Bioprinting and Organ-on-a-Chip for Drug Testing 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 pharmaceutical industry faces critical challenges in drug development, characterized by high failure rates, exorbitant costs, and ethical concerns surrounding animal models. Traditional 2D cell cultures fail to accurately mimic complex human physiology, leading to poor prediction of drug efficacy and toxicity. This course addresses this urgent need by providing advanced, hands-on training in the synergistic use of 3D Bioprinting and Microphysiological Systems (MPS) the technical foundation for Organ-on-a-Chip technology. Bioprinting, an additive manufacturing technique, allows for the precise, layer-by-layer deposition of bioinks to create biomimetic 3D tissue architectures. When integrated with OoC devices, which utilize microfluidics to replicate in vivo organ functions, the result is a powerful new generation of human-relevant in vitro models. Mastering this technology is essential for professionals seeking to accelerate preclinical drug screening, enhance the accuracy of toxicity assessment, and contribute to the rapidly expanding field of personalized medicine.

Bioprinting and Organ-on-a-Chip for Drug Testing Training Course is designed to equip participants with both the theoretical knowledge and practical biofabrication skills required to immediately implement Bioprinting and OoC protocols in their research or development workflows. We cover everything from the fundamental principles of biomaterial selection and bioprinter operation to the design and implementation of complex multi-organ-on-a-chip systems. Key learning areas include developing disease models for high-throughput analysis, performing advanced pharmacokinetics/pharmacodynamics (PK/PD) studies, and navigating the evolving regulatory landscape for these next-generation drug discovery tools. Upon completion, attendees will be proficient in creating and validating patient-specific in vitro models, dramatically improving the efficiency, cost-effectiveness, and ethical standing of their drug development pipeline.

Programme Curriculum

Bioprinting and Organ-on-a-Chip for Drug Testing Training Course

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Course Objectives

1. Master the fundamentals of 3D Bioprinting and Microfluidic principles for biofabrication.
2. Design and fabricate diverse Organ-on-a-Chip models for high-throughput screening
3. Evaluate and select optimal Bioinks and Biomaterials for specific tissue engineering applications.
4. Develop Vascularized and Innervated in vitro models to enhance physiological relevance.
5. Implement advanced techniques for Cell Sourcing and culture in dynamic OoC environments.
6. Execute comprehensive Cardiotoxicity and Hepatotoxicity drug assays using MPS.
7. Design and validate Patient-Specific Disease Models
8. Perform and interpret Pharmacokinetics/Pharmacodynamics (PK/PD) studies on multi-organ systems.
9. Integrate Sensing and Real-Time Monitoring technologies into microphysiological platforms.
10. Analyze complex data sets generated from Biomimetic models using Multi-Omics techniques.
11. Navigate the Regulatory Landscape and Commercialization pathways for OoC technology.
12. Apply the principles of the 3Rs (Replacement, Reduction, Refinement) in preclinical research.
13. Troubleshoot common challenges in Organoid and Microtissue maturation and functionality assessment.

Target Audience

1. Pharmaceutical and Biotechnology R&D Scientists.
2. Biomedical Engineers and Biofabrication Specialists.
3. Toxicologists and Pharmacologists.

4. Academic Researchers and Post-Docs.
5. Core Lab Facility Managers.
6. Regulatory Affairs Professionals.
7. Medical Device Developers.
8. Venture Capitalists and Business Development Executives.

Course Modules

Module 1: Foundational Concepts of Bioprinting & OoC

- Evolution of in vitro drug models
- Importance of Extracellular Matrix (ECM) and mechanical cues.
- Overview of Bioprinting technologies.
- Introduction to Microfluidics and its role in nutrient delivery and shear stress simulation.
- Case Study: Early-stage liver-on-a-chip for basic drug metabolism studies, demonstrating improved enzyme function over traditional culture.

Module 2: Bioink Design and Characterization

- Classification of Bioinks.
- Criteria for Biomaterial Selection.
- Rheological testing and mechanical characterization protocols.
- Strategies for functionalizing bioinks with growth factors, peptides, and nanoparticles.
- Case Study: Using a shear-thinning GelMA/Alginate hybrid bioink to successfully bioprint perfusable vascular channels.

Module 3: Bioprinter Operation and Calibration

- Detailed operation of standard Extrusion Bioprinters and key software interfaces
- Protocol development for cell encapsulation and maintaining high Cell Viability during the printing process.
- Sterile workflow and contamination prevention in biofabrication.
- Optimization of printing parameters.
- Case Study: Troubleshooting a low cell-viability print run by adjusting extrusion pressure and bioink crosslinking methods.

Module 4: Microfluidic Chip Design and Fabrication

- Principles of Microchannel architecture and fluid dynamics.
- Materials for OoC fabrication.
- Utilizing bioprinting to directly integrate tissue models onto the chip.
- Design considerations for media recirculation, oxygenation, and membrane integration.
- Case Study: Designing and fabricating a multi-layer Lung-on-a-Chip using soft lithography for mechanical stretching simulation.

Module 5: Developing Single-Organ-on-a-Chip Models

- Culturing human primary hepatocytes and non-parenchymal cells within the microfluidic environment.
- Assessing liver function
- Implementing dose-response and chronic toxicity studies.
- Incorporating mechanical and biochemical cues for tissue maturation.

