Book Review

Handbook of Biomedical Optics

David A Boas, Constantinos Pitris, and Nimmi Ramanujam, Eds., 831 pp., ISBN 978-1-4200903-6-9, CRC Press (2011), $149.95 hardcover.

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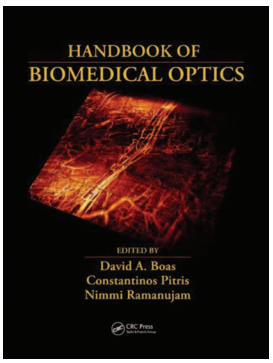

One of the most exciting fields of science uses light in the biomedical area. Light has several salient features that overshadow the electron. Light has color, speed, coherence, polarization, and shortest-pulse duration on the order of the femtosecond, and now attosecond, time scale. Light has created the field of photonics, which uses the photon in the same way as the field of electronics uses the electron. Electronics technology has created a lot of today's innovations and technologies that make our lives better. Now, the use of light and photonics in medicine offers great promise to make our health even better and to deliver less invasive diagnostics and treatment methods that are safer and more efficient. Photonics encompasses light sources such as lamps, lasers, and LEDs; optical fibers to deliver the light and signals; light detectors, such as photodiodes; video cameras; and charge-coupled devices, as well as optical filters and gratings to select color, spectrographs with complementary-oxide semiconductor intensified charge-coupled devices, etc. Current video camera sizes of 1 mm and less enable the development of compact medical robots and pills. Biomedical optics is a multidisciplinary area that covers the use of photonics in medicine and biology. Light provides molecular information without removing cells or tissues from the body. Optical biopsy is advancing medicine into the future by adding to the current medical armamentarium approaches.

The new *Handbook of Biomedical Optics* is a useful addition as an overall source to help educate the new and present generation of graduate students, researchers, and medical professionals. I have reviewed the *Handbook of Biomedical Optics* and highly recommend it. It provides an in-depth review and overall treatment covering most areas of biomedicine from the ground-level foundations of optics to background on photon transport in tissues, theory, and experiments.

The *Handbook of Biomedical Optics* is organized into six sections, and each section has several chapters. Topics include basic optics, optical properties of tissues, various spectroscopy methods of reflectance (elastic, Raman, and fluorescence), optical imaging in 2-D and 3-D, translation to clinical use, molecular targets of cancer cells, light treatment, and therapeutics. However, there are several missing subjects and prior art not covered in the *Handbook of Biomedical Optics*, such as time-resolved fluorescence, ballistic and snake imaging, optical memory, and coherent backscatter; in particular, in Chapter 27, "Nonlinear Optical Microscopy," key references of nonlinear optical microscopy in tissue imaging to Yici Guo (1997 to 1999) are missing.

Two new optical areas are on the horizon that biomedical researchers should be aware of: optogenetics, the control of the brain with light, and structured nonplanar twisting light beams that carry orbital angular momentum with spin, such as Laguerre-Gaussian and higher order Bessel light beams.

In all, the *Handbook of Biomedical Optics* is a major contribution to the biomedical optics field and will serve as a great resource.