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25th Nano Congress for Future Advancements

&

12th Edition of International Conference on

Nanopharmaceutics and Advanced Drug Delivery

August 16-18, 2018 | Dublin, Ireland

Keynote Forum

Day 1

Oliver G Schmidt, Nano Res Appl 2018, Volume 4
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Oliver G Schmidt

Institute for Integrative Nanosciences, Germany

Microtubular nanomembrane devices: From energy storage to reproduction technologies

Microtubular nanomembrane devices (MNDs) with outstanding properties are self-assembled into fully functional and integrative three-dimensional architectures. This makes them attractive for a broad range of applications and scientific research fields ranging from energy storage to reproduction technologies. MNDs are used to construct ultra-compact energy storage devices as well as ultra-sensitive advanced electronic circuitry, nanophotonic cavities, sensors and optofluidic components towards the implementation of a lab-in-a-tube system. They are also useful to study basic mechanisms of single cancer and stem cell migration, growth and mitosis in realistic 3D confined environments. Off-chip applications include biomimetic microelectronics for regenerative cuff implants and the development of hybrid microbiorobotic motors for paradigm shifting reproduction technologies. Cellular cyborg machinery is put forth for novel schemes in targeted drug delivery and cancer treatment.

Biography

Oliver G. Schmidt is the Director of the Institute for Integrative Nanosciences at the Leibniz IFW Dresden, Germany. His interests bridge across several disciplines, ranging from nanomaterials and nanoelectronics to microfluidics, microrobotics and biomedical applications. He has received several awards: the Otto-Hahn Medal from the Max-Planck-Society in 2000, the Philip-Morris Research Award in 2002, the Carus-Medal from the German Academy of Natural Scientists Leopoldina in 2005, and the International Dresden Barkhausen Award in 2013. Most recently, he was awarded the Gottfried Wilhelm Leibniz-Prize 2018 of the German Research Foundation. The Leibniz-Prize is Germany's most important research award and recognizes his outstanding work in the investigation, manufacturing and innovative application of functional nanostructures.

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Rongjun Chen, Nano Res Appl 2018, Volume 4
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Rongjun Chen

Imperial College London, UK

Bio-inspired anionic polymers as a platform for designing novel nanoscale intracellular drug delivery systems

It remains a major challenge to effectively deliver therapeutic agents, in particular macromolecules, through negatively charged lipid membrane barriers. It is the most limiting step preventing successful implementation of macromolecule-based cell modification and intracellular therapies. This is due to endosomal entrapment of macromolecules and their degradation in lysosomes. Many researchers have used cationic delivery systems to address this challenge. However, the positive charge could cause some issues, such as unfavorable biodistribution, rapid renal clearance and high non-specific cytotoxicity. This presentation presents an alternative delivery strategy based on an anionic drug delivery platform. It covers our recent efforts on design and synthesis of novel anionic, viral-peptide-mimicking, pH-responsive, metabolite-derived polymers, and evaluation of their use in intracellular drug delivery *in vitro* and *in vivo*. Strict control over the size, structure, hydrophobicity-hydrophilicity balance and sequence of the polymers can effectively manipulate interactions with lipid membrane, cell and tissue models. It has been demonstrated that the biomimetic polymers can successfully traverse the extracellular matrix in three-dimensional multicellular spheroids, and also enable efficient loading of a wide range of macromolecules into the cell interior. This can represent a versatile delivery platform, suitable for targeted therapeutic delivery and cell therapy for treatment of various diseases including but not limited to cancer.

Recent Publications

1. Wang S and Chen R (2017) pH-responsive, lysine-based, hyperbranched polymers mimicking endosomolytic cell-penetrating peptides for efficient intracellular delivery. Chemistry of Materials. 29(14):5806-5815.
2. Chen S et al. (2017) Membrane-anchoring, comb-like pseudopeptides for efficient, pH-mediated membrane destabilization and intracellular delivery. ACS Applied Materials & Interfaces. 9(9):8021-8029.
3. Chen S and Chen R (2016) A virus-mimicking, endosomolytic liposomal system for efficient, pH-triggered intracellular drug delivery. ACS Applied Materials & Interfaces. 8(34):22457-22467.
4. Zhang W et al. (2016) pH and near-infrared light dual-stimuli responsive drug delivery using DNA-conjugated gold nanorods for effective treatment of multidrug resistant cancer cells. Journal of Controlled Release. 232:9-19.
5. Khormaee S et al. (2013) Endosomolytic anionic polymer for the cytoplasmic delivery of siRNAs in localized *in vivo*. Advanced Functional Materials. 23(5):565-574.

