**PhD:** Food Science

**Title:** Grape related yeasts as source for designing specific "synthetics microbiota" to be used for wine fermentations.

**Proposing supervisor:** Prof. Giuseppe Blaiotta (Division of “Vine and Wine sciences”)

**Objectives of the research project and interdisciplinary collaborations**:

The wine industry has evolved over time, the "green" issues association with wine production, such as sustainability and carbon footprint, have attracted more and more attention from consumers and producers. Microorganisms represent dominant presence in terms of their vast diversity and multipronged functional capabilities in vine and wine ecosystems. After obtaining high grape quality, the natural microflora is the second key step in winemaking to increase quality and complexity. However, recent research demonstrated the diffusion industrial yeast strains in vineyard. This finding put us in a real emergency situation. Their presence on grapes may strongly interferes with the natural yeast microbiota reducing biodiversity. Therefore, the first aim of this proposal is the analysis of grape yeast microbiota of all cultivars growing of our region, including minor or ancient varieties/ecotypes. The real yeast diversity will be assessed by applying both culturomics and metagenomics on grapes and musts collected and fermented in sterile condition. The species and strain diversity of isolated cultures will be evaluated by molecular methods (including genome sequencing). Their potential impact on the grape ecosystem and during wine fermentation will be evaluated by analyzing their physiological properties. Terroir specific multi-species starter cultures (synthetic microbiota) will be designed and used in wine fermentations to evaluate their impact on wine quality.

**Innovation and originality of the project in relation to the state of the art**:

As recently pointed out by OIV, the microbiota associated with grape from different regions show biogeographical patterns, and certain characteristics of the wine from these regions may be related to the composition of the regional grapevine-associated microbial community (OIV-VITI 655-2021). The use of commercial stater cultures (*S. cerevisiae* mainly) reduces the potential of native microbiota to contribute to *terroir.* In fact*,* the metabolic interactions developing in spontaneous fermentation could be the key to the microbial contribute to *terroir.* By contrast, has been some concern regarding safety in natural wine (spoilage and synthesis of toxic by-products). Modern microbial biotechnologies can provide solutions to conciliate safety with instances of an enhanced contribution of microbes associated with spontaneous fermentation. The design of tailored mixed starter cultures for specific productions in such a way to mimic pro-technological microbial diversity associated to grape and spontaneous fermentation is a solution experienced worldwide.

The design of different synthetic microbiota to be used as starter cultures for production DOCG wines of Campania Region is novel approach to transformation the uncontrolled and mysterious spontaneous wine fermentation to a more rational and controlled process respecting, at the same time, the core microbiota involved to *terroir*. Fermentation with specific synthetic microbiota, related to a specific terroir, is an innovative way to regulate and control the fermentation and obtain wines with desired chemical and sensorial characteristics. The development of “friendly yeasts” (an new concept of starter cultures) that share their environment with other strains is an interesting low-input winemaking strategy.

**Grant availability (funds to support the research activities):**

PSR Campania (2014-2020) – Project “ECOVINI, Effects of cultivation practices and technological and microbiological parameters on the quality of fine red wines from Partenio area” (CUP F86B1900540009). Project Budget: 152.242,75 €. Scientific manager Prof. Blaiotta.

PSR Campania (2014-2020) - Project “RINNOVALA, Innovative repopulation of Aglianico Lasco of Ariano grape cultivar (CUP J92C20001030009). Project Budget: 135.776,65 €. Scientific manager Prof. Blaiotta.

PSR Campania (2014-2020) - Project “PANPRO, Enhancement of the biodiversity of local legumes for production of bread based on vegetable proteins (CUP H42C19000430009). Research Unit manager Prof. Blaiotta (Budget: 33.509,30 €).

**Collaborations with foreign institutions (max 500 characters):**

**Prof. W. Albertin, University of Bordeaux, France** – non-*Saccharomyces* genotyping by microsatellites technology. Already collaborated in this area (Aponte et al. 2017 - Occurrence and genetic diversity of *Brettanomyces* in Southern Italy wines. Microbial Diversity 2017 (Drivers of Microbial Diversity), Bari (Italy) October 24-26th 2017 (PS5-2, pg 398-399); Avramova et al. 2018 - *Brettanomyces bruxellensis* population survey reveals a diploid-triploid complex structured according to substrate of isolation and geographical distribution. Scientific Reports, 8:4136).

**Prof. G. Liti, University of Côte d'Azur, Nice – France** – Yeast genetics and genomics. We are collaborating with Prof. Liti on the genomics of *Saccharomyces cerevisiae* of natural (non-wine) origin and *Saccharomyces kudriazevii.*