International Conference on Biophotonics 2019

St Andrews, UK

Old Course Hotel

22-24 MAY 2019

Programme Booklet

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David Sampson

Brian Wilson

Local Committee

Adrià Escobet-Montalbán

Holly Fleming

Malte Gather

Frank Gunn-Moore

Sandra Murray

Philip Wijesinghe

Dear Participant,

Welcome to St. Andrews and to the International Conference on Biophotonics 2019 (ICOB2019). We hope that you will enjoy the meeting and your stay in St. Andrews.

Biophotonics is well recognised as an important area, having major implications in a wide range of interdisciplinary science and biomedicine. This area denotes the use of advanced photonics-based technologies with the aim of providing new methodologies for biologists and clinicians alike, with potential benefits in healthcare and for research into cell and molecular biology. ICOB2019 aims to bring together internationally recognised researchers to discuss their work and various exciting new breakthroughs in the field.

We thank SPIE., Coherent (UK), EPSRC, M Squared, Nikon Instruments, SULSA, SUPA, and the University of St. Andrews for their sponsorship of the meeting.

This booklet contains a programme and abstracts of the talks and posters for the meeting and details about the arrangements for the two days.

Once again, welcome to St. Andrews and to ICOB2019. We hope you enjoy the meeting.

With warmest regards,

Kishan Dholakia

Contact details:
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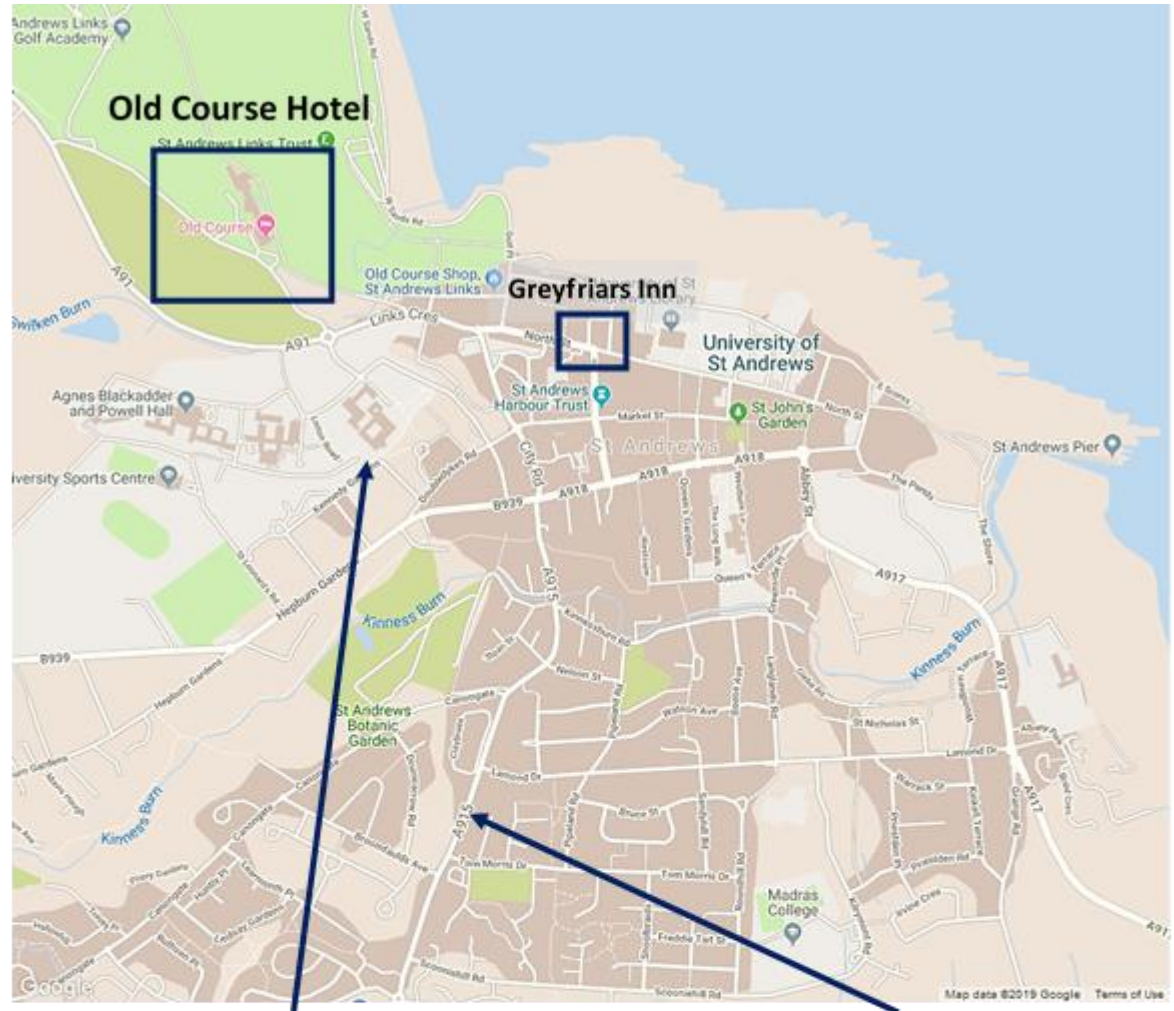
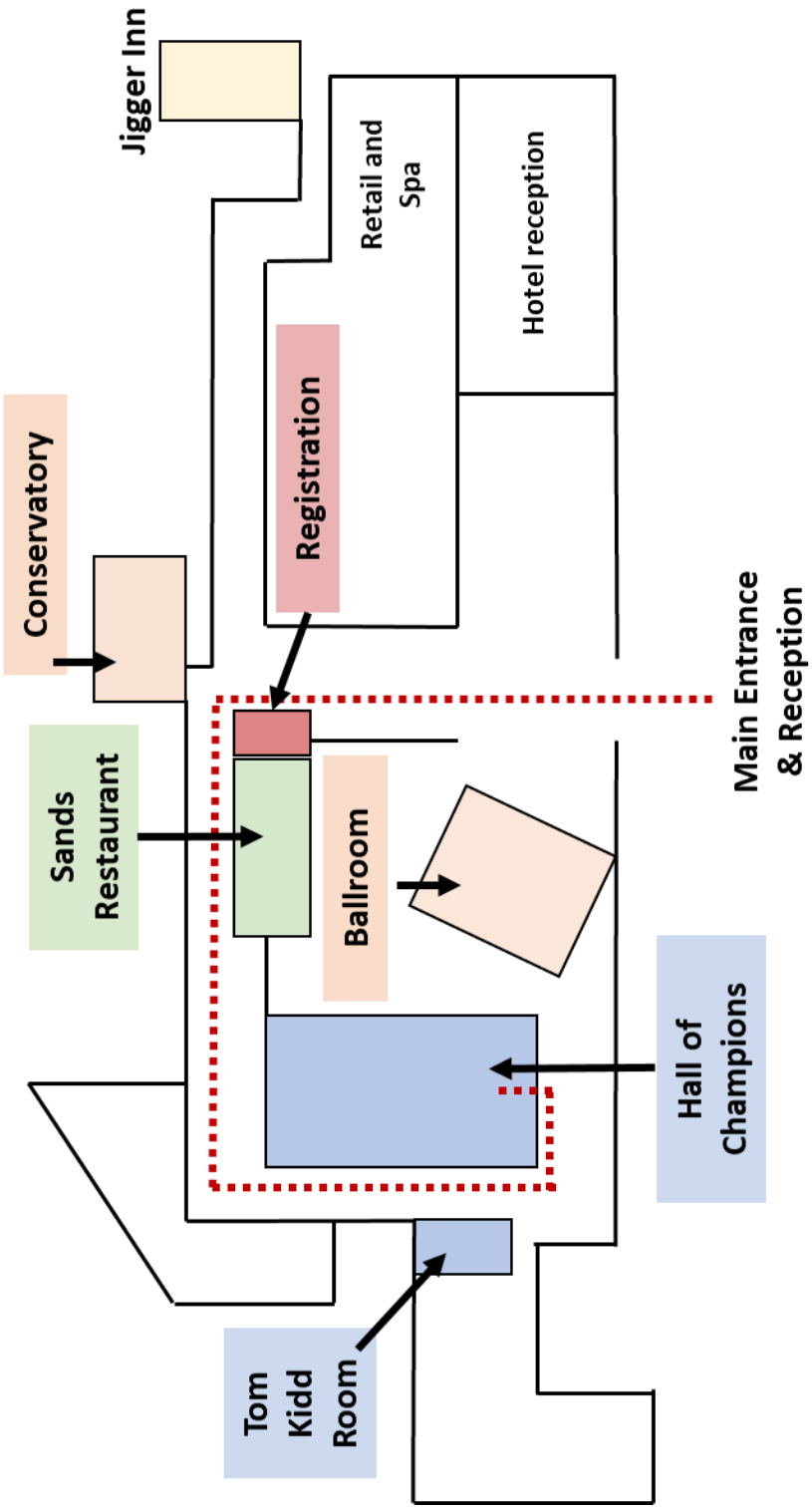


School of Physics and Astronomy

Premier Inn St. Andrews

Premier Inn to Old Course Hotel – 20-25 min walk
Greyfriars Inn to Old Course Hotel – 10 min walk

Old Course Hotel Ground Floor Plan



Meeting Arrangements

The whole meeting, including all lunches and the conference dinner, will be held at the **Old Course Hotel**. Sign posts are placed at various points around the hotel to guide you to various locations.

