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7th Euro Biosensors and Bioelectronics Conference

July 10-11, 2017
Berlin, Germany

Scientific Tracks & Abstracts

DAY 1

Sessions

Day 1 July 10, 2017

Biosensors | Bioelectronics | Types of Biosensors | Biosensing Technologies | Nanotechnology in Biosensors | Enzymatic Biosensors | Environmental Biosensors

Session Chair
Session Chair: Hiroyuki Takei
Toyo University, Japan

Session Co-chair
Chirasree Roy Chaudhuri
Indian Institute of Engineering Science and Technology, India

Session Introduction

Title: **Multi-pores; controlling and measuring the flow of charged species through tunable nanopores producing a rapid, multiplex assay**
Mark Platt, Loughborough University, UK

Title: **Novel approach for multiplex detection of antibiotic residues in milk by means of electrochemical biosensors**
Valerie Gaudin, ANSES-Laboratory of Fougères, France

Title: **Three types of nanostructure platforms for plasmonics detection of target molecules on a solid surface or in a complex medium**
Hiroyuki Takei, Toyo University, Japan

Title: **An electrical model for silicon-nanowire electrodes in intracellular signal measurement in biological environments**
Alex Hariz, University of South Australia, Australia

Title: **Water bodies pollutants screening by nanostructured optical biosensors**
Giorgi Shtenberg, Agricultural Research Organization, Volcani Center, Israel

Title: **Closed solid state nanopore array - A unique device for ultrasensitive label free impedance biosensors**
Chirasree Roy Chaudhuri, Indian Institute of Engineering Science and Technology (IIEST), India

Mark Platt, J Biosens Bioelectron 2017, 8:2(Suppl)
DOI: 10.4172/2155-6210-C1-033

Multi-pores; controlling and measuring the flow of charged species through tunable nanopores producing a rapid, multiplex assay

Mark Platt
Loughborough University, UK

Point-of-need analytical devices have important applications in environmental, food security, forensic, biological warfare and the outbreak of contagious disease. Such sensors save time, overheads and lives, and to meet this demand a variety of technology platforms have emerged. Nanopore technologies offer single particle analysis, being used to sequence DNA, detect proteins, cells or nanomaterials. They even offer controlled and preferred ion flow enabling current rectifiers and ion sensors. Changing the size, length and shape of the pores has enabled a range of analytes to be quantified and characterised. Here, we present some of our recent work developing multiplexed assays using aptamer modified nanomaterials and pores to compare the use resistive pulses or rectification ratios on a tunable pore platform. We compare their ability to quantify the cancer biomarker Vascular Endothelial Growth Factor (VEGF). Secondly, by tuning the ligands and the setup, we then show how the translocation speed, conductive and resistive pulse magnitude, can be used to infer the surface charge of a nanoparticle, and act as a specific transduction signal for the binding of metal ions to ligands on the particles surface, used to extract and detect copper (II) ions (Cu^{2+}) from solution. Finally, we show data from samples that contain bacteria and bacteriophage and strategies to quickly quantify them.

Biography

Mark Platt completed his graduation and PhD at University of Manchester. He has developed an interdisciplinary research team investigating nanomaterial synthesis, characterization and electroanalytical sensors. He is currently a Senior Lecturer in Analytical Science developing portable diagnostic technologies via the integration of nanomaterials, fluidics and aptamers into nanopore sensors. He has published more then 35 peer review papers, and is a member of East Midlands Biomedical Research Unit–Diet, lifestyle and physical activity and an Academic Member of Collaboration for Leadership in Applied Health Research and Care, East Midlands.

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Valérie Gaudin et al., J Biosens Bioelectron 2017, 8:2(Suppl)
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Novel approach for multiplex detection of antibiotic residues in milk by means of electrochemical biosensors

Valérie Gaudin, Caroline Bodin, Céline Hedou, Christophe Soumet and **Eric Verdon Anses**
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Antibiotic residues may be present in foodstuffs (e.g., milk, meat, eggs, etc.) after treatment of livestock. The first stage of food control is carried out through screening methods. Thus, routine detection of antibiotic residues with high sensitivity is central for food safety. Conventional screening methods are microbiological or immunological methods (e.g., ELISA). Biosensor type methods are in continuous development to improve the performance and portability of screening methods. Our laboratory has worked on the evaluation of screening methods developed from optical biosensors. Now, we focus on electrochemical biosensors which are a promising way to develop cost-effective and portable screening methods. To date, this track is not developed by any other laboratory from those in the field of antibiotic residue testing. An innovative method based on disposable electrodes, coupled to magnetic beads, allowing the electrochemical detection in milk of three families of antibiotics simultaneously was published by a Spanish academic team. Our laboratory will evaluate the transferability of the method. The optimization of the analytical parameters and the evaluation of the method performance according to the European decision 2002/657/EC (2002) will be presented here. Advantages and drawbacks in developing this type of electrochemical biosensor for the detection of antibiotic residues in food will be concluded.

