COURSE DESCRIPTION CARD - SYLLABUS

Course name
Biomimetic systems for biomedical applications [S1Bioinf1>UBIOM]

Course

Field of study
Bioinformatics

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge of physics, organic chemistry, physical chemistry of physical and biochemical processes; knowledge of cell biology; general academic-level math skills, basic knowledge of laboratory equipment and safety rules in a chemical laboratory

Course objective

The aim of course is to gain the knowledge and skills in the field of biomimetic systems which allow to solve complex technical problems and manufacture products inspired by nature for applications in biomedicine.

Course-related learning outcomes

Knowledge:
A graduate knows and understands:
- chemistry issues required to formulate and solve simple bioinformatic problems including basic definitions and laws of chemistry, organic chemistry and biochemistry (KW_04)

- selected groups of bioactives, their biochemical properties and impact on cells and living organisms (KW_08)
- modern analytical methods used for the evaluation of properties and structure of biomaterials and biomimetic materials (KW_016)

Skills:
A graduate is able to:
- use basic techniques and laboratory tools to solve the problems in the field of bioinformatics, biotechnology and related fields and to evaluate their usability (KU_05);
- integrate and interpretate information gained, draw the conclusions and formulate and explain his/her own opinions (K_U02)
- use analytical, simulation and experimental tools under the supervision of scientific tutor to formulate and solve reserach tasks (KU_07);

Social competences:
A graduate is ready to:
- cooperate and work in team taking various roles (K_K02);
- identify priorities in acomplishing the tasks set by him/herfself or by the other person (K_K03) ;
- take the responsibility for his/her and other person"s safety and make the appropriate decisions responding on an emergency (K_K06)

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture classes:
Written exam graded in the range 0-100 pts and the following scale is assumed:
3 50,1-60,0 %
3.5 60,1-70%
4 70,1-80,0 %
4.5 80,1-90 %
5 90,1-100 %
Additional points might be earned for active participation in the lectures.

Laboratory classes:
current evaluatoin of student"s knowledge before each class and grading the reports with the results of laboratory experiments.

Programme content

The program covers interdisciplinary topics related to utilizing patterns found in nature to solve problems in the field of biomedical sciences.

Course topics

Lecture:
1. Introduction to Biomimetics
2. Physical chemistry of biomimetic systems;
3. Mocdel biological membranes-Langmuir monolayers
4. Model biological membranes- liposomes and other in vitro models
5. Ultrathin biomimetic films
6. Characterization of biomimetic systems (SEM, AFM, TEM)
7. Biomimetic materials with controlled wettability
8. Adhesion in biomimetic systems
9. Biomimetic drug delivery systems (liposomes, dendrimers)
10. Microfluidics
11. Biomimetics in diagnostics, analytics and medical bioengineering
12. Biomimetic optical systems

Laboratory classes are practical excersisces related to the content of the lectures.

Teaching methods

Lecture: Presentation and discussion with quiz
Laboratory classes: practical excercices made by students in physicochemical laboratory.

Bibliography

Podstawowa
1. K. Konopka, Biomimetyczne metody wytwarzania materiałów, Wyd. Politechniki Warszawskiej 2013.
2. K. Dołowy, A. Szewczyk, S. Pikuła Błony biologiczne, Wyd. Śląsk, 2003.
3. J. Bar-Cohen, Biomimetics: Biologically Inspired Technologies, CRC Press, 2005.
4. G. F. Swiegers, Bioinspiration and Biomimicry in Chemistry: Reverse ‐ Engineering Nature, John Wiley & Sons Ltd., 2012
Uzupełniająca
1. A. UIman, Ultrathin organic films, Academic Press, 1991.
2. M. Petty, Langmuir-Blodgett films, Cambridge University Press, 2009.
3. Z. Xia, Biomimetic Principles and Design of Advanced Engineering Materials, John Wiley & Sons Ltd., 2016.
4. K. Dopierała, M. Krajewska, M. Weiss, Physicochemical Characterization of Oleanolic Acid-Human Serum Albumin Complexes for Pharmaceutical and Biosensing Applications, Langmuir 36, 13, 2020, pp.3611–3623.
5. M. Rojewska, M. Skrzypiec M., K. Prochaska, The wetting properties of Langmuir–Blodgett and Langmuir–Schaefer films formed by DPPC and POSS compounds, Chemistry and Physics of Lipids, 221, 158-166 (2019).
6. M. Skrzypiec M., M. Weiss, K. Dopierała, K. Prochaska, Langmuir-Blodgett films of membrane lipid in the presence of hybrid silsesquioxane, a promising component of biomaterials, Materials Science & Engineering C, 105 (2019) 110090.
7. L. Massaron , A. Boschetti Python. Podstawy nauki o danych. Wyd. II, Helion

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,50