Registration desk
This is located in the **Hamilton Grand**. Sandra Murray and Holly Fleming will be available for registration from 08.15 am on Wednesday 22nd May, 08.00 am on Thursday 23rd May, and 09.00 am on Friday 24th May.

Talks
All talks are held in **The Hall of Champions.**

Coffee/tea breaks are just outside **The Hall of Champions.**

Posters
Poster boards will be in **The Hall of Champions:** we ask all those presenting a poster to please check their poster number in this booklet and place their poster up by 14.15 on Wednesday 22nd. There will be poster prizes awarded for the best posters presented by early career researchers (e.g. PhD students and post docs).

Lunch
Lunch will be served in the **Sands Restaurant** of the Old Course Hotel.

Welcome Reception
The Welcome Reception will take place in the **Ballroom** on Wednesday 22nd at 18.30.

Conference Dinner
There will be pre-dinner drinks served in the **Conservatory** at 19.00.

The conference dinner and ceilidh will be held in the main **Ballroom** of the Old Course Hotel, commencing at 19.20 sharp. **A seating plan will be provided, please check this prior to the meal**. The seating plan will be available outside the Hall of Champions on Thursday afternoon.

Photos
Please note that photos and videos of may be taken during the meeting for publicity and marketing purposes.

SHORT PROGRAMME

Wednesday 22nd (full day)

8.15 - 9.00	**Registration (*coffee and pastries*)**	
9.00 - 9.10	**Welcome** *Kishan Dholakia*	
9.10 - 10.00	**Plenary**	
	Chair: Kishan Dholakia	
	Brian Pogue ***Optical Guidance in Surgery & Radiation Therapy***	*Dartmouth College, USA*
10.00 - 10.50	**SPIE Plenary**	
	Chair: Kishan Dholakia	
	Andrew Brown ***An SPIE View of Trends in Biophotonics***	*SPIE, USA*
10.50 - 11.10	Discussion	
11.10 - 11.30	***Coffee***	
11.30 - 13.00	**GLOBAL HEALTH AND INFECTION**	
	Chair: Brian Wilson and Dennis Matthews	
11.30 - 12.00	Andrew Blaikie ***The Arclight - "Less is More" - a medical diagnostic tool for low re-source countries***	*University of St Andrews, UK*
12.00 - 12.30	Beth Mills ***The development of fluorescence-based point-of-care diagnostics – design considerations for use in low resource settings***	*University of Edinburgh, UK*
12.30 - 13.00	Juergen Popp ***Photonics for Infection***	*IPHT, Jena, Germany*
13.00 - 13.15	Discussion	
13.15 - 14.15	***Lunch, Sands Restaurant*** **Exhibition and Posters**	
14.15 - 15.15	**ICOB Hot Topics Session**	
	Chair: David Sampson	
	Thomas Krauss ***Nanophotonic biosensors-clever photonics in a small package***	*University of York, UK*
	Malini Olivo ***Skin inflammation imaging using Raster Scanning Optoacoustic Imaging and its quantitative analysis***	*A*STAR, Singapore*
	Kirill Larin ***Translational dynamic optical coherence elastography***	*University of Houston, USA*
	Isla Barnard ***Simulating Light-Tissue Interactions with MCRT***	*University of St Andrews, UK*

15.15 - 16.15	**Breakout: Global Health and Infection**
	Discussion Chairs: Dennis Matthews, Brian Wilson and Juergen Popp
16.15 - 17.15	**Poster and Exhibition Session: *with coffee and refreshments***
17.15 - 18.30	**Free time**
18.30 - 20.00	***Welcome Reception, Ballroom***
	Canapes and Drinks will be served

Thursday 23rd (full day)

8.00 - 8.30	**Registration (*coffee and pastries*)**
8.30 - 10.00	**ENVIRONMENT, FOOD AND DRINK**
	Chair: Juergen Popp
8.30 - 9.00	Andrew Abell — *CNBP, University of Adelaide, Australia*
	Light activated molecular switches in chemical biology
9.00 - 9.30	Kate Bechtel — *Triple Ring Technologies, USA*
	Bridging the gap: what researchers can do to better the chances of successful transition from prototype to product
9.30 - 10.00	Oliver Valet — *mibic GmbH & Co. KG, Germany*
	Industrial and Academic Applications of a Smart Single Microbe Raman Test Platform
10.00 - 10.15	Discussion
10.15 - 10.30	***Coffee***
10.30 - 11.30	**Breakout: Environment, Food and Drink**
	Discussion Chair: Juergen Popp
11.30 - 12.15	**FUTURE TRENDS IN BIOPHOTONICS (1)**
	Chair: Halina Rubinsztein-Dunlop
11.30 - 11.45	Kishan Dholakia — *University of St Andrews, UK*
	Future perspectives for imaging at depth
11.45 - 12.15	David Sampson — *University of Surrey, UK*
	Polarisation-sensitive optical coherence tomography – here it comes again
12.15 - 13.15	***Lunch, Sands Restaurant***
	Exhibition and Posters

