Advanced Biomaterials for Drug Delivery Training Course Outline

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 landscape of pharmaceutical development is undergoing a profound transformation, driven by the need for more efficient, targeted, and patient-centric therapies. Traditional drug formulations often face limitations like poor solubility, rapid degradation, and non-specific systemic distribution, leading to suboptimal efficacy and dose-limiting side effects. This training addresses these critical challenges by focusing on Advanced Biomaterials, the foundational technology enabling next-generation therapeutics. We will deep dive into nanomaterials, responsive polymers, and hydrogels, exploring their sophisticated design principles including biocompatibility and biodegradability and their application in creating smart drug carriers. The core focus is translating cutting-edge materials science into practical drug delivery systems that revolutionize treatment across disease states, from chronic diseases to precision oncology.

The effective development of these sophisticated systems requires a multidisciplinary skillset spanning polymer chemistry, cellular biology, and translational engineering. Advanced Biomaterials for Drug Delivery Training Course Outline is designed to equip R&D scientists, formulators, and biomedical engineers with the in-depth knowledge and practical tools necessary to innovate within this rapidly advancing field. Through a combination of theoretical instruction, case studies on FDA approved systems, and hands-on methodology discussions, participants will master the principles of controlled release, targeted delivery, and drug device combination products. Upon completion, attendees will be prepared to design, characterize, and optimize novel biomaterial based delivery platforms that enhance therapeutic outcomes and accelerate products from the lab bench to the clinic.

Programme Curriculum

Advanced Biomaterials for Drug Delivery Training Course Outline

Introduction

The landscape of pharmaceutical development is undergoing a profound transformation, driven by the need for more efficient, targeted, and patient-centric therapies. Traditional drug formulations often face limitations like poor solubility, rapid degradation, and non-specific systemic distribution, leading to suboptimal efficacy and dose-limiting side effects. This training addresses these critical challenges by focusing on Advanced Biomaterials, the foundational technology enabling next-generation therapeutics. We will deep dive into nanomaterials, responsive polymers, and hydrogels, exploring their sophisticated design principles including biocompatibility and biodegradability and their application in creating smart drug carriers. The core focus is translating cutting-edge materials science into practical drug delivery systems that revolutionize treatment across disease states, from chronic diseases to precision oncology.

The effective development of these sophisticated systems requires a multidisciplinary skillset spanning polymer chemistry, cellular biology, and translational engineering. Advanced Biomaterials for Drug Delivery Training Course Outline is designed to equip R&D scientists, formulators, and biomedical engineers with the in-depth knowledge and practical tools necessary to innovate within this rapidly advancing field. Through a combination of theoretical instruction, case studies on FDA approved systems, and hands-on methodology discussions, participants will master the principles of controlled release, targeted delivery, and drug device combination products. Upon completion, attendees will be prepared to design, characterize, and optimize novel biomaterial based delivery platforms that enhance therapeutic outcomes and accelerate products from the lab bench to the clinic.

Course Duration

10

Course Objectives

Upon completion of this course, participants will be able to:

1. Evaluate the design principles of Smart Drug Delivery Systems.
2. Differentiate between various Nanocarrier platforms
3. Apply principles of Surface Functionalization for active targeting.
4. Analyze the Pharmacokinetics (PK) and Biodistribution of biomaterial-based drugs.
5. Design Stimuli-Responsive materials for on-demand drug release.
6. Assess the Biocompatibility and Immunogenicity of novel polymers.
7. Master the formulation techniques for Injectable Hydrogels and depots.
8. Develop strategies for delivering complex Biologics
9. Interpret regulatory guidelines for Drug-Device Combination Products.
10. Optimize Scale-Up and manufacturing processes for clinical translation.
11. Utilize advanced characterization techniques for nanocarriers.
12. Integrate AI/ML concepts into material property prediction.
13. Address real-world challenges in Precision Oncology drug targeting.

Target Audience

1. R&D Scientists
2. Biomedical and Chemical Engineers working on formulation.
3. Formulation and Process Development Specialists.
4. Materials Scientists seeking to apply expertise to drug delivery.
5. Pharmacists and Clinicians interested in advanced therapeutics.

6. Regulatory Affairs Professionals involved with combination products.
7. Graduate Students and Post-Docs in related fields.
8. Project Managers overseeing drug delivery pipelines.

Course Modules

Module 1: Foundations of Advanced Drug Delivery

- Biomaterials classification and evolution.
- The ADME challenge and the need for Controlled Release.
- Biocompatibility and degradation kinetics principles.
- Introduction to Translational Medicine in drug delivery.
- Case Study: The evolution of biodegradable sutures to drug-eluting stents.

Module 2: Liposomes and Lipid Nanoparticles (LNPs)

- Structure, preparation, and stability of Liposomes and LNPs.
- Critical role of LNPs in mRNA and Gene Therapy Delivery.
- Remote Loading and encapsulation efficiency optimization.
- Steric stabilization with PEGylation for extended circulation.
- Case Study: Regulatory journey and commercial success of COVID-19 mRNA vaccines.

