Course Package

Bionanotechnology & Advanced Biomanufacturing

Name module	BNT - Bionanotechnology and Advanced Biomanufacturing
Educational programme	MSc Biomedical Engineering
Period	Second quartile of the first semester (Quarter 1B)
Study load	15 ECTS

BNT - Bionanotechnology and Advanced Biomanufacturing, Physics-oriented			
Quarter 1A	**Quarter 1B**	**Quarter 2A**	**Quarter 2B**
	Biomedical Materials Engineering (5 EC)		
	Nanomedicine (5 EC)		
	Lab on a Chip (5 EC)		

Required preliminary knowledge: A proven knowledge of Organic chemistry, polymer chemistry, biomaterials, cell-material interactions.

201400283 **Biomedical Materials Engineering**
This course deals with the basic principles of tissue-biomaterial interactions, surface modification of biomaterials and polymer processing for regenerative medicine. Moreover, groups of 4-5 students draw up a research proposal that has to be defended during a plenary session.

201200220 **Nanomedicine** *(name might change)*
Nanomedicine is one of the most dynamic fields, which holds a high potential to make a huge impact on the medical science. Nanomedicine is in general defined as medical applications of nanotechnology. In recent years, nanotechnologies have been applied for drug delivery, imaging/diagnostics, biosensing, in vitro diagnostics, and tissue engineering. One of the largest areas for nanomedicine is the drug delivery/targeting. Conventional medicine, which are either administered orally or with injections, are not always successful for achieving the desired therapeutic effects but rather show high side effects. Therefore, novel drug delivery systems are highly crucial to develop, using which the drugs can be specially delivered at the targeted site or

even to the specific cell types. Using these novel approaches, high therapeutic effects and low/no side effects can be achieved. A large part of the course will be devoted to the drug delivery. Besides drug delivery, nanomedicine includes applications of nanomaterials for imaging and diagnostics as well as theranostics (therapeutics + diagnostics), which will be covered up during this course. Applications to drug delivery and imaging are mostly related to applications of nanotechnologies in vivo. In addition, nanomedicine also covers up in vitro applications such as diagnostics using biosensing techniques and microfluidics. Students will also write a research proposal during this course on an assigned topic of nanomedicine, which allows them to further develop their knowledge on this subject. Altogether this course provides a broader and in depth understanding of the emerging field of nanomedicine.

191211120 **Lab on a chip** *(Overlap with Biomedical Materials Engineering)*

The Lab on a Chip course will take the student to the world of miniaturised systems used in various fields of chemistry and life sciences. A "Lab-on-a-Chip" consists of electrical, fluidic, and optical functions integrated in a microsystem, and has applications in (bio)chemical and medical fields. The core of most lab-on-a-chip system is a microfluidic channel structure, through which nanoliter amounts of liquids with dissolved molecules are propelled, separated and reacted by hydraulic, electrokinetic or surface forces. The fluidic structures are machined in materials like fused silica, borofloat glass, or polymers. The course will treat a number of aspects of such microsystems in seven problem-based learning sessions.

Groups of 4 students receive the problem on Monday and try to find solutions to the problem during the week, using a.o. the material offered in a reader. They give a presentation of their solution to the other groups and the teachers on Friday, which is followed by a discussion on the subject treated. The problems offered concern the transport of liquid and dissolved molecules in microsystems, aspects of microfabrication, electrochemical and optical detection methods, the manipulation of cells in microfluidic systems and separations in microfluidic systems. The course is aimed at MSc students of Biomedical Engineering, Electrical Engineering, Nanotechnology, Chemical Engineering, Mechanical Engineering or Applied Physics.