Nanomedicine and Targeted Drug Delivery 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

Nanomedicine is an interdisciplinary field that leverages nanotechnology to address critical challenges in medicine. This revolutionary discipline is at the forefront of healthcare innovation, employing nanoscale materials and devices for enhanced diagnostics, advanced therapeutics, and regenerative medicine. The development of nanomedicine has unlocked unprecedented opportunities for precise interventions, particularly in the realm of targeted drug delivery. By engineering drug carriers at the nanoscale, we can overcome traditional limitations, minimizing off-target effects and increasing therapeutic efficacy. Nanomedicine and Targeted Drug Delivery Training Course provides a comprehensive overview of the fundamental principles and cutting-edge applications of nanomedicine, with a special focus on the strategic design and implementation of targeted drug delivery systems. We will explore the latest advancements, from smart nanoparticles to responsive drug-eluting scaffolds, and their profound impact on disease treatment and patient outcomes.

Targeted drug delivery represents a paradigm shift from conventional systemic treatments to highly localized and controlled therapies. It involves the use of specialized nanocarriers that selectively accumulate at the site of disease, whether a tumor, an infected cell, or an inflamed tissue. This approach is central to modern pharmacology, as it improves the therapeutic index of drugs by reducing dosage requirements and mitigating systemic toxicity. The synergy between nanomedicine and targeted delivery is propelling the development of personalized medicine, where treatments are tailored to an individual?ÇÖs genetic and molecular profile. This training course is designed to equip professionals and researchers with the essential knowledge and practical skills needed to innovate within this rapidly evolving landscape. Participants will gain insights into the entire pipeline, from material synthesis and characterization to in-vivo validation and clinical translation, positioning them to contribute to the next generation of healthcare solutions.

Programme Curriculum

Nanomedicine and Targeted Drug Delivery Training Course

Introduction

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Course Duration

10 Days

Course Objectives

1. Understand the core concepts of nanotechnology and their application in medicine.
2. Identify and characterize various types of nanomaterials, including liposomes, polymeric nanoparticles, and dendrimers.
3. Master active and passive targeting mechanisms for disease-specific drug delivery.
4. Analyze the in-vivo behavior of nanocarriers and their impact on drug efficacy.
5. Learn to functionalize nanoparticles with targeting ligands and therapeutic payloads.
6. Explore the integration of diagnostic and therapeutic functionalities within a single nanoplatform.
7. Evaluate the immune response to nanocarriers and strategies for evasion.
8. Apply nanomedicine principles specifically for cancer diagnosis and treatment.
9. Utilize nanoparticles for the delivery of nucleic acids and gene editing tools.
10. Navigate the regulatory pathways for nanomedicine products (e.g., FDA, EMA).
11. Understand the challenges and opportunities in moving from bench to bedside.
12. Grasp the importance of patents and intellectual property protection.
13. Integrate nanomedicine into the development of patient-specific therapies.

Target Audience

1. Biomedical Engineers
2. Pharmacists and Pharmacologists
3. Medical Researchers
4. Chemists and Material Scientists
5. Biotechnology Professionals
6. Graduate and Postgraduate Students
7. Clinicians interested in translational medicine
8. R&D Scientists in Pharmaceutical and Biotech companies

Course Modules

Module 1: Introduction to Nanomedicine

- Definitions and historical context of nanomedicine.
- Fundamental properties of materials at the nanoscale.
- The promise of nanotechnology in healthcare.
- Overview of major applications: diagnostics, therapeutics, and regenerative medicine.
- Ethical considerations and safety of nanomaterials
- **Case Study:** The clinical approval and success of Doxil, the first FDA-approved liposomal nanomedicine for chemotherapy.

Module 2: Nanoparticle Design and Synthesis

- Principles of top-down and bottom-up fabrication.
- Synthesis of liposomes, polymeric nanoparticles, and solid lipid nanoparticles.
- Creation of inorganic nanomaterials: gold, silver, and iron oxide nanoparticles.
- Strategies for size, shape, and surface charge control.
- Scalability challenges in manufacturing.
- **Case Study:** The development of lipid nanoparticles (LNPs) for mRNA vaccines.

Module 3: Passive and Active Targeting

- Principles of the Enhanced Permeability and Retention (EPR) effect.
- Design of nanoparticles for passive tumor targeting.
- Functionalization with targeting ligands (antibodies, peptides, aptamers).
- Receptor-mediated endocytosis for active cellular uptake.
- Challenges in achieving effective active targeting in vivo.
- **Case Study:** The design and preclinical validation of a HER2-targeted nanoparticle for breast cancer therapy.

Module 4: Responsive Drug Delivery Systems

- Stimuli-responsive nanomaterials: pH, temperature, and light-triggered release.
- Enzyme-activated drug release mechanisms.
- Remote-controlled release using magnetic fields or ultrasound.
- Polymersomes and hydrogels as smart drug delivery depots.
- Biomimetic nanoparticles for enhanced circulation.
- **Case Study:** A photo-responsive liposome loaded with a chemotherapeutic agent.