SHORT PROGRAMME

13.15 - 14.45	**FUTURE TRENDS IN BIOPHOTONICS (2)**	
	Chair: Halina Rubinsztein-Dunlop	
13.15 - 13.45	Chris Xu ***Deep and fast multiphoton microscopy***	*Cornell University, USA*
13.45 - 14.15	Daniele Faccio ***Deep-imaging with time-of-flight diffusive optical tomography***	*University of Glasgow, UK*
14.15 - 14.45	Andy Yun ***Laser particles for multiplexed cell tagging***	*Massachusetts General Hospital, Boston, USA*
14.45 - 15.00	Discussion	
15.00 - 15.15	***Coffee***	
15.15 - 16.00	**Breakout: Future Trends in Biophotonics**	
	Discussion Chair: Kishan Dholakia	
16.00 - 17.30	**Translation and Entrepreneurship Session**	
	Panel:	
	Ignatius Rasiah Dennis Matthews Brian Wilson Kate Bechtel	*National University of Singapore, Singapore* *UC Davis, USA* *University of Toronto, Canada* *Triple Ring Technologies, USA*
19.00	***Pre-dinner drinks, Conservatory***	
19.20	***Conference Dinner, Ballroom***	
	After dinner speaker: Miles Oglethorpe ***Bridging the past with the future***	*Historic Environment Scotland*

Friday 24th (Half day, ends after lunch)

9.00 - 9.30	**Registration (*coffee and pastries*)**	
9.30 - 11.00	**SHAPING PHOTONICS FOR NEUROSCIENCE**	
	Chair: Malini Olivo	
9.30 - 10.00	Silvia Paracchini ***Shedding light on language related disorders***	*University of St Andrews, UK*
10.00 - 10.30	Halina Rubinsztein-Dunlop ***Sculpted light for quantitative imaging of nano and microsystems***	*University of Queensland, Australia*
10.30 - 11.00	Malte Gather ***Microresonators and nanolasers to explore the biomedical world***	*University of St Andrews, UK*
11.00 - 11.15	Discussion	
11.15 - 11.30	***Coffee***	

11.30 - 12.30	**Breakout: Shaping photonics for neuroscience**
	Discussion Chair: Malini Olivo
	Time to discuss and prepare white papers
12.30	**Concluding remarks**
	Lunch, Sands Restaurant

Wednesday 22nd (full day)

Brian Pogue *Dartmouth College, USA*

Optical Guidance in Surgery & Radiation Therapy

The process of imaging medical treatments today is dominated by optical devices which are used at the point of care, in settings such as surgery and endoscopy. These procedure-based tools are used together with radiologic devices to capture unique contrast features that help guide medical decisions about tissue removal and tissue response to therapy. In the developments in technologies and nanotechnologies within the world of Optics in Medicine have made major advances, such as image-guided spectroscopy during surgery, as well as surgical guidance navigation tools, and now radiologic guidance tools. Examples from each will be used to highlight innovations in translational research that have gone from concept through to clinical trials, and now through to multicenter trial use. Translation beyond the initial feasibility phase involves the type of R&D which only companies can accomplish, and so partnerships with companies in translational research has been paramount, and examples in surgical guidance can show this. Translation through a start-up company, DoseOptics LLC, will be highlighted in which this pathway has enabled testing and deployment of a fundamentally new technology to image radiation dose delivery in real time.

Andrew Brown *SPIE, USA*

An SPIE View of Trends in Biophotonics

Photonics West/BiOS is the largest annual biomedical optics conference and exhibition in the world and has seen a 24% increase in the number of papers presented there over the last five years. All indications are that this rapid growth of biophotonics research and development will continue, driven by an increasingly broad range of light-based applications to healthcare, and the growing market penetration of cost-effective photonics-based diagnostic and therapeutic medical devices. These devices range from advanced gene sequencing systems to wearables capable of real-time monitoring of physiological health parameters. In this presentation, we highlight some of the more exciting biomedical optics trends that are evident from recent BiOS conferences. We also discuss some of the market challenges that are inherent in realizing the promise of biophotonics for better health.

