Course Package

BET Biomedical Membranes & Artificial Organs – Q3

Name module	BET Biomedical Membranes & Artificial Organs - Q3
Educational programme	MSc Biomedical Engineering
Period	First quartile of the second semester - Q3
Study load	15 ECTS
Coordinator	J. Huttenhuis

BET Biomedical Membranes & Artificial Organs			
Quartile 1	**Quartile 2**	**Quartile 3**	**Quartile 4**
		Biomedical Membranes & Artificial Organs 201400284 (5 EC)	
		Bionanotechnology 193400111 (5 EC)	
		Electives: choose 5 EC	
		Advanced Organic Chemistry - 201900123 (5 EC)	
		Biomedical Signal Acquisition – 191210720 (5 EC)	
		Development of Artificial Internal Organs – 202001409 (5 EC)	

Required preliminary knowledge: Fundamental knowledge and concepts from Molecular Biology; Cell Biology; Biochemistry; Organic Chemistry; Physical Chemistry especially Thermodynamics.

201400284 - **Biomedical Membranes & (bio) Artificial Organs**

The course covers biomedical applications where the (bio) artificial membrane plays a crucial role. Main topics are: membrane preparation and characterisation, drug delivery, blood purification-dialysis, blood oxygenation, bio-artificial kidney, bio-artificial pancreas, bio-artificial liver and tissue engineering. The course combines lectures where theory is presented as well as a practical.

193400111 - Bionanotechnology

Bionanotechnology is a field of research and applications that sits at the interface between nanotechnology on the one hand and life sciences on the other.

This course includes:

- An introduction into the field of bionanotechnology field.
- Basics of nanobiology, including structure and function of DNA/RNA, DNA supercoiling, chromatin structure, structure and function of proteins, lipids, membranes, molecular motors, biological cells.

The modules are tentative and subject to change. Please check the website regularly.

- (Biological) nanoparticles, including gene therapy and DNA nanoparticles, inorganica and iron oxide nanoparticles, quantum dots, the unfamiliar world at the nanoscale, molecular interactions, Brownian motion, and diffusion.
- Methods and techniques to study biology at the nanoscale, including fluorescence microscopy and other fluorescence-based technoniques, nanoscopy methods, scanning probe microscopy (AFM), single molecule force spectroscopy, elasticity mapping, optical tweezers, magnetic tweezers.
- Writing of a comprehensive essay on the applications of nanobiotechnology, based on a short literature study.

Electives: choose 5 EC

201900123 - Advanced Organic Chemistry

- Give insight in reaction mechanisms;
- Reacive groups, competing mechanisms;
- Structures of amino acids and proteins;
- Peptides and their chemical synthesis;
- Orthogonal chemistry;
- Protein modification;
- Chemistry on surfaces;
- Cell surface engineering;
- Protein arrays, protein sensors
- Antifouling and bio-activation of biomaterials.

191210720 - Biomedical Signal Acquisition

The electrochemical detection methods form a beautiful comprehensive part of this course: starting from electrochemical processes at an electrode and the subsequent mass transport phenomena result in the three basic operational principles (potentiometry, amperometry and conductometry). When the relation between the variable to be determined (ionic species and/or its concentration) and the measured quantity (voltage, current or conductance) is known, the relevant examples follow: the oxygen electrode (Clark electrode), the carbon dioxide sensor (Severinghaus principle) and the pH sensors (glass electrode). Additionally, other chemical biosensors like the glucose sensor, and biosensors based on optical detection principles are treated. The treatment of physical sensor systems is guided by the biomedical application: blood pressure and flow, lung volume and capacity. A bridge to the course Lab-on-a-Chip is formed by some examples of micro Total Analysis Systems, of which the detector is based on one of the mentioned sensor principles.

This course is open for TM, MBE, APH, NANO and EE students. General knowledge from your bachelor programs is required. For TM students, this course bridges the gap between biophysiology and biomedical signal processing and -analysis. This course consists of 12 lectures, where you actively participate in discussions to reach the learning objectives.. You will write your critical review paper in teams of two students to train and improve your knowledge and understanding via the original papers you have to review. Moreover, a 4-hr practical project concerning synchronous sensor data retrieval into a computer is one of the instructional modes of this course.

202001409 - Development of Artificial Internal Organs

The course will introduce you to the development of medical devices for the support or replacement of the internal organs heart, lungs, and kidneys, and it will incorporate the interaction between blood and the medical device, fundamentals of hemodynamics and the anatomy and physiology of the natural organ in comparison to the artificial organ.
The development process of artificial organs as medical devices will be the leading topic throughout the course, covering the user and design requirement specifications, risk analysis, design and usability, verification and validation testing, and documentation relevant for market approval.

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