



<b>Module</b>	<b>Process Chemistry and Development</b>
<b>Code</b>	MLS_S01
<b>Degree Program</b>	Master of Science in Life Sciences (MSLS)
<b>Cluster</b>	Chemistry
<b>Specialization</b>	Chemical Development and Production
<b>ECTS Credits</b>	4
<b>Workload</b>	120 student working hours: 56 lessons contact = 42 h; 78 h self-study
<b>Module Coordinator</b>	<p><b>Name</b> Dr. Roger Marti</p> <p><b>Phone</b> +41 (0)26 429 67 03</p> <p><b>Email</b> roger.marti@hefr.ch</p> <p><b>Address</b> Haute école d'ingénierie et d'architecture de Fribourg, Bd de Pérolles 80, CH-1700 Fribourg</p>
<b>Lecturers</b>	<ul style="list-style-type: none"> <li>• Dr. Christophe Allemann, HEIA-FR</li> <li>• Dr. Olimpia Mamula Steiner, HEIA-FR</li> <li>• Guest lecturers</li> </ul>
<b>Entry Requirements</b>	Bachelor of Science in Chemistry or in a related course of study including organic courses (Bachelor level)
<b>Learning Outcomes and Competences</b>	<p>After completing the module students will be able within the concept of Process Chemistry to:</p> <ul style="list-style-type: none"> <li>• understand and apply advanced organic chemistry and the concepts of green chemistry</li> <li>• realize a route finding and route selection</li> <li>• realize asymmetric syntheses and biocatalysis</li> <li>• plan and realize the enabling of synthesis on lab scale and perform a lab optimization (solvent/reagent selection, catalysis)</li> <li>• understand and apply novel synthesis technologies like flow chemistry</li> </ul>
<b>Module Content</b>	<p>Process Chemistry: Synthesis Development</p> <ul style="list-style-type: none"> <li>• Knowledge of the concepts of basic process research and implication on Process Research and Development (PRD) &amp; production</li> <li>• Reaction Metrics (E-Factor, etc.) and Green Chemistry</li> <li>• Route finding &amp; selections - concepts, applications &amp; case studies</li> <li>• Knowledge of the concepts of route enabling and synthesis optimization: "green" choice of solvent, reagent, catalysts, etc.</li> <li>• Knowledge of applications &amp; the use of catalysis in PRD</li> </ul> <p>Process Chemistry: Chemical Development</p>

	<ul style="list-style-type: none"> <li>• Route Enabling &amp; Lab Optimization</li> <li>• Planning and execution of laboratory work</li> <li>• Kinetics &amp; Mechanism evaluation in PRD</li> <li>• Optimization by understanding impurities and structure elucidation (2D-NMR)</li> <li>• New synthesis technologies like solid phase chemistry, flow chemistry, micro wave etc.</li> </ul> <p>Advanced Asymmetric Synthesis &amp; Catalysis</p> <ul style="list-style-type: none"> <li>• Knowledge of the concepts of asymmetric synthesis &amp; applications</li> <li>• Applications of enzymes in organic synthesis</li> </ul>
<b>Teaching / Learning Methods</b>	<ul style="list-style-type: none"> <li>• Lectures</li> <li>• Individual and group exercises</li> <li>• Active participation in the module is requested</li> </ul>
<b>Assessment of Learning Outcome</b>	<ul style="list-style-type: none"> <li>• Written exam (closed book): 100% of the final grade</li> <li>• Reassessment: oral exam</li> </ul>
<b>Bibliography</b>	<ul style="list-style-type: none"> <li>• N. G. Anderson, "Practical Process Research &amp; Development", Academic Press 2000.</li> <li>• O. Repic, "Principles of Process Research and Chemical Development in the Pharmaceutical Industry, Wiley 1998.</li> <li>• N. Yasuda, "The Art of Process Chemistry", Wiley 2010</li> <li>• R.A. Sheldon, I. Arends, U. Hanefeld, "Green Chemistry &amp; Catalysis", Wiley 2007.</li> </ul> <p>Documentation: <a href="http://cyberlearn.hes-so.ch">http://cyberlearn.hes-so.ch</a> (requires a login)</p>
<b>Language</b>	English
<b>Comments</b>	-
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