

Module Title:	Microbial Cell Factory
Language of Instruction:	English
Credits:	5
NFQ Level:	7
Module Delivered In	2 programme(s)
Teaching & Learning Strategies:	Microbial Cell Factory will be taught employing the dual approach of lectures and practicals so students will learn the theory of microbial metabolism with respect to primary and secondary metabolite production to include, alcohol, antibiotic and enzyme production. In addition students will engage with problem based learning and student led inquiry on selected microbial physiology scenarios.
Module Aim:	This module will provide learners with an overview of the applications that relate to the use of microbes in biotechnology and in biopharmaceutical manufacture of useful products and services. Syllabus content will include the historical discovery of useful microorganisms, strain selection and genetic improvement.
Learning Outcomes	
<i>On successful completion of this module the learner should be able to:</i>	
LO1	Describe how beneficial microbes have been discovered and employed in large scale bioprocesses
LO2	Explain the construction and composition of growth media used in the cultivation of microbes at industrial scale
LO3	Explain options for bioreactor design, control and optimisation in biotechnology and biopharmaceutical operations
LO4	Demonstrate a knowledge of the downstream processes employed in the purification and finishing steps involved in biopharmaceutical manufacture
LO5	Demonstrate adequate practical and theoretical skills in working with industrially important microorganisms and their metabolites in a laboratory environment
Pre-requisite learning	
Module Recommendations <i>This is prior learning (or a practical skill) that is recommended before enrolment in this module.</i>	
No recommendations listed	
Incompatible Modules <i>These are modules which have learning outcomes that are too similar to the learning outcomes of this module.</i>	
No incompatible modules listed	
Co-requisite Modules	
No Co-requisite modules listed	
Requirements <i>This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.</i>	
No requirements listed	

Module Content & Assessment

Indicative Content

Review Applied Microbiology with relevance to Industrial uses

Summary of 2nd year general and applied microbiological principles of particular importance to the commercial exploitation of valuable microbes.

Industrial Microbiology

Principles and definitions of fermentation, fermenter and bioreactor. Classification of fermentation products to include, biomass, metabolites and bio-transformations. Biotech products by sector, bulk and fine chemicals. Primary and secondary metabolites as industrially valuable products. Other biotechnological applications of microbial cells as bio-catalysts and in bio-remediation. Penicillin its discovery and large scale production. Novel approaches to antibiotic discovery. Production of organic acids, amino acids, industrial enzymes and other metabolites. The uses of immobilized enzymes and bio-catalysts. Microbial bio-transformation of steroids and amino acids. The importance of acetone butanol in the development of fermentation science and other selected topics.

Industrial Bio-processing

Upstream bio-processing: essential features of a fermenter, different kinds of fermenters, sterilisation and maintenance of sterility, introduction to gas exchange and mass transfer and scale-up. Downstream processing: separation technologies, centrifugation and filtration, cell disintegration, solvent extraction and other purification techniques. Screening for metabolites. Strain improvement. Culture management. Inoculum preparation. Substrates for industrial fermentations. Regulation of enzyme activity and synthesis. Metabolic control and the overproduction of desirable metabolites. Primary and Secondary metabolism.

Fungi in Biotechnology

100 years of *Aspergillus niger* and its products in Industrial Microbiology. Transport and metabolism in Fungi. Enzymes from Fungi. Solid state fermentation. The microbiology of mushroom production, alcohol, lactic acid and yeast production. Single Cell Protein. Yeast Microbiology in brewing and baking. Yeast genomics in brewing including evolution, domestication and diversity. Antifungals.

Assessment Breakdown

	%
Continuous Assessment	20.00%
Practical	20.00%
End of Module Formal Examination	60.00%

Special Regulation

Students must achieve a minimum grade (35%) in both the practical/CA and final examination

SETU Carlow Campus reserves the right to alter the nature and timings of assessment

Module Workload

Workload: Full Time		
<i>Workload Type</i>	<i>Frequency</i>	<i>Average Weekly Learner Workload</i>
Lecture	12 Weeks per Stage	2.00
Practicals	12 Weeks per Stage	2.00
Independent Learning	15 Weeks per Stage	5.13
Total Hours		125.00

Module Delivered In

Programme Code	Programme	Semester	Delivery
CW_SABTP_B	Bachelor of Science (Honours) in Biosciences with Biopharmaceuticals	6	Mandatory
CW_SABFQ_D	Bachelor of Science in Biosciences	6	Mandatory