessions.
- Hands-on exercises using real-world datasets.
- Role-playing and scenario-based simulations.
- Analysis of case studies to bridge theory and practice.
- Peer-to-peer learning and networking.
- Expert-led Q&A sessions.
- Continuous feedback and personalized guidance.

Register as a group from 3 participants for a Discount

Send us an email: info@fineskilltrainingcenter.org or call *+254769199797*

Certification

Upon successful completion of this training, participants will be issued with a globally- recognized certificate.

Tailor-Made Course

We also offer tailor-made courses based on your needs.

Key Notes

a. The participant must be conversant with English.

b. Upon completion of training the participant will be issued with an Authorized Training Certificate

c. Course duration is flexible and the contents can be modified to fit any number of days.

d. The course fee includes facilitation training materials, 2 coffee breaks, buffet lunch and A Certificate upon successful completion of Training.

e. One-year post-training support Consultation and Coaching provided after the course.

f. Payment should be done at least a week before commence of the training, to Fineskill Training Center account, as indicated in the invoice so as to enable us prepare better for you.

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
21 Sep 2026	25 Sep 2026	Online	$1,000
21 Sep 2026	25 Sep 2026	Physical	$1,500
21 Sep 2026	25 Sep 2026	Physical	$0
21 Sep 2026	25 Sep 2026	Physical	$0
21 Sep 2026	25 Sep 2026	Physical	$0
21 Sep 2026	25 Sep 2026	Physical	$0
21 Sep 2026	25 Sep 2026	Physical	$0
21 Sep 2026	25 Sep 2026	Physical	$0

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