Digging the trenches of biological physics

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Maiman at his 7 July press conference, a reproduction of his *Nature* paper, and a list of his scientific papers, patents, awards, prizes, and citations. It is particularly nice to see the photo of the original small ruby laser setup and its holographic reproduction, one of which I was given in Vancouver in 2010.

The Laser Inventor presents a lot of interesting material and captures a piece of the history of science. I recommend it to everyone who wants to learn about the laser's beginnings.

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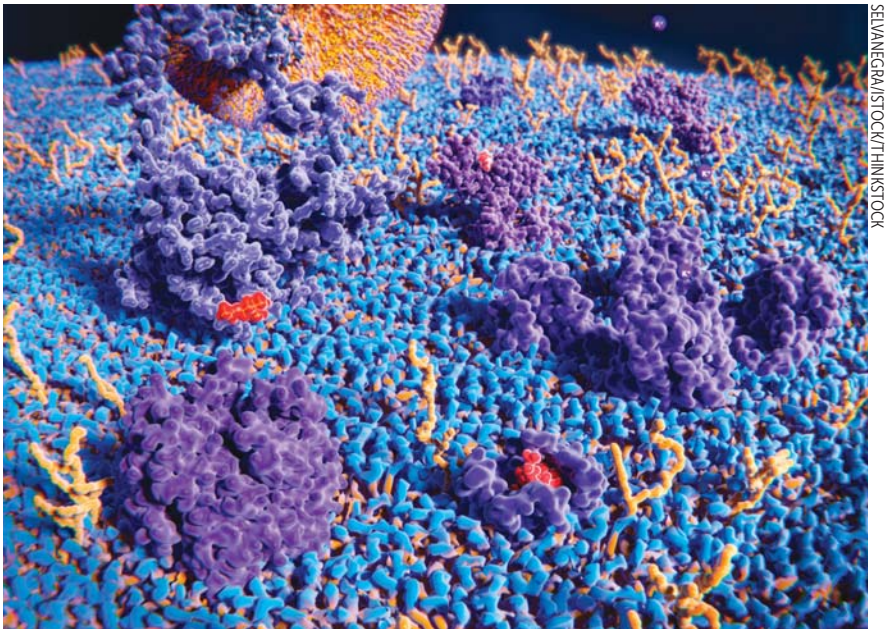

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Digging the trenches of biological physics

As scientists, we dig into and work away at new questions until, ideally, we gain a deeper understanding of them. If you, like me, practice biological physics, you realize that the digging is hardly straightforward: You are constantly detouring to explore more physics and sometimes even biology. Such detours are all the more frustrating because you can see that the landscape ahead of you is scientifically fertile and know how much more your conventional physicist colleagues could and should invest in helping biological physics get there. *Some Critical Questions in Biological Physics: A Guided Tour Around the Bugbears* by Thomas Waigh may be able to persuade more physicists to join us as we dig.

Some Critical Questions in Biological Physics
A Guided Tour Around the Bugbears
Thomas Waigh
IOP, 2017. $159.00

A handful of textbooks provide excellent platforms for undergraduate and graduate teaching in biological physics. *An Introduction to Systems Biology: Design Principles of Biological Circuits* (2006) by Uri Alon is a classic entry point that physicists usually appreciate. In *Physical Biology of the Cell* (2nd edition, 2013), Rob Phillips and his coauthors cover cell biology in the language of soft condensed matter and statistical physics and include

a wealth of useful course material. *Biophysics: Searching for Principles* (2012) by William Bialek gives a sense of how deep physics can go in terms of understanding signal processing in living systems. Philip Nelson's *Physical Models of Living Systems* (2015) is a compelling pitch for the value and meaning of doing physics in the world of life.

Together they showcase the contributions that methods from statistical, nonlinear, and condensed-matter physics can make to biology; often, physical approaches enable new biological questions to be posed and addressed. But valuable as they are, those books are mostly written by theoreticians. As a result of evolutionary complexity, biological modeling necessarily involves experimental data.

Which brings us to Waigh's contribution. *Some Critical Questions in Biological Physics* is a unique book. It is written in a personal, direct, and informal style. You can imagine Waigh pitching the field to prospective graduate students or to his departmental colleagues, or describing what the community has achieved and where it is headed. Waigh's own career and experiences, central to the topics covered in his book, give the text a personal connecting thread. I happened to enjoy that approach, but if you are looking for more unbiased coverage, this may not be the book for you.

Waigh is an experimentalist who has had a successful career using imaging, scattering, spectroscopy, and rheological tools to study biological systems and soft condensed matter. That experience gives him a different point of view from the authors of the textbooks listed above. Instead of gathering our current understanding into a systematic framework, Waigh takes stock of open problems—the "bugbears" of his subtitle. Those bugbears are mostly connected to experimental challenges, and Waigh looks for new tools or experimental designs that might solve them.

The book's structure makes the text very accessible. The 18 main chapters each begin with a roughly 10-page essay that includes introductory and advanced references; the next few pages explain specialized terms and the underlying physics and offer some further references. The topics include molecular motors, cell membranes, the role of physical chemistry, and regulation of gene expression. My favorite chapters are on the 21 types of mucins in a human and the challenges of gene delivery, but I enjoyed most of them.

Don't expect to learn any physics here, nor all the necessary biology to start working on outstanding research problems. The book's value is to highlight, in a clear and straightforward way, a number of frontiers where physicists can join biological physicists to tackle important open biological questions.

Some Critical Questions in Biological Physics should be read by physicists who want to appreciate what biological physics is about and perhaps transition into it. But biological physicists also will find it a pleasure to read—those of us in the field may find ourselves inspired to try to claim one of the lollipops Waigh promises in return for solving his bugbears! The book's main fault is the price: that is the only number that is off by an order of magnitude.

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