

Oenology,

A Savoir-Faire dedicated to Wine

Edited by

OEnoppia

Oenological Products
and Practices

International Association

OENOPPIA MEMBERS : OENOLOGY AS A PROFESSION

Either oenology generalists or specialists in some specific industrial areas, the societies that have joined Oenoppia have a profession in common: thinking, producing and distributing oenological products. Their vocation is also to make sure that these techniques are well implemented in the cellars. Within the larger scope of oenological practices carried out in wine making, oenological products are designed to bring out the highest qualitative potential of the grape, but also to prevent the wine from different types of defects, and to allow a good stability and preservation of the wine in the bottle. They are well-known technological tools for all the winemakers (yeasts, enzyme, bacteria, fining products, tannins...).

OENOPPIA GOAL: TO PARTICIPATE TO THE EVOLUTION OF OENOLOGICAL PRACTICES.

Oenoppia founding members wish to become a new partner of the institutions already involved in the evolution of oenological practices, in order to contribute to innovation and progress. They also want to assure the industrial feasibility of oenological products and guarantee satisfying conditions for the introduction of these products in the market. Oenoppia goal is also to contribute to the spread of both scientific and technical information. Oenoppia is an Observer Member of the International Vine and Wine Organization (OIV).

OENOPPIA PHILOSOPHY: ETHICAL AND REASONED OENOLOGY

The societies that have joined the association are inspired by the adoption of an Ethical chart for the respect of regulations but also the reasoned use of oenological products. Nowadays, both food safety and environment are considered as fundamental factors leading to the development and implementation of oenological products. The third axis consists in encouraging economic competition through the use of oenological products, which contributes to developing quality over international markets. One of Oenoppia's major mission will be to promote the information about nature and oenological products potential, through educational tools.

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Paris, Novembre 2012

OENOLOGY,

— What is oenology?

Wine, a traditional product, is not just derived from Man's domestication of the vine over the last few thousand years. It is also the work of an equally ancestral expertise named oenology.

Oenology is born from the winemaker's will to understand and domesticate the different stages of vinification in order to compensate for nature's weaknesses and to ensure that the wine does not turn into vinegar: we too often forget that nature is not perfect and that the natural result of grape fermentation is its transformation into vinegar.

Furthermore it was always important to check that the wine didn't deteriorate during storage or transport.

These issues have been present since the invention of wine and have only been mastered thanks to the intervention of oenology; genuinely accompanying a traditional product that is both fragile and qualitative. Whether it is considered as science, art or know-how, oenology gives expression to the importance of Man's intervention in the making of wine.

— A history of civilizations

Domesticating vines and producing wine date back to prehistory. According to historians, the first traces of wine making date back to the sixth millennium BC in the Middle East. Wine is found in Greece and in Italy as early as the fifth millennium.

At the time, storing wine and preventing it from turning into vinegar was a major problem for winemakers.

N A T U R E
V I N E G A R
D O M E S T I C A T I O N

They used a number of procedures to store their wine: adding honey, myrrh, spikenard, absinth, pitch, resin and even sea water, to such an extent that today's consumer would refuse to drink the beverage celebrated by great Greek and Roman writers. This problem was only solved relatively recently: for centuries, winemakers could only produce wines to be drunk within the year. Each year the wine from the previous year, already sour, was replaced by the one from the new harvest and sent to the vinegar makers.

The Middle Ages brought with it a profusion of new methods for improving "hygiene" and wine storage, despite the fact that a good number of these methods proved to be dubious: believing that they were fighting diseases linked to poorly controlled vinification, certain winemakers mixed all sorts of chemical substances into their wines, such as litharge (lead oxide) or plaster. The use of egg white or isinglass was introduced to improve limpidity in wine.



A SAVOIR-FAIRE DEDICATED TO WINE

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To protect the wine and ensure good transport conditions over long distances, the Dutch came up with the idea of using sulphur wicks during the 17th century - ancestor of the sulphites today found in wines. While these did considerably improve wine hygiene, they were used in random quantities (either insufficient or excessive) due to the lack of knowledge and tools available for valid dosage.

It was only after the end of the French revolution and the dawn of the 19th century that the foundations of contemporary oenology began to emerge. Important figures including Chaptal and Pasteur made a direct contribution to the noble qualities that are today undisputed in winemaking and oenology, by revolutionizing wine hygiene. The discovery of micro organisms and in particular the exact nature of alcoholic fermentation (a key stage in winemaking) and the role of yeast that transforms sugar into alcohol have given winemakers the means they require to put an end to incertitude, and to help overcome nature's inadequacies.

Chaptal and viticulture:

Born in 1777, Chaptal is best known for chaptalisation, a now authorised and regulated method that consists of adding sugar to musts to increase the alcohol content of the final wine.

