University of Gdańsk

Subject card

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| Subject name and code | NMR spectroscopy, PG_00192252 | | | | | | |
| Field of study | Biotechnology | | | | | | |
| Date of commencement of studies | October 2026 | | Academic year of realisation of subject | | 2026/2027 | | |
| Education level | Bachelor's studies | | Subject group | | Obligatory subject group in the field of study<br>Optional subject group<br>Subject group related to scientific research in the field of study | | |
| Mode of study | full-time studies | | Mode of delivery | | at the university | | |
| Year of study | 1 | | Language of instruction | | Polish | | |
| Semester of study | 2 | | ECTS credits | | 2.0 | | |
| Learning profile | academic | | Assessment form | | credit | | |
| Conducting unit | | | | | | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | | dr hab. Stanisław Ołdziej | | | | |
| | Teachers | | | | | | |
| Lesson types | Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
| | Number of study hours | 5.0 | 0.0 | 25.0 | 0.0 | 0.0 | 30 |
| | E-learning hours included: 0.0 | | | | | | |
| Learning activity and number of study hours | Learning activity | Participation in didactic classes included in study plan | | Participation in consultation hours | | Self-study | SUM |
| | Number of study hours | 30 | | 5.0 | | 15.0 | 50 |
| Subject objectives | Learn and acquire concepts and terminology used in nuclear magnetic resonance spectroscopy. Master advanced knowledge and skills necessary for the spectroscopic analysis of 1D, 2D NMR spectra of simple organic compounds, peptides, proteins. Become familiar with the methods of determining the primary and secondary structure of peptides and proteins on the basis of 1D and 2D NMR spectra. Getting acquainted with the analysis of homo- and heterocorrelation spectra (1H, 13C, 15N NMR). | | | | | | |

## Learning outcomes

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| [BIOTECHL3_U03] The graduate applies mathematical and statistical methods to describe phenomena and analyze data and is able to use professional databases used in biotechnology. | The student has the knowledge and skills necessary for spectroscopic analysis of 1D and 2D NMR spectra of simple organic compounds, peptides, and proteins. They are familiar with methods for determining the primary and secondary structure of peptides and proteins based on 1D and 2D NMR spectra. They have knowledge of the analysis of homo- and heteronuclear correlation spectra ($^{1}H$, $^{13}C$, $^{15}N$ NMR). | [SU5] implementation of a problem task |
| [BIOTECHL3_K01] The graduate is aware of the scope of their own knowledge and skills; demonstrates a willingness to continuously update them and pursue professional development. | The student is able to identify their limitations in knowledge and skills related to NMR spectroscopy. They demonstrate a willingness to further expand their knowledge of this technology. | [SK5] implementation of a problem task |
| [BIOTECHL3_W06] The graduate possesses structured and advanced knowledge of exact and natural sciences necessary to understand biological phenomena and processes, in particular cellular processes at the molecular level. | The student is familiar with the concepts and terminology used in nuclear magnetic resonance (NMR) spectroscopy. They have mastered the advanced knowledge and skills necessary for the spectroscopic analysis of 1D and 2D NMR spectra of organic compounds, peptides, and proteins. They are acquainted with methods for determining the primary and secondary structure of peptides and proteins based on 1D and 2D NMR spectra. They have familiarized themselves with the analysis of homo- and heteronuclear correlation spectra ($^{1}H$, $^{13}C$, $^{15}N$ NMR). | [SW4] test/exam - oral or written<br>[SW5] implementation of a problem task |

## Subject contents

Nuclear magnetic resonance spectroscopy. The phenomenon of nuclear magnetic resonance. Physical principles of NMR spectrum measurement. NMR spectrum recording apparatus and methods. Proton magnetic resonance spectroscopy: chemical shift, factors affecting its magnitude and its importance for the interpretation of 1H NMR spectra. Spin-spin coupling, coupling constant, multiplicity of the signal. Use of spin-spin coupling and dipole coupling (NOE effect) to determine the structure of a chemical compound. Coupling of a proton with other nuclei. One-dimensional and multidimensional NMR experiments. Types of 2D NMR spectra (COSY, TOCSY, NOESY/ROESY). Nuclear magnetic resonance spectroscopy of carbon 13C and nitrogen 15N. Application of one- and two-dimensional NMR techniques for structural analysis of chemical compounds. Interpretation of two-dimensional NMR spectra: COSY, TOCSY, NOESY of peptides.

## Prerequisites and co-requisites

not applicable

## Assessment methods and criteria

| Subject passing criteria | Passing threshold | Percentage of the final grade |
|---|---|---|
| Passing colloquium | 51.0% | 100.0% |

## Recommended reading

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| Basic literature | Zieliński W., Rajca A., Metody spektroskopowe i ich zastosowanie do identyfikacji związków organicznych, WNT, Warszawa, 1995<br><br>R.M. Silverstein, F.X. Webster, D.J. Kiemle, Spektroskopowe metody identyfikacji związków organicznych, PWN, 2007<br><br>John McMurry. Chemia organiczna. T. 2, (rozdział 13 ) Wydanie IV - PWN 2019 |
| Supplementary literature | Materials provided in class by the teacher |
| eResources addresses | |

## Example issues/ example questions/ tasks being completed

## Work placement

Not applicable

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