Biography

Rongjun Chen obtained his MSc Degree in Materials Science from Tsinghua University (P R China) in 2003; pursued PhD Degree at Cambridge University (UK) during the period 2003-2007, with focus on polymer drug delivery. He carried out his Postdoctoral Research at Cambridge University first on lyophilisation of pharmaceuticals and then on manufacture of clinical-grade lentiviral vectors for gene therapy during the period October 2006 to September 2009. In May 2013, he moved to Imperial College London as a Lecturer and is currently a Senior Lecturer since 2016. From October 2009 to April 2013, he started his independent academic career by taking a tenure-track faculty position as the Group Leader and BHRC Senior Translational Research Fellow at the University of Leeds. His research interests focuses on biomaterials, nano-medicine, drug delivery and cell therapy.

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Andrew David Miller

King's College London, UK

Progress in aligning nanomedicine with precision therapeutic approaches for the treatment of chronic diseases

Precision Medicine is considered by many to be a necessary future for the treatment for all diseases. Fundamentally, this can be divided into two subsections, namely personalized medicine and precision therapeutics. With personalized medicine, the aim is to understand the genetic, immunological and/or metabolic individuality of patients in order to match individual patients with the most appropriate active pharmaceutical ingredients (APIs) for treatment of their particular disease(s). With precision therapeutics, the aim is to take control of the delivery of APIs to disease target tissue, by means of nanomedicine, and/or make use of select APIs that have extreme target specificity. The focus of this lecture is in precision therapeutics, as demonstrated by four worked examples of precision therapeutic approaches (PTAs) that are currently being taken forward in my laboratories and the laboratories of key collaborators for the treatment of chronic diseases. The chronic diseases of interest are chronic pain, epilepsy, cancer, non-alcoholic fatty liver disease (NAFLD) /diabetes type II, and infectious diseases such as influenza, Zika virus and HIV. By way of example, the right-hand side panel outlines a PTA for the treatment of cancer. In effect, a combination of bio-imaging and the application of image-guided targeting enable anti-cancer drug delivery nanoparticles to accumulate in a tumour lesion of choice and no obvious place elsewhere in the body. Accumulated nanoparticles may then release these anti-cancer drugs for local activity against tumour tissue saving other body tissues from unwanted exposure to these otherwise cytotoxic drugs. Implementation of such a PTA in the clinic could radically improve patient chemotherapy outcomes whilst reducing both required drug doses and side effects to an unprecedented degree. Such potential step changes in disease treatment explain why precision therapeutics should be an indispensable part of future medicine.

Recent Publications

1. Miller A D (2016) Nanomedicine therapeutics and diagnostics are the goal. Ther. Del. 7(7):431-456.
2. Miller A D (2016) Precision active pharmaceutical ingredients are the goal. Future Med. Chem. 8(11):1209-1238.
3. Miller A D (2016) Evolving from academic to academic entrepreneur: overcoming barriers to scientific progress and finance. Future Med. Chem. 8(11):1157-1162.
4. Mašek J et al. (2017) Multi-layered nanofibrous mucoadhesive films for buccal and sublingual administration of drug-delivery and vaccination nanoparticles: important step towards effective mucosal vaccines. J. Control. Rel. 249:183-195.
5. Brody L P et al. (2017) Cationic lipid-based nanoparticles mediate functional delivery of acetate to tumour cells *in vivo* leading to significant anticancer effects. Int. J. Nanomedicine. 12:6677-6685.

Biography

Andrew David Miller is well known as a leading Chemist Expert in the understanding and exploitation of molecular mechanisms in biology. The overall goal of his academic research has been and continues to be the design and creation of advanced therapeutics and diagnostics that address unmet medical need in the treatment of chronic diseases (such as cancer, diabetes, pain and some infectious diseases). From 1990-2010, he was a Member of academic staff in the Chemistry Department of Imperial College London (UK) where he founded the Imperial College Genetic Therapies Centre (GTC) in 1998, and became Full Professor of Organic Chemistry and Chemical Biology in 2002. Since 2010, he has been affiliated with King's College London (UK) and more recently with the Veterinary Research Institute (VRI) in Brno, Czech Republic, where he is the Director of OPVVV Project FIT and its Key Foreign Scientist (KFS). He Co-Founded KP Therapeutics Ltd in 2016 with a pipeline of Precision Therapeutic Approaches (PTAs) in discovery & development for the diagnosis and treatment of chronic diseases. He has currently published nearly 250 papers, book chapters and alike, including at least 26 patents and patent applications. He is also Principal Writer of the first textbook of chemical biology *"Essentials of Chemical Biology"*, John Wiley & Sons.

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Day 2

Jacek Ulanski, Nano Res Appl 2018, Volume 4
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Jacek Ulanski

Lodz University of Technology, Poland

Solution processable phosphorescent organic light emitting diodes

Printed organic electronics is an emerging technology which attracts a lot of interest due to very broad range of possible applications. However in spite of very intensive reasearch carried out since several years in academic and industrial laboratories, there are still many unsolved problems hindering implementation of this new technology. Concerning printed organic light emitting diodes (OLEDs) among different obstacles two have fundamental meaning – low efficiency and poor solution processability. In this work we will present how one increase efficiency of electroluminescence by emplying triplet excited states using as the emitters new iridium complexes, and how one improve processability of the emissive layers by means of host-guest approach with ambipolar polymer as the host matrix.

Biography

Jacek Ulanski is an Professor at Lodz University of Technology in Lodz, Poland since 1994; Full Professor since 2001; since 1999, he is the Head of Department of Molecular Physics. His research work lies in physical properties of polymers, molecular crystals, composites and nanocomposites, hydrogels, molecular relaxations, phase transitions, intermolecular interactions, transport of energy and charges. Developing of new materials and new processing techniques (like reticulate doping or zone-casting) for organic opto-electronic devices; construction and characterisation of OFETs, OLEDs, photovoltaics, photodiodes. He is a Supervisor of 21 PhD thesis, author and co-author of over 230 papers and monographs, many patents and over 100 lectures at international conferences.

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Notes:

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Sergey Suchkov

Sechenov University, Russia

Personalized and precision medicine as a unique healthcare model to secure the national and international biosafety

A new systems approach to diseased states and wellness result in a new branch in the healthcare services, namely, *personalized and precision medicine (PPM)*. To achieve the implementation of PM concept, it is necessary to create a fundamentally new strategy based upon the subclinical recognition of biopredictors of hidden abnormalities long before the disease clinically manifests itself. Each decision-maker values the impact of their decision to use PPM on their own budget and well-being, which may not necessarily be optimal for society as a whole. It would be extremely useful to integrate data harvesting from different databanks for applications such as prediction and personalization of further treatment to thus provide more tailored measures for the patients resulting in improved patient outcomes, reduced adverse events, and more cost effective use of health care resources. A lack of medical guidelines has been identified by the majority of responders as the predominant barrier for adoption, indicating a need for the development of best practices and guidelines to support the implementation of PPM! Implementation of PPM requires a lot before the current model "physician-patient" could be gradually displaced by a new model "medical advisor-healthy person-at-risk". This is the reason for developing global scientific, clinical, social, and educational projects in the area of PPM to elicit the content of the new branch.

Biography

Sergey Suchkov was born in the City of Astrakhan, Russia. In 1980, graduated from Astrakhan State Medical University and was awarded with MD. In 1985, maintained his PhD at the I.M. Sechenov Moscow Medical Academy and Inst of Med Enzymology. In 2001, and then his Doctor Degree at the Nat Inst of Immunology in Russia. From 1989 through 1995, was being a Head of the Lab of Clin Immunology, Helmholtz Eye Research Inst in Moscow. From 1995 through 2004 - a Chair of the Dept for Clin Immunology, Moscow Clin Research Institute (MONIKI). In 1993-1996, was a Secretary-in-Chief of the Editorial Board, Biomedical Science, an international journal published jointly by the USSR Academy of Sciences and the Royal Society of Chemistry, UK.At present, Dr Sergey Suchkov, MD, PhD, is:

- Professor, Director, Center for Personalized Medicine, Sechenov University and Dept of Clinical Immunology, A.I.Evdokimov Moscow State Medical and Dental University;
- Professor, Chair, Dept for Translational Medicine, Moscow Engineering Physical Institute (MEPhI), Russia
- Secretary General, United Cultural Convention (UCC), UK.
- Dr Suchkov is a member of the:
- New York Academy of Sciences, USA
- American Chemical Society (ACS), USA;
- American Heart Association (AHA), USA;
- European Association for Medical Education (AMEE), UK;
- EPMA (European Association for Predictive, Preventive and Personalized Medicine), EU;
- ARVO (American Association for Research in Vision and Ophthalmology);
- ISER (International Society for Eye Research)
- Personalized Medicine Coalition (PMC), USA

Dr Suchkov is a member of the Editorial Boards of *"Open Journal of Immunology", EPMA J., American J. of Cardiovascular Research* and *"Personalized Medicine Universe"*.

