



Oxygen

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'You begin to kiss me as though you are getting oxygen out of each kiss'. Vytautas Pliura. (1951–2011) Lithuanian/American poet.

Oxygen means different things to different people. To the chemist oxygen is a chemical element, a member of the chalcogen group, which readily forms oxides with most elements. It is the third-most abundant element in the universe and the name oxygen was coined by Antoine Lavoisier in 1777.

Until very recently it was believed that all living creatures required oxygen to survive but Yaholomi et al. [1] claim to have isolated a species that does not require oxygen. Perhaps, like Einstein's discovery of the elasticity of time, our ideas of the necessity of oxygen may need to change.

Whatever about unicellular organisms it is clear that humans require a constant supply of oxygen. For those of us engaged in haemopoietic cell transplantation (HCT), one of the most feared complications is respiratory difficulties in recipients of HCT. Prior to the successful prevention and treatment of cytomegalovirus (CMV) pneumonitis this complication was dreaded by HCT physicians as the outcome was universally poor. However, with the development of CMV testing prior to and after HCT, the use of ganciclovir, valganciclovir, foscarnet and letermovir [2] have proved to be effective at preventing CMV disease [3] and these are the three most commonly used drugs in the treatment of CMV disease. The role of immunoglobulin remains unproven.

However, even with the development of new diagnostic tests and therapies, the prognosis for patients experiencing respiratory failure following HCT remains poor [4, 5]. The aetiology remains unclear in many cases and may be multifactorial. In spite of expert ICU care and aggressive diagnostic procedures many patients succumb.

The advent of a world-wide pandemic of COVID-19 infection has added another problem to HCT doctors although clinical studies are underway to evaluate the use of mesenchymal stem cell therapy [6] and vaccines are being pursued. Studies are also underway exploring anti-HIV drugs for the treatment of serious coronavirus infections. IL-6 inhibitors are being investigated.

Oxygen in Ireland has a completely different meaning to young people. Oxygen was the biggest annual music festival in Ireland since 2004 and has apparently also been called the best European festival (Fig. 1). It was purported to have a carbon footprint of zero. I don't understand this unless everybody attending went by bicycle or walked and did not consume any alcohol or drugs. Unlikely but possible.

The interaction between wine and oxygen is complex. O₂ can be a friend or foe of the winemaker. With apologies to those who understand biochemistry, oxygenation is the addition of O₂ to a solution and oxidation is the chemical combination of O₂ with another atom (or the removal of electrons from an atom). O₂ is important from the beginning of vine growing to the making of wine. By using the energy of sunlight, vines can convert carbon dioxide and water into carbohydrates and oxygen in a process called photosynthesis. Photosynthesis takes place in the leaves of the vine.

The role of O₂ in winemaking happens in two different ways at two different stages: Early on it allows the yeast to grow successfully, and later on, it allows the wine to develop and mature during the aging process. Yeast cells (on the grape skin) need to be healthy during fermentation but the high levels of sugar when the grapes are first crushed may be toxic. Yeasts can produce Hydrogen Sulfide (H₂S) which masks the fruit flavours in the wine and makes it appear harsh.

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Fig. 1 A large crowd of young people at an outdoor rock concert. Oxygen Rock concert, Ireland.



Fig. 2 Wine is poured through the device to allow it to mix with oxygen. Vin-Aire used for aeration of red wine before drinking.

O₂ added to the fermenting must (freshly crushed grape juice that contains the skins, seeds, and stems of the fruit) helps to limit the harmful effects of H₂S by raising the 'redox potential' of the wine (balance between H₂S and available O₂). O₂ can also help to stabilise the colour in red wine and to make tannins more rounded. It is up to the winemaker to decide which technique of adding O₂ to use to integrate into the vineyard's fermentation process. The level of free H₂S in a wine or must does not keep a wine from

taking up O₂ but helps to deal with the potentially negative secondary effects (eg. browning and microbial contamination). O₂ can also be quite useful in both rosé and white winemaking. The amount of O₂ added however is much less than in making red wine.

Micro-oxygenation, developed in 1991 by Patrick DuCornau, is the addition of O₂ into red wine in a controlled manner. The process normally occurs in multiple treatments that can either be one or two treatments during the early stages of fermentation or more prolonged treatment during the maturation period that can last for 4–8 months. This technique is favoured by large producers, sometimes combined with oak chips [7] but not used much by small producers because of the high cost of the equipment (personal communication from Leon Femfert, Fattoria Nittardi, Tuscany, Italy).

The aeration of red wine is something I practise regularly. I pour my red wine into a decanter via an aeration device (I use a device called Vin-Aire, Fig. 2, but there are many others). I rinse the bottle and then pour the wine through a filter back into the bottle 2–3 h before serving. When a wine waiter in a restaurant says: *I'll pull the cork and let the wine breath for a few minutes*, you know he/she doesn't know what they are talking about.

So, O₂ can be good or bad: from the cause of retrolental fibroplasia in premature infants to winemaking. Thankfully the vagaries of O₂ and winemaking don't concern most wine drinkers.

Compliance with ethical standards

Conflict of interest The author declares that he has no conflict of interest.

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