Advanced Tissue Culture and Stem Cell Applications Training Course

Professional Development Training Course Outline

Category	Biotechnology and Pharmaceutical Development	**Duration**	10 Days
Base Fee	$4,000 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

The converging fields of Advanced Tissue Culture and Stem Cell Applications are at the frontier of regenerative medicine and therapeutic development. Modern biotechnology demands a highly specialized workforce proficient in sophisticated in vitro techniques to bridge the gap between bench-top discovery and clinical reality. This advanced course provides intensive, hands-on training and deep theoretical knowledge in cultivating, manipulating, and characterizing human and animal cells, with a critical focus on Induced Pluripotent Stem Cells (iPSCs), Mesenchymal Stem Cells (MSCs), and developing complex 3D Bioprinting and Organoid models. Mastery of these techniques is essential for accelerating drug discovery, creating robust disease models, and enabling the manufacture of cell and gene therapies that are revolutionizing patient care globally.

Advanced Tissue Culture and Stem Cell Applications Training Course is specifically engineered to elevate participants?ÇÖ expertise beyond basic sterile technique to encompass Good Cell Culture Practice (GCCP), advanced bioreactor scale-up, and xeno-free media optimization. The curriculum integrates the latest breakthroughs in CRISPR-Cas9 gene editing and single-cell omics to prepare scientists for the rigorous demands of translational research and cGMP manufacturing. Upon completion, trainees will possess the critical skills to lead projects in tissue engineering, implement robust quality control standards for cell-based products, and navigate the complex global regulatory frameworks governing advanced therapies. This specialized skill set is crucial for innovation and career advancement in a rapidly expanding, high-value industry.

Programme Curriculum

Advanced Tissue Culture and Stem Cell Applications Training Course

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Course Duration

10 days

Course Objectives

1. Master Aseptic Technique and Good Cell Culture Practice for maintaining contamination-free Primary Cell Cultures and Cell Lines.
2. Perform successful isolation, expansion, and cryopreservation of clinically relevant Mesenchymal Stem Cells (MSCs) and Hematopoietic Stem Cells (HSCs).
3. Execute iPSC reprogramming from somatic cells and reliably maintain their Pluripotency using xeno-free and chemically defined media.
4. Design and implement Directed Differentiation protocols to generate specific cell lineages for Disease Modeling.
5. Utilize 3D Cell Culture Systems including Spheroids, Organoids, and Bioreactors to create complex, in vivo-mimicking tissue models.
6. Apply modern Genome Editing Technologies, such as CRISPR-Cas9, for precise genetic manipulation of cell lines and stem cells.
7. Employ advanced Flow Cytometry and Single-Cell Sequencing for comprehensive cell characterization and Quality Control (QC).
8. Develop strategies for Bioprocess Scale-Up and Media Optimization to meet cGMP manufacturing requirements for large-scale cell production.
9. Critically analyze and troubleshoot common cell culture issues, including Contamination Detection and Mycoplasma Elimination.
10. Integrate principles of Tissue Engineering and Biomaterials to design functional scaffolds for Regenerative Medicine applications.
11. Navigate the Regulatory Landscape for cell-based products, focusing on IND-enabling studies and Translational Science.
12. Design and validate new High-Throughput Screening assays using advanced 3D cellular models for Drug Discovery.

13. Explore emerging applications like Exosome-Based Therapeutics and Immune Cell Engineering for next-generation therapies.

Target Audience

1. Research Scientists
2. Bioprocess Engineers and Manufacturing Staff
3. Lab Managers and Core Facility Directors
4. Pharmacology/Toxicology Researchers
5. PhD/Post-Doctoral Fellows in Cell Biology/Biotechnology
6. Quality Control (QC) & Quality Assurance (QA) Specialists
7. Medical Professionals interested in Translational Medicine
8. Biomedical Engineers focused on Tissue Engineering

Course Modules

Module 1: Foundations of Advanced Cell Culture and Sterility

- Good Cell Culture Practice and laboratory setup for advanced therapies.
- Advanced Aseptic Techniques and working within Biosafety Cabinets.
- Selection and preparation of Xeno-Free and Serum-Free media.
- Contamination management
- Cell authentication methods and quality control.
- Case Study: Investigating a clinical trial failure due to non-authenticated cell lines.

Module 2: Primary Cell Isolation and Advanced Cell Lines

- Protocols for isolating key Primary Cells
- Principles of Cell Immortalization and banking of authenticated cell lines.
- Techniques for working with sensitive human cell lines
- Optimizing media for long-term culture stability and functionality.
- Determining Growth Kinetics
- Case Study: Optimizing primary hepatocyte isolation yield and viability for drug metabolism studies.

Module 3: Induced Pluripotent Stem Cells Technology

- Molecular biology of Pluripotency and the Yamanaka factors.
- Detailed protocols for iPSC Reprogramming from somatic cells
- Maintenance, passaging, and colony selection under feeder-free conditions.
- Pluripotency Characterization using immunofluorescence and qPCR markers.
- Troubleshooting low reprogramming efficiency and genetic stability.
- Case Study: Generating patient-specific iPSCs for Disease-in-a-Dish modeling of Alzheimer?ÇÖs.

Module 4: Directed Differentiation and Cell Lineage Specification

- Principles of developmental biology and signaling pathways for lineage commitment.
- Sequential small-molecule-based Directed Differentiation protocols.
- Generating Cardiomyocytes and Neural Progenitor Cells from iPSCs.
- Analysis of differentiation efficiency using Flow Cytometry and functional assays.
- Purification and enrichment techniques for specific cell populations.
- Case Study: Improving the yield of iPSC-derived ??-cells for diabetes research.

