

**Educational Objectives:**

1. The course will provide basis for mammalian cell processing from cell culture engineering to media development to metabolic engineering.

**Course Outcomes**

2. The course is particularly useful given the highly interdisciplinary nature of the field. Students from a wide variety of backgrounds will be given the opportunity to step back and understand the history behind the current state of the art: robust, efficient and defined production processes. Molecular biologists, process engineers, cell biologists, analytical scientists, project managers and chief scientific officers are just a few of the professionals that will benefit from these specialized approaches which have become embedded within the industry.

3. **Course Contents**

- a. Overview of mammalian cell culture
- b. Ultra scale down methodologies
- c. Cell line engineering
- d. Case Study: From development to production
- e. Modelling mammalian cell cultures
- f. The application of process analytical technologies
- g. Metabolic engineering and proteomics
- h. Scale-up of protein-free production processes
- i. Single use technologies for upstream processing
- j. Cell line selection
- k. Cell therapy
- l. Medium development and optimization
- m. Stem cell biology and the current status of stem cell therapy
- n. Engineered tissues as replacement body parts and as replacements for animal testing

- o. Key issues and tools used in industrial cell culture operations, including economies of scale, operations management, control charts, and process flow diagrams

**Recommended Books:**

1. Mammalian cell biotechnology in protein production by Hauser and Wagner. Berlin: Newyork: de Gruyter.
2. Gene Transfer and Expression in Mammalian Cells by Savvas C. Makrides. Gulf Professional Publishing
3. Protein therapeutics production: large-scale mammalian cell culture by Alfred Doig, Tracy Beaudoin. D&MD Publications