Module 3: Polymeric Micelles and Nanogels

- Design of Amphiphilic Block Copolymers for micelle formation.
- Critical Micelle Concentration and stability in biological media.
- Synthesis and application of Nanogels for large payload delivery.
- Tunable Release kinetics via polymer chemistry.
- Case Study: Micellar formulations for delivery of hydrophobic small molecules.

Module 4: Polymeric Nanoparticles and Microparticles

- Techniques.
- Use of PLGA and PCL in long-acting injectable formulations.
- Control over size, polydispersity, and surface charge.
- Strategies for overcoming the EPR effect limitations.
- Case Study: Development of single-injection microparticle vaccines.

Module 5: Surface Functionalization and Active Targeting

- Ligand Attachment chemistry
- Targeting strategies.
- Passive vs. Active Targeting efficiency and challenges.
- Stealth Technology to avoid immune clearance.
- Case Study: Antibody-drug conjugates (ADCs) as actively targeted nanocarriers.

Module 6: Stimuli-Responsive Drug Delivery Systems

- Design of Smart Polymers sensitive to pH, temperature, and light.
- Enzyme-Responsive and redox-responsive release mechanisms.
- On-Demand Release for temporal control in therapy.
- Integration with external triggers

- Case Study: Thermosensitive liposomes for localized chemotherapy delivery.

Module 7: Injectable and In Situ Forming Hydrogels

- Hydrogel materials.
- Cross-Linking mechanisms.
- Drug Depot formation for sustained localized delivery.
- Cell Encapsulation and regenerative medicine applications.
- Case Study: Biodegradable sealant hydrogels for post-operative pain management.

Module 8: Advanced Characterization Techniques

- Particle sizing
- Morphology.
- Chemical analysis.
- In Vitro Drug Release Assays and dissolution testing standards.
- Case Study: Correlating DLS PDI values with in vivo performance.

Module 9: Delivery of Biologics and Nucleic Acids

- Challenges in formulating sensitive Proteins and Peptides.
- Polyplexes and Viral Vectors for Gene Therapy.
- Protecting siRNA/miRNA from nucleases in vivo.
- Formulation strategies for oral delivery of biologics.
- Case Study: Design and challenges of inhaled insulin powder.

Module 10: Pharmacokinetics and Biodistribution Analysis

- Modeling drug release profiles
- Impact of particle size and surface charge on clearance kinetics.
- In Vivo Imaging techniques for real-time biodistribution tracking.
- Toxicology and organ-specific accumulation assessment.
- Case Study: Analyzing the differential PK of PEGylated vs. non-PEGylated nanomedicines.

Module 11: Immunological and Toxicological Considerations

- Immunogenicity of biomaterials
- Strategies to minimize the Foreign Body Reaction (FBR).
- Cytotoxicity and genotoxicity testing in vitro and in vivo.
- Role of the RES in nanocarrier uptake.
- Case Study: Lessons learned from the failure of certain polymers due to immunotoxicity.

Module 12: Scale-Up and Manufacturing (CMC)

- Quality by Design (QbD) principles for formulation development.
- Process validation and control for cGMP compliance.
- Transitioning from batch to Continuous Flow Manufacturing.
- Sterilization methods for heat-sensitive biomaterials.
- Case Study: Scale-up challenges for commercializing liposomal amphotericin B.

Module 13: Drug-Device Combination Products

- Regulatory definition and examples of Combination Products.

- Designing Drug-Eluting Stents and coatings.
- Regulatory Pathway strategies
- Risk assessment and quality systems for device components.
- Case Study: The successful commercialization and post-market surveillance of a drug-eluting ophthalmic implant.

Module 14: Biomaterials in Precision Oncology

- Targeting the Tumor Microenvironment
- Dual targeting and Multifunctional Nanomedicine design.
- Overcoming Multi-Drug Resistance using nanocarriers.
- Combining biomaterials with immunotherapy
- Case Study: Clinical trials utilizing tumor-penetrating peptides on nanoparticles.

Module 15: Future Trends and Ethics

- Integration of Artificial Intelligence for material design.
- Exosomes and naturally derived nanocarriers.
- Ethical considerations in gene delivery and personalized medicine.
- Future of Personalized Biomaterials and 3D printing.
- Case Study: Discussion on the future potential of ingestible electronic drug delivery systems.

Training Methodology

This course employs an immersive, mixed-modality approach designed for deep understanding and practical application:

- Interactive Lectures
- In-Depth Case Studies
- Methodology Workshops.
- Group Problem-Solving.
- Expert Q&A Panels.

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

Ready to enroll or request a customized program? Book online or contact us:

Register Online Now

Email: info@fineskilltrainingcenter.com | Website: www.fineskilltrainingcenter.com