Course Package

BET Bionanotechnology and Advanced Biomanufacturing - 1B

Name module	BET - Bionanotechnology and Advanced Biomanufacturing – 1B
Educational programme	MSc Biomedical Engineering
Period	Second block of the first semester (block 1B)
Study load	15 ECTS
Coordinator	J. Huttenhuis

BET - Bionanotechnology and Advanced Biomanufacturing			
block 1A	**block 1B**	**block 2A**	**block 2B**
	Biomedical Materials Engineering **201400283** (5 EC)		
	Advanced Drug Delivery and Nanomedicine **202200254** (5 EC)		
	Lab on a Chip **191211120** (5 EC)		

Required preliminary knowledge: Proven knowledge of Organic chemistry; Polymer Chemistry; Biomaterials; and Cell-Material Interactions; Biomedical Signal Acquisition; Micro Electro Mechanical Systems Design; Technology; General physics at bachelor level.

201400283 - Biomedical Materials Engineering

This course deals with the basic principles of regulation, processing, surface modification and analysis of biomaterials as well as of tissue-biomaterial interactions in regenerative medicine.

202200254 - Advanced Drug Delivery and Nanomedicine

Advanced Drug Delivery and Nanomedicine (ADDN) course provides both fundamental and applied knowledge on the topic of drug delivery and nanomedicine. Conventional medicines, either administered orally or systemically, are not always sufficient for achieving the desired therapeutic effects but rather exhibit adverse 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 with low side effects can be achieved. A large part of the course will be devoted to different drug delivery systems including nanomedicine. Besides drug delivery systems, use of nanomedicine for imaging and diagnostics as well as theranostics (therapeutics + diagnostics), will be covered during this course. Furthermore, a genetic disorder or chronic diseases can be treated by delivering nucleic acid (DNA or RNA) to the pathological cells, inducing or suppressing a specific genetic function. Also, gene delivery technologies are crucial to develop vaccines such as

mRNA vaccine against COVID-19. The ideal drug or gene delivery system should be nontoxic, biocompatible, safe, simple, and easy to fabricate as well as should provide efficient targeting. This course provides an in-depth overview of drug and gene delivery technologies including nanomedicine.

191211120 - Lab on a Chip

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.