FOOD

Of Bubbles, Landscapes, and Vines

Stuart West

Wine enriches our lives, mixing perfectly with food, friends, and social occasions. That it also mixes well with science is shown by two recent books that explore how our understanding and appreciation of wine can be improved by considerations of physics and geology.

Uncorked: The Science of Champagne
by Gérard Liger-Belair
Princeton University Press, Princeton, NJ, 2004. 158 pp. $19.95, £12.95. ISBN 0-691-11919-8.

Great Wine Terroirs
by Jacques Fanet, translated by Florence Brutton
University of California Press, Berkeley, CA, 2004. 240 pp. $39.95, £26.95. ISBN 0-520-23858-3.

Champagne is a special wine. Dom Pérignon realized this with his first glass, calling to his fellow monks, "Come quickly, brothers, I am tasting stars!" However, the bubbles that caused this exclamation don't just make champagne, they save it. Still wine from the champagne region is thin and acid, and it is with good reason it doesn't appear on wineshop shelves. It is the bubbles that transform it into something sublime.

Uncorked: The Science of Champagne is about the physics of these bubbles. Gérard Liger-Belair (a physical chemist at the University of Reims Champagne-Ardenne) provides a highly entertaining introduction to the science of champagne bubbles that can be read in a couple of hours. After describing the history and methods of champagne production, he devotes most of the book to explaining how bubbles form and what happens when they do. He bursts the conventional wisdom that bubbles form on impurities in glass, and he shows how they are instead born out of debris stuck on the glass wall.

But it is after the bubbles form that the exciting things begin to happen. The bubbles "kiss and tumble" their way to the top of the glass, where they form galaxies (two-dimensional vortices) or bubble flowers before exploding and sending a concentrated burst of aromatic compounds toward the drinker. The author's account includes numerous asides, such as why one should not wear lipstick or eat chips when drinking champagne (fatty molecules deflate bubbles) and the suggestion that the best planet on which to drink champagne would be Jupiter (its high gravity would lead to smaller bubbles).

Uncorked is very readable, and Liger-Belair's clear and simple descriptions of the physics are superbly suitable for a general audience. The book is also very aesthetically pleasing, making it an ideal present for wine lovers and bores alike. Central to this success is a fine collection of photographs and illustrations (often from the author's own research) that depict the processes described. Many of these images were taken with high-speed photography, which reveals the surprising beauty that exists in the life of bubbles.

However, while the book brings bubbles to life, Liger-Belair doesn't explain why champagne is unique. What is it that makes devotees extol the delights of champagne to the detriment of other sparkling wines, even when those are made with the same grape varieties? The answer to this question is terroir, the elusively defined French term for the combination of factors that define the characteristics of a wine-growing area.

In *Great Wine Terroirs*, a translation of *Les Grands Terroirs du Vin* (Hachette Pratique, Paris, 2001), Jacques Fanet (a former assistant director of France's National Institute of Appellations) explains how the characteristics of wine regions have been formed over the last 200 million years. His aim is to link the wine that comes from an area with the geological processes that have shaped its landscape. The main part of the book moves through the various broad types of terroir, describing the intricacies of the related growing areas and their associated grape varieties. Fanet discusses some 70 terroirs, arranging them according to their geologic setting: the edge of faults (e.g., Alsace), sedimentary basins (Champagne), Quaternary terraces (Pomerol), ancient basement (Coonawarra), foothills of mountains (Napa), and volcanic terrain (Tokaj).

Fanet has packed a lot of information into the book, which will reward multiple readings. He does an excellent job conjuring up how the landscapes have been formed and the implications for wine production. Some of the points he makes are quite general—for example, the importance of Mesozoic marine deposits in France and how rivers provide not only irrigation and transport but also erosion that leads to high-quality terroirs such as stony terraces. But he also goes into such details as how the pinot noir grand crus of Burgundy are located on the stoniest, most limestone soils and the factors that produce differences among these grand crus.

Fanet's book contains an impressive collection of color maps, diagrams, and photographs that help bring the terroirs to life. These are important, because in places the text is quite dense, with lots of jargon, and thus difficult to follow. The strong bias in the geographic coverage is understandable, as hundreds of years of trial and error have revealed the details of French terroirs. There are, however, important omissions (such as Marlborough with its prize-winning sauvignon blancs) and imbalances in the space allotted to other European areas (for example, the rieslings of Alsace receive twice the space of those of Germany).

Vines on the rocks. Most Châteauneuf-du-Pape vineyards are established on the Quaternary terraces of rounded, polished cobbles deposited by the Rhône River.

Although Fanet provides a wealth of geological information on how the different terroirs are formed, he is less clear in explaining how the different terroirs lead to different wines. For example, what links the gravel terraces of the Gironde with the terra rossa of the Coonawarra in their ability to produce cabernet sauvignon that lacks its characteristic vegetal aroma? Or why does *Botrytis* mold develop differently on vines grown on Carboniferous terrains, Brioverian schists,

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or Saint-Georges schists, and what are the consequences for the resultant wine? It isn't clear whether such details are gaps in our knowledge or gaps in the book's coverage. Consequently, one might gain the maximum benefit from the book by reading it alongside an existing wine encyclopedia or atlas.

Overall, *Great Wine Terroirs* left me wanting to travel to the areas Fanet describes, to use it as a guidebook while matching the wines and terroirs in person. In contrast, reading *Uncorked* gave me more reasons to crave champagne. Both books also have the potential to show nonscientists that scientific principles apply even to the simple pleasures of life.

