**Course Title: Upstream Processing – Mammalian Cell Culture**

**Description**

Upstream processing is the initial phase of the bioprocess from cell line development and cultivation to culture expansion of the cells through harvesting. Mammalian cell culture is an important tool for research, clinical, and pharmaceutical applications. In this course, students will learn techniques such as initiating, sub-culturing, trypsinization and cryopreserving a cell culture. Students will also have hands on experience performing cell counts, extracting media samples from a bioreactor and analyzing cell samples using a bio-analyzer to determine the growth rate of the cells.

**Course Logistics**

* Face-to-face instruction
* 16 hours
* Delivery will be over two days
* 6-12 participants

**Course Objectives**

Students will:

1. Learn about CGMP for Upstream Processing
2. Gain an understanding of cell biology
3. Demonstrate proficiency with adherent cell culture initiation, trypsinization, sub culturing and cryopreservation
4. Develop an understanding of aseptic technique when performing cell culture process
5. Gain a fundamental knowledge of common mammalian expression systems and the requirements for growth of suspension vs. adherent cell lines

**Outline of Instruction**

**Day 1**

1. Introduction to Cell Culture
	1. Cell Biology
	2. Biology of Cultured Cells
2. Processing Considerations
	1. Contamination- detection of
	2. Aseptic Technique (sterilization and handling)
3. Flu Vaccine: The biology of the Influenza Virus
4. History of Cell Culture
	1. Cell culture
	2. Cell lines
	3. Cell morphology
	4. Subculturing of cells: Adherent vs Suspension
	5. Cell counting: Automated vs Hemocytometer
5. Calculations Activity: C1V1=C2V2
6. Labs
	1. Aseptic Technique – cell environment
	2. Culture Initiation
	3. CHO-K1 Adherent cells trypsinization and subculture

**Outline of Instruction**

**Day 2**

1. Methods of genetic transfer
	1. Transformation
	2. Transfection
	3. Transduction
2. Growth media composition and conditions
3. Cell culture bioreactors
	1. Bioreactor system: iCELLIS
4. Metabolite analysis
	1. CEDEX Bioanalyzer
	2. Review analysis results
5. Cryopreservation
6. Mammalian Cell Culture Regulatory considerations
7. Labs
	1. iCELLIS Bioreactor
		1. practice removing carriers from sample bioreactor
		2. take media samples from iCELLIS and measure analytes
		3. review carriers with cells attached and carriers without cells under microscope
	2. Evaluation of samples for the presence of contamination
	3. Cryopreservation of cells

**Intended Audience:**

* Bioprocess Technicians, Bioprocess Engineers, Manufacturing Associates, Fermentation Technicians, Fermentation Lab Analysts.

**Related Courses**

* Cell Culture
* Microbiology Basics
* Upstream Processing

**Requirements for Successful Completion of the Course**

* Attendance 80%
* Participation: Attendance
* Additional Requirements: none