

**Book of Abstract
(Oral Presentations)**

Plasmonic Generation of Electricity

Professor Chris D. Geddes, Ph.D., FRSC.

Institute of Fluorescence, University of Maryland Baltimore County, Columbus Center,
701 East Pratt Street, Baltimore, MD, 21202 USA.

E-mail: geddes@umbc.edu

Fluorescence technologies are entrenched throughout the biosciences today. In nearly all aspects of fluorescence spectroscopy light is finally focused and collected by a detector which converts the photon flux into a digital signal which is ultimately displayed on a screen. To boost optical signatures the Geddes group has shown that the close proximity of fluorescent molecules to Plasmon supporting materials, significantly amplifies the fluorescence signatures many fold, as much as 10^3 in the far-field and much higher in the near-field, a technology recently called Metal-Enhanced Fluorescence (MEF). However, recently discovered and hidden within these close-range near-field fluorophore-metal interactions $< \approx 20$ nm, is an induced plasmonic current (an electrical current), directly proportional to the fluorophores' extinction coefficient. Importantly, the enhancements in the near-field are tremendous and difficult to realize in the far-field, but can be realized in near-field plasmonic current generation, a technology we have called **Plasmonic Electricity (PE)**. As we will show, the plasmonic current can be read directly, simply and inexpensively, opening up huge opportunities for both the amplification and the direct detection of fluorescence. The direct measurement of fluorescence, *without the need for a photodetector* is unheard of, and is likely to find profound applications and implications across the biosciences; promising to change both the way we think and use fluorescence spectroscopy today.

Graphene Biosensors for IL-6 Detection

Prof Alfred Tok

Nanyang Technological University
School of Materials Science and Engineering

Interleukin-6 (IL-6) is a multi-functional cytokine with a wide range of biological activities such as regulation of the immune system and generation of acute phase reactions. IL-6 also plays a key role in metabolism during exercise. IL-6 is predominantly produced within the working skeletal muscles during exercise. IL-6 circulation levels were also found to increase in response to acute exercise in young males and can be modulated by acute bout of high-intensity intermittent exercise in comparison to continuous moderate-intensity exercise (MOD). Currently, ELISA and western blot is the staple for detection of IL-6, requiring substantial time, machinery, high cost and specialized manpower training. The presented Graphene Oxide-based amperometric sensor has the advantage of cheap, simple, real-time yet sensitive. However, the coverage of mono-layered Graphene Oxide flake on SiO₂ substrate is limited to ca. 90% due to rinsing and unwanted cross-linking of 3-AminoPropylTriEthoxy Silane (APTES) adhesion layer. APTES silanization is commonly employed to coat a mono-layer of GO on SiO₂ via electrostatic attraction. Although complete mono-layered APTES coverage can be obtained via time-consuming APTES Chemical Vapour Deposition (CVD) growth, the rinsing step cannot be removed from procedure. This incomplete coverage leads to less available surface area, and more importantly, low sheet transconductance that limits sensitivity of the sensor. In our work, we demonstrate that carbon can be deposited on edges of Graphene Oxide flakes in an ethanol CVD environment, due to lower chemical potential at the flake edges. This deposition increases the area coverage of GO flakes on substrate and improves the transconductance and sensitivity of sensor. Finally, the transducer is fabricated into a liquid-gated biosensor and the detection window on IL-6 is presented. Our method provides a highly conductive carbon-based transducer that can be used to make cheap, simple, real-time yet sensitive amperometric sensors for IL-6.

Biosensors based on carbon nanostructures

Dr. Michael Holzinger

Département de Chimie Moléculaire (UMR CNRS 5250), CNRS-University of Grenoble Alpes, France
michael.holzinger@ujf-grenoble.fr

The outstanding properties of nanostructured carbon such as carbon nanotubes or graphene made them a widely used material as electronic or electrochemical transducer in biosensor devices^{1,2}. In particular, carbon nanotubes (CNTs) possess the outstanding combination of nanowire morphology, biocompatibility and electronic properties. Furthermore, their ease and well-documented organic functionalization brings new properties to nanostructured electrodes^{3,4} such as specific docking sites for biomolecules. Moreover, CNT films exhibits a high electroactive surface areas due to the natural formation of highly porous three-dimensional networks, suitable for the anchoring of a high amount of bioreceptor units, leading consequently to high sensitivities.

Since several years, monolayer graphene and related 2D carbon materials are shown as promising alternative to CNTs. The presented examples will show some interesting properties of monolayer graphene for SPR biosensors⁵ while CNTs remains the material of choice for 3D matrices as receptor-transducer interface for electrochemical biosensor devices.

- (1) Holzinger, M.; Le Goff, A.; Cosnier, S., *Frontiers in Chemistry* **2014**, 2, 63.
- (2) Le Goff, A.; Holzinger, M.; Cosnier, S., *Analyst* **2011**, 136, 1279-1287.
- (3) Singh, M.; Holzinger, M.; Biloivan, O.; Cosnier, S., *Carbon* **2013**, 61, 349-356.
- (4) Singh, M.; Holzinger, M.; Tabrizian, M.; Cosnier, S., *Carbon* **2015**, 81, 731-738.
- (5) Singh, M.; Holzinger, M.; Tabrizian, M.; Winters, S.; Berner, N. C.; Cosnier, S.; Duesberg, G. S., *Journal of the American Chemical Society* **2015**, 137, 2800-2803.

Chiral Field for Microwave Biosensing

E. O. Kamenetskii, E. Hollander, and R. Joffe

Microwave Magnetic Laboratory,

Department of Electrical and Computer Engineering,

Ben Gurion University of the Negev, Beer Sheva, Israel

Email: kmntsk@ee.bgu.ac.il

The rapid rate of adoption of mobile wireless communications has resulted in public concern about the health hazards of microwave fields emitted by such devices. Direct inspection of biological structures in microwave frequencies and understanding of the molecular mechanisms of microwave nonthermal effects is a problem of great importance. Nowadays microwave biosensing lacks the spatial resolution to probe structural characteristics of chemical and biological objects. In contrast, optical biosensing has benefitted from a large variety of such specialized tools. In particular, the resonant interactions between plasmon (or electrostatic) oscillations of metal nanoparticles and electromagnetic fields has become a powerful technique for chemical and biological sensing. For biomedical diagnostics and pathogen detection, special plasmonic structures with left- and right-handed optical superchiral fields are effectively used. Since resonance frequencies of plasmon oscillations in small particles are very far from microwave frequencies, the main ideas and results of the optical subwavelength photonics cannot be used for microwave biosensing. Nevertheless, there exists another type of subwavelength particles which show effective resonant interactions with microwave fields. There are small ferrite particles with magnetostatic oscillations. The near fields of these particles are microwave superchiral fields with strong localization of energy. In this paper we show unique properties of microwave devices with chiral probing fields. We discuss the problem of effective microwave characterization of chemical and biological objects with chiral properties.

Boosting the Sensitivity of Paper-Based Biosensors Using Isotachophoresis

Tally Rosenfeld¹ and Moran Bercovici^{1,2}

¹Faculty of Mechanical Engineering, Technion – Israel Institute of Technology, Haifa, ISRAEL

²Russell Berrie Nanotechnology Institute, Technion – Israel Institute of Technology, Haifa, ISRAEL

Microfluidic paper-based analytical devices (also known as 'µPADs') have gained significant attention in recent years due to their potential as a low-cost, durable, and simple to use diagnostic platform. To date, the most common use of paper-based test is in lateral flow strips, such as for malaria detection, and home pregnancy tests. However, despite well identified biomarkers, many diagnostic needs cannot be met as their sensitivity is fundamentally limited by the rate at which target molecules bind to the surface. This rate is proportional to the concentration of the reactants, and becomes a bottleneck in detecting low concentrations.

In our work, we aim to enhance the sensitivity of paper-based assays by leveraging the focusing capabilities of isotachophoresis (ITP). ITP is an electrophoresis technique capable of focusing sample ions of interest at a sharp electric field gradient formed between high electrophoretic mobility leading electrolyte (LE), and a low electrophoretic mobility trailing electrolyte (TE). In recent work, we have demonstrated the use of ITP in traditional microfluidic chips for improving the sensitivity of surface biosensors by two orders of magnitude, by delivering a high concentration target to a pre-functionalized surface, thus enabling rapid reaction at the sensor site.

Seeking to translate the technology to low-cost devices, we present a novel paper-based device and assay for ITP focusing, which is (i) self-contained on a simple piece of paper, (ii) does not require any specialized enclosures or cooling devices, (iii) enables over 1,000-fold focusing in 6 minutes and (iv) allows processing of sample volumes as high as 30 μ L. Furthermore, we will present our prototype stand-alone hand-held device demonstrating the ability to run the assay without the need for additional infrastructure. **We believe that these demonstrations lay the foundations for a low-cost, rapid and highly sensitive paper-based diagnostic platforms.**

Utilization of specific DNA-probes for the rapid detection of *Campylobacter* spp. in meat by using an OLED-based reader

Marisa Manzano¹, Lucilla Iacumin¹, Giuseppe Comi¹, Francesca Cecchini¹, Patrizia Melpignano²

¹Department of Food Science, University of Udine, via Sondrio 2/A, 33100 Udine, Italy

²OR-EL.doo, Volariceva Ulica 6, 5222 Kobarid (Slovenija)

The European Food Safety Authority (EFSA) and the European Centre for Disease Prevention and Control (ECDC) report campylobacteriosis was the most commonly reported zoonosis in 2012. The proportion of *Campylobacter*-positive broiler meat confirms broiler meat as a source of human *Campylobacter* infections. High cost to public health systems due to high rate hospitalization surveillance can be reduced by decreasing the number of outbreaks. Rapid tools are needed, cheap systems could allow a high number of samples to be subjected to safety evaluation. Methodologies based on the ISO 10272-1B: 2006 require long time to grow microorganisms leading to the distribution of contaminated food before the obtainement of the results. Molecular biology techniques have greatly improved the reduction the time required, but the utilization of DNA-probe biosensors could be the best solution. Targeting a specific DNA sequence in the 16S rDNA it was possible to design a couple of DNA probes to use for the specific detection of *Campylobacter* spp.. High specificity and high sensitivity have been obtained coupling the use of two DNA probes with an organic light-emitting diode (OLED) reader for analyzing poultry samples from the market. The detection probe labelled with a fluorophore was detected by an OLED reader and reached a sensitivity of 0.37 ng/ \square L DNA.

Electrochemical Lateral Flow Immunosensor Detection of Microbial pathogens¹

Robert S. Marks^{1, 2}

¹ Ben-Gurion University of the Negev, Department of Biotechnology Engineering, PO Box 653, 84105 Beer-Sheva, Israel

² Nanyang Technological University, School of Materials Science and Engineering, 1 CREATE Way, Singapore 138602

Electrochemical Lateral Flow Biosensors (ELFBs) are developed using screen-printed gold electrodes (SPGEs) integrated with a lateral flow test strip involving specific immunorecognition event along lateral flow bed and subsequent sandwich immunocomplexing on the electrode. As a first proof-of-concept the SPGE are modified with capture dengue NS1 antibody and integrated with cellulosic lateral flow strip. A cellulose glassy fiber paper is introduced as part of the lateral flow strip as conjugate pad that holds formulated immunonanobeads. The analyte antigen NS1 protein binds selectively and specifically to detection dengue NS1 antibody adsorbed on immunonanobeads and form immunocomplex. With an aid of a running buffer, the immunocomplexes flow and reach the electrode surface and form specific sandwich-type immunocomplex. The successful sandwich immunocomplex formation is then recorded electrochemically while the unbound immunonanobeads are washed away. Specific detection of NS1 is translated into electrochemical signal contributed by a redox label on detection antibody and proportional increase in faradic current is observed with increase in analyte NS1 protein concentration. The ELFB is simply assembled in a cassette and may potentially be delivered along with mini potentiostat to epidemic sites. Our ELFB successfully demonstrates wide linear range over a concentration range of 1-25 ng/mL with ultrasensitive detection limit of 0.5 ng/mL for the qualitative and quantitative detection of analyte dengue NS1 protein. In addition, our group is developing a sensor for whole bacteria such as E. coli for ater monitoring.

¹ Other abstracts related to this one presented as posters include the detailed projects as well as the collaborators involved

Can old (ancient) animals teach us new tricks?

Micha Ilan

Tel Aviv University

Many intra- and inter-specific interactions between organisms are mediated by compounds. These natural products have many ecological functions such as defense against predators, competition deterrence, protection from pathogens and more. We may take advantage of this rich source of biologically active natural products for various purposes including first of all development of novel drugs for pharmaceutical usage, but also for use in other industries. Marine natural products have been a rising source of novel drug leads especially from sessile invertebrates and microorganisms because of their rich diversity due to their unique evolution. How to discover new sources of novel compounds with new targets have been major aspects of research for several decades. Thereafter many studies focused on how to obtain large enough amount of natural products from organisms which are frequently rare and difficult to obtain and culture. More recently advances in sequencing technologies, bioinformatic analysis capabilities, and genetic manipulations opened options of utilizing also non-culturable organisms for drug discovery.

Disrupting cross-species communication: an arms race strategy?

