“Plant genome structure and practical implications in applied legume studies”		
Institute of Plant Genetics Polish Academy of Sciences	**Coordinator:** dr hab. Lidia Błaszczyk, prof. IPG PAS	**Lecturer:** Dr hab. Michał Książkiewicz, prof. IPG PAS

General information:

Number / form (s) / type (s) of classes	A series of lectures, 6 didactic hours (supervised by lecturers)
Didactic cycle	Summer (2nd) semester 2025/2026
Language	English
ECTS credits	2

Objective of the course:

To present the knowledge about plant genome with a specific focus on practical implications in legume breeding towards key agronomic traits

Topics:

1. Introduction to the plant genome structure and related research methods (2 academic hours) [31.03.2026]
2. Research approach that resulted in identification of structural variation underlying key mutations controlling vernalization and photoperiod responses in domesticated lupin species (2 academic hours) [07.04.2026]
3. Examples of successful studies on flowering and maturity traits in other legume species, including soybean (2 academic hours) [14.04.2026]

Effects of the course (in terms of knowledge, skills):

Knowledge:
After completing the course, the student

- Understands the structural organization of the genome.
- Knows the main methods used in genetic and genomic studies.
- Has the knowledge of the scientific approaches that resulted in identification of structural mutations (insertion-deletion polymorphisms) underlying key domestication traits in selected legume species.
- Knows the functional consequences of insertion-deletions in regulatory regions of selected genes from flowering induction pathways.

Skills:
After completing the course, the student is able to:

- Evaluate possible functional consequences of insertion-deletion polymorphism in regulatory regions.
- Point out appropriate methodology to investigate potential sequence polymorphism associated with agronomic traits.
- Integrate the information on the presence of sequence polymorphism with observed phenotypic diversity.

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Course content:
The course covers the practical implications of knowledge about plant genome structure in modern breeding, with special attention to case studies underlying worldwide domestication of selected legume species.

Key topics include:

- Plant genome content, chromatin structure including higher levels of organization such as chromatin loops, promoter–promoter chromatin interactions and topologically associated domains
- Whole-genome duplications during plant evolution.
- Gene structure and regulatory regions explained on the example of *Flowering locus T*, a gene integrating photoperiod and vernalization pathways to induce flowering.
- Selected methods used in genomic and genetic plant studies: Bacterial Artificial Chromosome (BAC) library screening, restriction enzyme fingerprinting and contig construction, molecular marker development, genetic linkage mapping, quantitative trait loci (QTL) mapping, genome-wide association study (GWAS)
- From a single plant in 1960s to dozens of cultivars in the 21st century - outline of international research approaches that resulted in identification of key structural mutations that enabled lupins cultivation as spring crops in Europe and as winter crops in Australia.
- 50 years of international efforts to make the soybean a worldwide photoperiod-independent crop cultivated from the equator to the 55th parallel.

Teaching methods / techniques: lectures

Evaluation of learning outcomes: written exam [21.04.2026]

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