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Introduction

One decade ago, the development of novel therapeutic laser and light applications in medicine focused on the investigation of light tissue interactions as function of photon (power) density and dielectric properties of the tissue. Some of this work is still ongoing and focuses more on the long term outcome. Examples thereof in these proceedings include partial porcine kidney resection (73731B) removal of atherosclerotic plaque (73731E), photodynamic therapy of skin disease (73730S) and lentotomy, the treatment of presbyopia, the loss of elasticity of the crystallize lens (73730H).

Now that lasers achieving $>10^{20}$ Wcm⁻² have been aimed at most common tissues and their immediate and long term responses are known, the attention of research is shifting towards exploiting this knowledge of tissue response towards maximizing the therapeutic efficacy. Maximizing efficacy in turn requires improved treatment planning, on-line treatment guidance, and biological response monitoring. A second more recent development is the exploitation of our knowledge of laser tissue interaction in biology which will become more important with recent development in molecular and cell biology as it becomes evident that single cells or small clusters of cells are driving biological and thus medically relevant processes.

Techniques to perform an intentional modification or therapies on individual cells, or small tissue volumes, require localization of the photon absorption in space and/or time such as through the use of: nanoparticles (737308), femtosecond exposure transient micro bubbles (73730D), localized x-ray sources (73730N), or micro-structuring of non-biological targets for prosthesis development (73731A). It is anticipated that this segment of "therapeutic" applications will continue to grow, as significant engineering challenges will need to be overcome which most likely will be unique for a rather large range of potential applications in medicine already apparent in the above list.

In respect to improving clinical delivery and therapeutic efficacy, modeling of therapies is becoming more prominent. Novel computing platforms such as graphic processing units (GPU), which become more easily accessible to the scientific community (see 737313, and 737315) will become more pervasive for these tasks. Modeling aspects covered here range from light penetration in skin (737316), temperature fields due to laser irradiation (73731R), to the use of corneal scattering for keratoplasty optimization (73731Y).

Also more prominent is the development of techniques which will enable monitoring of treatment progress, such as detection of tissue denaturation in real time (73730E), use of optoacoustic transients for retinal photocoagulation (73730K), and photo-bleaching of the eye's lens (73730I). Particularly within this

line of research, the separation between therapeutic and diagnostic laser application becomes fluid.

The expansion of laser therapies to a whole range of different applicants is also noticeable, ranging from laser osteo-perforation in bone disease (73731T), to endovenous laser treatment (EVL) (73731S).

Only the treatment monitoring work provides instrumentation development, see (73731M) and (73730P) hinting that laser and light sources for therapeutic applications have matured sufficiently and reached a commodity status.

The future will demonstrate if this trend will continue, away from light source development to real-time therapy monitoring technologies combined with a priority treatment monitoring.

The chairs thank the presenters for their contributions, and the audience and the authors for top information transfer and fruitful discussions. Thank you for making Therapeutic Laser Applications and Laser Tissue Interaction 2009 a scientifically interesting conference within the European Conference of Biomedical Optics 2009.

Lothar D. Lilge
Ronald Sroka