Karina Golberg^{1*}, Robert S. Marks^{1,2,3,†}, and Ariel Kushmaro^{1,3}

¹Avram and Stella Goldstein-Goren Department of Biotechnology Engineering, Ben-Gurion University of the Negev

²The Ilse Katz Center for Meso and Nanoscale Science and Technology

³School of Materials Science and Engineering, Nanyang Technological University, Singapore

*karingo@bgu.ac.il

Constantly compelled to adapt within fluctuating, stressful environments, bacteria evolved structural protection in the form of biofilms. Quorum sensing (QS), a communication of bacteria known to regulate biofilms, has attracted ample research as a viable anti-biofilm target. This is because quorum sensing inhibition may prevent biofilm without affecting bacterial growth or forcing them to embed in the self-produced matrix. The marine habitat is an important source for natural compounds with anti-biofilm properties. There is growing evidence that a variety of marine organisms, especially bacteria isolated from coral reefs, are capable of producing such compounds. Indeed the maintenance of coral homoeostasis depends in part on the domination of their symbiotic bacterial species via the synthesis of QS and QS inhibition compounds. These infochemicals aid in maintenance of coral health or may act as drivers of disease processes. Based on this logic, coral habitats were selected for extensive bacterial screening. More than 100 isolates, obtained from healthy coral colonies, were screened for their abilities to inhibit QS using different bioreporter strains. This was followed by active compound identification via separation using reverse thin layer chromatography, then preparative HPLC, and finally, MS and NMR spectroscopy to elucidate the active structure. Following elucidation of chemical structure we showed inhibition activity of these compounds against biofilm formation by *Pseudomonas aeruginosa* and *Acinetobacter baumannii*.

Nupharidine inhibits NF-κB activity, has synergistic cytotoxic activity with cisplatin and etoposide and induces apoptosis.

Gopas J^{1,4*}, Ozer J¹, Eisner N¹, Benharroch D² and Golan-Goldhirsh A^{3*}

¹Dept. of Microbiology, Immunology and Genetics, Faculty of Health Sciences Ben-Gurion University of the Negev, Beer Sheva, Israel.

²Dept. of Pathology and ⁴Oncology, Soroka University Medical Center, Beer Sheva, Israel and

³The Jacob Blaustein Institute for Desert Research, Albert Katz Department of Dryland Biotechnologies, Sede Boqer Campus 84990 Israel.

Introduction: The nuclear factor-kappa B (NF-κB) family of transcription factors plays a pivotal role in inflammation, proliferation, and prevention of apoptosis. Due to its central role in many physiological and pathological processes, including cancer, they constitute attractive targets for therapy. The use of plant extracts to alleviate inflammatory diseases is centuries old and continues to this day, therefore we screened thirty-four methanolic plant extracts for inhibition of constitutive NF-κB activity by a NF-κB-luciferase reporter gene assay.

Materials and Method: There was strong inhibition of NF-κB activity by *Nuphar lutea* L. SM. (Nuphar), leaf and rhizome extracts. An active fraction containing a mixture of dimeric sesquiterpene thioalkaloids was purified by solvent extraction, pH adjustment silica gel chromatography and HPLC. One- and two-dimensional NMR spectroscopy indicated the presence of nupharidine, 6-hydroxythionuphlutine as a major component.

Results and Discussion: Nupharidine showed a dose dependent inhibition of NF-κB activity by luciferase reporter gene assay as well as reduction of nuclear NF-κB subunits expression as tested by western blots and immunohistochemistry. Diminution of DNA binding was demonstrated by Electro Mobility Shift Assay (EMSA). Nupharidine inhibited both inducible and constitutive NF-κB activation and affected the canonical and alternative pathways. Suppression of NF-κB was not cell type specific. Induction of apoptosis by Nupharidine was demonstrated by time and dose dependent cleavage of procaspase-9 and PARP. Synergistic cytotoxicity of nupharidine with cisplatin and etoposide was demonstrated in vitro as well as in vivo with cisplatin, diminishing experimental B16 melanoma lung metastases.

Conclusion: Based on these results, we propose that Nupharidines may be further developed as possible “sensitizer” in anticancer treatment and as an anti-inflammatory compound.

Aquaponics in the Negev - Arid-Land Aquaculture

Schnmuel Applebaum

Ben Gurion University

Fish farming in the desert? Israel is already leading the way. Research at Ben-Gurion University has shown that easily accessible brackish water found in the desert is highly suitable, with regard to its salt content, temperature, purity and accessibility, for aquaculture. In the ponds, the water is supplemented by the organic waste produced by the fish.

If this water is rationally used for irrigating fields and plantations, the use of fertilizer is reduced and a chain of users is created. Dry zones cover approximately 40 percent of the planet, and the people living there belong to the poorest in the world. It is high time that these areas are no longer considered as useless arid lands.

Addressing Current Challenges & Adapting to Future Needs in Aquaculture

Hanna Rosenfeld

Israel Oceanographic & Limnological Research Ltd
National Center For Mariculture

The world's fisheries have steadily declined since the 1980s despite the expansion of fishing into deeper and more offshore waters. Over half of the world's catches are caught in less than 7% of the oceans, in areas characterized by an increasing amount of habitat damage from bottom trawling, pollution and dead zones, invasive species influxes and vulnerability to climate change. The decline in marine fisheries landings has been rapidly compensated for by aquaculture that contributes already, 43 per cent of aquatic animal food for human consumption, and is expected to grow further to meet the future demand. As part of the endeavor aiming at the reduction of fisheries pressure on wild stocks, main research effort at the National Center for Mariculture in Eilat Israel, focuses on (i) domesticating marine species for grow-out as agricultural products, and (ii) developing an environmentally friendly land-based system for rearing fish in seawater ponds. While this research area has expanded over the past two decades, much of the attention is being directed to identifying and keeping the pace with future uncertainties, which include the impact of climate change, practical limits in terms of scale and in the economics of integration and the development and acceptability of new bio-engineering technologies. It is likely that an increased output for providing additional foods for a protein-hungry planet, will require expansion in new environments, further intensification and efficiency gains for more sustainable and cost-effective production.

Novel high affinity protein inhibitors for selective targeting of human trypsins and matrix metalloproteinases in cancer therapy

Niv Papo

Ben Gurion University

Proteolytic enzymes that are highly expressed in the tumor microenvironment represent key contributors to tumor growth, invasion and metastasis. As such, these proteases present attractive targets for drug design in various cancers and have been a focus for inhibitor design for already several decades. My talk will focus on two such enzyme families, namely human trypsins and matrix metalloproteinases (MMPs). The most striking characteristic of the human mesotrypsin is its unique resistance to polypeptide trypsin inhibitors. Mesotrypsin has reduced affinity for such inhibitors, yet surprisingly, cleaves them at an accelerated rate. Among these inhibitors, the human Kunitz protease inhibitor domain of the amyloid precursor protein (APP), is unique by its high binding affinity, but yet is cleaved very rapidly at a specific bond within its binding loop. In our work we are using directed evolution by yeast surface display (YSD) to generate novel APP mutants with high resistance to the proteolytic activity of mesotrypsin and, equally important, mutants with elevated affinity and inhibitory potency.

So far, MMP inhibitors have also failed clinical trials, which is mainly due to their broad activity against numerous MMP family members and due to serious side effects generated by the proposed treatment. For this, we propose a new strategy for engineering bi-specific inhibitors that simultaneously target two members of the MMP family: MMP-2 and a MMP-14, which stimulates MMP-2 activation. For this purpose, we are using a combination of computational methodology and YSD to obtain specific inhibitors for each of the two MMPs based on a natural non-specific MMP inhibitor, N-TIMP-2. We envision that molecules generated from these studies will become new-generation therapeutics for cancer and other diseases.

CCHFV in Kosovo environment

L. Fajs, Humolli I, Saksida A, Knap N, Jelovšek M, Korva M, Dedushaj I, Avšič-Županc T

Institute of Microbiology and Immunology, Faculty of Medicine, University of Ljubljana
Campus for Research Excellence and Technological Enterprise, School of Materials Science and
Engineering, Nanyang Technological University
Email: lfajs@ntu.edu.sg

Crimean-Congo hemorrhagic fever (CCHF) is an acute, tick borne disease often associated with hemorrhagic presentations and high case fatality rate. Kosovo is a highly endemic area for CCHF, with a significant case fatality rate. In our study we wanted to determine the extent of CCHF in Kosovo environment. We tested 1105 serum samples from healthy population in both endemic and non-endemic areas in the country. Our results revealed a seroprevalence of 4.0% (range 0-9.3%) which is comparable to the seroprevalence in other countries. We show that seroprevalence is correlated to the disease incidence in each studied municipality. We also tested 401 animal sera (353 cow, 30 sheep, 10 goat and 8 chicken) in four endemic municipalities in Kosovo. We detected specific antibodies in all animals except in chicken. Seroprevalence in cows is comparable to other endemic areas and correlates to the seroprevalence in humans. We also tested 105 tick samples obtained in 2012 and 2013. Sequencing of CCHFV positive ticks from 2001 revealed that the virus is most closely related to viral strains that were detected in CCHF patients from Kosovo. Results suggest that mild CCHF cases are most probably underdiagnosed and consequently that the burden of disease is higher than reported. Also we show that different environmental factors have most likely influenced the spread of CCHF in Kosovo. Our study provides key information for CCHF surveillance and raises awareness for possible imported cases in CCHF non-endemic countries.

Spectroscopic approach of the interaction study of Ceftriaxone and Human Serum Albumin

M.M. Abu Teir^{*}, J. Ghithan, M. I. Abu Taha, S.M. Darwish, M.M. Abu-hadid
Al Quds University, Palestinian Authority

Under physiological conditions, interaction between ceftriaxone and human serum albumin was investigated by using fluorescence spectroscopy and UV absorption spectrum. From spectral analysis ceftriaxone showed a strong ability to quench the intrinsic fluorescence of HSA through a static quenching procedure. The binding constant (k) is **estimated as** $K=1.02 \times 10^3 \text{ M}^{-1}$ at 298 K. FT-IR spectroscopy with Fourier self-deconvolution technique was used to determine the protein secondary structure and drug binding mechanisms. The observed spectral changes **indicated** the formation of H-bonding between ceftriaxone and HSA molecules at higher percentage for α -helix than for the β -sheets.

Surface morphology and liquid crystal alignment on mechanically or optically treated substrates

Lewis Sharpnack¹, Miri G. Herzner², N. Arun Kumar², Ashok Chaudhary², M. Kelbanov³, N. Sheremt⁴, I. Abdulhalim², Yu Reznikov⁴, and Satyendra Kumar¹

¹Department of Physics, Kent State University, Kent OH 44242

² Department of Electro-Optic Engineering, Ilse Katz Institute for Nanoscale Science and Technology, Ben Gurion University, Beer Sheva 84105, Israel

³Department of Physics, Ben Gurion University, Beer Sheva 84105, Israel

⁴Institute of Physics of National Academy of Science, Kyiv 252022, Ukraine

The process of LC alignment using mechanically buffed polymer films on solid substrates has been empirically perfected over the past four decades. Much research effort also has focused on finding a practical noncontact method for LC alignment. Photoalignment methods, as viable alternatives, include linearly polarized UV treated polymer films, photopolymerizable polymers, and adsorbed LC layers. Chalcogenide glass films deposited on a substrate and subsequently exposed to polarized blue light offer another route to preparing optically treated alignment layers for use in LC devices. The mechanism responsible for aligning LC has remained relatively poorly understood. Two factors are accepted to be responsible for affecting LC alignment: (i) chemical interactions between the aligning interface and the LC molecules, and (ii) the topology of the interface and LC's anisotropic elastic properties.

High-resolution x-ray reflectivity (HRXR) studies have been conducted on a large number of alignment layers including films of various polyimides, polyvinyl alcohol, and polystyrene. Combinations of mechanical buffering and/or LPUV exposure were employed to treat the surfaces. The results show that the anisotropy in the morphology of substrate's surface on a length scale of $\sim 500\text{\AA}$ determine the direction of LC alignment. The anchoring energy increases with the degree of surface roughness anisotropy and is tempered by the chemical interactions between the LC and the alignment layer. Researchers at Ben-Gurion and Kent State universities are currently collaboratively investigating the chalcogenide glass films. Quantitative results obtained for variously treated substrates will be discussed.

Controlling absorption of light by molecules with integrated optics based systems

A. Karabchevsky

Optoelectronics Research Centre,
University of Southampton, Southampton, SO17 1BJ, UK.

Integrated optics is expected to play an increasingly important role in optical communications, imaging, computing and sensing with the promise for significant reduction in the cost, improved signal to noise ratio and increased sensitivity. Future advancement of integrated optics based sensors is critically dependent on an ability to develop techniques for the controlling absorption of light by molecules. An overview will be given over our recent results of controlling absorption of light by molecules with integrated optics. Designed system with demonstrated performance has the potential to achieve groundbreaking sensitivity and specificity in chemical sensing compared to conventional sensors such as spectrometers and refractometers, promising breakthroughs in chemical monitoring, healthcare and security applications.

Metal-Enhanced Fluorescence from Zinc Substrates can lead to Spectral Distortion and a Wavelength Dependence

Hilla Ben Hamo^{1,4}, Jan Karolin⁴, Buddha Mail⁴, Ariel Kushmaru^{1,2}, Robert Marks^{1,2,3} and Chris D. Geddes^{4*}

¹Avram and Stella Goldstein-Goren, The Department of Biotechnology Engineering, Faculty of Engineering Sciences, Ben-Gurion University of the Negev, P.O. Box 653, Beer-Sheva 84105, Israel

²School of Materials Science & Engineering, Nanyang Technological University, 50 Nanyang Avenue Singapore 639798

³The Ilse Katz Center for Meso and Nanoscale Science and Technology, Ben-Gurion University of the Negev, P.O. Box 653, Beer-Sheva 84105, Israel

⁴Institute of Fluorescence, Department of Chemistry and BioChemistry, University of Maryland Baltimore County, The Columbus Center, 701 East Pratt St., Baltimore, 21202, USA. *Chrisgeddes74@gmail.com

Metal-Enhanced Fluorescence enhancement factors up to 7-fold have been observed for Basic Fuchsin (BF) in close proximity to Zinc nano particulate substrates. In addition, the emission spectra of BF close-to Zinc as compared to a control sample is heavily distorted, particularly on the red-edge, giving systematic trends in enhancement, anywhere from 3 to 7 –fold. We discuss these remarkable wavelength dependent effects with regard to the mechanism of metal-enhanced fluorescence.