Andrew Blaikie *University of St Andrews, UK*

The Arclight - "Less is More" - a medical diagnostic tool for low resource countries

There are estimated to be 285 million visually and 360 million hearing impaired people in the world with the majority of cases considered preventable or treatable if diagnosed promptly. Ophthalmoscopes and otoscopes are typically designed for markets of wealthy countries and are complex, heavy and expensive with their basic design remaining relatively unchanged for over 100 years. Unfortunately only very few practitioners in low and middle-income countries (LMICs) have these essential tools. If they do own devices they are typically 'hand-me-downs' from well-minded donors but often not functional being dependent upon hard to find and expensive consumables such as bulbs and batteries. Sadly the vast majority of cases of vision and hearing impairment are however found in LMICs where access to diagnostic tools is least. The Lancet Commission's report on Technologies for Global Health has consequently recommended greater focus on 'frugal technologies' designed for the needs of LMICs rather than the markets of wealthy countries. We describe the inspiration, development and potential of the Arclight a novel low cost 'frugal' diagnostic tool for prevention of vision and hearing impairment.

Beth Mills *University of Edinburgh, UK*

The development of fluorescence-based point-of-care diagnostics – design considerations for use in low resource settings

The widespread availability of low-cost, yet robust LEDs and CMOS cameras, coupled with the advancement of pathogen-specific fluorescent imaging agents augment the development of frugal diagnostic platforms. Learning from wide-field optical endoscopy technology developed within the Proteus project for interrogating the pathology of the distal lung in real-time (Proteus.ac.uk), we are working with partners in India to expand our repertoire of optical point-of-care diagnostic platforms for aetiologies designated (by them) as important for rapid diagnosis within their communities. These conditions include skin, corneal and urinary tract infections. Designing and implementing technologies in rural primary care settings globally comes with challenges at the technical, financial and personnel levels. Often these requirements are overlooked by technologists, leading to the under-performance of many devices. Through stakeholder engagement in India we have come to acquire a detailed understanding of end-user requirements as we develop our technologies to ensure their applicability within the field.

Juergen Popp *IPHT, Jena, Germany*

Photonics for Infection

Infectious diseases are one of the major reasons of deaths worldwide. Successful treatment of infection relies on a timely identification of the infectious pathogen and its antibiotic resistance pattern to select the appropriate antibiotic treatment as early as possible. Here, we will highlight the potential of photonic approaches for the fast bedside identification of pathogens together with their antibiotic resistances. The challenges to overcome the valley of death to apply such novel photonic microbial analysis approaches for clinical routine requires novel infrastructures. To reach this goal, we established the research campus InfectoGnostics to safeguard the transfer from fundamental research into diagnostic systems.

ICOB Hot Topics Session

Thomas Krauss *University of York, UK*

Nanophotonic biosensors-clever photonics in a small package

Resonant nanophotonic concepts offer interesting opportunities for sensing and imaging applications. Our work focuses on guided mode resonances (GMRs), because they are easy to excite with out-of plane illumination. By chirping the grating, we have been able to integrate the sensing and the readout function. Using nanohole arrays in silicon, we have obtained remarkable results, including a very high surface sensitivity which is comparable to that of the plasmonic equivalent. Finally, we are now implementing common-path interferometric methods which further increase the available sensitivity. As a result, our detection limit is now approximately 1e-6 refractive index units, which is comparable to much more sophisticated approaches yet still compatible with a handheld device.

Malini Olivo *A*STAR, Singapore*

Skin inflammation imaging using Raster Scanning Optoacoustic Imaging and its quantitative analysis

According to a recent clinical survey in Singapore, 1 in 5 kids and 1 in 10 adults is affected by chronic skin inflammation condition such as Eczema or Atopic dermatitis. This has caused poor quality of life of those affected and substantial economic burden on Singapore healthcare system. Currently, eczema is qualitatively scored based on clinical questionnaires and it does not reflect the any sub skin surface characteristics such as morphology, vascular architecture and changes in epidermis thickness. Non-invasive imaging techniques for assessing this change in skin vascular structures could potentially serve as an objective indicators to characterize its severity that can help in developing an effective treatment procedure. Herein, for the first time, we present the preliminary results from an ongoing clinical study at Singapore National Skin Center, using non-invasive raster scanning optoacoustic mesoscopy (RSOM) imaging approach, which can combine the deep tissue interrogation of ultrasound and high contrast of optical techniques. Using RSOM imaging, we could objectively characterize the severity of eczema by visualizing the skin morphology and vascular pattern changes in the dermis and subdermis of patients enabling a quantification of inflammation in a label free manner.

