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SPECIAL ISSUE ARTICLE

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A portrait of budding yeasts: A symbol of the arts, sciences and a whole greater than the sum of its parts

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1 | INTRODUCTION

In the year 1660, 13-year-old Maria Sibylla Merian roamed the gardens and countryside of Germany taking detailed notes about caterpillars, moths, butterflies and their interactions with host plants, accompanying her notes were elaborate multimedia depictions of insect and plant life cycles (Figure 1). Merian's efforts in documenting interspecies relationships are regarded as early contributions to modern natural history and ecology, although the term 'ecology' was coined approximately two centuries later (Etheridge, 2011a, 2011b; Pieters & Winthagen, 1999). Her influence can be seen in the work of naturalists such as John James Audubon (Etheridge, 2015; Palmeri, 2017). Merian's success in part stems from her ability to use art to bolster her science and vice versa.

Merian is one of many scientists and artists who blended the arts and sciences over the centuries. In fact, scientist–artist polymaths like Aristotle and Leonardo da Vinci were more commonplace in part because of the common goal science and art share: interpreting and representing the natural world. The 'great divide' of the arts and sciences in Western cultures is thought to have started in the 19th century, coinciding with the term 'scientist' being coined (Braund & Reiss, 2019; Sumner, 1959; Zhu & Goyal, 2019). The division became reinforced. Schools for arts and sciences were separated as unfounded claims about brain differentiation formulated (Zhu & Goyal, 2019). For example, the right and left brain hemispheres were thought to be individually responsible for arts and science learning, respectively (Sperry, 1968). However, evidence from cognitive scientists favours a holistic view of the brain wherein a wide range of stimulation (e.g., arts and sciences) improves broad brain function and critical thinking skills (Braund & Reiss, 2019; Howes, Kaneva, Swanson, & Williams, 2013).

Today, the benefits of a holistic view of the arts and the sciences have been recognized by numerous institutions. For example, Science, Technology, Engineering, Arts and Mathematics (STEAM) inspired curriculum is used to help students build skills for broad problem solving in K–12 schools (Kim & Park, 2012; Peppler, 2013; Sochacka, Guyotte, & Walther, 2016). In higher education, artists, designers, researchers and inventors have formed forward-thinking coalitions such as the Center for Art, Science & Technology at Massachusetts Institute of Technology (https://arts.mit.edu/cast/) and ArtLab at Vanderbilt University (https://artlabvanderbilt.com/) to reunite the arts and sciences. These initiatives and many others have used the arts as an effective form of communication between scientists and the broader community (Illingworth, 2017), ultimately helping disseminate major scientific findings across society.

Perhaps one of the most important and recent scientific findings in the field of biological sciences is our understanding of the cellular life cycle. Seminal discoveries that unraveled the controls of the life cycle were made studying the model unipolar budding yeast *Saccharomyces cerevisiae* (Hartwell, Culotti, Pringle, & Reid, 1974). Comparative studies of *S. cerevisiae*, the fission yeast (*Schizosaccharomyces pombe*) and animals revealed striking similarities suggesting the life cycle is evolutionarily stable (Breeden & Nasmyth, 1987). Exploiting these similarities has enabled yeasts to be powerful models for cancer biology research and the development of anticancer therapeutics (Gao, Chen, & Huang, 2014; Guaragnella et al., 2014; Schwartz & Dickson, 2009). However, examination of non-conventional yeasts and their life cycles can provide novel insights important to the fields of cell biology, evolutionary biology and more. For example, species of the budding yeast genus *Hanseniaspora* have lost numerous cell cycle control genes, including *MAD1*, *MAD2* and *RAD9*, and components of the Anaphase Promoting Complex and display atypical bipolar budding patterns (Steenwyk

FIGURE 1 A watercolor depiction of a caterpillar, chrysalis and butterfly on an Indian pepper plant from 'Merian's Metaphorphosis insectorum surinamensium.' Image is available from the Wikimedia Commons as part of the public domain [Colour figure can be viewed at wileyonlinelibrary.com]

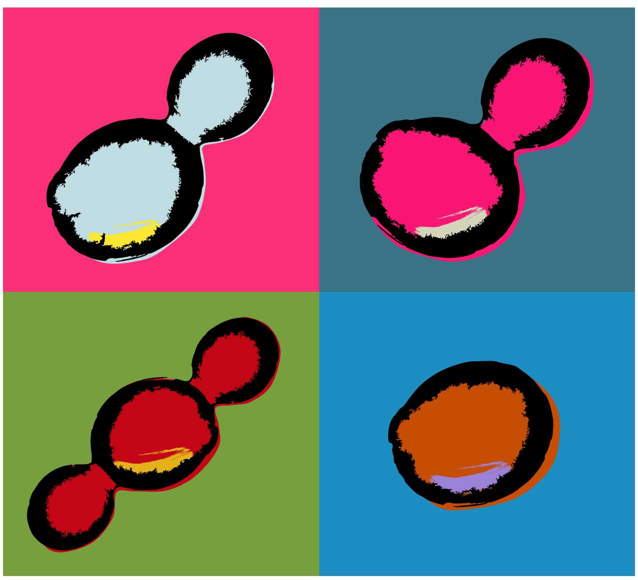

FIGURE 2 Andy Warhol-like portrait of budding yeasts by Jacob L. Steenwyk (https://jlsteenwyk.com/arts.html)

et al., 2019). These observations call into question the evolutionary stability of the yeast life cycle and suggest a treasure trove of novelties await discovery.

This special issue of *Yeast*, 'Exploring the yeast life cycles,' features original research and review articles detailing insights from studying the diversity of yeast life cycles. However, this issue goes beyond science. Similar to Merian's use of science and art to depict insect life cycles using visual art, this issue incorporates art to celebrate the yeast life cycle. Specifically, the cover image is of an Andy Warhol-like portrait of budding yeasts, which feature different budding patterns and shapes (Figure 2) and acts as a bridge between artists, scientists and the broader community. More specifically, scientists learn about the pop art movement of the mid-1990s and the work of Andy Warhol, while artists learn about how yeasts have served as models for numerous keystone discoveries (Royster, 2020). Efforts that combine the arts and sciences, such as this special issue, demonstrate that the totality of the arts and sciences offers an enriching experience that is greater than the sum of its parts. Future collaborations between the arts and sciences will likely benefit each field as well as foster broader community engagement.

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