Keywords: Metal-Enhanced Fluorescence; Plasmon-Enhanced Fluorescence; Surface-Enhanced Fluorescence; Zinc Nanoparticles; Spectral Distortion; Synchronous Spectral Analysis.

Ultrahigh enhancement of the electromagnetic fields by exciting LSPR using SPP waves

Li Shuzhou

Nanyang Technological University

Metal nanoparticles (NPs) over metal film have attracted lots of interests in plasmonic sensing because of their ability to generate well-controlled hot spots. This paper proposes a novel methodology to get drastically enhanced electromagnetic (EM) fields in metal NPs over metal film configuration through exciting the localized surface plasmon resonances (LSPRs) of the NP using the extended surface plasmon polaritons (SPPs) generated at the metallic film surface using the Kretschmann-Raether configuration. Both the finite-difference time-domain simulations and the surface-enhanced fluorescence (SEF) experiments demonstrate that excitation of LSPRs using extended SPP waves can generate much higher EM field intensity than direct excitation of the LSPRs using incidence from free space, ascribing to the strong confinement of the SPP waves in the vertical direction. We show that the largest EM field enhancement and the highest SEF intensity are obtained when the incidence angle is the SPP resonance angle of the underlying metal film. The dependence of the EM field enhancement on Si spacer thickness and Au NP diameter are also examined. The extremely enhanced EM fields generated from excitation of LSPRs using SPP waves possess great potential for highly-sensitive refractive index sensing, surface-enhanced spectroscopy, and enhancing the efficiency of optoelectronic devices.

Biofouling, microbes and anti-biofilm nanosurfaces

Karina Golberg, Noa Emuna, Dorit van Moppes, Robert S. Marks, Shoshana Malis Arad, Xiaodong Chen
and Ariel Kushmaro

Ben Gurion University

Biofouling, the settlement of micro- and macro-organisms on surfaces is relevant to clinical and industrial application. Microbial biofilm is a successful but economically detrimental strategy for survival in hostile environments, where coordinated bacterial communities establish biofilm structures via the regulation of quorum sensing (QS) communication systems. Fabricating freestanding, three-dimensional (3D) ordered porous graphene structure can service a wide range of functional materials such as environmentally friendly materials for antibacterial medical and environmental applications. The graphene-based freestanding honeycomb films exhibit superior broad-spectrum antibacterial activity as confirmed using *Pseudomonas aeruginosa* as model organisms. In addition we have developed an anti-adhesion and anti-biofilm coating from natural polysaccharide patches derived from the red microalgae *Porphyridium* sp. Polysaccharide with Cu complexes was found to extensively modulate bacterial adhesion and prevent biofilm formation without effecting cell growth. Therefore, it represents a powerful alternative for the eradication of biofilm and bacterial infections. These fabricated materials constitute therefore interesting platforms for a variety of applications.

Detecting large bio entities in water with nanoscale localized electromagnetic fields

Ibrahim Abdulhalim

Electro-optical Engineering Unit and the Ilse-Katz Center for Nanoscale Science and Technology, Ben Gurion University of the Negev, Beer Sheva 84105, Israel

Surface enhanced spectroscopies such as SERS and SEF are attributed to the highly amplified EM fields in the vicinity of the metallic structures due to localized and propagating surface plasmons. Nano-sculptured thin films (nSTFs) prepared by the glancing angle deposition technique made of silver were found by us to enhance SPR sensitivity, SERS and SEF signals from 4-Aminothiophenol (4-ATP) and Rhodamine 123 molecules respectively. For the use of specific detection of biomolecules of interest, biomolecular recognition layers of analyte specific ligands are, in general, immobilized on the surface of nSTFs. In most of the cases, entities such as antibodies, enzymes or other BREs (e.g. bacteriophages) are cross-linked to the metal surface via a suitable cross-linker. The capture of the specific analyte by the BREs results in a modulation of the SERS/SEF signal, which can quantitatively be translated into the concentration of the analyte in a given sample. Further, the specificity of such sensors is ensured by the BREs and the anti-fouling agents which are immobilized on the sensor surface to avoid any non-specific binding over the sensor surface. However, because the EM fields are highly localized near the metallic nanostructures, the enhancement of the Raman/fluorescence signal is only possible when the molecule is placed near the metal surface within few nm. Therefore, SERS/SEF signals from an analyte molecule can specifically be acquired only if: (1) they are very small in size, (2) the crosslinker+BRE length is small. The localized field of the plasmonic architecture must reach well within the analyte to enhance the Raman/fluorescence signal emitted from it. The localization of the plasmon enhanced EM field puts a limitation for its use to enhance the Raman/ fluorescence signals from analyte molecules of size greater than few nm sizes. Hence SERS and SEF phenomena cannot be used for direct assessment of SERS/SEF signals from such analyte molecules or large bioentities such as cells. However, if the crosslinker molecule itself is SERS/SEF active, the binding of the analyte to the BRE might be translated into a change in the SERS/SEF signal of the crosslinker molecule. Such a scheme is called indirect mode of operation and was recently implemented by us in the detection of endocrine disruptor biomarkers and E. Coli bacteria, which are quite large in size. Further, since the enhancement achieved is quite high, even very weak fluorescence signal can be amplified. In most of the sensors relying on the fluorescence technique, a fluorescent label must be tagged to the analyte molecule. Using this strategy we have demonstrated recently Vg protein and E.Coli detection in water with high specificity and low detection limit.

Other contributors: IoM group at Leipzig of Prof. Bernd Rauschenbach, Prof. Robert Marks group, Dr. Isam Khalilah, Dr. Sachin Srivastava, Dr. Alina Karabchevsky and Dr. Atef Shalabney.

Toxicity effect of nanoparticles on lux-reporter E-coli

Eltzov Evgeni ^{1,2}, Tal Laor¹, Huo Fengwei ², Zhang Qichun ² and Robert Marks ^{1,2,3,4}

¹Department of Biotechnology Engineering, Faculty of Engineering Science, Ben-Gurion University of the Negev, Beer-Sheva , Israel;

²School of Material Science and Engineering, Nanyang Technology University, Nanyang Avenue, 639798, Singapore

³National Institute of Biotechnology in the Negev, Ben-Gurion University of the Negev, Beer-Sheva, Israel

⁴The Ilse Katz Center for Meso and Nanoscale Science and Technology, Ben-Gurion University of the Negev, Beer-Sheva, Israel

Within the past decades, nanomaterial's have been deeply integrated into our everyday life. There are numerous examples of already established and possible applications of nanoparticles (NPs). According to the recent research over 1000 different manufactures of NPs were developed and some were introduced to the market. Some of them, after being released into the environment, may cause toxic effects in terraneous and aquatic organisms. Thus, there is a clear need for assessment of such potentially dangerous toxic effects in a short-term period. A new tool enabling such an assessment that is both affordable and rapid would be welcome. In this project genetically engineered microorganisms, tailored to respond by a dose-dependent signal to the presence of toxic chemicals were used. Twelve selected *Escherichia coli* reporter strains harboring fusions of selected gene promoters were exposed to three different metal NPs. Each of the three treatments activated different promoters to different extents, producing its own unique fingerprint (Figure 1) that will help us assess their toxicity potential.

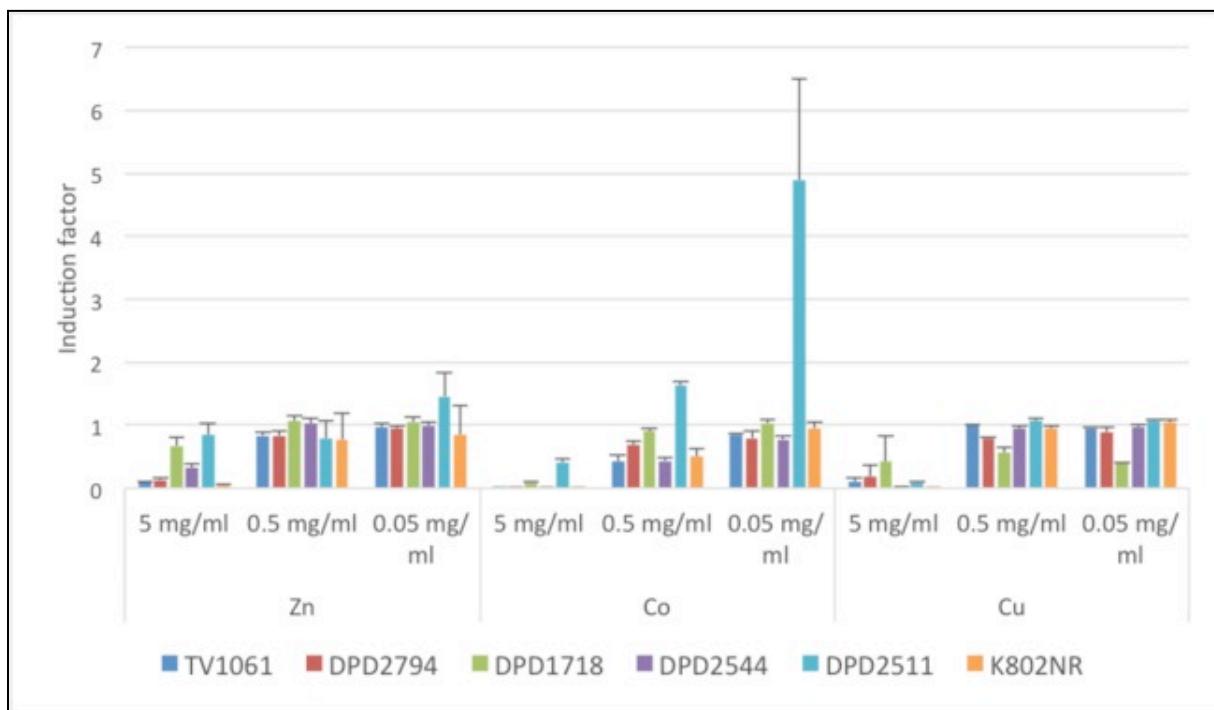


Figure 1: Response of the different bioluminescent strains to the nanoparticles

Photophysical study of stilbene derivatives for small molecule detection assay

Wu Yuan Yuan
Nanyang Technological University
School of Materials Science and Engineering

Stilbene compounds have a unique feature of *trans* to *cis* photoisomerization resulting in decrease in fluorescence intensity when being irradiated under excitation light. And the rate of this fluorescence decay process is affected by the surrounding environment such as the viscosity and steric hinderance. In our study, the fluorescence decay of several stilbene derivatives with different substituent has been studied and all of them have demonstrated the dependence of apparent fluorescence decay rate k_{app} on the medium viscosity η . For example, for Dimethyl amino stilbene Maleamide, the relationship can be described by $k_{app} = (1.066 \pm 0.011) + (0.309 \pm 0.012) \log(1/\eta)$ and for Dimethyl amino Maleamic acid the relationship is described by $k_{app} = (0.521 \pm 5E-3) + (0.100 \pm 5E-3) \log(1/\eta)$. On the other hand, aptamer, as a promising recognition element, recognizes its analyte by forming the compact binding pocket in the presence of the corresponding target. And the compactness has a similar effect as viscosity on the fluorescence decay of stilbene compounds. By forming aptamer-analyte complex initially, with the presence of the analyte in the detection medium, competitive binding will replace the analyte previously located in the aptamer binding pocket, changing the surrounding environment and hence the apparent fluorescence decay rate. Hence it is proposed that photochrome aptamer switch assay (PHASA) combining stilbene compounds and aptamer can be used for small molecules quantification based on a calibration curve between analyte concentration and fluorescence decay rate which is generated from different degree of influence on the fluorescence decay rate. As the measurement is simple and fast, on site detection is achievable and future miniaturization and commercialization is possible.

Heat resistant coatings for photothermal convertors

Shlomo Magdassi

Institute of Chemistry, The Hebrew University of Jerusalem, Israel

Solar thermal conversion has become one the leading approaches in concentrating solar power (CSP) systems. It is expected that with suitable support, by 2050, CSP may deliver more than 10% of the worldwide electricity. An essential component of the solar thermal convertor is the solar absorber, which is composed of a heat resistant layer that is capable to absorb a large fraction of the solar radiation. Most of the coating technologies involve vacuum (physical and chemical) deposition and sputtering, while only a few comprise wet deposition processes. We will describe coating formulations that can be used as conventional paints, and are suitable for large area application by spray coating. The active component of the formulation are black ceramic pigment, for high temperatures, and carbon nanotubes for medium temperatures. We will also present multilayer coatings, with tuneable spectral selectivity.

Hybrid nanomaterials for electrochemical devices in energy management

Pooi See LEE

School of Materials Science and Engineering
Nanyang Technological University, 50 Nanyang Avenue, Singapore 639798
*Email: pslee@ntu.edu.sg

Electrochemical active hybrid nanomaterials are highly beneficial for energy management, such as electrochromics in energy conservation and supercapacitors in energy storage. In this talk, I will elaborate our efforts on the combinatory syntheses of unique nanoheterostructures for supercapacitors and electrochromic applications. With optimized hybrid nanomaterials, the energy densities of the supercapacitors are enhanced with the shorten ion diffusion length and improved electronic conductivities. Meanwhile, the stable and facile ion intercalations are effective in enhancing the optical contrast and fast switching speed in electrochromics devices. These lead to improved energy efficiency, storage and conservation. In addition, I will also demonstrate the use of hybrid nanomaterials for stretchable devices fabrication which are desirable for wearable technology applications.

