

## Biophotonics (E030930)

**Course size** *(nominal values; actual values may depend on programme)*

**Credits** 4.0      **Study time** 120 h      **Contact hrs** 30.0 h

**Course offerings and teaching methods in academic year 2022-2023**

A (semester 1)      English      Gent      demonstration  
lecture      5.0 h  
25.0 h

O (semester 1)      English      Gent

**Lecturers in academic year 2022-2023**

Le Thomas, Nicolas      TW05      lecturer-in-charge  
Muyldermans, Serge      VUB      co-lecturer

**Offered in the following programmes in 2022-2023**

	crdts	offering
<a href="#">Bridging Programme Master of Science in Photonics Engineering</a>	4	A
<a href="#">European Master of Science in Photonics</a>	4	A
<a href="#">International Master of Science in Biomedical Engineering</a>	4	A
<a href="#">Master of Science in Biomedical Engineering</a>	4	A
<a href="#">Master of Science in Biomedical Engineering</a>	4	A
<a href="#">Master of Science in Photonics Engineering</a>	4	A, O

**Teaching languages**

English

**Keywords**

biophotonics

**Position of the course**

Exposing the student to various basic concepts in the field of biophotonics, positioning them in an interdisciplinary context

**Contents**

- 1 Introduction: necessity of biophotonics, public health, eco preservation, maritime, industrial, domestic, medical, biotechnology, aquatic environments
- 2 Micro-organisms: bacteria, viruses, protozoa, algae, phylogeny, structure and function
- 3 Fundamental biomolecules: nucleic acids, amino acids, DNA/RNA replication, transcription, translation, antibodies, antigens, enzymes, fatty acids, carbohydrates
- 4 Physiology: immune system, nervous system
- 5 Flow cytometry: principle and applications, cell enumeration, discrimination, heterotrophic, fluorescent in-situ, hybridisation, DNA probes, cell sorting advantages and disadvantages
- 6 PCR techniques: DNA amplification, molecular probes, real time PCR, DNA hybridisation
- 7: Microscopy: bright field microscopy, phase contrast microscopy, dark field microscopy, differential interference contrast microscopy, fluorescence microscopy, confocal microscopy, atomic force microscopy, electron microscopy

- 8 Optical coherence tomography: principles, time-domain OCT, fourier domain OCT, swept-source OCT, optical properties of tissues, system aspects, applications
- 9 Labeled sensors: sensor requirements, ELISA tests, gold nanoparticle labels, quantum dot labels, bead-based assays, padlock probes
- 10 Label-free sensors: advantages, surface plasmon sensors, evanescent wave sensors, Mach-Zehnder interferometers, resonant cavities
- 11 Lab-on-a-chip: principles, DNA microarrays, introduction to microfluidics

#### **Initial competences**

bachelor level physics

#### **Final competences**

- 1 Getting insight in the basics of biology.
- 2 Acquiring understanding in the principles behind microscopy, cytometry, PCR techniques, imaging techniques, labeled and label-free sensors, lab-on-a-chip.

#### **Conditions for credit contract**

Access to this course unit via a credit contract is determined after successful competences assessment

#### **Conditions for exam contract**

This course unit cannot be taken via an exam contract

#### **Teaching methods**

Demonstration, lecture

#### **Extra information on the teaching methods**

Classroom lectures: part of the lectures will be given in UGent, part of the lectures in the VUB, but there is the option of teleclassing.

#### **Learning materials and price**

Course notes, copies of slides

#### **References**

#### **Course content-related study coaching**

#### **Evaluation methods**

end-of-term and continuous assessment

#### **Examination methods in case of periodic evaluation during the first examination period**

Written examination with open questions

#### **Examination methods in case of periodic evaluation during the second examination period**

Written examination with open questions

#### **Examination methods in case of permanent evaluation**

Participation

#### **Possibilities of retake in case of permanent evaluation**

examination during the second examination period is possible

#### **Calculation of the examination mark**

100% exams