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November 05-06, 2018 | Philadelphia, USA

DAY 1

Keynote Forum

Ji Xin Cheng, Biomed Res 2018, Volume 29 | DOI: 10.4066/biomedicalresearch-C7-018

Ji Xin Cheng
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CHEMICAL MICROSCOPY OF LIVING CELLS: A NEW WAY TO ELUCIDATING THE RULES OF LIFE

Until now, understanding of the exceptionally fast and selective chemical reactions occurring inside single living cells has been very limited, partly because conventional chemical assays essentially treat the cell, a highly dynamic structure, as a static bag of molecules. Using intrinsic signals from molecular spectroscopy, highly sensitive chemical imaging of living cells offers a way to circumvent the challenge. This presentation will show most recent innovations in instrumentation and data science that allowed real-time volumetric chemical imaging of living systems. Several advanced modalities including coherent Raman scattering microscopy, transient absorption microscopy and mid-infrared photo thermal microscopy will be discussed. Applications of these modalities to cancer biology, neuroscience and infectious diseases will be highlighted.

Biography

Ji Xin Cheng is professor of photonics and optoelectronics at Boston University photonics center. He additional works at division of materials science and engineering, department of chemistry, department of physics, neurophotonics center. His area of interest is molecular spectroscopic, imaging technologies, label-free microscopy, medical photonics, neurophotonics and photonics for infectious diseases. He is awarded with Moustakas chair professor in photonics and optoelectronics, Boston University, Purdue University College of Engineering research excellence award, 2016, Craver Award from Coblentz Society, 2015, Chang-Jiang scholar, minister of education, China, 2015-17, fellow of AIMBE (American Institute of Medicine and Biological Engineering), 2014, translational research award from international society for optics and photonics (SPIE), 2014.

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Albrecht Lindinger, Biomed Res 2018, Volume 29 | DOI: 10.4066/biomedicalresearch-C7-018

Albrecht Lindinger

Freie Universität Berlin, Germany

Biography

Albrecht Lindinger has earned his PhD on helium droplet spectroscopy in Gottingen in the group of J-P Toennies and took his postdoc term in Berkeley in the group of D Neumark. He received his habilitation in the field of coherent control at the Freie Universität Berlin in the group of L Wöste and is now a lecturer (PD) in the Institute of Experimental Physics at the Freie Universität Berlin. He has published 84 peer-reviewed papers in reputed journals. His main scientific interests are laser optics, coherent control, and biophotonics.

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TAILORED LASER PULSES FOR SELECTIVE MULTIPHOTON EXCITATION AFTER OPTICAL FIBERS

In recent years ultrashort laser pulses were increasingly used for multiphoton excited imaging in biological samples. Fluorescent molecules were employed to distinguish between tissue structures and a high contrast is favorable for microscopic imaging. There to, laser pulse shaping provides a powerful tool by tailoring the pulses such that two species may selectively be excited. In particular, shaping of laser pulses is applied to exploit intrapulse interference effects in multiphoton excited fluorescence. Furthermore, laser pulse shaping is successfully used to control photo-induced molecular processes. Novel pulse shaping schemes for simultaneous phase, amplitude, and polarization control were designed recently, and a parametric sub pulse encoding was developed. Thereby, physically intuitive parameters like chirps and polarization states can be controlled. This yields new perspectives of utilizing all properties of the light field in the pulse modulation.

This contribution reports pulse shaping methods for improved multiphoton excited fluorescence contrast after transmitting a nanostructured kagome fiber. The distortions due to the optical fiber properties are precompensated to receive predefined shaped pulses at the distal end of the fiber. Special antisymmetric phase functions are employed for scans of the multiphoton excitation fluorescence. Application of phase-shaped pulses for imaging contrast enhancement is demonstrated for the auto fluorescing vitamins A and B2. Moreover, particularly phase and polarization tailored pulses are generated to optimally excite one dye in one polarization direction and simultaneously the other dye in the other polarization direction, thereby utilizing the anisotropy of the dye molecules. The presented method has a high potential for endoscopic applications due to the unique kagome fiber properties for imaging of endogenous fluorophores.

