

Bio- and chemosensing

Lecturer	Prof. Włodzimierz Kutner
Dates and location of classes	Spring 2024, Institute of Physical Chemistry, PAS, Warsaw
ECTS points	3
Language of lectures	English
Brief description	Bio- and chemosensing are parts of analytical chemistry covering methods for detecting and determining chemical compounds using chemical and biochemical sensors, as well as designing, manufacturing, and testing those sensors. These methods will be discussed and illustrated with various examples, along with biochemical and chemical sensor devising, fabricating, testing, and application. The lecture course's ultimate goal is to present the recent possibilities of bio- and chemosensing to the extent that it enables independent deepening of knowledge within topics the student selects.
Form/type of teaching activity	One-semester 15-hour interactive lecture course ending with a written exam
Scope of lecture topics	<ol style="list-style-type: none"> 1. Scope of the subject taught, basic concepts, and definitions. 2. Biochemical recognition. 3. Chemical recognition. 4. Electrochemical transduction. 5. Optical transduction. 6. Acoustic (piezomicrogravimetric) transduction. 7. Thermochemical transduction. 8. Semiconductive transduction. 9. Microcantilever transduction. 10. Multisensor arrays – artificial tongue. 11. Chemo- and biosensors as detectors in flow analytical and bioanalytical systems, including microfluidic systems. 12. Nanomaterials in bio- and chemosensing. 13. Wearable sensors. 14. Statistical analysis of chemical sensor data. 15. Trends in the future development of bio- and chemosensing.
Entrance requirements	Basic university knowledge of physical chemistry (especially spectroscopy and electrochemistry), organic chemistry, and analytical chemistry
Learning outcomes	Lectures will enable the student to learn the basic methods of detecting and determining chemical compounds, especially those of biological importance, using chemical and biochemical sensors.
Methods and criteria of student assessment	Written exam covering topics taught, rated at a maximum of 100 points; the student must score at least 60 points to pass the exam.
Literature	<ul style="list-style-type: none"> - F.-G. Banica, <i>Chemical Sensors and Biosensors: Fundamentals and Applications</i>, Wiley, 2012 - B. R. Eggins, <i>Chemical Sensors and Biosensors: 2 (Analytical Techniques in the Science (AnTs))</i>, Wiley, 2002 - G. Orellana, Moreno-Bondi, <i>Frontiers in Chemical Sensors: Novel Principles and Techniques (Springer Series on Chemical Sensors and Biosensors)</i>, Springer, 2005 - Santos, J. L., Farahi, F., <i>Handbook of optical sensors</i>, CRC Press, Taylor & Francis Group, 2017 - S. Cosnier (Ed.) <i>Electrochemical Biosensors</i>, Pan Stanford Publishing Pte. Ltd., 2015 - R. Lalauze (Ed.), <i>Chemical Sensors and Biosensors</i>, (Wiley-ISTE, 2012) - Kutner, W., Sharma, P. S., (Eds.), <i>Molecularly Imprinted Polymers for Analytical Chemistry Applications</i>, in <i>Polymer Chemistry Series</i> No. 28, The Royal Society of Chemistry, 2018 - Sazonov, E. (Ed.), <i>Wearable sensors: fundamentals, implementation, and applications</i>, Academic Press, 2020 - Z. Brzózka, E. Malinowska, W. Wróblewski, <i>Sensory chemiczne i biosensory</i>, PWN, 2022.