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Lasers for Medical Applications: Diagnostics, Therapy, and Surgery

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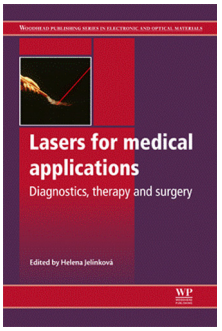

Lasers are part of our everyday life. They are used from manufacturing to entertainment, warfare (laser-guided weapons), construction, do-it-yourself (DIY) projects, communication, education, medicine, robotics, automotive, aviation, space, and more. Since their invention over five decades ago, the field of medicine has been a major beneficiary of laser technology. The book *Lasers for Medical Applications: Diagnostics, Therapy and Surgery* describes this subject in detail. This book is edited by Prof. Helena Jelinkova of the Czech Technical University of the Czech Republic in Eastern Europe.

The book is prudently divided into four distinct sections: basic principles of laser radiation and tissue interactions, various types of lasers used in medicine, laser-based technologies in medical diagnosis, and lasers in therapeutic uses. Ten of the contributing authors are from the Czech Republic, eight from the Russian Federation, six from the United States, five from Sweden, two each from Canada and United Kingdom, and one each from Germany, Japan, Romania, and China. Compiling, coordinating, and editing a book of this size (over 800 pages) is not a trivial matter. I therefore congratulate Prof. Jelinkova on accomplishing this difficult task.

The book has several strengths. One of the major strengths is that it is a great repository of articles on the use of lasers in many diverse fields of medicine. Possibly each chapter can be a potential topic for a separate book. Given its very broad scope, this book can be useful to students and other practitioners to find information of their interest in one place. The book describes applications of lasers to almost every organ and every tissue type in the human/animal body. These include soft (skin) and hard tissues (teeth and bones), including eyes, heart, kidneys, brain, and male and female reproductive organs. It also covers cosmetic issues, such as hair and tattoo removal, along with a discussion on laser safety. Perhaps this book will be complementary to other excellent books in this subject area, such as *The Biomedical Photonics Handbook*[1]and the *Handbook of Optical Biomedical Diagnostics,*[2] among others.

Five of the authors are well-known to the SPIE and JBO community. Professors Jelinkova, Tuchin, and Podaleaneu are SPIE Fellows, and Professors Tuchin and Svanberg are currently serving on the editorial board of the *Journal of Biomedical Optics*. Collectively, they have authored or coauthored a total of 9 chapters out of 25 in this book.

This book may be of interest to JBO readers and SPIE conference participants because SPIE has an impressive record of advancing laser applications in medicine. A glance over the book's table of contents shows that the listed chapter topics are commonly and frequently discussed topics at many SPIE and BiOS meetings over the past two decades in the U.S. and in Europe. These were later published in hundreds of SPIE Proceedings papers.

The *Journal of Biomedical Optics* was launched in 1996 and has published close to 4000 papers through January 2014. Additionally, a couple examples of other specialty journals in this area include *Lasers in Medical Science* by Springer and *Medical Laser Applications* by Elsevier, continued as *Medical Photonics*. Thanks to these contributions, light in general and laser light in particular is now playing a vital role in modern technologies of today, including medicine. It's no wonder, then, that the United Nations has proclaimed year 2015 as the International Year of Light.[3] This is indeed a very significant recognition and an honor to the optics/photonics research community and organizations such as SPIE, OSA, etc.

There are, however, several weaknesses with this book. I'll highlight only a few examples of these.

The book chapters do not follow a consistent style and format. Some of the chapters include excellent notes, conclusions, future trends, and recommended articles for further reading, while several others do not. Several good and current references are not cited. As an example, in chapter 17, "Laser Applications in Gynecology," the authors have neglected to include an excellent book *Lasers in Gynecology*.[4] Similarly, another very interesting article, "Applications of laser surgery in gynecology, hope or high tech?"[5] is also missing.

Neurology research is becoming a top priority in the U.S. In April 2013, President Barack Obama proposed an effort to map the brain's activity in unprecedented detail, as a step toward finding better ways to treat such conditions as Alzheimer's, autism, stroke, and traumatic brain injuries. The biophotonics community is contributing to this area of research and therefore should be highlighted. Chapter 19, "Lasers in Neurology" does not include a reference to the excellent article "Clinical application of laser Doppler flowmetry in neurology."[6] This is surprising because the technique of laser Doppler flowmetery has made valuable contributions to microcirculation research in neurology, ophthalmology, and several other areas of the human body. For a general overview, there is also an excellent open-access article, "Lasers in medicine" by Sian Harris.[7] The book does not include this reference either.

One of the important aspects of a technical book is that it not only exposes the reader to the basic principles and state-of-the-art knowledge at the time of writing, but also outlines the knowledge gaps and challenges the reader by opening up

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new possibilities for further development. While some chapters met this goal, others did not.

The use of the English language and the brevity of some chapters are admirable, while other chapters are lacking in this area. Also illustrations and graphics are all in black and white. Some of these, if presented in color, could have been more effective.

For a future edition, I would strongly suggest that each chapter briefly discuss whether the laser procedure(s) and technologies described are regulated and approved by agencies such as the Food and Drug Administration (FDA). For example, many procedures in the U.S. marketed for cosmetic uses are not approved by the FDA.[8] Every country in the world regulates laser devices in some form. The FDA's Center for Devices and Radiological Health (CDRH) is responsible for regulating firms who manufacture, repackage, relabel, and/or import medical devices sold in the United States. Similarly, other countries may have specific regulations to their own liking. I would suggest adding a brief chapter on this area or at least including a list of websites in chapter 24 so a reader can quickly browse specific requirements for various countries around the world.

Disclaimer

The views and opinions expressed in this book review are those of the reviewer and not those of SPIE, the *Journal of Biomedical Optics*, or the reviewer's employer (NASA and the United States government).

References

1. T. Vo-Dinh, Ed., *Biomedical Photonics Handbook*, CRC Press, Boca Raton, Florida (2003).
2. V. Tuchin, Ed., *Handbook of Optical Biomedical Diagnostics*, Vol. PM107, SPIE Press, Bellingham, Washington (2002).
3. "United Nations proclaims 2015 International Year of Light," *Optics.org*, 23 Dec. 2013, http://optics.org/news/4/12/32.
4. G. Bastert and D. Wallwiener, Eds., *Lasers in Gynecology: Possibilities and Limitations*, Springer-Verlag, Berlin (1992).
5. R. E. Blackwell, "Applications of laser surgery in gynecology, hope or high tech?," *Surg. Clin. North Am.* **71**(5):1005–22 (1991).
6. Z. Stoyneva, "Clinical application of laser Doppler flowmetry in neurology," *Perspect. Med.* **1**(1–12), 89–93 (2012).
7. S. Harris, "Lasers in medicine," *SPIE Professional*, January 2011, http://spie.org/x43738.xml.
8. "Removing hair safely," U.S. Food and Drug Administration, Updated 30 June 2010, http://www.fda.gov/forconsumers/consumerupdates/ucm048995.htm.