Kirill Larin *University of Houston, USA*

Translational dynamic optical coherence elastography

The biomechanical properties of tissues can be dramatically altered by various diseases, such as keratoconus for the cornea of the eye and systemic sclerosis for the skin. Therefore, the ability to measure tissue biomechanical properties could provide critical information for assessing its health and detecting disease etiology as well as monitoring disease progression. Here, I will present pilot results in development of noncontact dynamic optical coherence elastography (OCE) technique to evaluate the biomechanical properties of the cornea and skin of healthy subjects and those affected by diseases.

Isla Barnard *University of St Andrews, UK*

Simulating Light-Tissue Interactions with MCRT

Monte Carlo radiative transfer (MCRT) methods use localised scattering and absorption probabilities to describe the path of photon packets through a medium, and are are ideally suited to simulating radiation transfer through complex structures. An ongoing collaboration between the School of Physics and Astronomy, St Andrews, and the Photobiology department at Ninewells Hospital & Medical School, Dundee, has developed expertise in modelling light-skin interactions using modified astronomical MCRT computer codes. One such project, initiated by a clinician, investigates spectrally resolved skin penetration depths achieved by different phototherapy radiation sources.

Thursday 23rd (full day)

Andrew Abell *CNBP, University of Adelaide Australia*

Light activated molecular switches in chemical biology

The problem with biological probes and sensors is that they lack an ability to be switched on and off and to present dual functionality, such as the delivery of a therapeutic response following sensing or extended imaging capacity. Organic fluorescent probes also generally lack photostability required for extended intracellular imaging. A hybrid nanomaterial is reported with an organic fluorescent probe bound to a nanodiamond for concurrent and extended cell-based imaging and ratiometric detection of hydrogen peroxide. Far-red fluorescence of the nanodiamond offers continuous imaging without photobleaching, while green fluorescence of the attached probe detects hydrogen peroxide on demand. This nanosensor allows extended bio-imaging not possible with a standalone organic fluorescent probe. Recent work is also presented on developing photoswitchable antibiotics and protease inhibitors; sensors for detecting metal ions, Glutathione, NO, and protein-protein interactions; and also surface bound drug delivery systems and molecular devices.

TALK ABSTRACTS

Kate Bechtel *Triple Ring Technologies, USA*

Bridging the gap: what researchers can do to better the chances of successful transition from prototype to product

While most researchers dream of seeing their technology utilized by those who need it, many would rather not be involved in aspects of commercialization unrelated to their PhD – regulatory pathway, reimbursement/revenue strategy, cost of goods, etc. However, much work remains in the area of science that is often overlooked. This presentation focuses on the critical gaps that exist when a technology is released too early from the lab and what researchers can do to fill those gaps and better position the technology for development.

Oliver Valet *mibic GmbH & Co. KG, Germany*

Industrial and Academic Applications of a Smart Single Microbe Raman Test Platform

Non-growth based methods for the phenotypic investigation of microorganisms provide rapid and label free direct access to identity determination, vital metabolic functions and the study of microbial interactions with substances. We present academic and industrial applications of our software-controlled fully automated modular instrument concept GRAM-RAY + HESSE-X. For industrial applications, the liquid handling system with centrifuge (HESSEX) is used for reproducible sample preparation from complex matrices. A wine producer detects living yeast and harmful organisms in wine and controls up to 300 samples per day with HESSE-X and the micro Raman GRAM-RAY unit. A manufacturer of cooling lubricants is investigating the effectiveness of novel biocides by high-throughput in vivo tests. Academic applications use the highest sensitivity in single cell identification for the investigation of zoonoses and detection of pathogens from beverages and food. Vibriones such as Colera are living, difficult-to-cultivate germs (VBNC) and these can be reliably detected with GRAM-RAY without a previous cultivation step. Their metabolism is examined by stable isotopes Raman (SIRM). In addition to liquid handling and centrifugation of the samples, HESSE-X also produces silver nano colloids in situ. With the GRAM-RAY system, the viability of bacteria can be directly investigated using SERS. The suitability of potential antibiotics for specific bacteria was determined within only 1 hour. By visualizing the interaction of an antibiotic with the bacteria membrane, the mechanisms of antibiotic resistance are elucidated.

Kishan Dholakia *University of St Andrews, UK*

Something cool in physics on the day

Optically based methods for imaging have emerged as very powerful routes for biomedical discovery. In this talk I will describe routes for deeper penetration into tissue that allow the recovery of wide field images yet minimise photodamage. I will review some emergent areas in Biophotonics and focus on the use of temporal focusing for multiphoton imaging at depth. This approach enables us to retrieve images through scattering media in the absence of any form of aberration correction.

