

## Subject card

|                                             |                                                                                                                                                                                                                                                                                                                                                       |                                                          |                                         |                                     |         |                                                                                                                                                |     |
|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------|-------------------------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Subject name and code                       | Introduction to epigenetics, PG_00154717                                                                                                                                                                                                                                                                                                              |                                                          |                                         |                                     |         |                                                                                                                                                |     |
| Field of study                              | Wstęp do epigenetyki (Wykład)                                                                                                                                                                                                                                                                                                                         |                                                          |                                         |                                     |         |                                                                                                                                                |     |
| Date of commencement of studies             | October 2025                                                                                                                                                                                                                                                                                                                                          |                                                          | Academic year of realisation of subject |                                     |         | 2025/2026                                                                                                                                      |     |
| Education level                             | Master'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                            |                                     |         | 3.0                                                                                                                                            |     |
| Learning profile                            | academic                                                                                                                                                                                                                                                                                                                                              |                                                          | Assessment form                         |                                     |         | exam                                                                                                                                           |     |
| Conducting unit                             |                                                                                                                                                                                                                                                                                                                                                       |                                                          |                                         |                                     |         |                                                                                                                                                |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                                                                                                                                                                                                                                                                    |                                                          | dr Joanna Rojek                         |                                     |         |                                                                                                                                                |     |
|                                             | Teachers                                                                                                                                                                                                                                                                                                                                              |                                                          |                                         |                                     |         |                                                                                                                                                |     |
| Lesson types                                | Lesson type                                                                                                                                                                                                                                                                                                                                           | Lecture                                                  | Tutorial                                | Laboratory                          | Project | Seminar                                                                                                                                        | SUM |
|                                             | Number of study hours                                                                                                                                                                                                                                                                                                                                 | 30.0                                                     | 0.0                                     | 0.0                                 | 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                                                       |                                         | 4.0                                 |         | 41.0                                                                                                                                           | 75  |
| Subject objectives                          | Learning objectives1 To acquire knowledge of the biology and dynamics of chromatin2. knowledge of the mechanisms that regulate chromatin activity at the epigenetic level3. ability to correlate the knowledge of epigenetic control with the development of organisms and the importance of epigenetics in plant biology,biotechnology and medicine. |                                                          |                                         |                                     |         |                                                                                                                                                |     |

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| Learning outcomes                                        | Course outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Subject outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Method of verification                 |
|                                                          | [BIOLMU2_K07] the graduate is ready to systematically update biological knowledge and information on its practical applications                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | - The graduate systematically updates the knowledge of epigenetics and information on its practical applications (B2_K07)                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | [SK4] test/egzamin - ustny lub pisemny |
|                                                          | [BIOLMU2_U06] the graduate is able to use the acquired expertise in the biological sciences to interpret the collected empirical data and to make inferences                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | - uses the acquired expertise in epigenetics to interpret the collected empirical data and make inferences (B2_U06)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | [SU4] test/egzamin - ustny lub pisemny |
|                                                          | [BIOLMU2_U02] the graduate is able to make proficient use of the scientific literature of the biological speciality studied                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | - The graduate is proficient in the use of scientific literature in the field of epigenetics (both in Polish and English) (B2_U02)                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | [SU4] test/egzamin - ustny lub pisemny |
|                                                          | [BIOLMU2_W01] the graduate has an in-depth knowledge and understanding of natural phenomena and processes at different levels of complexity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | - The graduate has an in-depth understanding of cellular and cellular phenomena at the level of epigenetic (B2_W01)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | [SW4] test/egzamin - ustny lub pisemny |
|                                                          | [BIOLMU2_W04] the graduate has an in-depth knowledge of the chosen specialisation in the biological sciences                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | - The graduate has an in-depth knowledge of epigenetic control in the development of organisms (B2_W04)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | [SW4] test/egzamin - ustny lub pisemny |
| Subject contents                                         | <p>1. chromatin biology: histone variants and modifications, heterochromatin, correlation between gene activity and histone modifications;DNA methylation and its modifications; interactions between histone modifications and DNA; organization and compartmentalization of chromatin nuclear; structural maintenance of chromosome complexes2. chromatin dynamics: basic nuclear processes; formation and remodeling of nucleosomes, chromatin remodeling complexes3. cellular memory: PcG and TrxG complexes; mechanism of targeting chromatin domains by PCG / TrxG; memory switching and role of non-coding RNAs; erasure of epigenetic memory4. "dosage compensation" systems: compensation of gene expression levels; chromosome dosage compensation.5. genomic imprinting in mammals and flowering plants: characteristics and mechanism of differential expression of alleles depending on their parental origin; parental origin effect ("parent-of-origin effect"), paternally and maternally imprinted genes, maternal effect.6. RNA-based gene silencing system: source and classes of small RNAs; Dicer and Argonaute (AGO) proteins; RNA interference phenomenon;transcriptional and post-transcriptional gene silencing.7. Regeneration and reprogramming (plant and animal stem cells; chromatin dynamics during reprogramming).8. epigenetic control and tumorigenesis: DNA hyper- and hypomethylation in tumorigenesis; changes in histone modifications and PcG activity in tumorigenesis9. epigenetics and metabolism: intermediates of cellular metabolism as cofactors of chromatin-modifying enzymes.</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                        |
| Prerequisites and co-requisites                          | Credit for subjects in cell biology, genetics and molecular biology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                        |
| Assessment methods and criteria                          | Subject passing criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Passing threshold                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Percentage of the final grade          |
|                                                          | written test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 51.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 100.0%                                 |
| Recommended reading                                      | Basic literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | - Paro R et al. 2021. Introduction to epigenetics. Springer International Publishing- Williams ME. 2016 epigenetics. Teaching Tools in Plant Biology: Lecture Notes. The Plant Cell (online)- Tollefsbol T. 2017. Handbook of Epigenetics. The New Molecular and Medical Genetics. Academic Press, 2nd edition- lecture materials in Polish prepared by the instructor                                                                                                                                                                                                                                |                                        |
|                                                          | Supplementary literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | - recent scientific publications in epigenetics- Rojek J, Tucker MR, Rychłowski M, Nowakowska J, Gutkowska M. 2021. The Rab Geranylgeranyl Transferase Beta Subunit Is Essential for Embryo and Seed Development in Arabidopsis thaliana. International Journal of Molecular Sciences. 22(15):7907.https://doi.org/10.3390/ijms22157907- Rojek J, Tucker MR, Pinto SC, et al. 2021. Rab-dependent vesicular traffic affects female gametophyte development in Arabidopsis. Journal of Experimental Botany- Kuta E, Rojek J. 2004. Imprinting genomowy u roślin. Postępy Biologii Komórki 31: 353-371. |                                        |
|                                                          | eResources addresses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                        |
| Example issues/ example questions/ tasks being completed | 18. trxG and PcG components and role, antagonism of action19. epigenetic silencing of FLC gene (mechanism)-control of flowering process20. genomic imprinting in plants and animals, mechanism, examples of imprinted genes and clusters in plants and animals, where this control takes place ( note sexual processes vs. imprinting)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                        |
| Work placement                                           | Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                        |