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Stanley Schwartz, Biomed Res 2018, Volume 29 | DOI: 10.4066/biomedicalresearch-C7-018

Stanley Schwartz

University of Pennsylvania, USA

Biography

Stanley Schwartz is an affiliate of the main line health system and an emeritus associate professor of medicine at the University of Pennsylvania, currently in a private practice in Ardmore, Pennsylvania. Stanley Schwartz received his MD in 1973 from the University of Chicago in Chicago, Illinois. He then completed his residency at the University of Pennsylvania, followed by a fellowship in endocrinology and metabolism at the University of Chicago.

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A UNIFIED PATHOPHYSIOLOGIC CONSTRUCT OF DIABETES AND ITS COMPLICATIONS, INCLUDING MALIGNANCIES, IN THE CONTEXT OF THE β-CELL–CLASSIFICATION OF DIABETES

We have previously presented a proposal for a new, beta-cell centric classification of diabetes based on a consilience of genetic, metabolic, and clinical research that have accrued since the current classification was instituted. It recognizes that the beta-cell is the core defect in all patients with diabetes. Differences in the genetics, insulin resistance, environment and inflammation/immune characteristics of the damage to the beta-cell in each individual will determine the phenotypic presentation of hyperglycemia and allow for a patient-centric, precision-medicine therapeutic approach, part of which we labeled 'the Egregious Eleven'.

We now recognize the same pathophysiologic mechanisms that account for damage to the beta-cells govern the susceptibility of the cells involved in the complications of diabetes to damage by the now well-defined abnormal metabolic environment that typifies beta-cell dysfunction. This abnormal metabolic environment is typified by oxidative stress which alters metabolic pathways a la Brownlee's Hypothesis model, alterations in gene expression, epigenetics, and inflammation. This unified pathophysiologic construct of diabetes and its complications, including malignancies, in the context of the β-cell–Classification of Diabetes allows us to understand the varied risk of developing complications of diabetes with similar levels of glycemic control, how non-glycemic effects of some medications for diabetes result in marked complication risk modification and the value treating co-morbidities of diabetes in effecting complication risk.

Principles we outlined in using 'the Egregious Eleven' model- use agents that preserve beta-cell function, treat with least number of agents that treat most number of mechanisms of hyperglycemia- can be extended to use those agents, in combination, that also engender weight loss, and decrease CV outcomes. This approach allows for a more accurate assessment and treatment of each patient's disease and effecting true precision medicine.

We also believe that the same pathophysiologic mechanisms that account for damage to the beta-cells and govern the susceptibility of the cells involved in the complications of diabetes are likely to explain the association of cancer and cognitive deficiencies to diabetes and obesity, explaining why a diabetic medication may affect cancer risk and therapy.

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Ravinder K Jain, Biomed Res 2018, Volume 29 | DOI: 10.4066/biomedicalresearch-C7-018

Ravinder K Jain

University of New Mexico, USA

Biography

Ravinder K Jain is professor of ECE and physics at the University of New Mexico. After obtaining his PhD in electrical engineering from the University of California, Berkeley, and spending over 15 years in industry, notably Bell Labs, Hughes Research Labs, and Amoco Technology Company, he transitioned to academics as an Endowed Chair of Microelectronics at the University of New Mexico, where he served as associate director for the alliance of photonics technology. He has served on several professional society and conference committees, the board of governors at IEEE-LEOS, the board of directors at the Optical Society of America (OSA), and is currently serving as an associate editor for Optics Express. He has an H-index of 36 with over 160 publications and over 20 patents, and is a recipient of numerous professional awards, including SPIE's Edgerton award and is a fellow of OSA, IEEE, SPIE, and the American Physical Society.

