

“Bio-nanotechnology in plant research and biotechnology” – part I		
Institute of Plant Genetics Polish Academy of Sciences	dr hab. Lidia Błaszczuk, prof. IPG PAS Coordinator	Tutors: 1. Dibyendu Mondal, PhD, IPG PAS 2. Leonard Kiirika, PhD, IPG PAS 3. Tomasz Pniewski, PhD, IPG PAS 4. Franklin Gregory, PhD, IPG PAS

General information:

Number / form (s) / type (s) of classes	A series of lectures, 9 didactic hours + 3 lab. visits (supervised by lecturers)
Didactic cycle	Winter - Spring 2022/2023
Language	English
ECTS credits	2

Objective of the course: To understand the synthesis and applications of nanomaterials in plant research and biotechnology

Topics:

1. **Nanomaterials: Synthesis and task-specific applications**– 1 h lecture; Dibyendu Mondal, PhD, IPG PAS;
2. **Nanotechnology scope and application in plants** – 2 h lecture +1 h lab.; Leonard Kiirika, PhD, IPG PAS;
3. **Plant production and applications of virus-like particles** – 3 h lecture +1 h lab.; prof. dr hab. Tomasz Pniewski, IPG PAS;
4. **"Plant nanotechnology at IPG PAS" The essence of the NANOPLANT project** – 3 h lecture +1 h lab.; dr hab. Franklin Gregory, prof. IPG PAS.

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

1. **Title: Nanomaterials: Synthesis and task-specific applications**– PhD student will:
 - a) be familiar with different protocols for the synthesis of nanoparticles
 - b) be familiar with applications of nanomaterials as nanofertilizers and nanopesticides
2. **Title: Nanotechnology scope and application in plants** – PhD student will:
 - a) be familiar with the application of nanotechnology in crop plants
 - b) get the knowledge of essential nanomaterials, their uptake and translocation in plants
 - c) able to describe the mechanisms underlying plant-nanomaterials interactions
 - d) be familiar with the application of nanomaterials in detection, management of phytopathogens and the future prospects

3. **Plant production and applications of virus-like particles**
 - a) get the knowledge about types and applications of VLPs
 - b) able to describe plant expression systems in production of VLPs
 - c) be familiar with processing of plant-produced VLPs
 - d) would give an overall idea about the current research and prospects of VLPs at the institute

4. **"Plant nanotechnology at IPG PAS" The essence of the NANOPLANT project**
 - a) Would give an overall idea about the past and current research in plant nanotechnology at the institute
 - b) Gain knowledge about new avenues in plant nanotechnology

Course content:

1. **Title: Nanomaterials: Synthesis and task-specific applications**
 - a) Chemical and green synthesis of nanomaterials.
 - b) Characterization tools of nanomaterials.
 - c) Effect of nanoparticles' size, morphology and surface charge on plant growth and productivity.

2. **Title: Nanotechnology scope and application in plants**
 - a) Application of nanotechnology for improvement of horticultural crops
 - b) Essential nanomaterials utilized as nanopesticides or nanofertilizers, their uptake and translocation during plant growth
 - c) Mechanisms underlying the interactions of plants and commonly used nanomaterials in crop production
 - d) Utilization of nano-based probes for detection, management of plant pathogens and future prospects

3. **Plant production and applications of virus-like particles**
 - a) Types and applications of VLPs
 - b) Characteristics of plant expression systems in the aspect of VLPs production
 - c) Processing of plant-produced VLPs for specific applications
 - d) Biological effects of plant-produced VLPs and future prospects

4. **"Plant nanotechnology at IPG PAS" The essence of the NANOPLANT project**
 - a) Elicitation of interesting compounds using nanomaterials
 - b) Plant transformation using nanomaterials
 - c) Nanotechnology for bioprospecting from medicinal plants

Teaching methods / techniques:

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

Evaluation of learning outcomes:

- **written exam**