# **Environment and Biota**

## Proff. Marco Trevisan - Edoardo Puglisi

**Module Wine Microbiology**

Prof. Edoardo Puglisi

***COURSE AIMS AND EXPECTED LEARNING SKILLS***

The course aims at providing students an understanding of the main microorganisms and metabolic processes involved in the production of wines.

At the end of the course the students:

* will be able to understand the identity, distribution and activities of yeasts, lactic acid bacteria, acetic acid bacteria and molds in winemaking
* will be able to explain the main biochemical pathways involved in wine fermentations
* will know the main desired traits for yeasts and LAB starter cultures
* will be able to demonstrate an understanding of the main microbiological and molecular techniques used to study wine microorganisms
* will be able to manage alcoholic and malolactic fermentations and to control undesired microorganisms
* will be able to use the correct technical terminology in the field of wine microbiology

***COURSE CONTENT***

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|  | ECTS CREDITS |
| Cytology, taxonomy and ecology of vineyard, grape and wine yeasts. The biochemistry of alcohol fermentation and the metabolic pathways of wine yeasts. Oenological technological traits of interest in yeasts, and methods to evaluate them. Conditions of yeasts development: fermentation kinetics, nutrition requirements, activators and inhibitors. | 1.0 |
| Lactic acid bacteria (LAB): classification, metabolism, nutrition. LAB of oenological interest: desired traits, screening and selection. The malolactic fermentation: effects on wines sensorial and quality traits. Other microorganisms of oenological interest: acetic acid bacteria (AAB) and molds | 1.0 |
| Grapes and musts as substrates for microorganisms: spontaneous and guided fermentations. Omics approaches to assess the microbial ecology and chemistry of wines: metagenomics and metabolomics. Microbial ecology of harvest, pre-fermentation and fermentation. | 1.0 |
| Selected starters for wine production: yeasts and LAB. Genetic improvement of microorganisms of oenological interest. Undesired microbial activities: spoilage microorganisms and wine faults. Organoleptic defects caused by uncontrolled malolactic fermentations. | 1.0 |
| Tutorial: Isolation, cultivation and identification of yeasts, LAB and AAB. Microbiological analyses in the micro-vinification facilities of UCSC campus: application of starter cultures, morphological and molecular analyses of relevant strains. | 1.0 |
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#### READING LIST

Ribéreau-Gayon, P., Dubourdieu, D., Donèche, B.B., Lonvaud, A.A. *Handbook of Enology: Volume 1 – THE MICROBIOLOGY OF WINE AND VINIFICATIONS.* 3rd edition, Wiley, 2021.

Fugelsang, K.C., Edwards, C.G. *WINE MICROBIOLOGY – Practical Applications and Procedures.* 2nd edition, Springer, 2007.

***TEACHING METHOD***

The teaching method will embrace the following activities:

1) Indoor class where main course topics will be covered along with several applied examples. Teaching methos will use high interactivity between teacher and students to stimulate discussion and also help breaking the barrier of shyness.

2) Invited seminars held by industry experts actively invovled in research & development activities related to wine microbioogy, with a focus on the development of starter cultures. Guided visits to a company producing starters and at least one winery.

3) Laboratory activities where the students will learn laboratory methods to work with wine-making starters, perform microbiological analyses in a micro-vinification facility, leanr molecualr and microbiological methods to discrminate, identify and quantify microorganisms of oenological interest.

***ASSESSMENT METHOD AND EVALUATION CRITERIA***

Final assessment will be made through an oral exam.

The evaluation criteria will be based on the levels of topics knowledge, comprehension and ability to make conceptual links between the different topics. The student must also demonstrate to be able to correctly use the technical language of the discipline.

## ***OTHER INFO AND PRE-REQUISITES***

## The students should have a good background in microbiology and oenology to be able to follow the main concepts described.