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Pauline Y Lau, Nano Res Appl 2018, Volume 4
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Pauline Y Lau

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A breakthrough in enhancing the therapeutic index of immunotherapy and target therapy for cancer

Statement of the Problem: A common issue for anti-cancer drugs are the strong toxicity and low efficacy of most therapies. This is especially an issue to many immunotherapies such as IL12. This is caused by not enough drugs enter tumor tissues to have satisfactory efficacy, and left majority of the drugs enter normal tissues to cause high toxicities to the normal tissues. Target drug delivery technologies such as liposomes are effective in improving the therapeutic index (efficacy/toxicity) of small molecular chemotherapies. But, no effective technology has been demonstrated to effectively enhancing the therapeutic index of protein drugs including monoclonal antibody targeted therapies.

Breakthrough in Cancer Treatment: A new nanotechnology, MNC technology, has been dramatically improved the therapeutic index of all classes of anti-cancer drugs. Successful applications are demonstrated by Trastuzumab (monoclonal antibody), Interferon alpha (immunotherapy) and Sunitinib (chemotherapy).

Principle of Technology: MNC technology is a micelle nanocomplex that can reversably bind to drugs, target deliver majority of the drug to the tumor site plus effectively slow release of the drug from circulation to tumor to enhance the full usage of the drug and reduce toxicity.

Biography

Pauline Y Lau has been working in medical industry for over 35 years with experiences in both pharmaceutical and *in-vitro* medical device (IVD). Her accomplishment is well recognized by the international societies in the last 20 years. Suntec Medical Inc., USA (pharmaceutical company) under her leadership has successfully registered pharmaceutical products globally. Currently, the company is developing a portfolio of cancer therapies including immuno-oncology and targeted therapies utilizing its proprietary MNC technology platform. She is global Expert and accomplished Researcher in Precision Medicine. She was an Executive Director in Integrated Medicine at Roche Pharmaceuticals.

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Day 3

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H Jörg Osten

Leibniz University Hannover, Germany

Epitaxial oxides on silicon for nanoelectronic applications

The ability to integrate crystalline metal oxide dielectric layers into silicon structures can open the way for a variety of novel applications which enhances the functionality and flexibility ranging from high-K replacements in future MOS devices to oxide/silicon/oxide heterostructures for nanoelectronic application in quantum-effect devices. We present results for crystalline gadolinium oxides on silicon grown by solid source molecular beam epitaxy. The dielectric properties of such oxides are sensitive to small variations in structure and symmetry. It is known that thin layers of crystalline rare earth oxides can exhibit significant larger dielectric constants compared to bulk materials. We will explain these effects by strain induced structural phase deformations. First, we will report on the dependence of the dielectric constant on layer thickness for epitaxial Gd_2O_3 on Si (111). Controlling the oxide composition in ternary $(Gd1\text{-}xNdx)_2O_3$ thin films enables us to tune the lattice mismatch to silicon, and thus the strain-induced variation in the dielectric constants of the layer. We will finally demonstrate different approaches to grow Si nanostructures embedded into crystalline rare earth oxides. By efficiently exploiting the growth kinetics one could create nanostructures exhibiting various dimensions, ranging from three dimensionally confined quantum dots to the quantum wells, where the particles are confined in one of the dimensions. Double-barrier structures comprising epitaxial insulator as barriers and Si as quantum-well are attractive candidate for resonant tunneling devices. Embedded Si quantum dots exhibit excellent charge storage capacity with competent retention and endurance characteristics suitable for non-volatile memory device applications.

Biography

H Jörg Osten has studied Physics in Poland. First he was working at the Institute for Physical Chemistry in Berlin in the field of Radio-Frequency Spectroscopy. In 1988, he joined the Institute of Semiconductor Physics (IHP) in Frankfurt, Germany. In 2002, he became the Director of the Institute Electronic Materials and Devices at the Leibniz University of Hannover, Germany, where he also holds a Chair for Electronic Materials and Technology. He has published more than 270 papers and gave more than 80 invited and 200 contributed talks at international conferences.

