Advanced Vaccine Formulation and Adjuvants 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

In the post-pandemic era, the need for rapid, thermostable, and broadly protective vaccines has driven a revolution in immunology and pharmaceutical science. Advanced Vaccine Formulation and Adjuvants Training Course delves into the next-generation vaccinology required to meet global health challenges, moving beyond traditional platforms to embrace rational vaccine design and cutting-edge delivery systems. The judicious selection and engineering of adjuvants substances that enhance and direct the immune response is the single most critical factor in achieving superior vaccine efficacy and establishing long-term, broad-spectrum immunity. This program provides a comprehensive, translational science perspective on the intricate physicochemical and biological principles governing the stability, immunogenicity, and manufacturing of complex adjuvanted vaccine products.

The modern vaccine landscape demands professionals proficient in integrating nanotechnology, synthetic biology, and systems vaccinology to accelerate the development pipeline. From understanding the Toll-like Receptor (TLR) agonist mechanisms to mastering the complexities of Lipid Nanoparticle (LNP) formulation and Cold Chain Management, this course is meticulously structured to transform theoretical knowledge into practical, industry-ready expertise. Participants will critically evaluate real-world case studies including the success of mRNA LNP and AS01/AS03 adjuvanted vaccines to develop strategies for optimizing antigen-adjuvant synergy and navigating the stringent CMC (Chemistry, Manufacturing, and Controls) and regulatory pathways essential for global licensure. This is the definitive training for leaders shaping the future of immunization.

Programme Curriculum

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Course Duration

10 days

Course Objectives

1. Master the principles of Rational Vaccine Design and Antigen Engineering for subunit and nucleic acid platforms.
2. Evaluate the Mechanism of Action (MoA) for diverse Adjuvant Classes and their impact on immune polarization
3. Optimize Lipid Nanoparticle (LNP) and Virus-Like Particle (VLP) formulation for enhanced mRNA/DNA delivery and stability.
4. Apply advanced analytical techniques (DLS, DSC, Cryo-EM) for comprehensive Vaccine Characterization and Quality Control (QC).
5. Design preclinical models and assays to rapidly predict Immunogenicity and screen novel Adjuvant Candidates.
6. Develop robust Formulation Strategies to ensure vaccine Thermostability and dose-sparing effects.
7. Navigate the regulatory landscape, focusing on CMC documentation for novel adjuvanted and combination vaccines.
8. Analyze the latest breakthroughs in Mucosal and Needle-Free Delivery Systems
9. Investigate the application of Synthetic Biology and Self-Amplifying RNA in next-generation vaccine platforms.
10. Assess the safety profile, reactogenicity, and risk mitigation strategies for novel adjuvants in clinical development.
11. Differentiate between prophylactic and Therapeutic Vaccine design, including applications in Cancer Immunotherapy.
12. Utilize High-Throughput Screening methodologies for accelerating adjuvant discovery and optimizing Antigen-Adjuvant Synergy.

13. Implement best practices for Aseptic Processing and Cold Chain Logistics to maintain product integrity globally.

Target Audience

1. Formulation Scientists and Engineers in Biopharmaceutical R&D.
2. Immunologists and Vaccine Biologists.
3. Process Development and Manufacturing Scientists
4. Regulatory Affairs Professionals handling vaccine dossiers (IND/BLA/MAA).
5. Quality Assurance (QA/QC) personnel.
6. Preclinical Research Managers and Toxicologists evaluating adjuvant safety.
7. Academia and Government Researchers.
8. Clinical Development Associates

Course Modules

Module 1: Foundations of Vaccine Immunology & Adjuvancy

- Innate and Adaptive Immunity.
- Toll-like Receptors and PRRs.
- Immune Polarization
- Principles of Antigen-Adjuvant Synergy and co-localization.
- Case Study: The mechanism of CpG and its role in Th1-biased immunity.

Module 2: The Evolution of Licensed Adjuvants

- History of Adjuvancy
- Mechanism and limitations of Alum
- Oil-in-Water Emulsions
- Saponin-based Adjuvants.
- Case Study: The use of AS04 in HPV and Hepatitis B vaccines.

Module 3: Advanced Nanoparticle-Based Adjuvants

- Design principles of particulate delivery systems
- Lipid Nanoparticles
- Virus-Like Particles.
- Polymeric and Inorganic Nano-adjuvants
- Case Study: The formulation and success of mRNA LNP vaccines against COVID-19.