Module 5: Pharmacokinetics and Biodistribution

- Factors influencing nanoparticle circulation half-life.
- The role of the mononuclear phagocyte system (MPS) in clearance.
- Techniques for tracking nanoparticles in vivo: fluorescence, PET, and MRI.
- Predicting and optimizing biodistribution profiles.
- Toxicity assessment and elimination pathways.
- **Case Study:** A comparative study of PEGylated vs. non-PEGylated liposomes.

Module 6: Nanomedicine for Cancer Therapy

- Nanoparticle-mediated chemotherapy and co-delivery of multiple drugs.
- Photothermal therapy (PTT) using gold nanorods.
- Photodynamic therapy (PDT) with photosensitizer-loaded nanoparticles.
- Combination therapies: chemo-photothermal and radio-immunotherapy.
- Overcoming multidrug resistance with nanocarriers.
- **Case Study:** The application of Abraxane, an albumin-bound paclitaxel nanoparticle, in cancer treatment.

Module 7: Gene and Nucleic Acid Delivery

- Challenges in delivering DNA, siRNA, and mRNA.
- Viral vs. non-viral delivery vectors.
- Design of cationic lipids and polymers for nucleic acid complexation.
- CRISPR/Cas9 delivery using lipid nanoparticles and gold nanoparticles.
- In-vivo applications of gene therapy and RNA interference.
- **Case Study:** A clinical trial of a siRNA-loaded liposome for a specific genetic disease.

Module 8: Nanomedicine for Regenerative Medicine

- Nanofiber scaffolds for tissue engineering.
- Delivery of growth factors and stem cells.
- Injectable hydrogels for wound healing.
- Nanoparticle-mediated signaling for tissue repair.
- Biocompatibility and long-term integration of nanodevices.
- **Case Study:** The use of a smart injectable hydrogel for cartilage regeneration.

Module 9: Immunomodulation and Vaccines

- Nanoparticles as adjuvants for enhanced immune response.
- Developing nanovaccines for infectious diseases.
- Targeting immune cells with nanoparticles for immunotherapy.
- Modulating the tumor microenvironment to overcome immune evasion.
- The role of nanomedicine in personalized cancer vaccines.
- **Case Study:** The development and success of mRNA vaccines encapsulated in lipid nanoparticles.

Module 10: Nanodiagnostics and Imaging

- Nanoparticles as contrast agents for MRI, CT, and ultrasound.
- Quantum dots and fluorescent nanoparticles for cellular imaging.
- Point-of-care diagnostics using lateral flow assays.
- SERS and Raman spectroscopy for biomarker detection.
- Theranostic nanoplatforms: combining diagnosis and therapy.

- **Case Study:** A theranostic nanoparticle loaded with both an MRI contrast agent and a chemotherapy drug.

Module 11: Clinical Translation and Regulatory Landscape

- Good Manufacturing Practices (GMP) for nanomedicines.
- Preclinical toxicity and safety studies.
- Navigating the FDA and EMA approval processes.
- Challenges in clinical trials for complex nanomaterials.
- Post-market surveillance and pharmacovigilance.
- **Case Study:** The regulatory journey of Onpattro (patisiran), the first FDA-approved siRNA therapy.

Module 12: Advanced Manufacturing and Scale-up

- Microfluidic synthesis for precise nanoparticle control.
- Lyophilization and long-term stability of nanomedicines.
- Quality control and characterization in large-scale production.
- Sterilization and formulation challenges.
- From lab bench to industrial production.
- **Case Study:** The scale-up process for the industrial production of a liposomal drug.

Module 13: Future Trends and Commercialization

- Next-generation nanomedicine: personalized and AI-driven.
- Investment and market trends in nanotech.
- Startups and intellectual property protection.
- Ethical and societal impact of nanomedicine.
- The role of nanomedicine in global health.
- **Case Study:** The emergence of a new startup focused on using exosomes as natural nanocarriers.

Module 14: Safety and Toxicology

- Nanotoxicity mechanisms: oxidative stress and inflammation.
- In-vitro and in-vivo toxicity assays.
- Biodegradation and clearance of nanomaterials.
- Risk assessment and safe handling practices.
- Long-term effects of nanoparticle accumulation.
- **Case Study:** A retrospective analysis of the long-term safety profile of gold nanoparticles used in clinical trials.

Module 15: Nanomedicine in Infectious Diseases

- Nanoparticle-based antimicrobials and antivirals.
- Targeting bacterial biofilms with nanoparticles.
- Nanotechnology for diagnostics of infectious diseases.
- Drug delivery across the blood-brain barrier for CNS infections.
- Challenges in developing nanomedicines for global health.
- **Case Study:** The use of silver nanoparticles as an antimicrobial agent in wound dressings.

Training Methodology

- **Interactive Lectures:** Core concepts will be presented through detailed presentations with Q&A sessions.
- **Case Studies:** Real-world examples of successful and failed nanomedicine products will be analyzed to understand practical applications and challenges.
- **Hands-on Workshops:** Practical sessions on nanoparticle characterization, data analysis, and software simulation.
- **Group Discussions:** Collaborative sessions to foster critical thinking and problem-solving skills.
- **Expert Guest Speakers:** Industry leaders and researchers will share their insights and experiences.
- **Final Project:** Participants will design a hypothetical nanomedicine delivery system, presenting their work for peer review.

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

Start Date	End Date	Location	Price
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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