Recent advances in enzymatic fuel cells

Dr. Serge Cosnier

Département de Chimie Moléculaire (UMR CNRS 5250), CNRS-University of Grenoble Alpes, France
Serge.Cosnier@ujf-grenoble.fr

For four decades, the development of biointerfaces has been the subject of increasing research efforts in the field of biosensors and energy conversion. In this context, the functionalization of the nanostructured electrodes by biomaterials based on polymers and / or carbon nanotubes exhibiting affinity or covalent binding interactions towards biomolecules, is constantly increasing [1].

Concerning the bioconversion of energy, an example of biofuel cell based on carbon nanotube/enzyme compressions, employing glucose oxidase for glucose oxidation, and laccase for oxygen reduction will be reported as well as its performance implanted in a freely moving rat [2,3]. Recent advances in the elaboration of enzyme electrode based on electropolymerized films or carbon nanotube coating will be presented for the design of biocathodes or bianodes. We report thus the synthesis and electrochemical characterization of a novel electropolymerizable Ru(II) complex containing two phenanthrolinequinone ligands. This monomer can be dispersed in aqueous solution and electropolymerized in its adsorbed state. After polymer formation, the latter exhibits efficient electrocatalytic properties toward NADH oxidation and allows the physical entrapment of dehydrogenases [4]. The combination of carbon nanotube coating and an electropolymerized polypyrrole film of a protein: concanavalin A is also an original strategy for the non-covalent immobilization of glycoproteins via specific interactions with polymerized concanavalin A [5,6]. Finally, another approach concerns the fabrication of biocathodes based on the specific immobilization and wiring of this enzyme on tissue electrode resulting from the combination of carbon nanotube coating with polynorbornene films [7].

1. S. Cosnier, M. Holzinger, Chem Soc. Reviews, 40 (2011) 2146-2156.
2. B. Reuillard, A. Le Goff, C. Agnès, et al, S. Cosnier, Phys. Chem. Chem. Phys., 15 (2013) 4892.
3. A. Zebda, S. Cosnier, J.-P. Alcaraz, M. Holzinger, et al. Nature Publishing Group, Sci. Rep., 3 (2013) 1516.
4. B. Reuillard, A. Le Goff, S. Cosnier. Anal.. Chem. 86 (2014) 4409–4415.
5. V. Papper, K. Elouarzaki, K. Gorgy, A. Sukharaharja, S. Cosnier, R. Marks. Chem. Eur. J., 20 (2014) 13561-13564.
6. K. Elouarzaki, M. Bourourou, M. Holzinger, Alan Le Goff, R. S. Marks, S. Cosnier. Submitted.
7. S. Cosnier, R. Haddad, D. Moatsou, R. K. O'Reilly, Carbon , submitted.

Microbial Fuel Cell: a sustainable technology for power generation towards waste water

Qichun Zhang

School of Materials Science and Engineering; Division of Chemistry and Biological Chemistry, School of Physical and Mathematical Sciences, Nanyang Technological University (NTU).
E-mail: QCZhang@ntu.edu.sg. Website: <http://www.ntu.edu.sg/home/qczhang/>.

In this talk, I will talk our recent progress in MFCs (Figure 1). We developed several different materials as hybrid conducting biofilms, which dramatically enhance the performance of MFCs (at least 5 times).

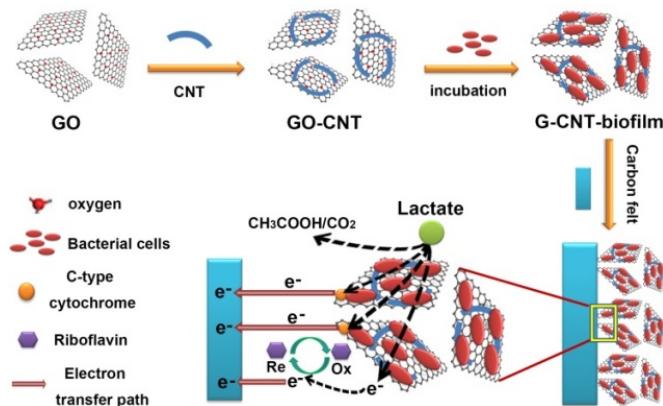


Figure 1 Illustration of the construction of electroactive hybrid biofilm on anode surface and electron transfer process from hybrid biofilm to electrode

Reference:

- (1) Cui-e Zhao, Jiansheng Wu, Staffan Kjelleberg, Joachim Say Chey Loo, **Qichun Zhang*** "Employing flexible and low-cost polypyrrole nanotube membrane as an anode to enhance current generation in microbial fuel cells" *Small*, 2015, online.
- (2) Cui-e Zhao, Jiansheng Wu, Yuanzhao Ding, Victor Bochuan Wang, Yingdan Zhang, Staffan Kjelleberg, Joachim Say Chye Loo,* Bin Cao* and **Qichun Zhang*** "Hybrid Conducting Biofilm with Built-in Bacteria for High-Performance Microbial Fuel Cells" *ChemElectroChem*, 2015 accepted (10.1002/celc.201402458) As front cover
- (3) Cui-e Zhao, Jia Chen, Yuanzhao Ding, Victor Bochuan Wang, Binqing Bao, Staffan Kjelleberg, Bin Cao, Joachim Say Chye Loo, Lianhui Wang* and **Qichun Zhang*** "Water-soluble Organic Quantum Dots for Enhancement of Current Generation in Microbial Fuel Cells". Submitted.
- (4) Victor Wang, Natalia Yantara, Teck Ming Koh, Staffan Kjelleberg, Qichun Zhang, Guillermo C Bazan, Joachim Loo and Nripan Mathews "Uncovering alternate charge transfer mechanisms in *Escherichia coli* chemically functionalized with conjugated oligoelectrolytes" *Chem Comm.* 2014, 50(60), 8223-8226.

From Marine Natural Porous Aragonite to Formation of Complex Tissues and Clinical Models

Razi Vago

Avram and Stella Goldstein-Goren Department of Biotechnology Engineering,
Faculty of engineering Sciences, Ben-Gurion University of the Negev, Beer-Sheva 84105, Israel

In the present study, we use porous aragonite derivatives as bioactive *in-vitro/vivo* bone production promoting agents. Bone marrow-derived mesenchymal stem cells (BM-MSCs) were incorporated into a three-dimensional co-culture biolattice that supports osteoblast differentiation and the development and stabilization of vascular tube-like structures. The crystalline material architecture having rounded void area resulted in increased tubule numbers and complexity. We suggest that by affecting the cadherins super family, direct calcium uptake from the biomaterial may have an important role in MSC's osteogenic differentiation while the architecture of the microenvironment may have an additional effect on endothelial differentiation. Our three-dimensional models also demonstrate that BM-MSCs can be differentiated either to osteoblasts and endothelial like cells that are closely interacting. We further suggest that our newly described model can be used for a variety of basic and clinical studies that demonstrate the role of microenvironment and MSCs in the developmental processes of solid tumors.

Development Of Quantitative Real-Time Polymerase Chain Reaction (Q-Rt-Pcr) Test For Fast, Sensitiv Cost Effective For Monitoring Sewage Contamination In Recreational Waters: From Experimental Design To Field Application

Adam Friedmann*#, 'Yaeli Etstein* Itay Kilovaty*, Michel Dutang *** and Francois Enguehard***,

** School of Marine Sciences Ruppin Academic Center, Michmoret

#Hebrew university of Jerusalem –Israel

**Veolia Environment, Paris, France

New Q-RT PCR method for *E coli* and enterococci has been developed for detection and quantification in recreational waters. Compared to current culture or enzymatic methods, it prove very sensitive and faster. The usual drawback of live versus dead microorganisms detection using PCR methods has been overcome with the use of special azide reagents.. The goal was attained by a thorough examination of all expression genes of the microorganisms and the following of their survival rate in different water environments. Application to wider purpose such as distribution water is looked upon

Purpose:

The major human health concern for recreational waters is micro-organismal contamination by bacteria, viruses, and protozoa. The permitted levels of intestinal bacterial contaminations were installed and set as regulations in 1975 and revised in 2006 in order to keep consistent with the Federal Beaches Environmental Assessment and Coastal Health (BEACH) Act requirements. These revised regulations became effective on April 3rd, 2006. The present techniques used for detection of microbial contamination in bathing waters are based on detection of bacteria by culture and specific enzymatic activities such as β -D- glucuronidase for *detection of E. coli* and β -glucosidase for detection of intestinal *Enterococci*. Because culture based-methods are used, the minimal period of time required to obtain a meaningful result is 36 hours. The enzymatic and culturing methodologies suffer from three sever disadvantages: a) too long a time period until results concerning decision for opening or closure of recreational waters are received [3]. B) Limited ability to detect environmentally stressed bacteria that are alive but are not cultivable or show no or very low enzymatic activity-VBNC (viable but not cultivable) [4]. C) Sensitivity of the tests is not adequate to meet the new microbiological criteria 5XE. *Coli* and 2X*Enterococci* in 1ml of recreational waters. The present research was aimed at developing a method based on Q-RT-PCR for the detection of live *E. coli* and intestinal *Enterococci* in recreational waters. In addition the developed test gives additional information on the fate and physiological state of *Ecoli* bacteria in sea water.

Methods

Q-RT-PCR, Affymetrix expression profile-GeneChips and bioinformatics were used. Propidium monoazide (PMA) was applied for differential amplification of DNA extracted only from live bacteria.

Results

Eleven *E. coli* and *Enterococci* genes sequences were selected for Q-RT-PCR and the specific detection of only *E. coli* or *Enterococci* in sea water. A protocol for amplification of only live bacterial DNA was also developed. Using Expression profiles of all known *E. coli* genes we have selected a battery of genes that are expressed in good growth conditions (oxygenating pools) and during short and prolonged stress (Sea water). The calculated ratios between the levels of gene expression during growth to that at stress give a good estimation of the timing of the bacterial contamination.

Conclusions: The Q-RT-PCR protocol developed complies with new European directive for detection of Sewage contamination in recreational waters. The test developed is specific, fast, and cost effective and detects only live bacteria.

This research was supported by a grant from Veolia Environnement

Lyse-it™ - An Ultra Rapid and Cost Effective Cellular Lysing and DNA Fragmentation Platform

Professor Chris D. Geddes

Institute of Fluorescence, University of Maryland Baltimore County, The Columbus Center, 701 East Pratt St., Baltimore, 21202, USA.

Chrisgeddes74@gmail.com

Sample preparation (lysis) is key to the development of many clinical Point-of-Care (POC) and laboratory tests involving cellular genetic analysis. For example, sample preparation is a significant bottleneck in PCR (Polymerase Chain Reaction)-based approaches, the gold standard in both pathogen and clinical (hospital setting) detection today, with available technologies today taking many cumbersome, lengthy and costly steps. In addition, commercially available lysis kits today require different kits and protocols for different media, i.e. broth, urine, blood etc.

To address this bottleneck of speed, cost, complexity and the fact that many laboratories employ multiple lysing kits for routine testing, Professor Geddes has both developed and launched, *Lyse-it™*, a means to lyse virtually any cell, spore or virus rapidly (typically < 20 seconds) in a single-step on a single platform, thereby enabling the genetic material (e.g. DNA) to be collected for downstream analysis on any platform. In this presentation, Dr Geddes will discuss *Lyse-it™*, and how this low cost and rapid lysing platform is a paradigm shift in how we lyse cells today.

Flow reversal for high recovery and low antiscalant use: From concept to field experience

J. Gilron and N. Perlmutter

Ben Gurion University, Israel
CTO – Rotec Ltd., Israel
jgilron@bgu.ac.il

Limitations of water resources, problems of concentrate disposal, and increasing stringencies on release of chemicals to the environment are driving needs for higher recoveries. Since high recovery leads to supersaturation, one might think that any supersaturation in a membrane separation process would be unacceptable. However antiscalants have been used to increase induction times so that precipitation will not occur in the membrane module. Still, supersaturations beyond a certain level are no longer controlled by antiscalants, and in some cases environmental restrictions restrict their use. The new process of flow reversal meets these needs by periodically switching the inlet and concentrate connections at times that are less than that of inductions time for sparingly salts to scale the membrane. This talk will chart how this idea was taken from laboratory to bench pilot in the university to full-scale field demonstrations with the setup of a startup company, Rotec, providing critical financial and engineering support and a framework for commercializing the technology. Major pilot studies were completed, including one involving retrofit of a 1000 m³/day brackish groundwater abstraction plant in Europe and another in China. In these plants recoveries were increased significantly, and in the European plant no antiscalant whatsoever was used.

Book of Abstract (Posters)

Electrochemical Lateral Flow Immunosensor Detection of Dengue NS1-protein

Prima D. Sinawang¹, Varun Rai¹, Rodica E. Ionescu^{1,2}, Robert S. Marks^{1,3}

¹Nanyang Technological University, School of Materials Science and Engineering, 1 CREATE Way, 138602 Singapore

²Laboratoire de Nanotechnologie et d'Instrumentation Optique, Institute Charles Delaunay, Universite' de technologie de Troyes, UMR-CNRS 6281, 12 Rue Marie-Curie CS 42060, 10004 Troyes Cedex, France

³ Ben-Gurion University of the Negev, Department of Biotechnology Engineering, PO Box 653, 84105 Beer-Sheva, Israel

Electrochemical Lateral Flow Biosensors (ELFBs) are developed using screen-printed gold electrodes (SPGEs) integrated with a lateral flow test strip involving specific immunorecognition event along lateral flow bed and subsequent sandwich immunocomplexing on the electrode. The SPGE is modified with capture dengue NS1 antibody and integrated with cellulosic lateral flow strip. A cellulose glassy fiber paper is introduced as part of the lateral flow strip as conjugate pad that holds formulated immunonanobeads. The analyte antigen NS1 protein binds selectively and specifically to detection dengue NS1 antibody adsorbed on immunonanobeads and form immunocomplex. With an aid of a running buffer, the immunocomplexes flow and reach the electrode surface and form specific sandwich-type immunocomplex. The successful sandwich immunocomplex formation is then recorded electrochemically while the unbound immunonanobeads are washed away. Specific detection of NS1 is translated into electrochemical signal contributed by a redox label on detection dengue antibody and proportional increase in faradic current is observed with increase in analyte NS1 protein concentration. The ELFB is simply assembled in a cassette and may potentially be delivered along with mini potentiostat to epidemic sites. Our ELFB successfully demonstrates wide linear range over a concentration range of 1-25 ng/mL with ultrasensitive detection limit of 0.5 ng/mL for the qualitative and quantitative detection of analyte dengue NS1 protein.