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GLASS BASED ADVANCED MID INFRARED PHOTONIC DEVICES

Advances in low loss high purity glasses were initially driven by fiber-optic communications, and the related interest in developing low loss optical fibers covering a variety of spectral regions, which in turn led to development of fibers as rare earth and transition metal ion host media for numerous unique fiber amplifier and attenuator applications. Much lower Rayleigh scattering losses achievable at longer wavelengths spurred the development of low loss mid-IR fibers leading to three dominant families of glass fibers, namely fluorides, chalcogenides, and tellurites. Of these families of mid-IR fibers and glasses, the fluoride glass fiber technology has emerged as the most mature because of its unique combination of broad transparency, glass stability, and its "fiberizability" into low-loss single-mode fibers.

The "fiberizability" of glasses is not only significant for fiber lasers and amplifiers, but is also a good measure of the glass stability, which is quite critical for making high-Q microresonators with a low amount of light loss due to scattering from crystallites and surface roughness. More recent work has focused largely on the development of high optical nonlinearity glasses for applications ranging from Raman amplifiers and comb generators to continuum generation. I will review device optimization issues related to glass based mid infrared optoelectronic devices, notably mid infrared fiber lasers and fiber amplifiers, nonlinear optic frequency convertors and comb generators, and microresonators for sensors and mid-IR microlasers. The use of advanced fabrication techniques for fabrication of mid-IR glass fibers and mid-IR microresonators, including the use of specialized molds for pouring molten glass to cast such microresonators will be discussed. Specific achievements – including the attainment of >20 Watts of output power in mid-IR fiber lasers will be discussed, along with the prospect of achieving narrow linewidth sub-megahertz operation of mid-IR fiber lasers spanning the entire mid-IR spectral range between 2-7 microns.

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JMA Hannan, Biomed Res 2018, Volume 29 | DOI: 10.4066/biomedicalresearch-C7-018

JMA Hannan

Independent University, Bangladesh

Biography

JMA Hannan earned a PhD in pharmacology from University of Ulster, UK. He started his research career as research officer at the department of pharmacology, research division, BIRDEM, Dhaka, Bangladesh. He is the founder chairman of the department of pharmacy, North South University, Dhaka currently working as professor and head of the department of pharmacy in the Independent University, Bangladesh (IUB), Dhaka. He has over 20 years of teaching and research experiences with 76 full publications and 93 abstracts to his credit. He published a textbook on 'Medical and Pharmaceutical Statistics'.

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Note:

SPIRULINA PLATENSIS STIMULATES GLUCOSE-STIMULATED INSULIN SECRETION IN PERFUSED RAT PANCREAS AND BRIN-BD11 CELLS THROUGH THE cAMP-DEPENDENT PKA PATHWAY

Background and Aim: The antihyprglycemic effects of *Spirulina platensis* has previously been reported in rats and humans. In this study the effects of *S. platensis* were evaluated on insulin secretion together with exploration of its mechanism underlying insulin action in isolated perfused rat pancreas and BRIN-BD11 cells.

Method: The ethanolic extract was successively partitioned using hexane, chloroform, ethylacetate and 1-butanol. Butanol part was dissolved in Krebs-Ringer bicarbonate (KRB) buffer solution (pH adjusted to 7.4), continuously bubbled with O2 and perfused, via a cannula into the aorta, to the celiac and mesenteric arteries of pancreas, isolated by surgery under pentobarbital anesthesia. Insulin in the effluent (collected from a cannula in the portal vein at 1 min interval) was measured by an ELISA technique with a rat insulin assay kit. Insulin secretory activity was also observed using rat clonal β-cells (BRIN-BD11 cells). For the studies on the mechanism underlying the insulin secretory activity, 16.8 mM glucose, 30 mM KCl, 50 μM verapamil, 300 μM diazoxide and 10 mM theophylline were used.

