

Course Package

Imaging & Diagnostics

Name module	Imaging & Dagnostics
Educational programme	MSc Biomedical Engineering
Period	First quartile of the first semester (Quarter 1A)
Study load	15 ECTS

Imaging & Dagnostics			
Quarter 1A	Quarter 1B	Quarter 2A	Quarter 2B
Biophysical Techniques and Molecular Imaging (5 EC)			
In Vitro Diagnostics (5 EC)			
Biostatistics (5 EC)			

Required preliminary knowledge: Fundamental knowledge and concepts from cell biology, biochemistry, chemistry, physics: - Biology/Biochemistry: Cell structure, organelles, DNA, RNA, proteins, enzymes, antibodies; - Chemistry: fundamentals of inorganic and organic chemistry, standard techniques; - Physics: Fundamentals of optics, thermodynamics; - Math: Statistics.

193640020 **Biophysical Techniques and Molecular Imaging**

Biophysical Techniques & Molecular Imaging (BT&MI) introduces a selection of advanced micro-spectroscopic techniques for molecular and cellular studies. The course treats imaging techniques based on fluorescence spectroscopy and vibrational spectroscopy. The general concepts of contrast, resolution, localization, sensitivity and signal-to-noise ratio will be presented and related to microscopic properties of molecules. Electro-magnetic properties of the light field, basic to contrast, will be put in the context of microscopic methods. Light distributions in the focus of microscope objectives will be presented to understand the basics of resolution. Micro-spectroscopic techniques are essential to modern biomedical sciences, such as in-vivo imaging, quantitative biology, stem cell research and studies of fundamental cellular processes, for example cell-division, apoptosis, phagocytosis, cell differentiation, carcinogenesis. Concepts will be illustrated with examples from the life and (bio)-material sciences.

201700040 **In Vitro Diagnostics**

In vitro diagnostics (IVD) is the analysis of bodily fluids and tissue samples for the purpose of medical diagnostics. Main aims of the course:

- To understand the requirements an IVD device has to fulfil
- To understand the processes and concepts employed in existing IVD devices

The modules are tentative and subject to change. Please check [the website](#) regularly.

To apply this understanding to critically assess recent developments and proposed concepts for targeted biomarkers and/or diseases.

After an introduction on the purpose of IVD devices and the requirements they have to fulfil, the lectures will focus on the (bio)-chemical and physical processes and technical concepts employed in these devices:

- Sample preparation techniques
 - enrichment/purification/separation
 - amplification
 - labelling
- Detection techniques:
 - label free
 - fluorescence based
 - electrochemical/electrical
- Microfluidics for IVD
- Point-of-care diagnostics

201400285 **Biostatistics**

Central concepts of probability theory like (conditional) probability, expectation and variance are treated. Also, the calculation of expectations and variances of linear functions of the observations is a topic of the course and this topic ends with principal components. The principles of statistical testing theory are explained considering the case of one sample (discrete and continuous data). Statistical tests are focused towards: the comparison of two samples, regression, analysis of variances (including repeated measures) and logistic regression. Within analysis of variance we spend some time on multiple comparison / post hoc analysis / simultaneous confidence intervals.

Each week you have to do an assignment. You have to deliver a written report for the first three assignments and the last assignment. You need to use SPSS (or another statistical package if the student prefers that) for the last 5 assignments and these last 5 assignments have to be discussed individually, except for the last one.