David Sampson *University of Surrey, UK*

Polarisation-sensitive optical coherence tomography – here it comes again

Polarisation-sensitive optical coherence tomography (PS-OCT) has a long history, dating back to the early 1990s when the field of OCT began. Alteration of the polarisation state of light by biological tissue is an appealing source of contrast, and polarised light microscopy has an even longer history, and continues to evolve today. PS-OCT probes the presence and arrangement of fibrous structures, such as collagen or muscle cells, and the shape of scatterers, such as cells. It is complicated by the influence of the propagation path on the contrast, and the complex physics of polarised light-soft tissue interactions. Translational applications have been pursued for some time in glaucoma, tumour, and burns assessment and wound monitoring. Why has PS-OCT, then, not made more of a mark to date? In this talk, we will describe what has changed recently, and why we expect polarisation-based contrast to demonstrate great advances over the coming years.

Chris Xu *Cornell University, USA*

Deep and fast multiphoton microscopy

Multiphoton microscopy is the go-to technique for high spatial resolution, deep imaging in scattering biological tissue. Multiphoton imaging will likely play an essential role in understanding how the brain works at the level of neural circuits. In this talk, the fundamental challenges of deep tissue, high-resolution optical imaging are discussed. New technologies for in vivo structural and functional imaging of mouse brain using long wavelength excitation and three-photon microscopy will be presented. We will illustrate the requirements for imaging the dynamic neuronal activity at the cellular level over a large area and depth in awake and behaving animals, and show applications where 3-photon microscopy outperforms conventional 2-photon microscopy in both signal strength and image contrast. Finally, we will discuss several future directions, including adaptive optics and new laser sources, to further improve the imaging depth and speed in biological tissues.

Daniele Faccio *University of Glasgow, UK*

Deep-imaging with time-of-flight diffusive optical tomography

An outstanding challenge in optical medical imaging is the ability to image small objects or regions that a embedded in deep tissue, where by "deep" here we refer to samples that are 5-20 cm thick. The scattering coefficients of typical biological (e.g. brain) tissue imply that with these thicknesses we are in the diffusive regime where light propagates similarly to heat. Moreover, over these distances ballistic or snake photon are essentially undetectable and cannot be used for imaging. Different approaches must therefore be searched for that typically rely on computational inversion to reconstruct an image of embedded objects. We report on a novel computational technique that can image deeply embedded objects using light transmitted through the opaque material and measured using picosecond time-resolving single-photon cameras.

Andy Yun *Harvard Medical School and MGH Boston, USA*

Laser particles for multiplexed cell tagging

Laser particles that have a size of an optical wavelength in all three dimensions and emit distinct narrowband spectra are new, promising optical probes for biomedical applications. We present biocompatible semiconductor laser disks suitable for tracking many cells for imaging and single-cell analysis.

Friday 24th (Half day, ends at lunch)

Silvia Paracchini *University of St Andrews, UK*

Shedding light on language related disorders

Language-related disorders like dyslexia affect 5-10% of children and are caused by a significant genetic component (~70%). So far, very few underlying susceptibility genes have been identified and for those it is very difficult to dissect the role in diseases. We apply a range of assays based on the properties of light to understand the role of genes associated to disorders during neurodevelopment. These assays are allowing us to study tissues-specific patterns of expression since the very early phases of development; to fine-tune expression regulation and study the downstream effects of lower/higher expression; and study the effect of genes on the mechanical properties of cells. Gene function characterization is a major challenge for translational research derived from genetic discoveries. These assays provide new avenues to advance the field of complex trait genetics.

Halina Rubinsztein-Dunlop *University of Queensland, Australia*

Sculpted light for quantitative imaging of nano and microsystems

Use of spatial light modulators enables unprecedented control and highest versatility of light. We can now structure or sculpt light in such a way that it enables control of matter, studies of light-matter interactions, development of new and improved imaging techniques and many other applications. It is used in many fields and at scales ranging from nano to microsystems, from quantum physics to studies of complex biological systems. The use of sculpted light can vastly improve image resolution as well as enable applications of much stronger optical forces to the system under study. It provides valuable tool to studies in biophotonics.

Malte Gather *University of St Andrews, UK*

Microresonators and nanolasers to explore the biomedical world

Optical resonators provide one of the most accurate rulers known to mankind. In this talk I will summarize our recent work on translating this capability to studies of cells and tissue. In one example, we use ultra-soft elastic Fabry-Perot micro-resonators as substrates for cells and interferometrically detect the forces cells apply to these – with piconewton precision and at video-rate speed. This has enabled direct observation of biophysical processes relevant to cancer invasion, immune cell migration, kidney failure, cardiac contraction and others. In another example, we integrated nanoscale lasers into live cells and used dense spectral multiplexing of multiple lasers to tag and track individual cells within large cell populations and over extended periods of time. We recently developed this further to perform in vivo intracellular sensing, e.g. to measure contractility in the beating heart.

