



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 essay that will be evaluated.



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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



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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.



UNIVERSITÀ DEGLI STUDI DI MILANO
Dottorato di Ricerca in Agricoltura,
Ambiente e Bioenergia

Advanced technologies for metabarcoding and metagenomics

Massimo Delledonne

Dipartimento di Biotecnologie, Università degli Studi di Verona

DATE: June 10, 2021

TIME: 17.00 – ROOM: Microsoft Teams

<https://teams.microsoft.com/l/team/19%3abht-ZnPQhXQFVBisyBDWUmuV-6l7W4mdHdbjguI9wt1%40thread.tacv2/conversations?groupId=244b2ccb-9aa8-453b-9b43-e9f88795137a&tenantId=13b55eef-7018-4674-a3d7-cc0db06d545c>

Hosts: Piero A. Bianco and Laura Rossini

Abstract

Metabarcoding and Metagenomics are fantastic approaches to get a snapshot of 'what is there' and 'changes over time', to find novel genes and gene variants and to assess metabolic potential. I'll provide an overview of the current technologies as well as an evaluation of the performance potential of the most advanced - less adopted - strategies.

Curriculum Vitae

Massimo Delledonne received his Ph.D. from Università Cattolica del S. C. in 1994. During 1995-1998 he visited Chris Lamb at the Salk Institute for Biological Studies in California, discovering the function of nitric oxide in plant disease resistance. In 2001, he joined the University of Verona as Associate Professor of Plant Genetics and a few years later he joined the genomic revolution by adopting the new technologies that NGS (Next Generation Sequencing) was offering to

microbial, plant, animal and human biologists. He is currently Full Professor of Genetics and manages a vigorous research program that emphasizes interdisciplinary approaches to understanding plant and human biology.

His own expertise is in the areas of genetics, molecular biology and genomics, and collaborates with researchers in diverse fields, including bioinformatics, microbiology and plant genomics, and medicine.



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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?