Module 4: Nucleic Acid Vaccine Formulation

- Challenges in nucleic acid delivery.
- Optimization of LNP manufacturing.
- The role of ionizable lipids in endosomal escape and transfection efficiency.
- Self-Amplifying RNA and Circular RNA platforms.
- Case Study: Analysis of the manufacturing process and stability profile for a licensed mRNA vaccine.

Module 5: Subunit Vaccine Engineering and Conjugation

- Selection and purification of recombinant protein and peptide antigens.
- Conjugate Vaccine chemistry

- Strategies for multivalent antigen display and presentation.
- Impact of glycosylation and folding on antigen quality.
- Case Study: Formulation challenges in developing a multi-component Pneumococcal Conjugate Vaccine

Module 6: Physicochemical Characterization and Quality Control

- Assessing particle size distribution and zeta potential.
- Structural analysis using Cryo-EM and Small-Angle X-ray Scattering
- Purity and potency assays.
- Evaluation of Adjuvant-Antigen Interaction
- Case Study: Investigating lot-to-lot variability in adsorbed protein vaccines using advanced chromatography.

Module 7: Bioprocessing and Manufacturing Scale-Up

- Downstream processing and purification challenges for complex adjuvants.
- Aseptic Formulation and fill/finish operations for sterile products.
- Mixing and homogenization techniques for high-shear emulsions and LNPs.
- Validation of cleaning and sterilization for multi-product facilities.
- Case Study: Scaling up the production of an oil-in-water emulsion adjuvant from pilot to commercial scale.

Module 8: Vaccine Stability and Degradation Pathways

- Major degradation routes.
- Stress Testing and accelerated stability studies.
- Developing stabilizing excipients and buffers.
- Lyophilization and alternative drying techniques for improved Thermostability.
- Case Study: Designing a Cold Chain Management strategy to maintain global product integrity.

Module 9: Preclinical and Clinical Evaluation

- In vivo animal models for immunogenicity and challenge studies.
- Biomarker discovery and the role of Systems Vaccinology.
- Assessing Reactogenicity and local/systemic adverse events.
- Translating preclinical immunogenicity data to clinical efficacy predictions.
- Case Study: Analyzing immunogenicity data from a Phase I/II Shingrix trial.

Module 10: Novel and Emerging Adjuvant Targets

- New TLR Ligands and their clinical progress.
- STING and cGAS-STING Pathway agonists for enhanced cellular immunity.
- Metabolic and epigenetic modulators as next-generation adjuvants.
- Combining different MoAs in Adjuvant Systems for synergistic effects.
- Case Study: The preclinical development and mechanism of a novel STING agonist-adjuvanted cancer vaccine.

Module 11: Regulatory Strategy and CMC Documentation

- Global regulatory requirements
- Structure and content of the CMC section for adjuvanted vaccines.
- Managing changes and post-approval variations for complex formulations.

- Risk assessment and control strategies for starting materials and excipients.
- Case Study: Preparing a CMC dossier for an LNP-encapsulated vaccine product.

Module 12: Delivery Innovations and Alternative Routes

- Mucosal Vaccines.
- Needle-Free Delivery.
- Dermal and intradermal delivery.
- Formulation considerations for dry powder and dissolvable delivery systems.
- Case Study: Examining the clinical efficacy and patient compliance of a licensed intranasal influenza vaccine.

Module 13: Therapeutic Vaccines and Cancer Immunotherapy

- Fundamental differences between prophylactic and therapeutic vaccine design.
- Adjuvants for breaking immune tolerance in Cancer Vaccines.
- Personalized neoantigen vaccines and combination with checkpoint inhibitors.
- Vaccines against chronic infectious diseases
- Case Study: The formulation and clinical results of a personalized neoantigen vaccine in melanoma.

Module 14: Computational Vaccinology and High-Throughput Screening

- In silico tools for predicting Antigenicity and immunogenicity.
- Using Machine Learning and AI for rapid adjuvant candidate selection.
- High-Throughput Assays for formulation stability and activity screening.
- Systems Vaccinology.
- Case Study: Using Genomic/Proteomic data to select conserved epitopes for a universal flu vaccine.

Module 15: Future Directions and Global Health Equity

- Vaccines for Emerging Infectious Diseases and Pandemic Preparedness.
- Addressing Vaccine Hesitancy through improved formulation and perception.
- Focus on Low- and Middle-Income Countries.
- Ethical and public policy considerations in advanced vaccinology.
- Case Study: The global effort to create a stable, low-cost Malaria Vaccine

Training Methodology

The course employs a blended, translational learning approach:

1. Expert-Led Lectures.
2. Interactive Workshops.
3. Real-World Case Studies
4. Hands-on Lab Demonstrations/Simulations.
5. Regulatory Simulation.

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