„Functioning of plant genomes in relation to the environment” – part I		
Institute of Plant Genetics Polish Academy of Sciences	**dr hab. Lidia Błaszczyk** Coordinator	**Tutors: scientists from the Institute of Plant Genetics, Polish Academy of Sciences**

General information:

Number / form (s) / type (s) of classes	A series of lectures, 15 didactic hours + 5 lab. visits (supervised by lecturers)
Didactic cycle	Autumn – winter 2021/2022
Language	English
ECTS credits	2

Objective of the course: Expanding knowledge on plant evolutionary and ecological genomics

Topics:

1. **Structural genomics of plants** – 3 h lecture + 1 h lab.; dr hab. Michał Książkiewicz, IPG PAS;
2. **Cytogenomics** – 3 h lecture + 1 h lab.; dr hab. Karolina Susek, dr Magdalena Kroc, IPG PAS;
3. **Regulation of gene expression in plants – molecular mechanisms** – 3 h lecture + 1 h lab.; dr hab. Agnieszka Kiełbowicz-Matuk, IPG PAS;
4. **Physiological response and adjustment of plant metabolism to survive environmental stress conditions** – 3 h lecture + 1 h lab.; prof. dr hab. Arkadiusz Kosmala, IPG PAS;
5. **Plant microbiome** – 3 h lecture + 1 h lab.; dr hab. Lidia Błaszczyk, IPG PAS;

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

1. **Structural genomics of plants** – PhD student will:
   a) get knowledge of chromatin structure and its modifications
   b) get knowledge of major genome components constituting coding and non-coding sequences
   c) understand how structural polymorphism (insertion/deletions) and chromatin modifications influence plant responsiveness to key environmental cues

2. **Cytogenomics -** – PhD student will:
   a) get knowledge of cytogenetic methods for plant genomic research
   b) get knowledge of cytogenetics and its integration with genetic, genomic, and evolutionary research
   c) get knowledge of the plant genetic resources characterisation

3. **Regulation of gene expression in plants – molecular mechanisms** – PhD student will:
   a) be able to define the levels of regulating gene expression
   b) get knowledge of various mechanisms that control gene expression in plants
   c) get knowledge of molecular methods for studying the gene regulation

4. **Physiological response and adjustment of plant metabolism to survive environmental stress conditions** – PhD student will:
   a) be able to define drought tolerance/avoidance and winter-hardiness,
   b) know components of winter-hardiness and strategies of drought survival,
   c) understand plant reactions to water deficit and low temperature,
   d) know the essential physiological parameters describing plant metabolism under stress conditions.

5. **Plant microbiome** – PhD student will:
   a) know the structure of phytomicrobiome;
   b) know interlinkages between the plant holobiont components;
   c) know the factors influencing changes in the phytomicrobiome;
   d) understand the role of the microorganisms in the functioning of the plant genome.

Course content:

1. **Structural genomics of plants:**
   a) chromatin structure (i.e. organization of DNA in the nuclear genome)
   b) DNA methylation and chromatin modifications
   d) genome components (i.e. coding and non-coding sequences)
   c) examples from photoperiod and vernalization pathway showing influence of chromatin structure and its modifications on plant transition from vegetative to generative growth

2. **Cytogenomics**:
   a) basis of mitosis and meiosis
   b) cytogenetic techniques
   c) chromosomes – *in situ*, *in silico*
   d) comparative analyses in plant genome evolution
   e) importance of genetic resources.

3. **Regulation of gene expression in plants – molecular mechanisms:**
   a) basis of gene expression regulation in plants
   b) transcription factors as the main regulators of gene transcription
   c) post-transcriptional gene expression regulation
   d) methods to study gene regulation at the transcript and protein level, protein interactions with nucleic acids, RNA interference (RNAi)

4. **Physiological response and adjustment of plant metabolism to survive environmental stress conditions:**
   a) strategies of drought survival,
   b) methods used to analyse plant performance under water deficit conditions,
   c) photosynthetic apparatus and antioxidative system in the conditions of water deficit,
   d) winter-hardiness – definition, main components,
   e) methods used to analyse plant performance under low temperature conditions,
   f) photosynthetic apparatus and antioxidative system in the conditions of low temperature.

5. **Plant microbiome:**
   a) attempts to define of the core microbiome;
   b) functions of the microbiota and functional plasticity of the phytomicrobiome;
   c) molecular dialogue between the host plant and its microbiota.

Teaching methods / techniques:

- **lectures in English,** using multimedia techniques (including ZOOM platform – depending on current situation)
- **visiting laboratories/experiments**

Evaluation of learning outcomes:

- **written exam**