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Conducting wine symphonics with the aid of synthetic yeast genomics

A perfectly balanced wine can be said to create a symphony in the mouth. To achieve the sublime, both in wine and music, requires imagination and skilled orchestration of artistic craftsmanship. For wine, inventiveness starts in the vineyard. Similar to a composer of music, the grapegrower produces grapes through a multitude of specifications to achieve a quality result. Different *Vitis vinifera* grape varieties allow the creation of wine of different genres. Akin to a conductor of music, the winemaker decides what genre to create and considers resources required to realize the grape's potential. A primary consideration is the yeast: inoculate the grape juice or leave it 'wild'; which specific or combined *Saccharomyces* strain(s) should be used; or proceed with a non-*Saccharomyces* species? Whilst the various *Saccharomyces* and non-*Saccharomyces* yeasts perform their role during fermentation, the performance is not over until the 'fat lady' (*S. cerevisiae*) has sung (i.e. the grape sugar has been fermented to specified dryness and alcoholic fermentation is complete). Is the wine harmonious or discordant? Will the consumer demand an encore and make a repeat purchase? Understanding consumer needs lets winemakers orchestrate different symphonies (i.e. wine styles) using single- or multi-species ferments. Some consumers will choose the sounds of a philharmonic orchestra comprising a great range of diverse instrumentalists (as is the case with wine created from spontaneous fermentation); some will prefer to listen to a smaller ensemble (analogous to wine produced by a selected group of non-*Saccharomyces* and *Saccharomyces* yeast); and others will favour the well-known and reliable superstar soprano (i.e. *S. cerevisiae*). But what if a digital music synthesizer—such as a synthetic yeast—becomes available that can produce any music genre with the purest of sounds by the touch of a few buttons? Will synthesizers spoil the character of the music and lead to the loss of the much-lauded romantic mystique? Or will music synthesizers support composers and conductors to create novel compositions and even higher quality performances that will thrill audiences? This article explores these and other relevant questions in the context of winemaking and the role that yeast and its genomics play in the betterment of wine quality.

Biography

Isak Pretorius is working as the Deputy Vice Chancellor and Vice President (Research) at Macquarie University in Sydney. He is internationally recognized as a pioneer in synthetic yeast genomics and wine biotechnology, and the translation of research outcomes to industry. He has published more than 200 peer-reviewed research papers and book chapters (current Scopus H-index of 47) and presented at more than 600 conferences (many as Invited Keynote Speaker) and research seminars. He has won many research grants (more than \$90 million) and awards, and filed six patents. Over the past three decades, he has supervised or co-supervised 33 PhD students and 56 MSc students. Currently, he leads the Australian team as part of the international Synthetic Yeast Genome (Yeast 2.0) project.

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