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BIOMEDICINE

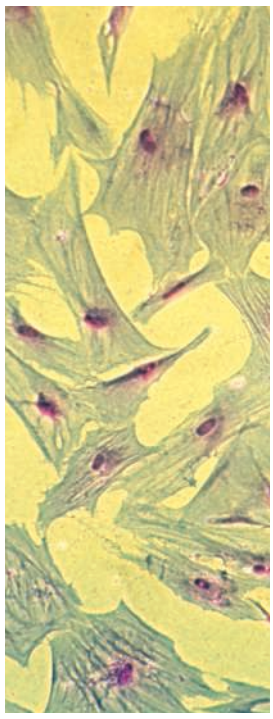
Cell Senescence in the Dock

Steven N. Austad

Normal human cells can divide in vitro only a limited number of times before permanently arresting their replication. This finding was huge news when first reported in 1961, because it overturned entrenched conventional wisdom that cells freed of the body could divide indefinitely in a dish. In early studies, these cells also died soon after ceasing replication, so the phenomenon came to be termed cellular senescence—in obvious parallel with the state of human senescence from which death shortly follows. Subsequent studies supported this interpretation by noting that cells harvested from older people reached "senescence" after fewer cell divisions than cells from younger people. A more precise parallel with aging was expressed by Leonard Hayflick, discoverer of cellular senescence, when he surmised that the "finite lifetime of normal cells constitute[s] a programmed mechanism that sets an overall limit on an organism's length of life" (*1*).

Cells, Aging, and Human Disease
by Michael B. Fossel
Oxford University Press, New York, 2004. 503 pp. $69.95, £43. ISBN 0-19-514035-4.

Over the next several decades, Hayflick's finding led to hosts of exciting discoveries about the complex web of molecular control over cell proliferation and its arrest, the role of telomere length in those processes, the enzyme telomerase, and a variety of cell cycle proteins. Even so, researchers studying senescence in whole animals rather than isolated cells grew dubious about the straightforward relationship between proliferative arrest and organismic senescence. Among the reasons for their doubt were that so many of the degenerative changes of later life occurred in cells such as neurons or cardiomyocytes (both of which replicate rarely or never in adulthood) and that people seem to die much more often because their cells replicate when they shouldn't (as in cancer) rather than cells not replicating when they should. Even those who initially embraced the equation of in vitro replicative cessation with senescence grew more guarded in their claims as it became evident that so-called senescent cells if properly cultured did not die but could live for years and that such cells were very rare even among those taken from the very elderly.



After arrest. The cells in this culture, which have been genetically engineered to age rapidly, are in a late phase of their life and no longer divide to produce new cells.

Given these developments, Michael Fossel is something of a throwback. *Cells, Aging, and Human Disease*, like an earlier trade book of his (*2*), shows him to be a proud true believer. He holds that cellular senescence underlies virtually every aspect of human senescence and that the appropriate activation of telomerase, which prevents senescence in human cells, will necessarily ameliorate or cure most problems that plague us as we age. The gist of Fossel's argument is that even though senescent cells are rare, they can—because of their loss of replicative ability and altered function—have far-reaching effects on their cellular neighbors, deleterious effects that cascade until a whole tissue or organ is compromised. As to the issue that some of the most serious maladies of aging humans affect primarily nondividing cells, he feels the underlying problem can still be traced to other, dividing cells such as support cells or cells that line nearby blood vessels. After introductory chapters on recent advances in aging research and mechanisms of cellular senescence, he provides a lengthy chapter devoted to the surmised impact of cellular senescence on cancer and a series of 10 short chapters that consider the pathology of aging skin, muscle, kidneys, eyes, and a host of bodily systems (cardiovascular, immune, etc.).

So how convincing are Fossel's arguments? "Arguments" is the operative word here, as the book makes no pretense of being a scientific review, which carefully sifts and interprets a corpus of evidence. It is instead a polemic, argued in the spirit if not the style of a legal document. Studies are selectively introduced to make a point: the ubiquitous influence of cellular senescence in aging. For a disease like cancer or a function (such as the immune system) in which robust cell division is self-evidently involved, the evidence Fossel adduces is compelling. Nearly everyone would agree that cellular senescence (by providing a telomere-based brake on cell division) acts as a potent antitumor mechanism. Cellular senescence's role in tumor suppression likely underlies the evolution of its mechanisms (*3*). By contrast, his case for interpreting Alzheimer's disease as a result of senescing cells requires a procrustean effort to force an unruly literature into a predetermined box that most researchers in the field would not recognize.

The book's target audience is not clear. The technical language, with a whole alphabet soup of gene names, suggests a work aimed at specialists in cellular and molecular biology. Nonspecialists will certainly find the book heavy going. However, Fossel (a clinical professor of medicine at Michigan State University) is not himself a researcher in the field but an enthusiastic and energetic spectator, and his grasp of the literature is broad rather than deep. This leads to an idiosyncratic, occasionally inaccurate, overview of current research in aging subdisciplines not directly related to cellular senescence. It is also reflected in his habit of invoking roles for telomeres or telomerase on the flimsiest pretext.

Readers interested in an account that places cellular senescence at the epicenter of human aging and assembles as much evidence as possible to support that view will find a great deal to satisfy them in *Cells, Aging, and Human Disease*. Those seeking a more general and balanced overview of recent progress in aging research should look elsewhere.

References
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