Chaptal was a chemist, a well-known politician, a member of the Academy of Sciences and founder of the School of Midwifery.

*He also revolutionized the viticultural industry with his *Treaty on the Vine*, the first substantial text ever written, at a time when winemaking was undergoing a major crisis due to overproduction, declining quality and especially a severe lack of knowledge.*

H Y G I E N E
C O N T R O L
C H A P T A L & P A S T E U R
M I C R O O R G A N I S M S
C O N T E M P O R A R Y O E N O L O G Y
T R E A T Y O N T H E V I N E
Q U A L I T Y O F W I N E S
C R I S I S O F T H E V I T I C U L T U R E
K N O W L E D G E

— Accompanying wine through each stage of its creation

Originating from the will to understand and control the stages of transforming grapes into wine, and derived from a thought process that began several centuries ago, oenology today accompanies the creation of wine through each of its key stages :

- > Harvesting
- > Pressing (white wines)
- > Alcoholic fermentation, which transforms the sugar from the grapes into alcohol thanks to yeasts
- > Malolactic fermentation: for red wines and high quality white wines, made possible by the action of beneficial bacteria that reduce wine acidity, stabilise and soften it
- > Clarification and stabilisation for removing natural sediment occasioned by the fermentation process
- > Fining
- > Maturing
- > Bottling

For each of these stages, oenology has developed a wide range of tools and techniques to accompany the winemaking process, in accordance with the extraordinary diversity of grape varieties, appellations, 'terroirs' and local specificities, while at the same time ensuring a strict hygiene programme. While diverse in origin, the majority are derived from natural sources:

- > Yeasts: without yeast there is no wine! They ensure grape fermentation: the fundamental stage of vinification that transforms the sugar from the grapes into alcohol



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-> Enzymes: these proteins are naturally present in grapes, as in all living organisms, and facilitate and accelerate vinification conditions. They come into play during maceration, pressing and clarification.

-> Bacteria: grape berries contain a vast microbial flora. Amongst these, lactic bacteria ensure malolactic fermentation that is necessary for the vinification of most red wines and certain high quality white wines. This phase is characterised by the softening of the wine and the enhancement of its bouquet.

-> Fining and stabilisation products: these are plant origin (gum arabic), organic (egg white or milk extract) or mineral (clay) and come into play at different stages of vinification and maturing to ensure full expression of the wine's bouquet and robe. Fining products contribute towards separating the wine from certain impurities that appear during fermentation.

Stabilisation products help stabilise certain compounds that are naturally unstable in wine, including colour or tartaric acid, a natural acid found in grapes that tends to transform into crystals in wine.

VIN
RAI-
SIN
ŒNOLOGIE
FERMENTATION
STABILISATION
OUTILS ET TECHNIQUES

OENOLOGY, A SAVOIR-FAIRÉ DEDICATED TO WINE

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— A Science mainly based on Biology

It should also be noted that these genuine oenological catalysts only represent a minuscule part of vinification: The tools used by the oenologist during vinification represent less than one gram per litre of wine; once they have deposited at the bottom of the tank, they are largely eliminated during the different racking procedures (separation of the clear wine from the deposit). In total, less than 0,2 grams of oenological ingredients are added to the wine found in a bottle.

This proportion is hence extremely limited and takes away nothing of the wine's natural character.

These tools and techniques are principally derived from the vine itself or from traditional methods that have been the object of successive improvements to adapt them to the demands of the vine and to increasingly strict hygiene regulations.

The case of yeasts, enzymes and bacteria, the three major components in winemaking, is particularly revealing as all three are natural products, naturally present on the grape berry. They make up part of the extremely rich flora of micro organisms.

Oenology has been able to take advantage of this flora by selecting the micro organisms the most likely to ensure the production of quality wines, by ensuring they are available in sufficient quantity in fermentation and by blocking the action of micro organisms that are detrimental to the wine.

In short, by intervening at this level oenology has been able to domesticate nature's work by putting an end to the random character that made wine making a hazardous business each year.

OVERALL, THE NUMBER OF INGREDIENTS IMPLEMENTED TODAY TO ELABORATE WINES IS LARGER BUT IS USED IN SMALLER QUANTITIES AND WITH A HIGHER LEVEL OF CONTROL THAN BEFORE THE ADVENT OF CONTEMPORARY OENOLOGY

YEASTS

The role of yeasts in alcoholic fermentation was revealed by Pasteur's work on wines from the Jura. These microscopic fungi naturally transform sugar from the grapes into alcohol, and are naturally present on grapes.