Utilization of Bamboo Powder for the Removal of Organic Pollutants in Aqueous Solution

Maria Regina Hartono¹, Ariel Kushamro^{1,2}, Robert S. Marks^{1,2}

¹Nanyang Technological University, School of Materials Science and Engineering, 1 CREATE Way, 138602 Singapore

²Ben-Gurion University of the Negev, Department of Biotechnology Engineering, PO Box 653, 84105 Beer-Sheva, Israel

This study reports the application of bamboo fibre powders (BPs) as potential low-cost adsorbent for removal of noxious organic compounds in aqueous solution. Bisphenol-A (BPA), a bio-refractory endocrine disruptor compound, was chosen as model compound in this study. Treatment of the raw BPs with alkali, ionic and non-ionic surfactants appeared to improve the BPA removal performance of the BPs with the best removal efficiency reached at 39% for an adsorbent dosage of 4g.L⁻¹ gained after treatment using the cationic surfactant Hexadecyltrimethylammonium bromide (CTAB). Effects of contact time, adsorbent dosage and particle sizes (55µm, 300 µm and 1000 µm) of CTAB treated BPs (CBPs) towards adsorption of BPA were further assessed in batch system with optimum BPA removal observed for 55 µm CBPs particle size. Linear and Freundlich adsorption isotherm models were used to model the experimental data.

Keywords: bamboo, bisphenol-A, biosorbent

Natural Quorum Sensing Inhibitors from Previously Uncultured Marine Bacteria

Hilla Ben-Hamo^{1,2*}, Robert S. Marks^{1,3,4,5} and Ariel Kushmaro^{1,3,5}

¹Avram and Stella Goldstein-Goren, The Department of Biotechnology Engineering, Faculty of Engineering Sciences, Ben-Gurion University of the Negev, P.O. Box 653, Beer-Sheva 84105, Israel

²Institute of Fluorescence, Department of Chemistry and BioChemistry, University of Maryland Baltimore County, The Columbus Center, 701 East Pratt St., Baltimore, 21202, USA.

³School of Materials Science & Engineering, Nanyang Technological University, 50 Nanyang Avenue Singapore 639798

⁴The Ilse Katz Center for Meso and Nanoscale Science and Technology, Ben-Gurion University of the Negev, P.O. Box 653, Beer-Sheva 84105, Israel

⁵School of Materials Science & Engineering, Nanyang Technological University, 50 Nanyang Avenue Singapore 639798

*hillab@post.bgu.ac.il

The marine environment contains 75% of all organisms, making it an exciting resource for the discovery of unknown bioactive agents that may have therapeutic effects. Marine bacteria play a major role in their environment, affecting numerous ecological processes. Their intercellular communication processes, termed Quorum Sensing (QS), controls the behaviors of these bacteria affecting pathogenesis, symbiosis, motility and biofilm formation that are linked to 65% of all infectious disease. Processes of QS and its inhibition (QSI) mechanisms are important in attenuating bacterial populations with respect to virulence and pathogenicity. In contrast to bacterial antibiotic resistance development, QSI may act on certain bacterial populations without affecting the bacterial growth, minimizing the selective pressure, and are thus less likely to impose a selective pressure that leads to resistance. Since, to date, bacterial screening for bioactive agents is limited by our ability to culture the relevant bioactive bacteria, we suggest a new in-situ culture and QSI screening technique. To illustrate this technique, coral Favia sp.mucus samples were encapsulated and in-situ incubated for 5 weeks in their natural habitat, then screened for QSI compounds produced by their bacteria consortium; the spheres containing bacterial consortia that showed QSI were 16S sequenced and subsequent phylogenetic analysis. In addition, these spheres were reproduced into new spheres to obtain large numbers of spheres with QSI activities necessary to provide enough material for chemical analysis. Using MS, a putative active QS molecule with a precursor m/z 371 was detected and its molecular structure is currently being elucidated.

Bioluminescent pad bioreporter biosensor for monitoring water toxicity

Tim Axelrod¹, Eltsov Evgeni ^{1,2} and Robert S. Marks ^{1,2,3,4}

¹Department of Biotechnology Engineering, Faculty of Engineering Science, Ben-Gurion University of the Negev, Beer-Sheva , Israel;

²School of Material Science and Engineering, Nanyang Technology University, Nanyang Avenue, 639798, Singapore

³National Institute of Biotechnology in the Negev, Ben-Gurion University of the Negev, Beer-Sheva, Israel

⁴The Ilse Katz Center for Meso and Nanoscale Science and Technology, Ben-Gurion University of the Negev, Beer-Sheva, Israel

There is a need for on-site testing of environmental sites putatively contaminated by pollutants of varying nature. Existing approaches do not allow portable and on site measurements, are complicated and expensive. The biosensor designed here enables municipalities and other institutions to dispatch testers with a simple instrument with pill-pads (figure 1). Responses are fairly quick and results can be remotely sent for quicker response by a hazmat-like team, water company or other. This system consists of two main parts, a non-disposable constant (e.g. CMOS sensor) and a replaceable (bioluminescent bacteria immobilized in a calcium alginate pad matrix). The pads are placed inside an insert along with water samples. Presence of the pollutant in the water will induce cell light response via a glow and signal measurements will be detected by the photodetector (CMOS). As the first step, a prototype was build and the overall system optimized (e.g. determination optimal matrix volume, bacterial (figure 2) and alginate concentrations). Finally bacterial strains were exposed to different chemicals in the aforementioned configuration and validated with microplate assays in a Luminometer. The main advantage of the proposed system is not only the low price of all used components, but also the simplicity of the measuring process.



Figure 1. Bacteria immobilized in a calcium alginate pad matrix.

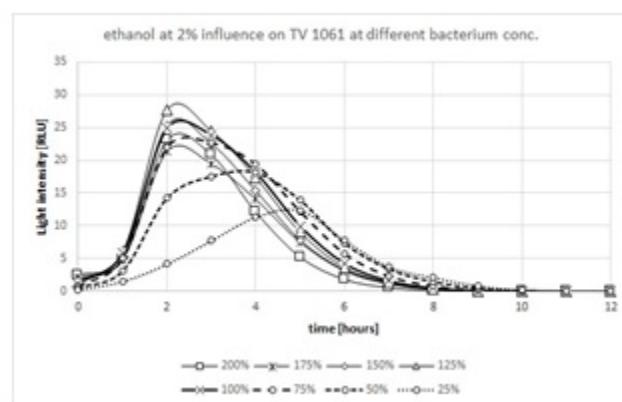


Figure 2. Optimizing bacterial concentration. Luminescence strength versus bacterium concentration.

Anti-Quorum Sensing and Anti Biofilm Compounds from Marine Microbiome

Karin Yaniv¹, Karin Golberg¹ Robert S. Marks¹ Oded Beja² and Ariel Kushmaro¹

¹ Avram and Stella Goldstein-Goren Department of Biotechnology Engineering, Ben-Gurion University of the Negev, Beer-Sheva, Israel. karily@post.bgu.ac.il karingo@post.bgu.ac.il arielkus@bgu.ac.il

² Department of Biology, Technion-Israel Institute of Technology, Haifa, Israel, Haifa, Israel.
beja@tx.technion.ac.il

Quorum Sensing (QS) is a cell to cell communication process relying on the production of signaling molecules that enable the synchronization of gene expression. This process affects an array of microbial community functions including the ability to develop biofilms. Understanding these communication processes and how to disrupt them, may help in the development of innovative methodologies for producing novel antimicrobial agents. In order to assess the quorum sensing inhibition (QSI) characteristics of uncultured bacterial species, 2500 environmental Bacterial Artificial Chromosome (BAC) vectors from a Red Sea metagenomic library were screened using a soft agar overlay technique with the bacterium *Chromobacterium violaceum* CV026 as an indicator. This screening method revealed that 7% of the bacterial clones showed high QSI activity (>40%) against *C. violaceum* CV026, suggesting that QSI ability is common in the marine environment. The clones that showed inhibition activity were cultured and the active phase was extracted from the supernatant. The results indicated that the most active compound found in this study, eluted from strain 14-A5, possess not only the ability to disrupt QS signaling pathways, but also is able to reduce biofilm formation of *P. aeruginosa* and *A. baumannii*. Since biofilm forming bacteria are resistance to conventional therapeutic drugs, the biofilm prevention approach may provide a promising treatment and is a worthy area for research.

Real-time precise detection of biological liquids, oil impurities, and water contamination

E. Hollander, E. Elman, G. Vaisman, and E. O. Kamenetskii

Microwave Magnetic Laboratory,

Department of Electrical and Computer Engineering,

Ben Gurion University of the Negev, Beer Sheva, Israel

Email: kmntsk@ee.bgu.ac.il

Real-time, accurate analysis of biological liquids, oil impurities, and water contamination is realized in continuous flows using an effective microwave resonance device. Different compositions flowing through the device are directly correlated to the change in its resonance characteristics. By using a secondary ferrite resonator, extremely high sensitivity is achieved due to interference processes. New capabilities in microwave instrumentation, developed in the Microwave Magnetic Laboratory, BGU provide unprecedentedly precision spectroscopy of different-type liquids. By embedding an extremely narrowband tunable small ferrite resonator inside a standard microwave cavity and utilizing a phase interference phenomenon (Fano resonance), we are able to detect exactly the cavity resonance-frequency change in otherwise impossible conditions and increase sensitivity by orders of magnitude. By doing so, small changes in liquid contents can now be detected. Sensors implemented by the above technique can be cheaply incorporated into mass production since it consists of standard microwave components. Due to the sensor low power consumption and stand alone properties, by spatially distributing arrays of such sensors, the monitoring of liquid quality can be easily implemented in very large networks and facilities.

Impedimetric Immunosensors using Carbon Nanotube Interfaces: Amplification of the recognition and transduction Event.

Quentin Palomar, Chantal Gondran, Michael Holzinger, Robert Marks, Serge Cosnier

The constant need of fast and reliable tools for medical diagnostics and environmental monitoring led to a tremendous evolution of biosensors in recent years. Many immobilization strategies for biomolecules (enzymes, antibodies, DNA ...) were developed to equip transducer surfaces with specific receptor units. Among these methods, the use of functional conductive matrices such as polypyrrole films is an innovative approach to immobilized bioreceptors since such films can be formed in a perfectly controlled way on any conductive surface via electropolymerization; monomers can be modified with any desired function which confers an adjusted property to the film for optimal immobilization of a specific bioreceptor unit via entrapment, chemical or optical covalent grafting, or noncovalent supramolecular or coordinative interactions. In this context, we report the immobilization of biotinylated cholera toxin on Cu²⁺ or Ni²⁺ complexes of polypyrrole-NTA (nitrilotriacetic acid) films onto which can coordinate biotin tags. This immobilization procedure is as efficient as the conventional (strept)avidin–biotin affinity system without the necessity of the supplemental protein layer which has a detrimental effect on the biosensor sensitivity.

Pyrrole-NTA was electropolymerized on multiwalled carbon nanotube (MWCNT) modified glassy carbon electrode. CNT-modified electrodes have shown to be an excellent material to accumulate a huge quantity of bioreceptors due to its high specific surface. Furthermore, CNTs are highly conductive which makes them particular appropriate for electrochemical biosensors. The mostly used procedure to modify electrodes with CNT deposits is drop coating followed by drying. However, by using this method, the morphology of the formed film is little controlled and presents a clear drawback for impedimetric transduction. We present a reliable procedure based on dispersion and filtration of CNTs forming homogeneous films with controlled thicknesses and morphologies which can easily be transferred on electrode surfaces.

Taking into account the mentioned issues, we developed a new impedimetric immunosensor based on controlled CNT deposits functionalized with polypyrrole-NTA for the detection of Cholera Antibody.

The electrode preparation was optimized and the electrodes were characterized by electrochemical impedance spectroscopy and cyclic voltammetry. Furthermore, different parameters affecting electrochemical measurements were optimized.

The resulting impedimetric cholera sensor shows excellent reproducibility, increased sensitivities, and an exceptional linear range for anti-cholera detection between 1 ng.mL⁻¹ and 1 mg.mL⁻¹.