Result: The butanol fraction of *S. platensis* substantially increased insulin release 1.4 - 4 fold (compared to 5.6mM glucose, $P<0.05$ – $P<0.001$) in a dose dependent manner at concentrations 8 to 5000μg/ml from BRIN-BD11 cells. The butanol fraction produced 10-fold increase in insulin secretion from perfused pancreas ($p<0.01$). Perfusion of pancreas with fraction along with 16.8 mM glucose caused a significant ($P<0.01$) steep rise of insulin release. The infusion of diazoxide (300 μM), (a KATP channel opener) and Verapamil (50 μM), (a voltage-dependent Ca2+ channel blocker) in presence of 16.8 mM glucose did not significantly affect insulin secretion by *S. platensis*. Therefore, this study indicating that effect was not associated with changes in glucose metabolism, Ca^{2+} signals or KATP channel activity. The fraction increased insulin secretion in presence of a cAMP competitor (theophylline, 10mM) significantly ($p<0.01$) from perfused pancreas. Diazoxide and verapamil did not significantly inhibit the insulin enhancing effects of the fraction in BRIN-BD11 cells. The fraction also stimulated insulin release from chemically depolarized BRIN-BD11 cells incubated with 30 mM KCl at 16.7 mM glucose. The augmentation of insulin secretion in completely depolarized conditions and in presence of cAMP competitor (theophylline) is strongly suggestive of an action on second messenger systems, such as adenylate cyclase-cAMP or phosphatidylinositol pathway, or on exocytosis.

Conclusion: These data suggest that butanol fraction of *S. platensis* may be capable of improving insulin secretion in type 2 diabetes by a variety of actions.

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Giorgio Pettinari
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Biography

Giorgio Pettinari is a researcher at the Institute of Photonics and Nanotechnologies of the National Research Council of Italy. He got a PhD in materials science from Sapienza University of Rome (Italy, 2008) and was an assistant researcher at High Field Magnet Laboratory of the Radboud University of Nijmegen (The Netherlands, 2009-2011) and a Marie Curie Research Fellow at the University of Nottingham (UK, 2011-2013). His interests range from the experimental investigation of semiconductor nanostructures to micro- and nano-fabrication and investigation of innovative photonic and plasmonic devices. Recently, he developed a novel strategy for the post-growth fabrication of site-controlled, single-photon emitting quantum dots. Pettinari published more than 40 peer-reviewed original papers in academic journals (among which 2 invited review papers), 2 invited book chapters, and he given more than 20 oral contributions and seminars (7 invited) at international conferences and research institutes.

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NOVEL STRATEGIES FOR SITE-CONTROLLED QUANTUM EMITTER FABRICATION

Many of the most advanced applications of semiconductor quantum dots (QDs) in quantum information technology require a fine control of the QDs' position and confinement potential, which are hardly to be achieved with conventional growth techniques. Here, a novel and versatile approach for the post-growth fabrication of site-controlled QDs is presented based on a spatially selective incorporation or removal of hydrogen atoms in dilute nitride structures. Hydrogen incorporation in GaAsN results, indeed, in the formation of N–H complexes that neutralize all the effects of N on GaAs, including the N-induced large reduction of the bandgap energy. Therefore, by engineering the spatial incorporation and/or removal of hydrogen in dilute nitrides it is possible to attain a spatially controlled modulation of the bandgap energy in the growth plane and, eventually, to tailor the carrier-confining potential down to a nm scale, resulting in the fabrication of site-controlled QDs that are able to emit single photons on demand.

Two different fabrication approaches have been developed to control spatially the hydrogen incorporation and removal in the system: either a lithographic-based technique for defining hydrogen opaque masks for the spatial control of hydrogen incorporation and a laser-assisted spatially selective hydrogen removal technique that takes advantage of a local N–H complex dissociation induced within the light spot generated by a scanning near-field optical microscope. Both techniques relies on the peculiar ultra-sharp diffusion profile of hydrogen in dilute nitrides and allow a control on the hydrogen implantation and/or removal on a nanometer scale. This novel fabrication technique feature state-of-the-art position accuracy (up to 20 nm) as well as a fine control on the emission energy of the realized QDs. The strategy for a deterministic spatial and spectral coupling of such quantum emitters with photonic crystal cavities has been also developed.

Note: