Topic Categories

European Conferences on Biomedical Optics (ECBO)

25 - 29 June 2017
Messe Munich, Munich, Germany

Topic Categories

Clinical and Preclinical Optical Diagnostics
Diffuse Optical Spectroscopy and Imaging
Novel Biophotonics Techniques and Applications
Advances in Microscopic Imaging
Opto-Acoustic Methods and Applications
Optical Coherence Imaging Techniques and Imaging in Scattering Media
Medical Laser Applications and Laser-Tissue Interactions
Head and Neck Optical Diagnostics and Intervention (held in conjunction with ECBO)

Clinical and Preclinical Optical Diagnostics

Spectroscopic and imaging methods have become valuable tools for both pre-clinical and clinical applications, ranging from *in vivo* tissue monitoring to the investigation of excised samples on the molecular scale. In clinical diagnostics, optical spectroscopy and imaging provides detailed structural and functional information on organs, tissues and body liquids. Basic preclinical biomedical applications include the detailed investigation of tissues and cells down to the level of single molecules, helping to understand the principles of cellular and sub-cellular processes that contribute to the early transformation of normal to diseased tissue, such as when malignant tumours are developed.

This conference provides an interdisciplinary platform to promote interaction between physicians, physicists, engineers, biologists, chemists and related researchers, in order to strengthen an integrated and holistic understanding of normal tissue development and the genesis of diseases, with the ultimate goal of using this understanding to develop and translate new, more efficient diagnostic and treatment modalities.

Contributed papers are solicited on, but not limited to, all areas of development and pre-clinical or clinical application of optical spectroscopy and imaging, including steady-state and time-resolved fluorescence, autofluorescence, linear and nonlinear microscopies, linear and nonlinear Raman, NIR, polarization, laser speckle, back-reflectance, light scattering spectroscopy, and combined approaches (multimodal imaging):

A. Biomedical and clinical applications

- *in vivo* diagnostics and physiological monitoring (structural and functional spectral imaging of cells, tissues, organs), including endoscopic, noninvasive and minimally invasive methods
- tissue pathology and tissue characterization
- spectral biomarker analysis
- spectroscopic micro- and nanosensors
- biochip technology for point-of-care diagnostics
- guidance and monitoring of therapies
- diagnostics and tissue engineering.

B. Investigation of cellular and sub-cellular processes

- analysis of cell dynamics by single-molecule techniques
- high spatial resolution microscopy
- structural analysis of cells and tissues on the nano-to-microscale
- cellular metabolic sensing and imaging
- biomarker discovery for spectroscopic techniques.

Diffuse Optical Spectroscopy and Imaging

The study of diffuse light spectroscopy and imaging in tissue continues to provide new insight into the structural and functional properties of tissues that are not easily accessed by alternative methods. The research and development of systems that exploit this approach has led to clinical prototype systems that are used in basic studies and medical research. Scientific applications range from the study of cerebral physiology to cancer patho-physiology in both animals and humans. Medical applications being explored encompass detection and diagnosis of breast cancer, brain cancer, cognitive neuroscience, stroke, hemorrhages, brain and muscular oxygenation, peripheral vascular diseases and joint diseases as well as establishing novel methods in drug discovery and tracking. Integration of diffuse light spectroscopy and imaging into existing clinical instrumentation is a key area of development, and combining diffuse light with new contrast agents or other imaging modalities are also emerging as major growth areas.

Further improvement in these and other application areas relies on continued advancement in the theory of radiation transport through random media, in data analysis and image reconstruction algorithms, and in instrumentation design.

This meeting provides a key interdisciplinary forum for engineers, physicists, mathematicians, biomedical scientists and physicians to report on recent results, improvements, and new approaches and applications for using diffusing light to characterize the structural and functional properties of tissue.

Contributed papers are solicited concerning, but not limited to, the following areas:

- Diffuse optical tomography and spectroscopy
- Diffuse fluorescence and bioluminescence imaging
- Diffuse correlation spectroscopy
- Novel molecular contrast agents
- Hybrid-modality imaging with diffuse light
- Modeling of light propagation
- Tissue optical properties
- Image reconstruction algorithms
- Instrumentation, spectroscopy and imaging systems

- Clinical and preclinical applications of diffuse optics
- Muscle physiology studies
- Breast cancer imaging and spectroscopy
- Brain monitoring and imaging of functional activation, oxygenation, stroke, hemorrhage, etc.

Novel Biophotonics Techniques and Applications

Aside from the well-recognized avenues of biomedical optics for diagnostics, therapeutics and analytics/microscopy, a number of novel and highly promising approaches are under development. These new techniques often rely on the confluence of two or more diverse fields, drawing on their complementarity in order to overcome the inherent complexity and heterogeneity of biological tissues. Examples include mid-infrared spectroscopy, laser induced breakdown spectroscopy, holography, phase and polarization imaging, photodiagnostics in monitoring and guiding therapies in real time ("theranostics"), and the use of MRI to constrain optical tomographic reconstructions. These approaches are driven by task-specific (functional or cost) requirements of a particular application. Moreover, a number of new ideas are being investigated based on new methodologies, physical basis, instrument development, integration of techniques and data analysis. This conference will present a highly interdisciplinary discussion forum of interest to instrument designers, sensor builders, basic and applied clinical researchers, and other scientists interested in exploring novel directions in biophotonics.

Topics for contributions are thus broadly open and include:

- photothermal imaging and diagnostics
- speckle-based techniques
- polarized light diagnostics
- holography and micro-holography
- laser induced breakdown spectroscopy
- radiomics
- theranostics
- lab-on-a-chip approaches
- micro-fluidics
- quantitative low level laser therapy
- optical waveguides
- nano-probes and nano-biophotonics
- lensless imaging
- MRI/optical image fusion
- novel technologies and studies in endoscopy
- ultrasound/optical image fusion
- new approaches for ophthalmology
- new approaches for photon discrimination in turbid media
- hybrid approaches in photomedicine
- other new/emerging biophotonic techniques

Advances in Microscopic Imaging

This conference will explore the rapidly developing field of multidimensional microscopy, including confocal microscopy, nonlinear optical microscopies, super-resolution microscopies, light sheet-based microscopy and other novel imaging modalities. Consideration will be given to the characteristics of the overall system design, as well as to topics of contrast, image formation, image recording, deconvolution, and digital methods of producing and displaying the resulting reconstruction. Recent innovations in multi-dimensional microscopy have a serious impact on the biological and medical fields. We hope that the broad range of relevant topics presented at this conference will encourage the interaction among instrumentation engineers, computer image analysts, and researchers in the various fields of biomedical and life science application.

Papers are invited on all areas of development and application of confocal, nonlinear optical, and novel optical microscopies including, but not limited to, the following and related areas:

- high resolution optical imaging on the nanometer scale (e.g. PALM, STORM, STED)
- fast imaging of large and complex biological specimens (e.g. SPIM, DSLM)
- multiphoton microscopy, SHG, THG, CARS, SRS, FWM microscopies using exogenous and/or endogenous contrast
- adaptive optics, spatial and temporal control of the excitation
- endoscopic microscopy
- single molecule microscopy and microanalysis
- phase microscopy, holographic based microscopy, absorption microscopy, polarization microscopy
- multi-modal spectroscopic analysis in microscopy
- novel image contrast enhancement approaches such as SER and other near field surface effects
- FRET-FLIM modalities, Fluorescence Correlation Spectroscopy
- biomedical instrumentation
- micro-optics and MEMS based optical systems for the biomedical diagnosis
- fast image acquisition with time-resolving image acquisition systems
- applications to cell biology, developmental biology, animal models
- clinical applications of optical microscopy
- macroscopic imaging obtained with microscopy, when using high spatial dynamic range microscopy
- advanced methods in neurophotonics.

Opto-Acoustic Methods and Applications

In the last decade optoacoustic (photoacoustic) imaging has grown significantly to a powerful optical imaging platform suitable for basic research, clinical translation, and drug discovery. Advances in the system design, laser and ultrasound detection technology in conjugation with the ability to visualize a large range of anatomical, functional and molecular bio-markers have led to new and exciting ways of visualizing structure and function in biological tissue.

One of the promising aspects of the optoacoustic methodology is its versatility, manifested in the numerous distinct imaging concepts employed in it: multispectral imaging, nonlinear imaging, real-time imaging, tomography, microscopy, endoscopy, etc. Label-free imaging of functional parameters of vasculature including hemoglobin oxygenation and oxygen metabolism can be combined with simultaneous detection of exogenous molecular agents to provide more complete views of pathologies at appropriate scales from optical diffraction-limited microscopy to depths of several centimeters.

Additionally, the ability to detect nanoparticles of interest by means of their optical absorption enables unique in vivo visualization. This emerging field of the imaging sciences integrates many scientific disciplines from physics and engineering to chemistry and biotechnology. It is the aim of this conference to bring together those disciplines which make up the optoacoustic field with particular emphasis on development and adaption of optoacoustic technology to enable novel biological and clinical applications. All areas in optoacoustic sensing and imaging are welcomed, from hardware and algorithmic developments, to novel concept, applications and contrast generation mechanisms, including photo-absorbing agents and nanoparticles.

Areas of interest consider, but are not limited to, progress in the following topics:

- imaging and tomography
- optoacoustic microscopy
- multi-spectral approaches
- theory and image reconstruction algorithms
- small animal imaging
- clinical imaging
- genetic reporters and cell-labeling for optoacoustic imaging
- novel agents and nanoparticles

- novel detection technologies
- novel illumination technologies
- nonlinear optoacoustics
- doppler phenomena
- multi-modality imaging.

Optical Coherence Imaging Techniques and Imaging in Scattering Media

This conference is a continuation of "Optical Coherence Tomography and Coherence Techniques" and seeks to broaden the scope to cover the general area of imaging in biological scattering media based on coherent light and its interactions with biological tissues. The conference provides an interdisciplinary forum for topics in research and development on a physical and theoretical basis of coherent imaging including techniques like optical coherence tomography/microscopy, adaptive optics ophthalmoscopy, nonlinear coherence imaging, photothermal and magnetomotive imaging and imaging with advanced wavefront control. In addition, this conference will focus on the development of new light sources, new probes, new detection schemes and new signal processing algorithms for coherent imaging. Applications of coherent optical techniques for morphological as well as functional assessment in different living tissues and phantoms in various medical fields are also covered.

Contributed papers are solicited concerning, but not limited to, the following areas:

- optical coherence tomography (OCT) - technology, systems and applications
- imaging using advanced spatio-temporal light modulation
- imaging in turbid media
- holographic imaging
- coherent imaging system, theory and signal processing
- contrast enhancement techniques for coherence imaging
- novel light sources and MEMS probes for coherence imaging
- optical coherent techniques for tissue spectroscopy and imaging
- coherent light microscopy
- speckle analysis and methods for speckle reduction
- adaptive coherent optical systems
- multi-modal optical coherence imaging platforms.

Medical Laser Applications and Laser-Tissue Interactions

Medical laser application is a broad area for research and development with the vision of improving clinical therapeutic procedures or to extend into new fields for lasers in medical use. Novel biomedical laser applications are emerging due to the advent of new types of lasers that widen the possible spectrum of laser-tissue interactions to improve the target-oriented precise application of laser radiation in clinical practice. Laser light applications include the whole range of non-thermal to thermal reactions up to ionization effects either on the macro-scale, e.g. soft tissue smoothing without ablation, or on the micro scale, e.g. selective retina therapy, to the nano-scale for surgery within cells, as well as short-pulsed laser applications to treat soft and hard tissue in patients. In addition to that new laser light application techniques as well as innovative medical keyhole techniques such as laser assisted NOTES (Natural Orifice Transluminal Endoscopic Surgery) are under investigation.

Highly sophisticated targeting strategies including endogenous or applied chromophores as well as conjugation of chromophores or nanoparticles with antibodies pave the way for new treatment modalities. Furthermore combination therapies such as the synergetic use of photodynamic therapy and immunomodulatory or antiseptics are encouraging new fields for research and clinical studies.
Improved understanding of biological reactions triggered by laser radiation interacting with natural absorbing sites, targeting molecules, photosensitizers, or nanoparticles will lead to progress in the creation of minimally-invasive clinical laser light applications or assist in elucidating particular immunological responses from the tissue.

Theoretical considerations and modeling of laser light distribution in tissue with subsequent energy transfer and tissue interactions constitute a solid basis for therapy planning in patients, particular if combined by improved light delivery and monitoring techniques.

This conference will provide an interdisciplinary forum for scientists, engineers, technicians, and medical doctors using laser assisted treatment modalities to discuss the progress in all these topics. The forum joins presentations from in-vitro investigations up to clinical studies of new laser light irradiance in the range of 10(-3) – 10(18) Wcm(-2) to lead to actual clinical and medical questions where laser assisted techniques can play an important role in future. Contributed papers are solicited concerning, but not limited to, the following topics:

- photo-biological and photo-chemical reactions
- photo-thermal and photo-mechanical tissue reactions
- modelling of laser-tissue interactions
- cellular micro- and nano-effects of laser radiation
- nanoparticlaes for targeted phototherapies
- laser-induced microdissection and catapulting of cells
- tissue ablation and cutting with short and ultra-short laser pulses
- hard tissue ablation, benign tissue destruction
- photodynamic therapy (PDT) of tumors, neoplasia, and other pathologic conditions
- antimicrobial PDT, PDT mediated immunology
- cellular mechanisms of low power laser therapy
- minimally invasive laser surgery
- laser applications in NOTES
- progress in therapeutic laser applications
- in-vitro, ex-vivo, preclinical and clinical studies
- experiences in clinical laser application .

Head and Neck Optical Diagnostics and Intervention (Held in Conjunction with ECBO)

The Head & Neck Optical Diagnostic Society (HNODS) was founded in 2008 in order to improve the early diagnosis and treatment of patients suffering from head & neck malignancies by promoting and encouraging the study and practice of optical diagnostics techniques, by facilitating communications between clinicians, scientists, physicists, engineers, technicians, radiologists and pathologists (particularly those with interest in the pathology of the head and neck) and by building close relations with laser, optical and surgical associations, societies, research groups, industry and patient's organizations. We are anticipating to have some highly acclaimed experts in the field of head & neck optical diagnostics giving invited lectures, and are encouraging the submission of papers (free lectures and posters) of both young and experienced clinicians and researchers.

The methods that should have been applied in contributing papers include (but are not limited to):

- Fluorescence Imaging (intensity and lifetime)
- Spectroscopic methods
- Optical Coherence Tomography / Microscopy
- Photo-acoustic imaging
- Probe-based Confocal Laser Endomicroscopy
- Photodynamic Therapy
- Photochemical Internalization.

Copyright ©2018 The Optical Society