Bacterial diversity in water wells in the Arava valley

Shimrit Laor¹, Eitan Ben-Dov^{1,2}, Dalit Vaizel-Ohayon³, Dana Atia-Glikin³, Oded Swed³, Ram Cohen³, Tzachi Tzvi³, Ariel Kushmaro^{1,4}

¹Ben- Gurion University of the Negev, Department of Biotechnology Engineering , Be`er Sheva, Israel

²Achva Academic College, Department of Life Sciences, M.P. Shikmim, Israel

³Mekorot, the National Water Company of Israel

⁴Ben- Gurion University of the Negev, The National Institute for Biotechnology, Be`er Sheva, Israel

The majority of well fouling, leading to clogging, occurs due to biofilm formation. Studies implicated the important role of sulfate- and iron-reducing bacteria, sulfur- and Iron- oxidizing bacteria in biofouling in aquatic environments. Despite this, there is still a lack of information regarding the characterization of the bacterial populations, which form the biofilm in water wells in general and in wells of the Arava in particular. The aim of this research is characterization of the bacterial population in clogged water wells in order to develop treatment and prevention methods. We collected samples during clogged water well rehabilitation of several wells. From these samples we extracted total genomic DNA, which was amplified using PCR, and sequenced using Next Generation Sequencing methods. In general, similar bacterial diversities were found in most of the water drilling sites. More particular, Iron reducers and oxidizers, sulfate reducing bacteria, nitrificants and denitrificants, known as contributors to water wells clogging, were found in all sites. Better understanding of bacterial consortium inhabiting water drilling sites can shed light on the underlying mechanisms of biofilm formation, which may lead to developing efficient treatment methods.

Polarimetric Spectral Surface Plasmon Resonance Sensor

Ibrahim Watad*, and Ibrahim Abdulhalim

Department of Electro-optic Engineering and Ilse Katz Institute for Nanoscale Sciences and Technology,
Ben Gurion University of the Negev, Beer Sheeva 84105, Israel;

*Corresponding author E-mail: watadib@post.bgu.ac.il

Intensity based surface plasmon resonance (SPR) sensors are widely used, but they still lack the sensitivity of detection, especially of low analyte concentrations. Profiting from the sharp jump in phase under SPR, we suggest working with this aspect in the spectral domain, which is more sensitive than the angular domain and its polarimetric properties were not investigated thoroughly. The prism and sample are between a polarizer and an analyzer and for each measurement of the phase difference we took three intensity measurements at three different orientations of the polarizer\analyzer. Measurements at different concentrations of Ethanol in Water were carried out using several polarimetric signals and compared to the intensity measurements. The maximal value of the cosine of the phase shift between the p and s-polarization components of the reflected wave is found to be much better defined than the minimum value in the intensity. This leads to a better sensitivity and a lower detection limit.

References:

- [1] Y. H. Huang, H. P. Ho, S. K. Kong, and A. V. Kabashin, Ann. Phys. (Berlin) 524, No. 11, 637-662 (2012).
- [2] A. Shalabney and I. Abdulhalim, Laser Photonics Rev. 5, No. 4, 571-606 (2011).
- [3] M. Piliarik and J. Homola, Optics Express, Vol. 17, No. 19, Sep. (2009).

DNA Origami Nanorobot for Biosensing and Delivery

Torelli Emanuela,¹ Cesare Polano,¹ Luca Piantanida,² Marco Lazzarino,² Giuseppe Firrao¹

¹Department of Agricultural and Environmental Sciences, University of Udine, Italy.

²IOM-CNR National Laboratory TASC, Basovizza, Trieste, Italy. 4Italian Institute of Technology (IIT), Genova, Italy.

E mail: torelli@uniud.it; phone: +39.0432.558532

DNA is an attractive material for programmable synthesis of intricate nanoscale architectures characterized by functions with molecular precision.

We have designed, produced and tested a 3D DNA origami (14x14x48 nm; internal cavity 3 zeptoliters) with a movable flap, whose opening movement is controlled by the hybridization status of an externally born DNA sensor probe (yellow in figure). The actuation is specifically triggered by the interaction with an external nucleic acid (red) according to a pulling process.

Upon hybridization target/probe, the actuated flap exposes an horseradish peroxidase mimicking DNAzyme precursor (green) and in the presence of hemin (gold) the complex hemin/G-quadruplex DNAzyme catalyzes a colorimetric or chemiluminescent reaction.^[1]



The nanorobot is used as an autonomous biosensor that has been proven able to detect picomol amounts of a viral DNA target. The versatile DNA probe and the control mechanism reported here are well suited for the development of DNA nanorobot-based sensor that can be used for the detection of specific toxins. In detail a DNA aptamer^[2] is introduced into the probe sequence of the switchable nanorobot to detect a fungal toxin, ochratoxin A (OTA), which is nephrotoxic, teratogenic, immunosuppressive, carcinogenic, and represents one of the most common mycotoxins contaminating feed and foodstuffs. The OTA-specific probe can bind with high affinity and specificity OTA. Currently we are exploiting the newly designed biosensor for OTA detection and for intelligent delivery of biological activators.

References

- [1] E. Torelli et al. (2014). A DNA Origami Nanorobot Controlled by Nucleic Acid Hybridization. *Small*, **10**: 2918-2926.
- [2] J.A. Cruz-Aguado and G. Penner (2008). Determination of ochratoxin A with a DNA aptamer. *J Agric Food Chem*, **22**: 10456-10461.

Optimization of the protocol for the *Brettanomyces bruxellensis* detection using LSPR phenomenon with AuNPs.

Priya Vizzini¹, Kun Jia², Marisa Manzano¹, Rodica Ionescu³

¹Department of Food Science, University of Udine, Udine, Italy

²School of Microelectronics and Solid-State Electronics, University of Electronic Science and Technology of China, Chengdu, China

³Laboratoire de Nanotechnologie et d'Instrumentation Optique, Institute Charles Delaunay, Universite' de technologie de Troyes, Troyes, France

The yeast *Brettanomyces bruxellensis*, is well-known in the oenological field for being the cause of significant defects in wine called "Brett character". *B. bruxellensis* is responsible for contamination of cellars that lead to consequent economic losses. Classical plate methods and molecular techniques such as PCR, nested-PCR, RFLP, FISH and dot blot are used for its detection. Plate techniques are time-consuming, PCR bases on enzyme activities, thus it can fail due to the presence of polyphenols, and hybridization based techniques cannot reach high sensitivity. Localized Surface Plasmon Resonance (LSPR) has been used to build a LSPR label-free optical biosensor in connection with gold nanoparticle substrate (Au NPs). The aim of this work was to test several protocols to optimize the best one that may become an important part of the routine analysis using *B. bruxellensis* like positive control and *Saccharomyces cerevisiae* as negative control. Buffer, hybridization time and probe concentration were optimized to give high sensitivity.

Mapping the poly-ubiquitin binding sites on Rpn10

Dorin Harpaz, Tal Keren-Kaplan & Gali Prag

Department of Biochemistry and Molecular Biology, George S. Wise Faculty of Life Sciences Tel-Aviv University

One major ubiquitylation signal is directing proteins for proteasomal degradation. Ubiquitylated proteins recognized by ubiquitin (Ub)-receptors, proteins that contain Ub-binding domains (UBDs). Interestingly, Ub-receptors are themselves regulated by ubiquitylation. Rpn10 is one of the proteasomal Ub-receptors that recognizes K48 poly-ubiquitylated proteins. We demonstrated that Rpn10 undergoes self-ubiquitylation on K84. This research aim to examine the function of distinct Rpn10 domains to direct self-ubiquitylation to K84 and in recognition of K48 poly-ubiquitin chains. I built four short (1-245 a.a) Rpn10 constructs: wild-type; VWA mutant— I147A, T173, 175R; UIM mutant—A231G, S235A; and double mutant (that contains both VWA and UIM mutations). The biochemical, biophysical and bacterial genetic studies from our lab shows that VWA is a *bona fide* UBD and provides a molecular explanation for the selectivity of Rpn10 towards K48-polyubiquitylated-substrates.

I expressed and purified the constructed Rpn10 proteins from *E. coli*. Using these proteins, we plan to examine the binding to poly-Ub chains by Nuclear magnetic resonance (NMR) chemical shift perturbation. In addition, using our developed ubiquitylation system in *E. coli*, I purified ubiquitylated-Rpn10 constructs for downstream mass spectrometry studies.

Assessment of TBEV diversity in a diverse environment setting in Slovenia

L. Fajs

Campus for Research Excellence And Technological Enterprise
School of Materials Science and Engineering,
Nanyang Technological University
Email: lfajs@ntu.edu.sg

Tick-borne encephalitis virus (TBEV) is the most important arboviral agent causing infections of the central nervous system in central Europe. TBEV exhibits pronounced genetic variability, which is often correlated its geographical origin. Genetic diversity of TBEV has been studied predominantly in rodents and ticks, while information about the variability in patients is scarce. We wanted to assess the diversity and genetic relationships of TBEV within a diverse environment in Slovenia between three different hosts: ticks, rodents and patients. We sequenced TBEV E and NS5 protein genes, by direct sequencing of RT-PCR products from TBE-confirmed patients as well as from rodents and ticks collected from TBE-endemic regions in Slovenia. A total of 27 partial E protein gene sequences representing 15 human, 4 rodent and 8 tick samples and 30 partial NS5 protein gene sequences representing 17 human, 5 rodent and 8 tick samples were obtained. Phylogenetic analysis of the E and NS5 protein gene sequences revealed a high diversity of TBEV in patients, ticks and rodents. Furthermore, we show correlation between geographical and phylogenetic clustering independent of TBEV host. We also show a possible recombination event in the TBEV from a patient sample. This is the first study that simultaneously analyzed the genetic relationships of directly sequenced TBEV samples from patients, ticks and rodents and provides the largest set of patient-derived TBEV sequences up to date. In addition, we have confirmed the geographical clustering of TBEV sequences in a diverse environment in Slovenia and have provided evidence of a possible recombination event in the TBEV genome, obtained from a patient.

Grating Based Photonic and Plasmonic Structure for Biosensing Applications

Mohammad Awesat*, and Ibrahim Abdulhalim

Department of Electro-optic Engineering and Ilse Katz Institute for Nanoscale Sciences and Technology,
Ben Gurion University of the Negev, Beer Sheva 84105, Israel;

*Corresponding author E-mail: awesat@post.bgu.ac.il

Photonic and plasmonic structures are arguably among the most exciting optical structures, and nowadays are at the forefront of theoretical and experimental research. In our study we are interested in the design and optimization of these structures for biosensing applications. We propose a structure which combines a dielectric diffraction grating that is coupled with a metallic thin film. The structure is shown to give changes in the reflection function due to variations in the analyte refractive index with some unique features that improve the sensor stability and sensitivity. The proposed structure can be used as a sensor with a good spectral sensitivity of about $600\text{ nm}/\text{RIU}$. One of the unique features of the structure is that the reflection function has two dips, with only one of them is sensitive to the analyte refractive index change. This means that the second one can be used as a reference, which makes the measurement more accurate and less sensitive to temperature fluctuations and optomechanical misalignments. Investigations of the different reflectivity dips observed both in the angular and spectral modes will be presented as well as the field distribution calculations using COMSOL software.

Bioluminescent Engineered *Escherichia coli* strains for detection of bamboo powders toxicity

Riccardo Muzzi¹, Marisa Manzano¹, Elena Rodica Ionescu², Evgeni Eltzov^{3,4}, Robert Marks^{3, 4,5,6}

¹Department of Food Science, University of Udine, Udine, Italy

²Laboratoire de Nanotechnologie et d'Instrumentation Optique, Institute Charles Delaunay, Universite' de technologie de Troyes, Troyes, France

³Department of Biotechnology Engineering, Faculty of Engineering Science, Ben-Gurion University of the Negev, Beer-Sheva , Israel

⁴School of Material Science and Engineering, Nanyang Technology University, Singapore

⁵National Institute of Biotechnology in the Negev, Ben-Gurion University of the Negev, Beer-Sheva, Israel

⁶The Ilse Katz Center for Meso and Nanoscale Science and Technology, Ben-Gurion University of the Negev, Beer-Sheva, Israel

The utilization of bacteria based biosensors for the study of toxic compounds is regarded as a key advancement for rapid and reliable detection of hazards for health and environment, such as the use of bamboo composite products in homebuilding.

The purpose of this study was to test the toxicity of bamboo (*Phyllostachys edulis*) powders, both pure and treated with epoxidic resins, using the engineered bioluminescent *Escherichia coli*, TV 1061, sensitive to protein damage, and *Escherichia coli* DPD 2794, sensitive to DNA damage. Other elements of known toxicity were tested, to create a standard for comparison. Different protocols for the interaction between bacteria and toxic agent with different concentrations were tested. The bioluminescent signal given off by the bacteria was analysed with luminometer and normalized as induction factor. Scanning electron microscope was used to evaluate cell surface modifications. For both strains the luminescence damage response followed a peculiarly shaped curve.

Biography of Presenters



Dr Chris D. Geddes, Ph.D., FRSC, Professor, has extensive experience in fluorescence spectroscopy, particularly in fluorescence sensing and metal-fluorophore interactions, publishing over 250 peer-reviewed papers (h-index: 41), and > 20 books.

Dr Geddes is internationally known in fluorescence and plasmonics and his laboratory is widely attributed to the development of the Metal-Enhanced Fluorescence (MEF) and related plasmon-fluorescence technologies, securing in excess of \$25 million in recent years to pursue his research aspirations. He is the editor-in-chief of the Journal of Fluorescence and founding editor-in-chief of the Who's Who in Fluorescence, Annual Reviews in Fluorescence and the Annual Reviews in Plasmonics volumes. In addition, due to the labs' pioneering efforts in the fields of metallic nanoparticle-fluorophore interactions, Dr Geddes launched a Springer Journal "Plasmonics" in 2005, which is a leading journal in the field today.

Dr Geddes is Director of the Institute of Fluorescence, a department within UMBC (University of Maryland Baltimore County), Maryland, USA, which focuses on the nano-bio-technological applications of fluorescence. Dr Geddes has been a permanent member of the NIH's EBIT R01 study section (2007-2012) and chaired the NIH's Analytical and BioAnalytical SBIR study section from ~ 2004-2009. Dr Geddes is a fellow of both the Royal Society of Chemistry (FRSC) and the Institute of Physics. Dr Geddes holds > 100 patents in the fields of fluorescence and plasmonics and his roles and interactions with industry have created enterprise value in excess of \$100 Million dollars today. In 2011, Professor Geddes was honored by the Maryland House of Delegates in Annapolis, (House Resolution #326), for his outstanding contributions to education, biotechnology, economic development and innovation.



