

Foreword to the edited volume *Life Science Management*

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We are living in an age of biology. As commentators often point out, when one walks around university campuses, a usual sight is that of biomedical start-up companies. Fifty years ago, such ventures were mostly in electronics and the burgeoning field of computer engineering. Indeed, nowadays, many funded projects in electrical or mechanical engineering departments have an overtly biomedical character. Economically, the overall life sciences industry, generally thought of as encompassing the biotechnology, medical technology and pharmaceutical domains, has a vast footprint. Just as an indication, mergers and acquisitions in this sector amounted to US\$306 billion in 2019, US\$159 billion in the pandemic year of 2020 and US\$219 billion in 2021 (*Ernst & Young M&A Firepower report*, 2022).

This volume, edited by Avo Schönbohm, Henning von Horsten and Philipp Plugmann presents an excellent primer on the various aspects related to managing a life sciences enterprise that is up-to-date and also diverse in its topics and perspectives. It covers, amongst other topics, the use of artificial intelligence tools in healthcare management, the issue of patents, what makes life sciences a special field, securing funding for a burgeoning start-up, hospitals of the future and the interesting concept of a ‘ludic’ leadership framework. As such, the volume is especially well-suited as a starting ground for anyone wishing to read a timely account of current concerns, trends and challenges in the field. In this foreword, I will briefly highlight a few additional viewpoints that may help to further contextualize the book’s scope and focus.

In the post-pandemic world, certain trends apply to any type of business activity, whereas others are specific to the life sciences. One of the major threats specifically facing biomedicine is that of antimicrobial resistance. Noncommunicable diseases also pose unique challenges. A report in 2011 by the World Economic Forum and the Harvard School of Public Health estimated that this category of diseases will cumulatively cost more than US\$30 trillion by 2030 (Bloom *et al.*, 2011). These and other challenges are part of the reason why life sciences companies are emphasizing innovation and transformation by promoting positions such as ‘chief transformation officers’ or ‘chief innovation officers’.

Also in demand are roles such as ‘chief digital officers’. The growth of digital medicine and ‘personalization’ in healthcare is continuing at a rapid pace. Consider, for instance, that whereas there were approximately 8 billion Internet of things (IoT) devices in 2019, this number is estimated to be more than 41 billion by 2027 (Newman, *Business Insider* 2020). For better or worse, the ‘dyad’ of person–device is a reality for the foreseeable future. Importantly, however, what really underlines the special nature of the life sciences industry is that what is at stake is human health and well-being.

Indeed, upon the commercialization of an idea, a biotech/medtech entrepreneur should think carefully about what the ultimate aim is, really. This may sound naive, but it is crucial. Is the goal primarily economics *through* science and health? Or is it science and health first and then economics? Is the goal growth toward eventual acquisition by bigger entities? Or independent growth and innovation? Honest answers to these and similar questions are required to set one’s (and others’) expectations on the right track. Along these lines, Holden Thorp, editor-in-chief of the journal *Science*, cautions that “for too long, fledgling companies promoting technological and scientific advances have relied too much on style and not enough on substance”; Thorp further asks: “how about companies led by highly accomplished scientists who give dull and boring PowerPoint presentations full of outstanding data?” (*Science* 2022; p. 121). Valuing substance over style is essential not only in the outcome of the enterprise, but also in gaining and maintaining the public’s trust.

Publicly-funded projects have been paramount in many of the major biomedical advances that have been successfully commercialized. Public financing also crucially extends to the later procurement of commercialized products. Moreover, the 'risk' of products and project outcomes that never see the light of day is also heavily borne by the public. As such, not only are companies responsible to their workforce, customers, shareholders and suppliers, but also to their broader community stakeholders and the public at large. A recent survey reports that 72% of consumer respondents value companies' behaviors as importantly as the products they sell (*Ernst & Young Future Consumer Now survey, 2021*). In addition to a competitive and innovation-driven approach, there are ever more reasons to also move towards a more equitable, ethical, socially-responsible and sustainability-conscious management ethos.

Innovations in the life sciences industry do not always have to be high-tech. There are many seemingly 'low-hanging-fruit' yet crucial avenues that remain underexplored. Consider, for example, that despite almost every molecular biology laboratory's reliance on cell cultures, no "universal chemically defined cell culture medium" still exists (van der Valk, *Science* 2022; p. 144). Furthermore, innovative impacts can also be made on a more systems-level basis. To give two examples, Bradley Biggs and colleagues point to the industrial biotechnology sector, i.e. "commercial-scale manufacturing of chemical products by use of cellular or molecular biocatalysts", as requiring a restart (*Science* 2021; p. 1563). Adam Marblestone and colleagues advocate for a type of nonprofit start-up which they call "focused research organizations" that can "take on mid-scale projects that don't get tackled by academia, venture capitalists or government labs" (*Nature* 2022; p. 188).

In closing, in a recent book titled "You Bet Your Life: From Blood Transfusions to Mass Vaccination, the Long and Risky History of Medical Innovation" (2021), Paul Offit writes: "nature reveals its secrets slowly, grudgingly, and often with a human price. Scientists, clinicians, academicians, and pharmaceutical company executives must stay humble and respect the requisite learning curve that comes with new discoveries" (p. 209). In managing a life sciences endeavor, as in any other task that deals with science and nature, patience and humility are demanding yet vital ingredients.

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