

Book Review

Uncorked: The Science of Champagne

by Gérard Liger-Belair (Princeton University Press, 2004) 142 pp., ISBN 0-691-11919-8; \$19.95 hardcover)

A book review by Dennis J. Sardella

When Socrates said that the unexamined life is not worth living, I'm fairly certain that he meant it to apply to much more weighty issues than the bubbles rising in a glass of champagne, the contemplation of which may seem at first blush to be the province of over-privileged people with way too much time on their hands. However, the apparently mundane and trivial can often mask matters of more substance, as is the case with Gérard Liger-Belair's intriguing little book (140 pages, not including references, glossary and contents) on champagne, and specifically on its bubbles, which he has studied intensively for the past several years, since joining the faculty of the Department of Physical Sciences at the University of Reims Champagne- Ardenne.

Many a graduate student (or researcher, come to think of it) has stared moodily or absently at the bubbles rising in a glass of beer (the typical graduate student probably being unable to afford champagne), and perhaps even engaged in the type of philosophico-scientific discussions that late nights, weariness, and fellow-laborers can engender. Most, however, do not have the type of epiphany that launches them on a lifelong research project. Liger-Belair is the exception, and *Uncorked* is in effect a status report on his continuing attempt, not simply to gaze at the bubbles rising gracefully in a flute of champagne, but to develop a physical chemistry research program by turning the scientist's eye (and techniques such as high-speed stroboscopic photography) on the process of bubble creation and growth, the kinetics and hydrodynamics of ascension, formation of bubble rafts, bubble bursting, with the goal of not simply appreciating the aesthetics of champagne, but of understanding the basic physics and chemistry. Adam Gopnik in his book of essays, *Paris To The Moon*, said "I looked for the large in the small, the macro in the micro, the figure in the carpet, and if some big truths passed by, I hope some significant small ones got caught." The results, described here for the general reader are an elaboration of Liger- Belair's 2003 *Scientific American* article, "The Science of Bubbly."

Liger-Belair begins with two chapters devoted to a brief historical overview of the discovery and development of champagne, reaching back in time beyond the famed monk Dom Pérignon, whose exclamation to his fellow monks about champagne's effervescence ("Brothers, I am drinking stars!") is often mistakenly taken to mark the wine's discovery (Pérignon was, apparently, not the discoverer of champagne, but a refiner of technique for its production – an achievement worthy enough in itself, since it launched an industry and assured the perpetuation of Dom Pérignon's name).

The science portion of *Uncorked* begins with a description of the nucleation process and Liger-Belair's rather surprising discovery that the nucleation sites are not the irregularities in the surface of the champagne flute, as most chemists would probably have guessed, but small bits of extraneous fiber with air trapped inside (illustrated nicely by several photos chronicling the time-evolution of bubble formation), meaning that bubbles will not form in a scrupulously cleaned champagne flute.

The next chapter covers experimental studies of the growth of bubbles and particularly the role of surfactants in controlling bubble growth and their rate of ascension. Liger-Belair also discusses the difference in the behavior between champagne and beer, with its higher content of both surfactants and dissolved gas. I could not help recalling a remark from an Alsatian colleague in Strasbourg, who said whimsically that "Here you are standing at the border of two great cultures, the beer-drinking culture and the wine-drinking culture." Apparently the difference between those cultures is not simply sociological, but physico-chemical as well!

The book's longest chapter deals with the bursting of bubbles and includes some rather impressive and aesthetically appealing photos of the actual bursting process and the subsequent jet of liquid expelled from the surface of the wine, which give it its characteristic fizziness and bouquet.

Liger-Belair concludes with a brief look into the future, speculating on the potential influence that global warming may have on the champagne industry, including the possibility that the center of production could conceivably shift from a too-warm France to Britain – yet another Anglo-Saxon assault on Gallic culture.

Uncorked, with only 142 pages of text (double-spaced), of which approximately 40 are photos or diagrams, can fairly be described as a slender volume, and the work described in it might at first glance look like something that would qualify for one of Senator William Proxmire's infamous "Golden Fleece" awards. However, to anyone who goes beyond the pictorial, it is clear that there is scientific substance to complement the aesthetic appeal of the photos, and that Liger-Belair's work is in fact real science. The text includes references to critical radii for bubble formation, Henry's Law,

intermolecular forces, surfactants, fluid dynamics and numerous other concepts that I had discussed not long before in my freshman chemistry course. While He eschews detailed discussions of the theory, readers with an appetite for the technical who consult any of the original papers listed in the bibliography (many of them in journals such as *Langmuir* and *Physical Review*) will find mathematics and scientific sophistication aplenty. For those content simply to find another level on which to appreciate the taste, sight and sound of a glass of good champagne, or to simply enjoy just looking at the pictures, *Uncorked* offers an enjoyable and informative read. Proxmire might have hated it, but I think that Don Ho would have loved it.