Module	**Sustainable Biotechnology**
Code	MLS_S11
Degree Program	Master of Science in Life Sciences (MSLS)
Cluster	Bio/Pharma
Specialization	Applied Biosciences
ECTS Credits	4
Workload	120 h: Contact 56 lessons = 42 h; Self-study 78 h
Module Coordinator	**Name** Dr. Fabian Fischer **Phone** +41 27 606 86 58 **Email** Fabian.Fischer@hevs.ch **Address** HES-SO Valais, Sion
Lecturers	• Fabian Fischer (HES-SO//Valais Wallis) • Bruno Schnyder (HES-SO//Valais Wallis) • Simon Crelier (HES-SO//Valais Wallis) • Manfred Zinn (HES-SO//Valais Wallis) • Hans-Peter Meyer (HES-SO//Valais Wallis)
Entry Requirements	Bachelor of Science in Life Technologies (orientation Biotechnology or Analytical Chemistry) or in a related course of study (Bachelor level)
Learning Outcomes and Competences	After completing the module students will be able to: To know what are renewables, biofuels, biopolymers, biorefining, chiral building blocks, and the knowledge in Industrial Biotransformation with emphasis on sustainability and metrics. An important aspect is the design of entire bioconversion processes based on literature data including the evaluation of the environmental feasibility. The student must be able: • Can analyse Industrial Biotechnology business cases and respond to content questions. • Gives examples and explanations for commercial biocatalysis projects, in which positional specificity, and stereo specificity and green metrics aspects are of importance. • Compares and contrasts processes that are realized with whole cells and free enzymes. Sees the advantages of immobilised biocatalysts. • Knows about most important advantages of biocatalysis and is capable to compare them with other production technologies such as chemistry. • Can identify some of the major problems that could cause problems for biocatalytic processes in view of sustainability. • Knows the steps to improve Biotransformations with whole cells using metabolomics and fluxomics.

	• Knows the value of patents for the commercial success of products generated by biocatalysis. • Can describe biorefinery concepts for given feedstocks. • Knows how to produce major biofuels and renewable materials. • Describes platform chemicals and their use.
Module Content	**Sustainable Biotechnology** • Economic and sustainable industrial production through Biotransformation • Bioconversion Technology • Whole cell use for bioconversions • Use of purified enzymes and other biomolecules in bioconversion **Applied Sustainable Biotechnology** • Biorefining • Renewables • Biofuels • Biopolymers • Phytobiotechnology
Teaching / Learning Methods	Lectures, seminar-style work, case studies and exercises. Active participation in the module is required
Assessment of Learning Outcome	Individual exercises spread over the entire module (20% of the module grade). Written examination at the end of the semester (80% of the module grade). Remediation: written exam
Bibliography	• Octave, S., and Thomas, D. Biorefinery: Toward an industrial metabolism. Biochimie, 2009, 91, 659-664. • Roessner, U., and Bowne, J. What is metabolomics all about?. Biotechniques 2009, 46, 363-365. • Tao, J., and Xu, J. H. (2009). Biocatalysis in development of green pharmaceutical processes. Current opinion in chemical biology 2009, 13, 43-50. • Liese, K. Seelbach, C. Wandrey, Industrial Biotransformations, Wiley-VCH, Weinheim, 2000. • Straathof A.J.J. and Adlercreutz P. Applied Biocatalysis Taylor & Francis, London, Second Edition, 2000. • Kurt Faber, Biotransformations, Springer Verlag, Heidelberg, 2000. • Oldiges, M., Kunze, M., Degenring, D., Sprenger, G. A., and Takors, R. Stimulation, monitoring, and analysis of pathway dynamics by metabolic profiling in the aromatic amino acid pathway. Biotechnology progress 2004, 20, 1623-1633. • Ralf Takors, Metabolic and Bioprocess Engineering – a Fruitful Symbiosis Schriften des Forschungszentrums Jülich Reihe Lebenswissenschaften / Life Sciences Band /Volume 23, 2005. • Li, T., and Li, X. Comprehensive mass analysis for chemical processes, a case study on L-Dopa manufacture. Green Chemistry 2014, 16, 4241-4256. • Hans E. Schoemaker, Daniel Mink, Marcel G. Wubbolts Dispelling the Myths-Biocatalysis in Industrial Synthesis Science 2003, 299, 1694-1697. • Schmid, A., Dordick, J.S., Hauser, B., Kiener, A., Wubbolts, A.M., Witholt B. Industrial Biocatalysis today and tomorrow Nature 2001, 409, 258-268. • Martin Patel et al., Medium and Long-term Opportunities and Risks of Biotechnological Production of Bulk Chemicals form Renewable Resources-The Potential of White Biotechnology, 2006.

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Comments	
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