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Christian Gagnon

Environment and Climate Change Canada, Canada

Silver nanoparticles in municipal wastewaters and environmental fate

Silver nanoparticle is largely used for various products and is finally found in discharged wastewaters. Silver was typically detected in all investigated municipal wastewaters. Concentrations of total silver in municipal were measured to assess Ag removal efficiency of treatment plants. Wastewater samples were also analyzed by the technique of single-particle inductively coupled plasma–mass spectrometry (SP-ICP-MS) to identify and determine that they contained silver nanoparticles. Nano-sized forms would account for less than 5% of the total Ag released from municipal effluents. Once released in the receiving environment, Ag NPs can undergo major transformation and their initial properties can be modified under natural conditions. The developed analytical approach was used for tracking silver nanoparticles and their degradation products over a period of 80 days. Particle size distributions changed significantly under different experimental conditions where most material was found in coarse colloidal fractions (<100 kDa). The presence of natural humic substances slowed degradation of nanoparticles, which is characterized by the increase of free/small ion complexes and the detection of colloids with a size less than 80 nm. Haft-live values were generally estimated to be less than 15 days under natural conditions. Future research on nanotoxicity should consider exposure conditions, and then potential transformation, for risk assessment studies.

Biography

Christian Gagnon is a Senior Researcher in Geochemistry at Environment and Climate Change, Canada. He obtained his PhD from the University of Quebec/INRS-Oceanography and completed his Postdoctoral studies on the bioavailability of contaminants at the State University of New York, Stony Brook. His research focuses on the fate, transformation and behaviour of chemical contaminants released into the aquatic environment. All of its work aims at a better understanding of the mechanisms of transformation and the fate of metals and emerging substances in waste water discharges and the receiving environment. He has published over 150 scientific publications and reports and has contributed to over 250 scientific presentations on contaminant behaviour in the aquatic environment.

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Krasimir Vasilev

University of South Australia, Australia

Nano engineered plasma polymer films for biomedical applications

In this talk, author will present recent developments from his lab on various biomaterial coatings that are facilitated by plasma deposition. These include antibacterial coatings, drug release platforms and cell guidance/capture surfaces. Undesired bacterial adhesion and subsequent colonization of medical devices is a substantial medical problem causing complex and sometime fatal infections. We have developed various strategies for generation of antibacterial coatings that can be applied to medical device surfaces. These involve means such as silver nanoparticles, antibiotics, nitric oxide, quaternary ammonium compounds (QACs) or simply coatings that have intrinsic low fouling properties. All these coatings are facilitated by plasma deposition, a technique that provides functional films placed to the surface of any type of material. Important for applications, we not only extensively test our coating for their antibacterial efficacy against medically relevant pathogens but also assess their potential cytotoxicity to mammalian cell and inflammatory consequences. We have also developed methods for the synthesis and surface immobilization of hybrid antibacterial nanocapsules and nanoparticles, including such capable of triggered release. In a second part of the talk author outline his work on developing advanced nanoengineered plasma polymer coatings capable of directing cellular behavior including adhesion, proliferation, differentiation and migration. We have developed unique capabilities to control and tailor entire spectrum of surface properties such as chemistry, wettability, ligand densities, nanomechanics and nanotopography in a substrate independent fashion. We can tailor all these surface properties in a gradient manner too. Author will demonstrate how we use surface gradients of nanoparticles density to study the influence of surface nanotopography on the behavior of various cell types, including immune cells and author will outline how we guide the differentiation of stem cells by tailoring surface chemistry, nanotopography or density of signaling molecules. Author will briefly present drug delivery and release platforms that we have developed including a method for solvent free encapsulation of drug particles. A recently developed device for selective cancer cell capture for complex liquids and how it is used for diagnostic of bladder cancer will also be presented.

Biography

Krasimir Vasilev completed PhD at the Max-Planck Institute for Polymer Research in Mainz, Germany in 2004. After a short postdoctoral stay as a Marie Curie Fellow at the Institute of Genomics and Molecular and Cellular Biology in Strasbourg, France, in 2005, He accepted a research position at the University of South Australia. He was appointed as a Senior Lecturer in March 2009. In 2010, He was awarded the prestigious Future Fellowship from the Australian Research Council. He was promoted to Associate Professor in January 2012. He have held positions such as Associate Head of School-Research (2012-2013) and Research Education Portfolio Leader (2014-2015). In 2016, He was awarded two prestigious fellowships i.e. the Humboldt Fellowship for Experienced Researchers from the Humboldt Foundation and a Research Fellowship from National Health and Medical Research Council (NHMRC). He was promoted to Full Professor on 1st of January 2017.

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