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Saccharomyces cerevisiae, the species of yeast used by winemakers, is present on the grape berry along with a multitude of other micro organisms. Not all these micro organisms have a positive action on fermentation. Once the role of yeasts was discovered, oenologists immediately began to select the most suitable yeasts for revealing the aromas present in the grapes, and to prevent the action of other yeasts that could impede vinification or have a detrimental effect on the wine. Following on from Pasteur, oenologists have developed tools that have improved knowledge concerning beneficial yeast strains present on the grape and enabled them to be isolated. As for detrimental strains, such as Brettanomyces, also known as “contamination yeasts”, the oenologist now has the capacity to block them

BACTERIA

The bacteria used during malolactic fermentation are also derived from the microbial flora naturally present on grape berries. Some of them, lactic bacteria – and in particular Oenococcus oeni – play an essential role in winemaking, carrying out malolactic fermentation that takes place during vinification of the large majority of red wines and a large number of white wines, and developing the wine’s aromatic qualities. Others, including acetic acid bacteria, are a constant threat as they are

responsible for early transformation of the wine into vinegar. Contemporary oenology’s role has been to ensure understanding and control of this flora throughout wine vinification, maturing and aging.

OENOLOGY AND ORGANIC WINES

Recent discussion initiated at European level concerning the introduction of specific legislation for organic wines has generated the opportunity for major league oenologists to evoke their attachment to the intrinsically natural character of their activity.

Contemporary oenology is indeed founded on respect for the consumer and the natural qualities of the wine. As such, it also aims to accompany organic winemakers



O E N O L O G Y ,
 A S C I E N C E
 M A I N L Y B A S E D
 O N B I O L O G Y

— Revelation of grape varieties on a terroir

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Besides its direct action on transforming the sugar present in the grapes into alcohol, yeasts also contribute towards revealing aromas, the precursors of which are naturally present in the grapes. They cannot artificially create aromas known as “varietal”, i.e. typical of a given grape variety.

As such, the fundamental role played by the different grape varieties as well as the “terroir” should be recalled, i.e. climate, geology, relief, hours of sunshine and all the factors particular to the geographical location of the estates but also the viticultural techniques employed: while a Cabernet sauvignon, a grape variety widely used in the Bordeaux region, and a Gamay, mainly used in the Beaujolais region, have very different tastes, a Cabernet sauvignon will not create the same wine when planted in the south of France as in Chile.

The function of revealing varietal aromas is thus essential in yeast. It releases enzymes into the fermenting wine that render aromatic compounds that were blocked by the grape molecules volatile – and thus odorous.

The challenge faced by oenology was to select the yeasts the most able to ensure this revelation of aromas present in the grape varieties and conditioned by the terroir effect. Oenology today has been able to identify a multitude of yeasts in order to respond to the diversity of local lands and to ensure

better control of this tool. For that matter, it should be noted that yeast can produce so called “fermentative” aromas in variable quantities depending on the strains and particular fermentation conditions. These aromas, identified with amyl notes of certain types of wines (“fruit drop” or “banana” for example) can be sought after or on the contrary, avoided. This choice can be guided thanks to the natural diversity of yeast strains.

Today, The majority of wines throughout the world are vinified with yeasts selected by oenologists.

It should also be noted that the use of oenological products in vinification, and more particularly yeasts and bacteria, has allowed wines to maintain a certain degree of sustainability in terms of taste across different vintages. Before, when the stages of vinification were not domesticated, the composition of yeasts and bacteria present on the grapes could often change from one year to the next, sometimes with disastrous consequences for the wine (unpleasant taste, instability). With the advent of contemporary oenology, winemakers can ensure that only beneficial yeasts and bacteria are available during vinification.

... — **Oenology, hygiene, health and wine storage**

**CASE STUDY:
THE EXAMPLE OF SAUVIGNON**

Sauvignon is known to be a particularly aromatic grape variety. It is present extensively in French, American, South African, Australian and New Zealand vineyards. It encompasses a number of aromas: citrus, exotic fruit, cherry or boxwood bud aromas.

It is the analysis of sauvignon must during the 1990's and the identification of a yeast strain that has a particular affinity with sauvignon that paved the way for yeast stains that reveal varietal aromas.

When applied to other grape varieties, a sauvignon yeast will not reveal their aromas, much less reveal aromas that are not found in sauvignon. In a sauvignon grape variety, the sauvignon yeast will only reveal the aromas that are there... i.e. those that the grape variety is capable of producing on a given land.

The positive role of drinking a moderate amount of red wine for preventing cardiovascular disease has been extensively documented: It is linked to the potentially beneficial action of the polyphenols naturally contained in red wine tannins.

Their role as a natural antioxidant contributes towards preventing cancer, inflammatory, cardiovascular and neurodegenerative diseases, to the extent that it has attracted the attention of pharmaceutical companies that use them as additives.