POSTER LIST

P1 **Investigating the forces in heterogeneous cultures of cancer cells through resonant photonics**
Dinesh Kumar, *University of St Andrews*

P2 **Super-resolution label-free non-linear techniques for bio-imaging**
Peter Johnson, *University of Southampton*

P3 **Interferometric sensing with guided-mode resonances**
Isabel Barth, *University of York*

P4 **Artificial neural networks for light delivery through complex media**
Alex Turpin, *University of Glasgow*

P5 **Label-free optical hemogram of granulocytes enhanced by artificial neural networks**
Roopam Gupta, *University of St Andrews*

P6 **Highly sensitive label-free biosensing with all-dielectric nanohole arrays**
Donato Conteduca, *University of York*

P7 **Label-free imaging for light sheet microscopy**
Niall Hanrahan, *University of Southampton*

P8 **Podocyte injury elicits loss and recovery of cellular forces**
Paul Reynolds, *University of St Andrews*

P9 **Light-sheet microscopy for histopathology**
Stella Corsetti, *University of St Andrews*

P10 **Organic light-emitting diode photostimulation for optogenetics**
Andrew Morton, *University of St Andrews*

P11 **Spectral unmixing of oxygen abundance for dye-free retinal angiography**
Tomasz Tkaczyk, *Rice University*

P12 **Spatially offset optical coherence tomography**
Philip Wijesinghe, *University of St Andrews*

P13 **TRAFIX: Multiphoton imaging through scattering media**
Adrià Escobet Montalbán, *University of St Andrews*

P14 **Through Bottle Sensing using Advanced Raman Geometries**
Holly Fleming, *University of St Andrews*

P15 **Semiconductor intracellular nanolasers**
Alasdair Fikouras, *University of St Andrews*

P16 **Human salivary Raman fingerprint as biomarker for the diagnosis of Amyotrophic Lateral Sclerosis**
Cristiano Carlomagno, *Fondazione Don Gnocchi*

P17 **Spectrally and spatially resolved depth penetration achieved by phototherapy lamps**
Isla Barnard, *University of St Andrews*

P18 **Microlaser-based contractility sensing in single cardiomyocytes and whole hearts**
Marcel Schubert, *University of St Andrews*

P19 **Fabrication of lasing networks for enhanced light-matter interaction**
Soraya Carlos Caixeiro, *University of St Andrews*

P20 **Multiphoton excitation in light sheet microscopy**
Federico Gasparoli, *University of St Andrews*

P21 **Podocyte injury elicits loss and recovery of podocyte cellular forces**
Nils Kronenberg, *University of St Andrews*

P22 **High-throughput analysis of individual protein aggregates in human cerebrospinal fluid**
Juan Varela, *University of St Andrews*

P23 **Quantitative phase and polarisation endoscopy applied to detection of early oesophageal tumourigenesis**
George Gordon, *University of Nottingham*

P24 **Tissue recognition in gastro intestinal tract using diffuse reflectance spectroscopy**
Siddra Maryam, *Tyndall National Institute*

P25 **Real-time imaging of cellular forces with piconewton precision**
Andrew Meek, *University of St Andrews*

P26 **Shining a light on mesoscale signalling in the vascular endothelium**
Larry Fitzpatrick, *Durham University*

P27 **Measurement and analysis of invadopodia forces in 2D and 3D environments**
Eleni Dalaka, *University of St Andrews*

P28 **Numerical model of laser tissue ablation and thermal injury**
Lewis McMillan, *University of St Andrews*

P29 **Numerical comparison of robustness of multimode and multicore fibre sensitivity against fibre bending**
Madhu Veettikazhy, *Technical University of Denmark*

P30 **Pushing the limits of label-free non-linear techniques for bio-imaging**
Sumeet Mahajan, *University of Southampton*

P31 **MAGNIFI - Margin assessment using global non-invasive fluorescence imaging**
Khushi Vyas, *Imperial College London*

P32 **Direct measure of the effect of Isoniazid on M. smegmatis using acoustic trapping combined with wavelength modulated Raman spectroscopy.**
Vincent Baron, *University of St Andrews*

P33 **iPlacenta - tackling the challenge of imaging vasculature endoscopically**
Lukas Markwalder, *University of Dundee*

P34 **Multiparameter susceptibility test based on hydrodynamic trapping of individual E. coli**
Giampaolo Pitruzzello, *University of York*

NOTES