© 2013 THOSS Media & DE GRUYTER DOI 10.1515/aot-2013-0022 — Adv. Opt. Techn. 2013; 2(3): 209–210

Editorial

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New microscopes push the limits of far field microscopy

Although available for more than 400 years, microscopes have seen tremendous technological progress in the last 20 years. For a long time, the main ambition of microscopy remained to make smallest structures visible to the human eye. This appeared to be limited by basic optical laws already described by Ernst Abbe a century ago. With the advent of laser technology, advanced staining (if we may call the use of green fluorescent proteins so) and above all incredible computing power some fascinating new developments became possible. Several articles in the focus section of this issue will shine a light on these developments.

The main driver for device and technology development is usually the user and his requirements: Today scientists want to see cellular structures in three dimensions with a resolution beyond the wavelength, with a temporal resolution down to the timescale of molecular processes for new insights into biomedical phenomena.

Most recently, the combination of spectroscopical (fluorescence) and optical technologies allowed the development of sub-wavelength microscopes, so-called super fluorescent technologies, allowing for the determination of those cellular structures and interactions at a precision that was not known before. They do not invalidate Abbe's law, but they offer some revolutionary ideas which are much more than just workarounds. They make a resolution far beyond the wavelength of the visible light a reality. The review article by Kempe et al. gives a comprehensive overview of these new approaches to far field microscopy and their pros and cons.

While one direction of the development of microscopes always went towards higher resolution, another one is directed to new devices that can look into tissue. That is an old dream and even if it is just a few millimeters it might already save lives or the patient's vision. The availability of sophisticated lasers, and advanced computing and camera hardware allowed for the development of OCT technology, which enables medical doctors to examine the spatial structures of living tissue such as human retina in vivo with a resolution below 10 microns. The latest technological developments as described in the paper by Lankenau et al. resulted in an iOCT device that can even be used during operations attached to commercial microscopes. The article by Vandersmissen et al. goes one step further into the details of technical development and discusses the latest progress in OCT-detector technology.

This is just a very small glimpse of current developments in microscopy technology. We will follow this topic in the future and continue to publish articles on the latest trends in optical technology for microscopy as shown in this issue's focus topic.

Furthermore, we will establish a more general section of articles beside the focus section. *Advanced Optical Technologies* has proven itself as a platform for publications on current trends in optics with eight different focus issues to date, covering topics from various fields of optics: components (plastic optics, micro-optics, imaging sensors/cameras), optical design, and applications (lithography, material processing). Now we would like to publish articles from all these fields of applied optics along with one focus topic in each issue of *Advanced Optical Technologies*. The idea behind this is to widen our perspective and to publish continuously on relevant trends in optical technologies. You, as a reader, are invited to contribute your knowledge as an article. Looking at the download statistics, the new format of the Tutorial section has proven most successful, many of which went immediately into our list of most downloaded articles. For more information on publishing opportunities in *Advanced Optical Technologies* you may refer to our website or contact the editorial team directly at contact@advanced-optics.org.

Finally we would like to thank Ulrich Sander (Leica Microsystems AG, Heerbrugg, Switzerland) and Alberto Diaspro (Istituto Italiano di Tecnologia, UNIGE, Genoa, Italy) for their support in the preparation of this focus issue.

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Andreas Thoss studied physics and received the diploma and PhD degrees from the Free University Berlin in 1995 and 2003, respectively. For both degrees, he did research at the Max-Born-Institute Berlin on the field of ultra-short and ultra-intense laser pulses. From 1996 to 1999, he worked as a development engineer for medical laser systems with Aesculap-Meditec (now ZEISS Meditec) in Jena. In 2003 he joined the international publishing house John Wiley & Sons. There, he gathered comprehensive experience as Publisher, Editor and Commissioning Editor in the areas of book, journal and online publishing. Among others, he co-founded the journals *Laser & Photonics Reviews* (2007) and the *Journal of Biophotonics* (2008). Since its foundation in 2010 he manages THOSS Media, where he co-founded *Advanced Optical Technologies*. Andreas Thoss is a member of various societies, e.g. the German Physical Society, the German Society of Applied Optics DGaO, the American Optical Society and SPIE. He holds several patents.

Michael Pfeffer graduated in 1998 at the Institute of Applied Optics at EPFL (Switzerland), obtaining his PhD for a thesis in the field of optical nanotechnology. In 2002, after several years working in the Swiss optics industry, he was appointed Full Professor of Optics and Engineering in the Department of Physical Engineering of Hochschule Ravensburg-Weingarten, University of Applied Sciences (Germany). Dr. Pfeffer teaches and researches in the field of optics, physical instrument design and nanotechnology. Currently, he serves as Vice-Rector for Research and International Relations. In 2005, the General Membership Meeting elected him to the Executive Board and CEO for the DGaO-Annual Meeting 2006. From 2008 to 2012 he served as President of the German Society of Applied Optics (DGaO). In 2012 he was elected as Secretary of the Board of the European Optical Society (EOS). Dr. Pfeffer is member of the German Physical Society (DPG), the German Society of Engineers (VDI), and the Standards Committee Precision Engineering and Optics of the German Institute of Standardisation (DIN).