Module title	**Tissue Engineering for Drug Discovery**
Code	BP6
Degree Programme	Master of Science in Life Sciences
Group	Bio/Pharma
Workload	3 ECTS (90 student working hours: 42 lessons contact = 32 h; 58 h self-study)
Module Coordinator	**Name**: Dr. Michael Raghunath **Phone**: +41 (0)58 934 55 18 **Email**: ragh@zhaw.ch **Address**: ZHAW Life Sciences and Facility Management, Einsiedlerstrasse 31, 8820 Wädenswil
Lecturers	• Dr. Michael Raghunath, ZHAW • Dr. Laura Suter-Dick, FHNW • Dr. Markus Rimann, ZHAW • N.N., ZHAW • Guest lecturers
Entry requirements	Bachelor Degree in Life Sciences (Biotechnology, Bioanalytics, Pharmatechnology, Chemistry with specialization in Cell Biology or Tissue Engineering, Biomaterials) Key words: • cell surface receptors, signal transduction, • Extracellular matrix and cell-matrix interactions • Biomaterials, assembly of (bio)polymers • Three dimensional cell culture, stem cell differentiation • Tissue engineering, screening, drug development Basics are covered by the indicated literature (Lanza, Alberts, selected articles) provided on Moodle, including a self-test on Moodle.
Learning outcomes and competences	After completing the module, students will be able to: • Critically assess tissue engineering (TE) strategies including bioprinting vis-à-vis clinical viability, industrial value • Identify current bottlenecks in TE in general and for drug development in particular • explain differences between TE for regenerative medicine, academia and drug development • differentiate between 2D, ultraflat 3D and thicker 3D tissue constructs • develop concepts of industrial applications of TE depending on tissue type and question to be answered • delineate rationale for TE design to address questions in disease modelling and cosmetics • improve presentation technique and defend view points
Module contents	"Tissue Engineering for Drug Discovery" is an advanced course for graduate students to critically interrogate current approaches and methods of tissue engineering and how they can be harnessed for the generation of in vitro tissue models for drug and substance testing. In order to build a tissue its microarchitecture (histology) and its physiology must be understood. As a perfect tissue will not arise in vitro, a selection must be made as to which functional features of this particular tissue should be

	preserved to be testable and which are relevant for the drug or cosmetic substance to be tested. We will discuss this using skin and liver as an example. Skin is one of the oldest and most successful tissue engineering feats in both clinical and in vitro settings, yet full physiology has not been reached. Liver is a central organ relevant to pharmaco-toxicity but also fulfill a myriad of synthetic functions. Therefore, every tissue model needs to fulfill different needs for different purposes. The topics span stem cell as tools for tissue differentiation and as a focus for personalized medicine and the newest 3D approaches to generate living tissue models. This will set the stage for the group presentations that will tackle to build a suitable organ model and to emulate the necessary physiological functions. Selected organs and tissues are set for problem-based groups.
Teaching / learning methods	• Lectures, self-study, company presentation • Team based learning (groups to extract information from the internet) • Interactive discussions, presentation clinic • Final group presentations (problem-based learning) with detailed-feedback on form and content • Overview of teaching hours (27 lectures by M. Raghunath, 6 by L. Suter-Dick, 6 by M. Rimann, 3 by guest speakers).
Assessment of learning outcome	1. One group presentation on selected topics (3-4 students) (40%) 2. Final exam, closed book (60%)
Format	7-weeks
Timing of the module	Spring semester CW 15-21
Venue	Mix of online and on-site lectures (in Olten or Berne)
Bibliography	<u>Pre course work</u> "Molecular Biology of the Cell", Bruce Alberts, Alexander Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, Peter Walter, 6th edition, "Garland Science, Taylor & Francis, 2014, ISBN-13: 978-0815345244; Chapters 19 (Cell junctions and the extracellular matrix), 22 (Stem Cells and Tissue Renewal) "Principles of Tissue Engineering", Lanza, Langer & Vacanti, 4th edition, 2014, Academic Press, Chapters 1-4 (Introduction to TE); Chapters 13-17 (In vitro Control of Tissue Development) <u>Course Material (Moodle)</u> Chen C, Peng Y, Wang Z, Fish, P, Kaar J, Koepsel R, Russell A, Lareu R., Raghunath, M. 2009. The Scar-in-a-Jar: Studying antifibrotic lead compounds from the epigenetic to extracellular level in a single well. Br J Pharmacol 158(5):1196-1209. Epub 2009 Sep 28. Chen CZC, Loe F, Blocki A, Peng Y, Raghunath M, 2011. Applying macromolecular crowding to enhance extracellular matrix deposition and its remodeling in vitro for tissue engineering and cell-based therapies. Adv Drug Deliv Rev 63(4-5):277-290. Further Material for problem-based learning presentation groups is posted on Moodle.
Language	English

Links to other modules	BP5 “Physiology and Immunotherapies”
Comments	
Last Update	20.09.2021