CH-448

Photomedicine

Cursus	Sem.	Type
Chimiste	MA2, MA4	Opt.
Photonics minor	E	Opt.

Language of teaching	English
Credits	2
Session	Summer
Semester	Spring
Exam	Oral
Workload	60h
Weeks	14
Hours	**2 weekly**
Courses	2 weekly
Number of positions	

Remark

Pas donné en 2026-27

Summary

The most important clinical diagnostic and therapeutic applications of light will be described. In addition, this course will address the principles governing the interactions between light and biological tissues, their optical properties and basic concepts in photobiology and photochemistry.

Content

- Brief history
- Radiometry and Photometry
- Brief introduction to general optics and tissue optics
- Light dosimetry
- Light-tissues interactions
- Introduction to molecular optical spectroscopy (Absorption, fluorescence spectroscopy and imaging techniques; vibrational and Raman spectroscopy; time-resolved luminescence spectroscopy and imaging)
- Dyes and luminophores
- Instrumental aspects (Light sources, detectors and optical systems)
- Light sources, detectors and optical systems.
- Illustrative and most important clinical applications of light in photomedicine

Keywords

Photomedicine, tissue optics, photobiology, photochemistry, light-tissue interactions, photodiagnosis, phototherapy, light dosimetry, dyes, photosensitizers.

Learning Prerequisites

Important concepts to start the course

Basic background in biology, chemistry and optics.

Learning Outcomes

By the end of the course, the student must be able to:

- Define the spectral design of apparatus used in biomedical optics.

- Compute the light dose in biological tissues.
- Identify the optical components to develop an apparatus used in photodetection and phototherapy.
- Describe the working principles of apparatus used in biomedical optics.
- Model the propagation of light in biological tissues.
- Interpret data obtained or published in the field of photomedicine.
- Describe the photobiological and photochemical mechanisms involved in photomedicine.

Transversal skills

- Communicate effectively with professionals from other disciplines.
- Access and evaluate appropriate sources of information.
- Write a scientific or technical report.
- Write a literature review which assesses the state of the art.
- Summarize an article or a technical report.
- Demonstrate the capacity for critical thinking

Teaching methods

Lectures, Exercises performed during the courses, recent literature review papers, classroom discussion + oral presentation.

Expected student activities

Exercises, lecture of review papers, classroom discussion + oral presentation.

Assessment methods

Oral exam (2/3) + oral presentation (1/3).

Supervision

Assistant.e.s No

Resources

Bibliography

- Optical-Thermal Response of Laser Irradiated Tissue, A.J. Welch & M.J.C. van Gemert (Plenum, 1995).

- Principles of Fluorescence Spectroscopy, J.R. Lakowicz (Kluwer, 1999).

- Optics, E. Hecht (Addison Wesley, 2000).

- Handbook of Photomedicine, M. Hamblin & Y.-Y. Huang (CRC Press, 2013).

- Handbook of Biomedical Fluorescence, M.-A. Mycek & B. W. Pogue (Dekker, 2003).
- Photosensitizers in Biomedicine, M. Wainwright (Wiley-Blackwell, 2009).
- Quantitative Biomedical Optics, I. Bigio & S. Fantini (Cambridge Univ. Press, 2016).

Ressources en bibliothèque

- Optical-thermal response of laser-irradiated Tissue / Welch
- Optics / Hecht
- Handbook of photomedicine / Hamblin
- Principles of fluorescence spectroscopy / Lakowicz
- Photosensitizers in biomedicine / Wainwright

- Quantitative biomedical optics / Bigio
- Handbook of biomedical fluorescence / Mycek

Notes/Handbook

Slides available on Moodle.

Websites

- https://www.epfl.ch/labs/lifmet/wagnieres/

Moodle Link

- https://go.epfl.ch/CH-448

Prerequisite for

Master. Academic research and R/D activities in the industry of this field