

## Biophysical optics in a single voice

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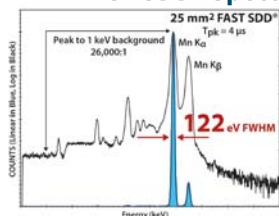
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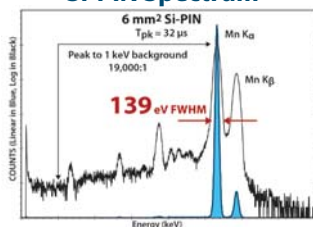
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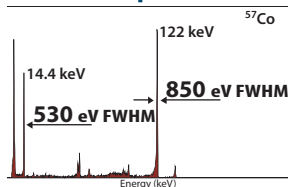
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future direction, she does present important episodes in SETI's history through the lens of Tarter's experience. Those include the launch of second-generation SETI searches with Project Phoenix, in which the Parkes Observatory telescope in Australia and the Robert C. Byrd Green Bank Telescope in West Virginia were used to search millions of frequencies for advanced extraterrestrial signatures. Scoles also discusses Tarter's grandest SETI ambition: the Allen Telescope Array. She doesn't shy away from describing the intricate details of the project and the tumultuous financial and experimental road that finally led to commissioning tests and initial observations in 2007.

Scoles also highlights connections be-

tween SETI's fascinating research and the broader interdisciplinary science of astrobiology. She stresses that we now know that the universe is teeming with potentially life-supporting planets. That truth, she continues, only bolsters Tarter's determination to find other civilizations in the universe.

Jill Tarter's life is now woven into the arc of SETI history and will be reflected on for years to come. Her story reminds us to keep pursuing answers to pivotal scientific questions, regardless of the ideological barriers. Tarter's life's work has made us better prepared to continue the search for extraterrestrial life and better prepared for actual cosmic contact.

Shelley Wright

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## Biophysical optics in a single voice

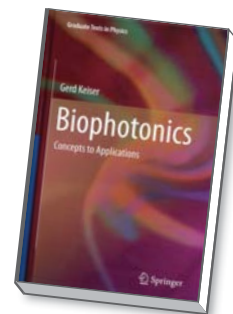
Biophotonics, or biomedical optics, is a rapidly growing interdisciplinary field. Its research encompasses optical imaging, spectroscopy, and therapeutics of biological materials ranging in size from subcellular scales to organ systems. Its applications include cancer detection and diagnosis, noninvasive tissue biopsy, functional brain monitoring, image-guided surgery, light-based therapeutics, and microscopies of many types targeting biomarkers in cells and tissues. *Biophotonics: Concepts to Applications*, a new volume by Gerd Keiser, aims to serve as a course textbook for advanced undergraduate and graduate students and to be a working reference for biomedical and biophysical researchers.

Presently, most books covering biomedical optics are edited volumes with chapters on different topics written by different authors. Comparatively few textbooks have been written in a single voice about the whole field. In my view, we need more single-author books, and I enjoyed working through Keiser's text.

The 11 chapters of *Biophotonics* systematically take the reader from underlying concepts about light, including the basic optical techniques needed for most

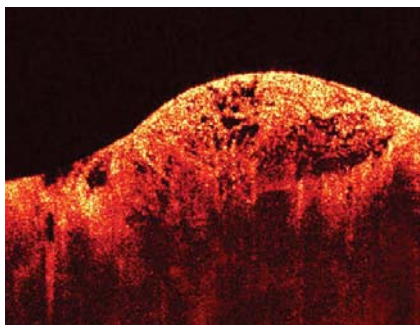
### Biophotonics Concepts to Applications

Gerd Keiser  
Springer, 2016.  
\$99.99



biomedical measurements, to a discussion of light-tissue interactions that carefully builds from basic physics to therapeutics. The early sections set up a series of chapters about increasingly modern advances, including fluorescence spectroscopy, photon correlation spectroscopy, optical coherence tomography and microscopy, linear and nonlinear spectroscopy, interferometry, and optical trapping. In total, the material is covered in less than 350 pages.

Some of the book's sections are more successful than others, which is not surprising given its ambitious scope. I found the three chapters on optical fibers, light sources, and optical detectors to be a strength. These tools are important to the field, and the author guides the reader step-by-step through a



**IMAGE OF A SARCOMA**, or muscle tumor, obtained using optical coherence tomography. (Wikimedia Commons, courtesy of Dr Stephen Boppart, Biophotonics Imaging Laboratory, UIUC.)

plethora of devices of increasing complexity. Light collection and detection methods and signal-to-noise in the detection process are well explained, and the systematic description of light sources (with extensive and useful references) and their characteristic features is excellent.

Throughout, Keiser introduces and explains useful formulas and then cements the discussion by working out sample problems. I found the worked examples to be very helpful. The chapter on light–tissue interactions provides essential results compactly and has an interesting subsection on interaction mechanisms. The remaining chapters teach new material and provide the interested reader with valuable references for further exploration. However, in my view those chapters would have benefited from more extensive discussions of diffuse optical spectroscopy and tomography and of functional near-IR spectroscopy, which are especially important for probing deep tissues such as brain, breast, and muscle.

*Biophotonics* is a good textbook and will undoubtedly be a valuable lecture supplement in an advanced undergraduate or graduate-level course. However, because the text covers so much in so few pages, it sometimes lacks the rigor I prefer. Courses in biomedical optics are challenging to teach because the students typically come from multiple fields and have different scientific and mathematical backgrounds. Therefore, I tend to rely on texts with comprehensive discussions of fewer topics. For example, I have found the recent textbook *Quantitative Biomedical Optics: Theory, Methods,*

*and Applications* by Irving Bigio and Sergio Fantini (2016) particularly well-suited for such courses; another older but still excellent text is *Biomedical Optics: Principles and Imaging* by Lihong Wang and Hsin-i Wu (2007).

On the other hand, scientists, engineers, technicians, and clinicians working in the biomedical optics community will find that *Biophotonics* offers quick, quantitative insight into many important topics, especially in connection with

light sources, light detection, light guiding, and light–tissue interactions. In all the book's chapters, the material is pertinent and is presented clearly enough to provide a springboard for further study. Researchers will appreciate its reasonably complete and up-to-date accounting of state-of-the-art biomedical optics techniques and applications.

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