Prof. Edoardo Puglisi receive students after class or by appointment at the Department for Sustainable Food Systems (DiSTAS)

# **Module Soil fertility and vine nutrition**

## Prof. MARCO TREVISAN

***COURSE AIMS AND EXPECTED LEARNING SKILLS***

The course aims to introduce the student to the concept of soil fertility and vine nutrition; the student in the first part of the course will be introduced on the basic of soil chemistry concepts and definitions relating to soil organic matter management, nutrient uptake processes and plant nutrients availability. After the students will be introduced on the concepts, objectives, and components of sound soil fertility management programs, factors affecting plant growth and soil management strategies. Finally, will be showed how is possible preserving and improving soil fertility with a focus on composition and use of manures and fertilizers. The physiological and metabolic processes involved with grapevine growth and production will be explained with focus on elements playing important roles in vine functioning, growth, yield and/or quality. Nutritional deficiencies of the key elements in soils and nutritional effects on wine quality will be identified to produce a correct nutritional management of grapevine. The student will receive a theoretical training in the fundamentals of the subject together with practical applications; 8 hours of practice in the laboratory will allow the students to be more familiar with the analytical techniques adopted for soil fertility evaluation. A guided educational visit to the relative management problems.

**Knowledge and analysis ability**.

At the end of the course the student is expected to own fundamental knowledge about soil fertility management, fertilizers, soil amendments and plant biostimulant, vine nutrition and selection criteria, application methods, timing of application to preserve vine health.

**Know-how and its application**

The student must be able to apply the learned concepts to recognize limiting factors affecting soil fertility and vine health and providing suitable solutions. More specifically, the student is expected to successfully manage soil fertility using more useful nutrient to enhance plant growth and soil health. For each of these items, the student is expected to be able to provide the most suitable solutions.

**Autonomy in self-assessment**

In front of a vineyard, the student is expected to provide autonomous analysis and thinking inspired to the acquired knowledge rather than based on popular “rule of thumbs” applications.

**Communications skills.**

The student is expected to be able to successfully deliver, in both oral and written forms, a correct diagnose and discussion of the different problems related to soil fertility and vine nutrition, using suitable and proper technical language.

**Learning capacities**

Regardless of previous background, at the end of the course the student will have to hold learning capacities suitable to either lead her/him to higher study courses or to successfully tackle a job appointment.

***COURSE CONTENT***

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| **Soil fertility** | CFU 2 |
| Lecture 1 covers basic of soil fertility and soil chemistry concepts and definitions relating to soil organic matter management, nutrient uptake processes and plant nutrients availability  Lecture 2 covers the role of individual plant nutrients and nutrient cycling are discussed. Nutrient imports and exports  Lecture 3 presents plant uptake of nutrients and nutrient mobility within the plant  Lecture 4 presents the concepts, objectives, and components of sound soil fertility management programs. Factors affecting plant growth. Soil management, soil compaction and soil erosion  Lecture 5 describes how is possible preserving and improving soil fertility. Organic fertilizers  Lecture 6 describes synthetic fertilizer, amendments, plant biostimulant  Lecture 7 Perspective and definition of soil fertility and soil health |  |

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| **Vine nutrition** | CFU 1 |
| Lecture 1 covers the roles of nutrients in growth and productivity of grapevines and their sources  Lecture 2 presents quantitative and qualitative assessment of vine nutrient status  Lecture 3 covers fertilizer management, selection criteria, application methods, timing of application  Lecture 4 covers management practices to enhance soil nutrition and health |  |
| Practical Activities  Laboratory basic of soil analysis, organic matter content, nitrogen and phosphorus soil content, Microelements analysis  A guided educational visit to the relative management problems. | 1.0 |

#### READING LIST

Additional reading materials will be handed out during the course.

***TEACHING METHOD***

The teaching method will embrace the following activities: Lectures, practice in the laboratory, educational visit.

***ASSESSMENT METHOD AND EVALUATION CRITERIA***

Oral exam. During the oral examination, each candidate receives at least three general questions which, in turn, generate more specific questions. Maximum score to be assigned to each general question is 10/30. Score will reflect the following items: a) effective knowledge of the subject and good overal handling of the matter; b) language clarity during the interview; c) ability to make connections and links between different topics.

## ***OTHER INFO AND PRE-REQUISITES***

Prof. Marco Trevisan is available to meet with students on the days when lectures are held, at the DiSTAS, Section Chemistry.