- Case Study: Utilizing a liver-on-a-chip to accurately predict the clinically observed hepatotoxicity of an anti-cancer drug candidate.

Module 6: Developing Single-Organ-on-a-Chip Models

- Sourcing and culturing induced Pluripotent Stem Cell (iPSC)-derived cardiomyocytes.
- Bioprinting techniques for creating aligned, Anisotropic cardiac microtissues.
- Real-time monitoring of beating frequency, contractility, and action potential.
- Integration of electrical stimulation protocols for functional maturation.
- Case Study: Evaluating the cardiotoxic effects of a known chemotherapeutic agent and comparing the OoC results to animal data.

Module 7: Bioprinted Disease Models: Tumor-on-a-Chip

- Fabricating Tumor Spheroids and Organoids using bioprinting and embedding them in specialized ECM.
- Modeling the Tumor Microenvironment.
- Assessing the efficacy of novel cancer therapeutics in a 3D barrier model.
- Developing personalized Patient-Derived Xenograft (PDX)-on-a-Chip models.
- Case Study: Creating a bioprinted glioblastoma-on-a-chip to test a novel targeted therapy and observe resistance mechanisms.

Module 8: Multi-Organ-on-a-Chip (MOoC) and Inter-Organ Communication

- Design principles for connecting multiple organ modules in series.
- Calculating and maintaining physiological Flow Rates and media recirculation for systemic interactions.
- Modeling the absorption, distribution, metabolism, and excretion (ADME) of drugs.
- Maintaining long-term viability and balancing organ-specific media requirements.
- Case Study: Integrating a gut-on-a-chip with a liver-on-a-chip to study oral drug absorption and subsequent hepatic metabolism.

Module 9: Advanced Techniques: Vascularization and Innervation

- Strategies for creating perfusable Microvascular Networks within bioprinted constructs
- Co-culture of endothelial cells and pericytes for stable vessel formation.
- Bioprinting complex models like the Blood-Brain Barrier (BBB)-on-a-chip.
- Techniques for patterning neurons and glia to mimic organ Innervation.
- Case Study: Using a bioprinted BBB-on-a-Chip to screen drugs for their ability to cross the barrier for CNS treatments.

Module 10: Cell Sourcing and Culture for Bioprinting

- Guidelines for selection and quality control of primary cells, cell lines, and iPSCs.
- Techniques for cell expansion and large-scale production for industrial application.
- Requirements for clinical translation of biofabricated constructs.
- Methods for preparing high-density, high-viability cell suspensions for Bioink formulation.
- Case Study: Scale-up challenges in generating sufficient quantities of functional, iPSC-derived kidney cells for a renal-proximal tubule OoC.

Module 11: Quantitative Analysis and Readouts

- Functional assays for Microtissue characterization.
- Techniques for integrating Biosensors into the OoC platform.

- Using Transepithelial Electrical Resistance (TEER) and non-invasive imaging.
- Molecular Analysis
- Case Study: Utilizing TEER measurements and cytokine release assays to quantify the inflammatory response of an Intestine-on-a-Chip to a pharmaceutical agent.

Module 12: Data Interpretation and Bioinformatics

- Principles of High-Content Screening and automated image analysis for OoC data.
- Statistical methods for comparing OoC and animal model data with human clinical outcomes.
- Combining transcriptomics, proteomics, and metabolomics data from MPS.
- Developing Computational Models to predict drug response and optimize experimental design.
- Case Study: Using machine learning to analyze the gene expression profiles of bioprinted cardiac tissues under drug treatment to identify early biomarkers of toxicity.

Module 13: Scale-Up and Automation for Industry

- Transitioning from single-chip research to High-Throughput plate-based MPS formats.
- Integration with Robotic liquid handling systems for automated media exchange and dosing.
- Addressing reproducibility, standardization, and manufacturing consistency.
- Cost-effectiveness analysis.
- Case Study: The industrial adoption of a 96-well plate-based Kidney-on-a-Chip system for rapid, large-scale nephrotoxicity screening.

Module 14: Regulatory and Ethical Landscape

- The 3Rs Principle and the ethical imperative for alternatives to animal testing.
- Current guidance and initiatives from regulatory bodies for the acceptance of MPS data.
- Establishing the reliability and relevance of OoC models.
- Intellectual Property considerations in Bioprinting and Microfluidic device design.
- Case Study: Review of an FDA-accepted submission where OoC data was successfully used to supplement or partially replace animal data for an Investigational New Drug (IND) application.

Module 15: Future Trends and Commercialization

- 4D Bioprinting, Assembloids, and Patient-Specific Biofabrication.
- The role of Artificial Intelligence (AI) and Machine Learning in optimizing Bioink formulation and OoC data analysis.
- The technological roadmap toward integrating all major human organ systems.
- Licensing, spin-offs, and service provision in the Organ-on-a-Chip market.
- Case Study: Analyzing the market entry strategy of a successful commercial OoC technology provider and their key partnerships.

Training Methodology

The course employs a Blended Learning Approach with a strong emphasis on practical skills transfer:

1. Interactive Lectures.
2. Hands-on Lab Sessions.
3. Case Study Analysis.
4. Design Challenge.
5. Data Analysis Workshop.

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
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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