Module 5: Mesenchymal Stem/Stromal Cells

- Sources, isolation, and clinical relevance of MSCs
- Advanced expansion protocols and characterization
- Trophic and Immunomodulatory properties of MSCs and their secretome.
- Tri-lineage Differentiation assays.
- Regulatory considerations for clinical-grade MSC production.
- Case Study: Assessing the immunomodulatory potential of allogeneic MSCs for GvHD therapy.

Module 6: 3D Cell Culture: Spheroids and Organoids

- Fundamentals of 3D Microenvironments and Extracellular Matrix components.
- Techniques for generating unguided Spheroids
- Protocol for generating complex Gut Organoids and Brain Organoids.
- Imaging and advanced analysis of 3D structures.
- Application of 3D models for Drug Toxicity Screening and basic research.
- Case Study: Utilizing patient-derived tumor organoids for personalized chemotherapy testing.

Module 7: Bioreactors and Bioprocess Scale-Up

- Design and operation of Bioreactors for high-density cell culture
- Concepts of Bioprocess Monitoring and control
- Protocols for expanding stem cells from the research bench to Pilot-Scale production.
- Perfusion and Fed-Batch culture modes for different cell types.
- Optimization of Cell Harvest and downstream processing.
- Case Study: Scaling up hMSC production from T-flasks to a 5-L bioreactor for a Phase I clinical trial.

Module 8: Tissue Engineering and Biomaterials

- Principles of Tissue Engineering
- Properties and applications of different Biomaterials
- Introduction to 3D Bioprinting technologies
- Designing bio-scaffolds that promote cellular adhesion and vascularization.
- Assessing the mechanical and biological integrity of Engineered Tissues.
- Case Study: Engineering a vascularized skin substitute using a bio-printed collagen scaffold.

Module 9: Genome Editing in Advanced Cell Systems

- Fundamentals of CRISPR-Cas9 system design and delivery to stem cells.
- Protocols for targeted gene knock-out and knock-in for disease correction.
- Techniques for single-cell cloning and selection of successfully edited cells.
- Off-target analysis and validation of genetic modifications.
- Ethical and regulatory considerations for gene-edited cell therapies.
- Case Study: Correcting a genetic mutation in iPSCs from a patient with Cystic Fibrosis.

Module 10: Advanced Cell Characterization and Flow Cytometry

- Design and execution of multi-color Flow Cytometry panels for cell phenotype.
- Principles of cell sorting for purifying stem cell subpopulations.
- Detection and quantification of intracellular and surface markers.
- Viability and Apoptosis analysis using flow cytometry.
- Data compensation, analysis, and generation of publication-quality plots.

- Case Study: Defining the purity of a clinical-grade HSC preparation using a 10-color panel.

Module 11: Omics Technologies for Cell Culture Optimization

- Introduction to Transcriptomics and Proteomics in cell identity.
- Application of Single-Cell RNA Sequencing for characterizing cell heterogeneity.
- Using Metabolomics to track nutrient consumption and waste production in culture.
- Bioinformatic tools for data analysis and visualization
- Leveraging omics data to inform media optimization and differentiation protocols.
- Case Study: Using scRNA-Seq to identify novel progenitor cell populations in a differentiating organoid culture.

Module 12: Quality Control (QC) and Assay Validation

- Developing and validating robust Quality Control release assays for cell products.
- Validation of potency and identity assays
- Sterility, endotoxin, and adventitious agent testing.
- Understanding and minimizing Batch-to-Batch Variability.
- Documentation practices and Audit Trails essential for cGMP compliance.
- Case Study: Developing a potency assay for a CAR-T cell product targeting cancer cells.

Module 13: Regulatory and Ethical Landscape

- Overview of Global Regulatory Frameworks for Cell and Gene Therapies.
- Preparation of Investigational New Drug applications.
- Compliance with Good Manufacturing Practice and Good Laboratory Practice
- Ethical issues in Stem Cell Research
- Clinical trial design and requirements for cell-based products.
- Case Study: Analyzing the regulatory challenges of bringing a novel allogeneic stem cell product to Phase I trial.

Module 14: Emerging Applications: Exosomes and Immunotherapies

- Isolation and characterization of Extracellular Vesicles from cell cultures.
- Therapeutic potential of Exosomes for tissue repair and drug delivery.
- Introduction to Immune Cell Engineering and expansion.
- Designing and culturing cells for in vivo transplantation and integration.
- Scale-up and manufacturing challenges for non-cellular therapies
- Case Study: Engineering an exosome-based therapeutic loaded with microRNA to target myocardial infarction.

Module 15: Commercialization and Future Trends

- Intellectual Property and patent considerations in regenerative medicine.
- Strategies for Technology Transfer from lab to manufacturing plant.
- Economic analysis and Cost of Goods for cell-based products.
- 4D Bioprinting, Artificial Intelligence in media design, organ-on-a-chip.
- Developing a strategic commercial plan for a novel cell therapy product.
- Case Study: Evaluating the commercial viability and market entry strategy for an iPSC-derived retinal patch.

Training Methodology

The course employs an intensive Blended Learning approach, ensuring both deep theoretical understanding and practical competency.

1. Interactive Lectures & Seminars.
2. Hands-on Wet Lab Sessions.
3. Virtual Lab Simulations.
4. Case Study Analysis & Problem-Solving Workshops
5. Industry Guest Speakers.

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
23 Nov 2026	04 Dec 2026	Online	$2,000
23 Nov 2026	04 Dec 2026	Physical	$3,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$6,000

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$9,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$12,000

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