UNIVERSITÀ DEGLI STUDI DI MILANO

DIPARTIMENTO DI SCIENZE AGRARIE E AMBIENTALI
PRODUZIONE, TERRITORIO, AGROENERGIA

PhD School on Agriculture, Environment and Bioenergy

Insights on the plant biosystem: enemies, friends or just biomes

Summer School 2020- 2021

In recent years, with the advance in high-throughput sequencing (HTS) technologies, the description and functional characterization of host-associated microbial communities and virome gained momentum among both the scientific community and the general public, in particular regarding the health and well-being of humans, animals, plants, and the environment. In agricultural science, these important components of the plant holobiont constitute an untapped resource for sustainable crop production. Understanding the mechanisms with which beneficial and detrimental microorganisms and viruses interact with each other, their hosts, and the environment can improve the agricultural production both by exploiting beneficial interactions and by hindering detrimental ones, limiting the effects of pathogens. At the moment, the study of these aspects is based on the use of molecular biology tools to sequence specific, taxonomy-relevant genes or whole genomes from different environments and hosts, and the use of computational tools to analyze the obtained data. These data are therefore dependent on the knowledge of both molecular biology techniques to produce the data and of bioinformatics to handle the impressive amount of data that these analyses yield.

In this scope, the goal of this summer school is to provide PhD students in the disciplines of plant science the knowledge and tools necessary to produce, handle, and analyze in a critical fashion data related to microbiome and virome, as well as insights in their relevance in various fields of plant science, such as genetics and plant pathology. In its two-weeks program, the summer school will provide both theoretical lectures and hands-on experience on these topics, while allowing the participants to get involved with experts in the field and develop a network that will prove invaluable for future research work.

The summer school will involve a total of 23 hours of lectures and 17 hours of workshops, according to the academic system the final achievement will be equivalent to 5 CFU/ECTS for the PhD Students and the Master Students attending the summer school. At the end of the summer school the attendees will have to produce a written assay that will be evaluated.

PhD School on Agriculture, Environment and Bioenergy

Lecturers:

Davide Bulgarelli - Principal Investigator, School of Life Sciences, University of Dundee at the James Hutton Institute
Invergowrie, United Kingdom (https://www.lifesci.dundee.ac.uk/people/davide-bulgarelli)

Sébastien Massart - Associate Professor, Laboratory of Integrated and Urban Phytopathology, TERRA – Gembloux AgroBio Tech, Liège University, Belgium (https://www.gembloux.ulg.ac.be/phytopathologie/research/diagnostic-surveillance-and-epidemiology/?lang=en)

Course aim: The summer school will focus on the interaction between plants and their associated microbiome/virome with a comprehensive vision on the aspects that are closely related to these interactions (e.g. plant genetics, nutrition, pathology, and biosecurity) and how they can be employed to face agriculture's current challenges (climate changes, input reductions, higher production). Theoretical lectures will introduce aspects of plant-microbe/virus interactions along with notions of molecular biology and bioinformatics related to HTS, while ample time will be dedicated to practical workshops, allowing participants to have a hands-on approach to the bioinformatic tools used in such analyses, consolidating the knowledge acquired during the lectures.

Highlights:

Lectures focusing on the genetic determinants of plant microbiome and its contribution to plant mineral nutrition, pathogen resistance, and sustainable crop production

Learning by doing: lectures alternating with active learning on personal computer to strengthen knowledge and develop appropriate skills

Understanding the impact of HTS technologies at scientific, legal, commercial and biosecurity levels

When: June 14th - 25th, 2021. Theoretical lectures are planned for the afternoon (16:00-18:00 CEST), while workshops will take place in the morning (10:00-13:00 CEST). The definitive program of the summer

school, with details regarding the precise schedule of each lecture, will be communicated to participants. Also, an introductory seminar will be held on June 10th by Prof. Massimo Delledonne (announcement attached).

Target: The main target audience of this summer school is PhD students. Master's degree students and post-docs are welcome to apply as well.

Where: This summer school will take place remotely, on Microsoft Teams.

Registration: Applicants for the summer school should send an e-mail to alessandro.passera@unimi.it, stating their intention to join the summer school in full or attending only the lectures, and attaching a motivation letter (maximum 500 words) briefly describing their background, research topic and how attending the summer school will benefit them. Deadline for application submission: June 9th at 12:00 CEST. The lectures will be available to all applicants, while the workshops will allow a maximum of 15 participants. If more applicants intend to take part in the workshops, the organizers will select the 15 participants for the workshops based on their motivation letter.

Organization: Piero Attilio Bianco, Laura Rossini, Alessandro Passera

Credits info:
6 EC
The Summer School will involve a total of 40 hours of lectures/workshops, according to the academic system the final achievement will be equivalent to 6 CFU/ECTS points for the PhD Students and the Master Students attending the summer school.

PhD School on Agriculture, Environment and Bioenergy, University of Milan, Summer School:

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Mon 14 June 16:00 – 18:00 — Course Introduction and Kick-off Meeting

Part 1: Defining, dissecting and capitalising on the plant microbiome for sustainable crop production

Davide Bulgarelli, University of Dundee

Tue 15 June 16:00 – 18:00	**Lecture 1:** Plants wear their guts on the outside
Wed 16 June 10:30 – 13:00	**Workshop 1:** Introducing R for sequencing data analysis
Wed 16 June 16:00 – 18:00	**Lecture 2:** It takes more than two to tango: determinants of plant microbiome
Thu 17 June 10:30 – 13:00	**Workshop 2:** Use of ecological indexes and multivariate statistical analysis
Thu 17 June 16:00 – 18:00	**Lecture 3:** An "extended" phenotype: plant genetics as a driver of the plant microbiome
Fri 18 June 11:00 – 13:00	**Lecture 4:** Synthetic community approaches to gain insights into the plant microbiome
Fri 18 June 16:00 – 18:00	**Lecture 5:** Practical applications of the plant microbiome for sustainable agriculture

Part 2: A glimpse on the reliable identification of plant viruses from high throughput sequencing data

Sébastien Massart, Liège University

Mon 21 June 16:00 – 18:00	**Lecture 1:** Viruses & Plants: foes, friends and hijackers
Tue 22 June 10:00 – 12:00	**Lecture 2:** Introducing HTS for plant virus detection
Tue 22 June 15:00 – 18:00	**Workshop 1:** HTS for plant virus detection – step-by-step pipeline; part 1
Wed 23 June 09:00 – 12:00	**Workshop 2:** HTS for plant virus detection – step-by-step pipeline; part 2
Thu 24 June 10:00 – 12:00 17:00 – 19:00	**Workshop 3:** HTS for plant virus detection – one-click pipeline
Fri 25 June 10:00 – 12:00	**Lecture 3:** International guidelines for use of HTS in plant health
Fri 25 June 16:00 – 18:30	**Workshop 4:** How can I improve reliability of HTS technologies in the lab?