Advanced Bioreactor Selection, Scale-Up and Optimisation Training Course

15 – 19 November 2026
Muscat

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Training Center

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Ref: 1422_204996 **Date:** 15 – 19 November 2026 **Location:** Muscat **Fees:** 6500 Euro

Overview

Advanced Bioreactor Selection, Scale-Up and Optimisation Training Course is a one-week course for bioprocess engineers, scientists, manufacturing technologists, and technical leaders who leave with a Bioreactor Selection and Scale-Up Decision Portfolio. Participants connect reactor choice, cell requirements, mass transfer, mixing, heat removal, instrumentation, process control, scale translation, contamination prevention, and lifecycle economics. Agile Leaders Training Center presents bioreactor selection and scale-up as an integrated engineering discipline.

Who Should Attend

- Bioprocess development functions responsible for cell culture, fermentation, and process characterization
- Process engineering functions responsible for vessel selection, scale translation, and technology transfer
- Manufacturing functions responsible for bioreactor operation, monitoring, deviation response, and productivity
- Automation functions responsible for sensors, control loops, alarms, data, and process analytical technology
- Quality functions responsible for process control, contamination risk, validation, and change management
- Technical leadership functions responsible for capacity, investment, platform, and lifecycle decisions

The course assumes participants already work with biological processes or process engineering and leaves out introductory biology, equipment maintenance, and product-specific regulatory submissions.

Departments and Industries

The course supports departments and industries that develop, scale, operate, or govern biological production systems.

- Biopharmaceutical and vaccine process-development departments
- Industrial biotechnology and fermentation operations
- Food, enzyme, and cultured-ingredient manufacturing
- Cell and gene therapy manufacturing functions
- Research, pilot-plant, and technology-transfer groups
- Engineering, automation, quality, and capital-project teams

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Learning Objectives

By the end of this course, participants will be able to:

- Compare bioreactor configurations against biological and production requirements
- Analyze mixing, oxygen transfer, heat removal, and shear constraints
- Build monitoring and control strategies for critical process parameters
- Evaluate scale-up and scale-down criteria across operating ranges
- Diagnose performance, contamination, and control deviations
- Prioritize equipment options using lifecycle and risk evidence

Course Agenda

Day 1: Selection Architecture and Process Requirements

- Biological Process Requirement Definition Canvas
- Stirred-Tank, Airlift, Rocking, and Fixed-Bed Comparison Matrix
- Batch, Fed-Batch, Perfusion, and Continuous Mode Decision Tree
- Single-Use and Stainless-System Selection Scorecard
- Bioreactor Capacity and Lifecycle Cost Model

Day 2: Mixing, Transfer, and Cell Environment

- Power-per-Volume and Impeller Tip-Speed Assessment
- Mixing-Time and Concentration-Gradient Mapping Method
- Oxygen Transfer Rate and kLa Calculation Sheet
- Gas Flow, Carbon Dioxide Removal, and Foam Control Map
- Heat-Transfer, Shear, and Cell-Sensitivity Operating Window

Day 3: Monitoring and Process Control

- Critical Process Parameter and Quality Attribute Linkage Map
- Sensor Selection, Calibration, and Data-Integrity Checklist
- Dissolved-Oxygen Cascade Control Logic
- Feed, pH, Temperature, and Antifoam Control Strategy
- Process Analytical Technology Monitoring Plan

Day 4: Scale Translation and Reliable Operation

- Scale-Up Criterion Selection Decision Matrix
- Laboratory-to-Production Operating Range Translation
- Scale-Down Model Design and Qualification Plan
- Contamination Pathway and Aseptic Boundary Analysis
- Deviation Diagnosis and Root-Cause Evidence Tree

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Day 5: Bioreactor Decision Practice

- Exercise: Select a Bioreactor for a Cell-Culture Case
- Exercise: Balance Mixing, Oxygen, Shear, and Heat Constraints
- Exercise: Design a Monitoring and Control Architecture
- Exercise: Build a Scale-Up and Troubleshooting Plan
- Capstone Exercise: Bioreactor Selection and Scale-Up Decision Portfolio

Practical Exercises

The course uses suggested activities drawn from biologics, fermentation, food biotechnology, and cell-based manufacturing.

- Suggested activity: compare reactor platforms using biological needs, operating mode, contamination exposure, capacity, and lifecycle cost.
- Suggested activity: calculate an oxygen-transfer requirement and test its compatibility with mixing, shear, gas flow, and heat constraints.
- Suggested activity: map sensors, control loops, alarms, sampling, and response actions for a production scenario.
- Suggested activity: integrate selection, operating ranges, scale criteria, risks, and troubleshooting evidence in the capstone portfolio.

FAQs

Who suits advanced bioreactor selection and scale-up training, and what does it assume?

Advanced bioreactor selection and scale-up training suits professionals who already handle biological processes, process engineering, manufacturing, automation, quality, or technical investment decisions.

How does bioreactor selection training differ from introductory biotechnology training?

Bioreactor selection training evaluates equipment, transport phenomena, controls, scale effects, risks, and economics, while introductory biotechnology training establishes basic biological concepts and laboratory methods.

Which criteria guide bioreactor selection for biotechnology processes?

Bioreactor selection uses cell sensitivity, oxygen and mixing demand, heat removal, operating mode, sterility, scale, control capability, facility fit, changeover needs, and lifecycle cost.

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How is bioreactor scale-up evaluated without holding every parameter constant?

Bioreactor scale-up evaluates acceptable operating ranges for parameters such as power per volume, tip speed, mixing time, gas flow, oxygen transfer, shear, and heat removal against biological performance.

Why does process analytical technology matter in bioreactor control?

Process analytical technology supports timely measurement, process understanding, control decisions, trend detection, and evidence that critical conditions remain within the intended operating range.

Conclusion

The course integrates reactor selection, transport phenomena, cell requirements, control, scale translation, contamination prevention, troubleshooting, and economics. Participants take back a Bioreactor Selection and Scale-Up Decision Portfolio. The portfolio changes technical decisions by making requirements, assumptions, tradeoffs, operating ranges, controls, risks, and evidence explicit.