

MULTIMODAL FULL-FIELD OPTICAL COHERENCE TOMOGRAPHY

Arnaud Dubois
Laboratoire Charles Fabry de l'Institut d'Optique
Centre National de la Recherche Scientifique, UMR 8501
Université Paris-Sud
Campus Polytechnique RD 128
91127 Palaiseau, France
Email: arnaud.dubois@institutoptique.fr

KEY WORDS: optical coherence tomography, interference microscopy, white-light interferometry, spectroscopy.

Optical coherence tomography (OCT) is a well-established cross-sectional optical imaging technique with micrometer-scale resolution [1-3]. The most significant impact of OCT is in ophthalmology for *in situ* examination of the pathologic changes of the retina and measurement of the dimensions of the anterior chamber of the eye. OCT has also been established in a variety of other biomedical applications and for material characterization.

Full-field optical coherence tomography (FF-OCT) was introduced a few years ago as an alternative method to conventional OCT using an interference microscope and a camera as an array detector combined with a low coherence illumination source for parallel acquisition of *en-face* oriented tomographic images [4,5]. FF-OCT is a technique of choice for noninvasive three-dimensional imaging of *ex-vivo* biological tissues with ultra-high ($\sim 1 \mu\text{m}$) spatial resolution [6,7].

We present here a multimodal FF-OCT system, capable of measuring simultaneously the intensity, the polarization and the spectrum of light backscattered by the structures of the imaged biological sample. These measured optical properties are combined to produce multi-contrast images for better tissue visualization and differentiation. With a spatial resolution approaching that of microscopy, this technology has the potential to replace conventional histology methods without requiring sample preparation.

REFERENCES

- [1] D. Huang, E. A. Swanson, C. P. Lin, J. S. Schuman, W. G. Stinson, W. Chang, M. R. Hee, T. Flotte, K. Gregory, C. A. Puliafito, and J. G. Fujimoto, *Science* **254**, 1178 (1991).
- [2] A. F. Fercher, *J. Biomed. Opt.* **1**, 157 (1996).
- [3] W. Drexler, U. Morgner, F. X. Kärtner, C. Pitris, S. A. Boppart, X. D. Li, E. P. Ippen, and J. G. Fujimoto, *Opt. Lett.* **24**, 1221 (1999).
- [4] L. Vabre, A. Dubois, A.C. Boccara, *Opt. Lett.* **27**, 530 (2002).
- [5] A. Dubois, K. Grieve, G. Moneron, R. Lecaque, L. Vabre, and A.C. Boccara, *Appl. Opt.* **43**, 2874 (2004).
- [6] K. Grieve, M. Paques, A. Dubois, J. Sahel, A.C. Boccara, J.F. Le Gargasson, *Invest. Ophthalmol. Visual. Sci.* **45**, 4126 (2004).
- [7] A. Dubois, G. Moneron, K. Grieve, A.C. Boccara, *Phys. Med. Biol.* **49**, 1227 (2004).