Alfred Tok (PK; Ph.D, NTU; C.Eng, MIMMM; MBA, NTU) has been a faculty in the School of Materials Science and Engineering since 2003. He studied Mechanical Engineering at the Queensland University of Technology, Australia, and graduated with a first class honors in 1995. He was also conferred the Dean's Award for Excellence for being top graduate on the course. After graduation, he worked as a mechanical engineer at ST Aerospace Engineering. In 1997, he was awarded 2 scholarships at Nanyang Technological University (NTU) to pursue his PhD in Mechanical Engineering. He obtained his MBA (Dean's List) in 2009 from the Nanyang Business School, and in 2009, he was appointed Division Head of Materials Technology in MSE (till 2012) and since 2011, he has been the Deputy Director of the Institute for Sports Research in NTU. He also consults extensively for companies from various industries.



Michael Holzinger works since the late nineties in the field of functionalization of single-walled carbon nanotubes and was one of the first organic chemist in Europe who worked in this field. During his Ph.D work in the group of Prof. Dr. Hirsch at the Institute of Organic Chemistry, University Erlangen-Nürnberg, Germany, he firstly reported several new organic chemical reactions for the exothermal modification of nanotubes like the attachment of radicals or nitrenes and participated to further functionalization methods like the cycloaddition of azomethineylides. His pioneering work contributed to a better processability of this exceptional material.

After his Ph.D. he joined the group of Patrick Bernier at the university Montpellier II, France, where he worked on the fabrication of reinforced carbon nanotube composites and the optimization of the production of carbon nanotubes and nitrogen-doped carbon nanotubes. He worked at the Max Planck Institute for solid state research in Stuttgart, Germany, in the group of Sigmar Roth where he developed a new functionalization method for such hetero nanotubes. After a short stay at the Robert Bosch GmbH in Schwieberdingen, he joined the group BEA of Serge Cosnier in 2006. Since that time his research interest is focused on the development of biosensors and biofuel cells based on functionalized nanomaterials.

He received the researcher award of the Analytical Chemistry Division of the French Chemical Society (SCF) in 2013 where he also was elected distinguished junior member.



Dr. Eugene O. Kamenetskii received Diploma of Engineer in electrical engineering and the PhD degree in physics and mathematics from the Electrical Engineering Institute, St. Petersburg, Russia, in 1969 and 1986, respectively. He is presently with Ben Gurion University of Negev, Israel as a Head of Microwave Magnetic Laboratory. He is an author (co-author) of 150 journal papers and conference presentations. His special fields of scientific interests are magnetic waves and oscillations, spectral theory of artificial atomic structures, metamaterials for microwave and optics applications, microwave microscopy, and microwave biosensing.



Dr. Moran Bercovici is an Assistant Professor in the Faculty of Mechanical Engineering at Technion – Israel Institute of Technology. He received his BSc (2001, *summa cum laude*) and MSc (2007 *summa cum laude*) from the Faculty of Aerospace Engineering at Technion. Between 2001 and 2006 he was a Research Engineer at the R&D directorate at RAFAEL, working on experimental and computational aerodynamics. He is the recipient of a Fulbright Doctoral Fellowship from the US State Department (2006-2008) and a Stanford Graduate Fellowship (2006-2010) and pursued his PhD at the microfluidics laboratory at Stanford University (2006-2010) where his research focused on computational and experimental electrokinetics. During 2010-2011, he was a postdoctoral fellow in the Department of Urology at Stanford University School of Medicine, and joined Technion in October 2011 where he directs Technion Microfluidic Technologies Laboratory. In 2012, he received the European Union Marie Curie Career Integration Award and was named a Horev Fellow in the Leaders in Science and Technology program supported by the Taub Foundation. In 2014, he received the Daniel Shiran Memorial Research Prize for outstanding research in Bio-Medicine and the Krill Prize for Excellence in Scientific Research from the Wolf Foundation. His research interests span from basic research in microscale transport phenomena, electrokinetics, separation and concentration techniques, and flow instability, to novel applications in lab-on-a-chip, molecular diagnostics, environmental monitoring, alternative energy, and pharmaceutics



Marisa Manzano is an Associate professor at the University of Udine, Italy. Research activities base on the development of PCR, qPCR protocols for the detection and quantification of microorganisms

mainly in food and beverage samples. Researches focus on the utilization of blotting techniques, design of specific DNA probes to develop biosensors for the direct detection of culturable and unculturable microorganisms, denaturing and temperature gradient gel electrophoresis (DGGE/TGGE) for genetic analysis of microbial communities. Teaching: Molecular Biology Techniques, Selection and Use of Enological Yeasts, Biotechnology of Microorganisms, Genetic of Microorganisms. Patent - detect Listeria monocytogenes in organic fluids by PCR, using a new couple of primers, 1996, C12Q. Member of Academic commettes, reviewer for International Journals, author of 123 papers, 10 book chapters, supervisor of 60 thesis and 3 Phd thesis.



Prof. Robert S. Marks is a Full Professor at the Department of Biotechnology Engineering, the Ben-Gurion University of the Negev, Israel, and affiliated to the National Institute for Biotechnology in the Negev and the Ilse Kats Centre for Nanotechnology. He is presently a program coordinator for the NRF CREATE program "Nanomaterials for Water and Energy Management" through MSE at the Nanyang Technological University. He has published in viral immunosensors (Ebola virus, West Nile virus, Rift Valley fever, Dengue, Hepatitis C) and has extensive experience in biosensors including chemiluminescent-based optical immunosensors to pathogen-elicited antibodies as well as amperometric immunosensors. He has developed new sensor configurations, such as establishing diagnostics based on luminescence emitted by primed neutrophils. His work also encompasses environmental toxicology such as monitoring water pollution via fiber-optic probes glowing in the presence of toxicants through their associated luminescent bacteria, or developing a nanometer particle-sensitive bioassay. His group has also participated in developing enzyme nanolithography, as well as ITO-based biochip configurations. He is the Editor-in-Chief of a 2007 2-volume Wiley Handbook in Biosensors and Biochips and Founding Editor of the 'High of Biotech' book series from Pan Stanford. He is the author of 115+ papers and numerous chapters. He has 4 issued patents as well a dozen filed.



Prof. Micha Ilan, BSc, MSc & PhD Tel Aviv University and on 1991 following postdoc at UC Santa Barbara joined Department of Zoology in Tel Aviv University.

He is a marine biologist, an expert in marine invertebrate ecology and biotechnology, mainly sponges, their associated microorganisms, natural products and biomimetic mineralization (and loves cats). A former chair of TAU Department of Zoology and heads the National Center for High Throughput Screening of novel bioactive compounds.



Jacob Gopas PhD is a faculty member at the Ben Gurion University, Dept. of Microbiology, Immunology and Genetics, Faculty of Health Sciences, since 1982. He obtained his B.Sc. and M.Sc. degrees from the Bar-Ilan University in Ramat Gan Israel. On the *in vitro* culture of B cells, his Ph.D. was obtained at the Albert Einstein College of Medicine, New York, USA on the characterization of mutant MHC class I antigens. After which, he did a postdoctorate in the Ben Gurion University in cellular immunology and immunochemistry. Today, he holds the rank of a full Professor. In addition, he is also the Head of the Laboratory of the Institute of Oncology, Soroka University Medical Center, Beer-Sheva. Between 1990-91, he spent a sabbatical year in the National Cancer Institute, Frederick, Maryland USA working on the biochemistry of oncogenes.

He is active in a variety of academic and administrative capacities. He coordinates and teaches the subject of Cell and Cancer Biology, in addition to being the advisor to Five Postdoctoral fellows, eleven Ph.D. students and nineteen M.Sc. students.

His recent scientific work is characterized by blending basic and clinical subjects in Cancer Biology, especially related to Hodgkin's lymphoma (HL) biology. A second line of research in his laboratory is the search for new compounds from plants against chronic inflammation, pathogens and cancer. Over the years, he had published about 90 articles in collaboration with Israeli, German and American scientists and physicians and held several patents related to cancer treatment and inflammation. His work had been founded by several Israeli agencies, such as the Israel Science Foundation, the Israel Ministry of Health, the Israel Ministry of Science, the Israel Cancer Association as well as the American National Institute of Health.



Samuel Appelbaum, born in Israel, achieved his PhD degree in Hamburg. The focus of his work is the biology and physiology of fish and their behaviour, nutrition and reproduction. Through this interest and under the climatic conditions in Israel, he developed possibilities for aquaculture in desert zones.

During my years at Ben-Gurion University I ascertained the huge potential of the rich geothermic brackish water existing under the desert sand, writes Prof. Appelbaum. In this water, he sees an excellent medium for fish farming and even for the production of high quality organic fish. Appelbaum encouraged farmers in the Ramat Negev Desert district to create fish farms, which did not exist prior to his research. Today commercial fish farms in the Negev Desert produce low-cost, high-quality edible fish, as well as ornamental fish.



Hanna Rosenfeld is the director of the National Center for Mariculture, Israel Oceanographic & Limnological Research (NCM-IOLR). Her main research interest are studies on fish reproductive physiology including mechanisms controlling sex differentiation, environmental and hormonal cues that initiate and regulate sexual maturity, and in vivo/ in vitro procedures promoting gamete maturation and fertilization. Rosenfeld has vast experience in developing technologies for broodstock management of various marine fish and in establishing hormone-based therapy for alleviating reproductive dysfunctions under captive conditions. The accumulated knowledge as well as the workable protocols developed have been already utilized to identify the exact blocks of reproductive development revealed in captive fish, directing the endocrine therapy to optimize the management strategy for successful breeding and sustainable egg production in various fish of commercial importance, including: grey mullet (*Mugil cephalus*), white grouper (*Epinephelus aeneus*) and bluefin tuna (*Thunnus thynnus*). Aiming to explore the evolutionary basis of the vertebrate endocrine system, Rosenfeld's lab has developed a novel approach to study invertebrate endocrinology. Utilizing methods borrowed from fish endocrinology, the lab investigates the main endocrine "players" involved in the physiological processes and signal deployment associated with reproductive function in the edible sea urchin (*Paracentrotus lividus*) as well as in the sea anemone *Aiptasia diaphana* and the coral *Stylophora pistillata*.



Joseph Kost D.Sc. The Abraham and Bessie Zacks Professor of Biomedical Engineering is the Dean of the Faculty of Engineering Sciences at Ben-Gurion University in Israel. He completed his undergraduate and graduate degrees in Chemical Engineering at Technion, Israel Institute of Technology before earning a doctorate in Biomedical Engineering at the same institution and Post-Doctoral training at University of Washington, MIT and Harvard Medical School. He is a pioneer in the field of ultrasound-based drug delivery systems, co-founder of Sontra Medical and co-inventor of the FDA-approved ultrasound based transdermal delivery system, SnoPrep™. His research interests include biotechnology, biomaterials, nanotechnology, polymeric systems for genes and drug delivery, application of ultrasound for enhanced transport through membranes and cellular and intracellular transport.



Dr. Niv Papo is an assistant professor at the Department of Biotechnology Engineering, Ben-Gurion University and affiliated to the National Institute for Biotechnology in the Negev (NIBN). Dr. Papo and his research group are using protein engineering to develop natural ligands as alternatives to antibodies for applications in cancer therapy and imaging. In particular, Dr. Papo and his team aim to develop combinatorial and rational synthetic tools for engineering a new generation of protein ligands capable of targeting molecular markers of angiogenesis and metastasis, a strategy reflective of a new and fast developing branch in the field of protein-based therapeutics.

Their research contributes to cutting-edge protein engineering research on several fronts. First, it offers a new quantitative platform that enables high-throughput screening of large protein libraries and can simultaneously identify variants with improved expression, stability, and/or affinity to a desired target. This quantitative, multiple-parameter screening technologically eclipses currently used cell-free, non-display, and phage display selection methods. Second, their research provides new protein engineering strategies for altering natural ligand–receptor interactions to modulate biological responses and to generate ligand-based antagonists (and agonists) with therapeutic potential. Finally, the research performed in Dr. Papo lab utilizes a directed evolution approach that enable proteins to acquire properties optimized for *in vivo* applications, such as serum stability, tissue penetration, blood clearance, and target retention.



Luka Fajs Graduated in Microbiology at the Biotechnical faculty, University of Ljubljana. Completed his PhD in Biomedicine at the Institute of Microbiology and Immunology, Faculty of Medicine, University of Ljubljana. The areas of research vary from basic virology, immunology, diagnostics, viral hemorrhagic fevers, zoonosis, genetic diversity, epidemiology and clinical research. Within research the main focus is on BSL3/4 agents like Crimean-Congo hemorrhagic fever, Tick-borne encephalitis and hantaviruses. Most of the research was focused on the determination of the genetic variability of these viruses in different hosts: patients, vectors and natural reservoirs. Besides phylogenetic studies the main emphasis was on the determination of the immune response to viral zoonoses and the host-pathogen interactions. Other studies include epidemiological and sero-epidemiological surveys, field work (sampling of rodents, ticks and collection of blood from humans), development of diagnostic assays, cell culture, expression of recombinant proteins, etc. Currently he is a research fellow at the Nanyang Technological University, under supervision of prof. Robert Marks at BGU/CREATE. The focus is development of point-of-care diagnostic assays for different applications ranging from clinical, environmental and food safety/quality.