Contemporary oenology also guarantees perfect wine hygiene. In the past, badly controlled phases of alcoholic or malolactic fermentation could produce potentially detrimental secondary compounds, such as biogenic amines or ethyl carbamates. As for storage or maturing phases, these could promote the proliferation of micro organisms that deteriorated the wine and affected its quality.

THE ROLE OF SULPHITES

It is now common knowledge that sulphites play an essential role in good wine hygiene: They are instrumental for controlling fermentations and wine storage, and for limiting the development of undesirable micro organisms. Today, even the majority of organic wines contain sulphites.



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Romans were aware of the role played by sulphites in wine storage, using runoff water from Mount Vesuvius, naturally rich in sulphur, to clean the amphorae designed to hold wine. It was not until the 17th century and the arrival of the Dutch merchants that sulphites were properly used for disinfecting barrels and ensuring wine storage and aging.

It was the discovery of microbiology that allowed the role played by sulphites in wine hygiene to be understood. Today, their usage is controlled, regulated and more restricted than before, thanks to both better dosage practices and improved general domestication. While sulphites are today currently still used before and after must fermentation and again at bottling, amounts are small and only come close to maximum authorised values during bad years, when the oenologist faces particularly adverse weather conditions (exceptionally heavy rain, lack of sunshine, early cold spells)! As an example, wet summers promote cryptogamic disease in vines such as *Botrytis cinerea* (grey rot), mildew or oidium. These parasites foster the development of micro organisms on the grape berry that damage wine quality (acetic acid bacteria, for example, that transform the wine into vinegar).

To stop these negative elements from appearing in the cellar, appropriate sulphite addition is essential to safeguard the quality of the vintage. Finally, it should be noted that yeasts naturally produce sulphites during their fermentation metabolism.

THE CONTRIBUTION OF BACTERIA AND ENZYMES

Major oenology specialists are today working on reducing the quantities of sulphites used in wine by implementing other methods for controlling wine hygiene.

Increasingly detailed knowledge of the role played by yeasts and bacteria in vinification constitutes a fundamental line of work as the oenologist is now in a position to use them to contribute towards wine hygiene and to reduce sulphite addition.

Other means also used to restrict the use of sulphites include protection against oxidation, use of tannins or lysozymes derived from egg white.

CASE STUDY: EGG WHITE, ALBUMIN AND LYSOZYME

Using egg white to stabilise wine after fermentation is a method used commonly since the Middle Ages, and which has proved to be essential: egg white, a readily available product, clarifies the wine and removes certain impurities. It does however raise a certain number of hygiene issues, as it is difficult to keep eggs fresh.

This contradiction was only raised in the 20th century with the identification of the egg white components that enable clarification: albumin and lysozyme.

These components are now used directly and can provide assistance at all stages of vinification.

The development of contemporary oenology has not only contributed to improving vinification hygiene and domestication. It has also helped improve overall wine quality by giving small producers access to oenological tools and techniques that were for too long restricted to the Grands Crus!

In this respect, it is important to recall the slow qualitative transformation experienced by European wine throughout the 20th century and more particularly the leap forward taken by the winemaking industry since the 1970's. The development of contemporary oenology and the evolution of consumer demands have put an end to poor quality wine and a certain level of quality is now available to all.

An especially revealing example is the case of oak barrels in which great Bordeaux wines are matured: discovered at the end of the Middle Ages to facilitate transport, they are today recognised throughout the world for their ability to confer wines with vanilla or toasted aromas, and for improving tannin richness.

Their high price does however prevent them from being brought into general use, to the extent that only 2% of the world's wine production is matured in oak barrels and at prices that make them inaccessible to most consumers

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— Traceability, quality and transparency

(a 225 litre French oak barrel costs around 600 Euros!). Modern oenology has developed woods for oenology. Derived from cooperage savoir-faire (heated using the same method as for barrels), these woods come from the same oak species and winemakers can now apply the aromatic complexity of wood maturing to all types of wines.

Since the beginning of the 20th century, oenology has been the subject of strict regulations, to ensure quality and traceability of wines and oenological procedures, both on a national and international level.

As early as 1924, wine producing and consuming countries joined forces to create the International Wine Office. Its heir, the International Organisation of Vine and Wine (OIV) today groups together governmental experts from 44 producer and consumer member countries who work to define and issue rules for good oenological practices throughout the world.

In France, the INAO (National Institute of Designation of Origin) was established in 1935 to ensure the protection and respect of 'designation of origin' wines (AOC), their characteristics and their link to their land.

Today, fewer than 60 oenological practices are authorised in Europe, to protect know-how and authenticity of wines. No other beverage or foodstuff can lay claim to such a strict set of specific regulations in regards to its means of production.

**CONTEMPORARY
OENOLOGY ALSO
GUARANTEES
PERFECT WINE
HYGIENE.**

Edited by



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Oenological Products
and Practices

International Association

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