

“Plant Microbiomics”		
PSD IPAN	dr hab. inż. Lidia Błaszczyk, prof. IGR PAN <i>main lecturer</i>	Tutors: scientists from the Institute of Plant Genetics, Polish Academy of Sciences

General information:

Number / form (s) / type (s) of classes	A series of obligatory lectures, 24 didactic hours
Didactic cycle	winter semester 2026/2027
Language	English
ECTS credits	2
Learning outcomes, according to Attachment 2 to the Programme of the Study (valid from October 1st 2026)	P8S_WG (pkt.1-5); P8S_UW (pkt. 1, 2), P8S_UK (pkt. 3), P8SUU, P8SUO (pkt. 3)

Objective of the course: Expanding knowledge on plant microbiomes.

Topics:

- 1. Plant-associated microorganisms: from community formation to plant health** – 16 didactic hours, dr hab. inż. Lidia Błaszczyk, prof. IGR PAN
- 2. Pathogens and mechanisms of plant resistance** – 6 didactic hours, prof. dr hab. Małgorzata Jędryczka.
- 3. Flexibility of *Fusarium* plant pathogens and their interactions with host organisms** – 2 didactic hours, prof. dr hab. Łukasz Stępień.

Course content:

- 1. Plant-associated microorganisms: from community formation to plant health:**
 - a) definition of a plant as a meta-organism - plant holobiont and hologenome concepts
 - b) co-evolution of plants and microorganisms throughout evolution;
 - c) microbial diversity and community assembly: bacteria, fungi, and archaea in plants;
 - d) anatomy, assembly, and colonization patterns in different plant compartments - rhizosphere, endosphere, phyllosphere, and seed microbiome;
 - e) core vs. dynamic microbiomes;
 - f) spectrum of plant-microbe interactions and mechanisms;
 - g) role of epigenetics in plant-microorganism interactions;
 - h) modern methodologies in microbiome research;
 - i) microbiome-mediated plant fitness and immunity;
 - j) engineering the plant microbiome: synthetic community approaches to enhance crop protection;

- k) microbiome-guided plant breeding.

2. Pathogens and mechanisms of plant resistance:

- a) diversity of pathogens and their habitats,
- b) top fungal, bacterial and viral plant pathogens worldwide,
- c) effect of pathogens on plant yield in Poland and worldwide,
- d) methods of pathogen detection from plants, soil, water and air,
- e) classical and molecular methods of pathogen identification,
- f) quantification of disease symptoms,
- g) modes of action of different pathogens,
- h) mechanisms of plant response to biotic stresses,
- i) phytoalexins and elicitors,
- j) structure of avirulence genes and resistance genes
- k) concept of special forms and pathotypes,
- l) breeding for resistance,
- m) role of plant microbiome in plant health.

3. Flexibility of *Fusarium* plant pathogens and their interactions with host organisms:

- a) *Fusarium* populations and their hosts: inoculum sources, infection process, plant diseases caused,
- b) fungal secondary metabolism and molecular communication with the host,
- c) signaling pathways and defense mechanisms,
- d) experimental models used in *Fusarium* research.

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

1. Plant-associated microorganisms: from community formation to plant health: – PhD student will:

- a) know the concepts of plant: microbiome, holobiont, hologenome, symbiome, pathobiome, core microbiome;
- b) be familiar with the history of plant-microbe interactions, host anatomical niches, and the diversity of microorganisms associated with plants;
- c) understand the functional role of the microbiome and its impact on plant vitality and health;
- d) be able to distinguish the molecular mechanisms of plant interactions with beneficial, symbiotic, and pathogenic microorganisms;
- e) understand how epigenetics shapes plant-microorganism interactions;
- f) be able to identify methodologies and advanced tools for microbiome analysis;
- g) understand the importance of plant microbiomes for modern agriculture and breeding.

2. Pathogens and mechanisms of plant resistance – PhD student will:

- a) name main pests and diseases of crop plants and recognise their economic importance,
- b) understand the diversity of pathogen habitats,
- c) can detect, subculture and identify various plant pathogens,

- d) know modes of action of different plant pathogens,
- e) understand the mechanisms of plant resistance to biotic stresses,
- f) understand differences between special forms, races and pathotypes,
- g) understand links between pathogens, plant microbiome and plant health,
- h) understand the role and importance of breeding for resistance.

3. Flexibility of *Fusarium* plant pathogens and their interactions with host organisms – PhD student will:

- a) know main groups of *Fusarium* species infecting crops worldwide,
- b) list basic mycotoxins produced by these pathogens,
- c) explain possible routes of infection and environmental factors responsible for successful plant tissue colonization,
- d) hypothesize the course of the infection – name pathogen effectors and plant defense mechanisms triggered by them.

Teaching methods / techniques: lecture with multimedia presentation, case study method, and didactic discussion; student: own work with the literature.

Evaluation of learning outcomes:

- **written exam**