Prof. Dr. Dr. Bernd Rauschenbach is director of the Leibniz-Institute of Surface Modification in Leipzig and Professor of Applied Physics at the University Leipzig (Germany). His fields of research are the interaction of ion and laser beams with solid surfaces, nanotechnology and thin film physics.



Musa Abu Teir is a professor in physics at physics department at Al-Quds University in Abu Dabbab, East of Jerusalem, and used to be the physics head department from 2006-2010. I am the principle of the biophysics research laboratory at Al-Quds University that was established since 2006 from a grant of DFG (Germany). Now my research interest is in the biophysics field using an FTIR spectroscopy in the near and far infrared region. I already published more than 30 publications in this field studying the interaction of different drugs, vitamins, and DNA with human serum albumin (HSA) beside the interaction of Digoxin and phospholipids with cholesterol in the mid-infrared region.



Professor Satyen Kumar is experimental physicist in the general area of soft condensed matter physics, with a PhD degree from the University of Illinois at Urbana-Champaign. After completing his postdoctoral research at Massachusetts Institute of Technology, he joined Tektronix, Inc. as Senior Scientist in 1984. He was member of a team that developed high-resolution liquid crystal light valve. He joined the faculty of Kent State University in 1987 and is now professor of Physics and Chemical Physics Interdisciplinary Program. He has made seminal contributions to the field of liquid crystals science and technology, authored over 200 scientific papers, edited/authored two books, and is named inventor on 14 patents. He was elected as the president of International Liquid Crystal Society for a four-year term in 2004.

From 2005-08, he served as Program Director for the Condensed Matter Physics and Biomaterials programs in the Division of Materials Research of National Science Foundation and was recipient of NSF Director's award for *Program Review Excellence*. He was appointed Associate Vice President for Research at Kent State University in 2009 where he served for nearly five years.



Dr Karabchevsky is a Research Fellow at the Optoelectronics Research Centre (ORC) at the University of Southampton, UK. She is leading work on integrated on chip surface enhanced spectroscopies for Point of Care applications since 2012. Her main research interests lie in the areas of integrated optics for vibrational spectroscopy and surface enhanced spectroscopy. Alina graduated from Ben-Gurion University (BGU) of the Negev with BSc and MSc degrees in Biomedical Engineering in 2005 and 2008 respectively and with a PhD degree in Electrooptic Engineering in 2012. Her thesis, entitled "Nanophotonic structures for optical biosensing and application in water quality control" was nominated for an '**excellent thesis award**'. In 2012, Alina was honoured with the **President's Award** by the BGU to perform her research in ORC. In 2014, Alina won the **Brilliance in Research prize** of the ORC for the development of a NIR spectroscopy laboratory on chip - the 'doctor-in-your pocket' device she created.



Dr. Li Shuzhou received his B.Sc, M.Sc, and PhD in chemistry from Nankai University, Peking University, and University of Wisconsin, respectively. After studying plasmonics in Northwestern University as a postdoc, he joined school of materials science and engineering in Nanyang Technological University. Currently, his research interests are focusing on (1) design high sensitive substrates for surface enhanced Raman scattering and fluorescence; (2) optical properties of metal-semiconductor nanostructure; (3) Assembly of metallic nanostructures.



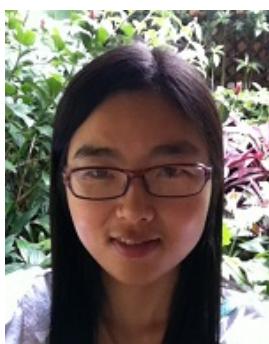
A/Prof. Ariel Kushmaro obtained his PhD in Microbiology and Zoology in 1999, studied the interactions between corals and their associated bacteria. He has been at Ben-Gurion University (Department of Biotechnology Engineering and the National Institute for Biotechnology in the Negev, Beer-Sheva, Israel) since 2001. His current research interests focus on marine and wastewater microbial-ecology, environmental biotechnology, bioremediation, bacterial immobilization, and environmental sensing. The group of **A. Kushmaro** includes 8 PhD students and 4 MSc students 2 post-docs and 3 technicians. He published more than 70-refereed journal articles, over 100 conference abstracts, 9 book chapters and several patents. His lab facility includes all the materials and equipment necessary to carry research in microbiology. He is from the department of biotechnology engineering at Ben Gurion University, affiliated with the BGU National Institute for Biotechnology in the Negev, BGU Nano-center, CREATE-NEW program and NTU (MSE), Singapore.



Ibrahim Abdulhalim is a professor in the Department of Electrooptic Engineering at Ben Gurion University. He has worked in research and development in variety of academic institutions and industrial companies such as: the Optoelectronic Computing Systems Center in the University of Colorado at Boulder, USA, the Optoelectronics Research Center of Southampton University, England, the Thin Films Center of the University of Western Scotland, KLA-Tencor and Nova measuring instruments, and in GWS-Photonics. Since October 2005 he joined the Department of Electrooptic Engineering at Ben Gurion University. His current research activities involve: liquid crystal devices, nanophotonic and plasmonic structures for biosensing, improved biomedical optical imaging techniques such as spectropolarimetric imaging and full field optical coherence tomography using liquid crystal devices. Prof. Abdulhalim has published over 130 journal articles, 70 conference proceedings papers, 10 book chapters, coauthored one book titled: Integrated Nanophotonic Devices (Micro and Nano Technologies), co-edited a book to appear in 2015 titled: Signal amplification in optical biosensing, and has over 15 patents. He became a fellow of the Institute of Physics, UK in 2004 and SPIE fellow in 2010. He is an associate editor of the SPIE Journal of NanoPhotonics and for the Journal of Physics Express. Prof. Abdulhalim is acting as the head of Department of Electrooptic Engineering since 2007. Recently he founded a company called Photonicssys, specialized in optical devices and plasmonic biosensors and acting as its president.



Evgeni Eltzov received his BSc from the department of Biotechnology Engineering, Ben-Gurion University of the Negev, Israel, in 2005. He received his MSc and PhD from the Department of Environmental Engineering, Ben-Gurion University of the Negev where he is now doing research on high-throughput methods for detecting sub-inhibitory concentrations of genotoxically and biologic active compounds from various environments.



Yuanyuan Wu obtained her bachelor Degree in Materials Science & Engineering from Nanyang Technological University (NTU), Singapore in 2012. Upon graduation, she joined the Doctor of Philosophy (Ph.D) programme of School of Materials Science & Engineering, NTU. Under the supervision of Dr. Vladislav Papper, Prof. Terry Steele and Prof. Robert S. Marks, she is now working on photophysical and photochemical study of stilbene and stilbene derivatives and their promising sensing applications in chemistry and biology.



Shlomo Magdassi is a professor of chemistry, at the Casali Center for Applied Chemistry, the Institute of Chemistry and the Center for Nanoscience and Nanotechnology at the Hebrew University of Jerusalem, Israel. His research focuses on colloid science, and in particular on formation, formulation and applications of novel micro and nanoparticles. These particles can be used as active components in functional inks and coating, for example metal nanoparticles and CNT for 2D and 3D printing. In addition to his scientific publications, he also has various inventions on applications of colloids in industrial products. Based on these inventions, some commercial activities evolved leading to worldwide sales

and establishing new companies. For more info see:

<http://chem.ch.huji.ac.il/casali/magdassi/magdassi.htm>



Pooi See Lee is a tenured associate professor in the School of Materials Science and Engineering (MSE), Nanyang Technological University, Singapore. She received her Ph.D. from the National University of Singapore in 2002. After working on technology and development in the semiconductor industry for two years, Pooi See joined the Nanyang Technological University, Singapore. She is a recipient of the 2001 Norman Hackerman Young Author award presented by the Electrochemical Society, USA. She was awarded the Tan Chin Tuan Fellowship in 2006. Pooi See was selected as a Fellow in the Hanse Wissenschaftskolleg Institute of Advanced Study in Germany in 2011. She has authored and co-authored more than 190 publications in the field of nanomaterials for electronics

and energy such as nanowire sensors, supercapacitors, electrochromics, piezo-energy, stretchable and flexible devices. She has more than 20 patents filed, she has authored 6 invited book chapters and published a book as co-editor. She serves as the Associate Chair in MSE since 2012. She is a member of the Materials Research Society and Institute of Engineers Singapore. She has been an organizer, chair or session chair for many international conferences. She is in the advisory board of Advanced Energy Materials and Scientific Report, she has also guest edited special issues in the journals of Small and Advanced Materials.



Serge Cosnier is Research Director at CNRS and heads of the Department of Molecular Chemistry at the Grenoble Alpes University (France). He received his doctoral degree in Chemistry from the Toulouse University (1982) and was an Alexander von Humboldt postdoctoral fellow. Cosnier's activity is focused on biosensors, biofuel cells, electrogenerated polymers, molecular electrochemistry and carbon nanotubes. He has made important contributions in the area of enzymatic biofuel cells, electrochemical biosensors, immunosensors and DNA sensors and inorganic composite modified electrodes and is an international leader in the field of electropolymerized films applied to bioelectrochemistry. Dr

Cosnier has authored over 294 peer reviewed publications which brought more than 8800 citations, forming an h-index of 51, 2 books and 17 book chapters and holds 13 patents. In 2009, he received the Katsumi Niki Prize of the International Society of Electrochemistry and was appointed as Fellow of this Society in 2010. He was appointed as Honorary professor of the College of Chemical and Chemical Engineering of the Yangzhou University in 2008 and as Distinguished Visiting Professor of the University of Medicine and Pharmacy of Cluj-Napoca (Romania, 2012) and of the Nanjing University of Science and Technology of Nanjing (China, 2013). In 2013, Dr Cosnier became a member of the European Academy of Humanities, Letters and Sciences and was nominated as a Finalist for the European Inventor Award 2014 by the European Patent Office.

Dr Cosnier is Speciality Chief Editor of Frontiers in Analytical Chemistry and Associate Editor of Current Analytical Chemistry, Frontiers in Bioenergy and Biofuel and of Journal of Integrated OMICS. He is also involved in several editorial boards: Electroanalysis, Talanta, The Open Current Process Chemistry Journal, The Open Analytical Chemistry Journal, Current Organic Synthesis, SRX Chemistry, Technology.



Dr. Qichun Zhang obtained his B.S. at Nanjing University in China in 1992, MS in physical organic chemistry (organic solid lab) at Institute of Chemistry, Chinese Academy of Sciences (Prof. Peiji Wu/Daoben Zhu, ICCAS, Beijing) in 1998, MS in organic chemistry (Prof. Fred Wudl) at University of California, Los Angeles (USA), and completed his Ph.D. in inorganic chemistry at University of California Riverside (Prof. Pingyun Feng, USA) in 2007. Then, he joined Prof. Kanatzidis' group at Northwestern University as a Postdoctoral Fellow (Prof. Mercouri Kanatzidis Oct. 2007 –Dec. 2008). Since Jan. 2009, he joined Nanyang Technological University (NTU) as an Assistant Professor. In 2014, he has been promoted to Associate Professor. Besides these, he also has three-year working experience in research institute of Nanjing Chemical Industry Co. (Aug. 1992 – Aug. 1995) and two-year's research experience in ICCAS (Aug. 1998 – Jun 2000). He received TCT fellowship in 2013 and lectureship from National Taiwan University in 2014. Currently, he is an associate editor of J. Solid State Chem. He has published > 157 papers and 4 patents (H-index 33). Some of his papers have been published in Nature Chemistry, Scientific Reports, Angew. Chem. Int. Ed., J. Am. Chem. Soc., Adv. Energy Mater., Adv. Funct. Mater. etc.



Prof. Razi Vago earned his Ph.D. in 1994 at the Department of Life Science, Bar-Ilan University, Ramat-Gan. He was later awarded an Australian Institute of Marine Science Post Doctoral Fellow Award where he was focusing on calcification processes, calcifying tissue and biotechnological applications of carbonated matrices of marine origin. Some aspects of his work were published in Nature Magazine (Vago et al., 1997) as a cover publication. In 1998 he joined the Institute of Applied BioSciences and in 2000 he took a part in the foundation of the Department Biotechnology Engineering at Ben-Gurion University. He is a recipient of the Koret Foundation Grant Award for 1998 and 1999, and the Israeli Ministry of Science Grant Award and fellowship (1999-2000). In last three years

Prof. Vago is the Head of the Avram and Stella Goldstain-Goren Department of Biotechnology Engineering. His laboratory is very active, positioned with technical staff, undergraduate and graduate students. His research combines bioengineering and basic approaches for studying biology and bioengineering of mesenchymal stem cells on one hand and their role in development of cancer on the other.



Professor Adam Friedmann, Dean of the School of Marine Sciences, Ruppin Academic Center and Professor Emeritus of The Hebrew University of Jerusalem. Professor of Genetics & Virology devoted his academic career to research on genes associated with disease and with quantitative traits. He taught in several academic courses, published over 140 refereed articles, participated in establishing four biotech companies, was the VP R&D of an international CRO company and served as visiting professor in world leading universities. Several of his past Ph.D. students are now professors in universities in Israel, U.S.A and England.



Jack Gilron is an associate professor and head of the Department of Desalination and Water Treatment at the Zuckerberg Institute for Water Research within the Blaustein Institutes for Desert Research at Ben Gurion University where he has been on the faculty since 1997. He is also on the teaching staff of the Environmental Engineering Unit of BGU. Dr. Gilron has a doctorate in Chemical Engineering from the Technion, Israel Institute for Technology and an M.Sc. (Cornell 1977) and B.A. (Brandeis 1974) in Chemistry. He began working in the water treatment field in 1978 working for a water treatment chemicals company and accumulated 14 years experience working in industry. He has been involved in membrane technology since 1982. He has over 40 published articles in peer reviewed journals and been awarded 8 patents.