Biography

Valerie Gaudin completed her MSc in Veterinary Pharmacy and Biochemistry and has 20 years of experience as a Government Analytical Biochemist. She has completed her PhD in 2016 at Rennes University, France. She is a Senior Analytical Biochemist at ANSES- Laboratory of Fougères, France. She is responsible for a number of research projects in the areas of antibiotic residues, veterinary medicines, and emerging biosensor techniques. She has published more than 26 peer reviewed papers based on microbiological methods, ELISA kits and biosensors.

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Hiroyuki Takei et al., J Biosens Bioelectron 2017, 8:2(Suppl)
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Three types of nanostructure platforms for plasmonics detection of target molecules on a solid surface or in a complex medium

Hiroyuki Takei[1], **K Watanabe**[1], **J Saito**[1], **S Yoneda**[1], **M Ebisawa**[1], **T Miyashita**[1], **K Kato**[1], **T Okamoto**[2], **H Vieker**[3], **A Beyer**[3], **N Frese**[3] and **A Gölzhäuser**[3]
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[3]Bielefeld University, Germany

Plasmonics is expected to play a growing role in biosensing and environmental monitoring. It is in the area of localized surface plasmon resonance sensing and surface-enhanced Raman/fluorescence spectroscopies where there is much expectation. It is crucial to develop techniques for producing requisite nanostructures reproducibly at low costs. Toward this end, we are working on a number of different techniques. One is based on metal film on nano-spheres (MFON) where randomly-adsorbed SiO_2 nano-spheres are used as a template. The second method is a chemical method whereby base metal nanoparticles are used as seed for growing silver nano-structures from $AgNO_3$. The third method is based on exploitation of naturally existing nanostructures such as butterfly wing scales; scales coated with Ag have been shown to be an effective SERS platform. We will discuss pros and cons of these three fabrication techniques. Furthermore, the method of detection protocols is important. We have been working on different configurations. One is intended for *in-situ* detection of target molecules on a solid surface, such as residual pesticides on agricultural produces as well as identification of chemical evidence at a criminal scene. With this in mind, we have prepared a flexible surface coated with noble metal nanostructures, calling it FlexiSERS. Placing FlexiSERS onto a surface allows *in situ* SERS identification of the chemical species on the surface. We have also combined a SERS surface with thin layer chromatography, TLC-SERS. This has allowed detecting Raman-active species in the complex medium such as food.

Biography

Hiroyuki Takei completed his PhD in Applied and Engineering Physics at Cornell University in 1992. Since then, he has been affiliated with various organizations such as Hitachi Ltd. (Electronics), Lamdagen LLC (Biosensor start-up in silicon valley), Fujirebio Inc. (Medical Diagnostics), and Tokyo Medical and Dental University. Since 2009, he has been Full Professor in Department of Life Sciences at Toyo University, Japan. His main research interest has been in the field of "Biosensing and analytical techniques based on plasmonics".

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Alex Hariz et al., J Biosens Bioelectron 2017, 8:2(Suppl)
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An electrical model for silicon-nanowire electrodes in intracellular signal measurement in biological environments

Alex Hariz and **Nasir Mehmood**
University of South Australia, Australia

Measurement of small signals originating from ionic activity inside a biological cell known as action potential, poses a great challenge to biomedical scientists. The electrical signals of the biological cells result from exchange of ions through the cell membrane. The characteristics of action potentials may reveal a great deal of information about the causes and symptoms of abnormal cell behavior. Hence, it is imperative to capture high quality action potentials through the use of nano-sensors from within the cell. Recently, developments in silicon nanowires (SiNW) fabrication techniques have demonstrated a great potential for them to be used as nano-electrodes. Large-scale assembly and integration of addressable complementary silicon nanowires arrays have been demonstrated for multiplexed biosensor arrays. The fabrication process resulted in a high-yield, high performance devices arrays for chemical and biological detection. In this paper, we seek to model the electrical interface that is responsible for recording the biological signals. We present electrical equivalent circuits that model the boundary between the biological cell and the nanowire electrode. Impedance measurement curves of nanowires for various sizes of length and diameter have also been presented and discussed in this paper. The impedance graphs show a hyperbolic dependence of resistance on length and diameter of nanowires. This non-linear behavior may be mitigated in software algorithms when interpreting the measured cell signals. We believe that the proposed electrical model will lead to a more accurate characterization of NW biosensor arrays which are now integrated on disposable PCB interfaces. It will potentially evolve the sensor arrays into a controllable and scalable nanowire biosensor platform for clinical and point-of-care diagnostic applications in the near future.

Biography

Alex Hariz completed his MS in 1983 and PhD in 1989 in Department of Electrical Engineering at University of Southern California. He then completed his Post-doctoral Fellow position in Department of Physics at Simon Fraser University in Canada. He joined the University of South Australia in 1992, and is currently a Senior Lecturer in School of Engineering, teaching courses such as electronic devices, linear electronics, integrated circuits, and MEMS. His research activities include “Silicon microelectronics, micro-engineering of inertial sensors, micro-optics and fabrication of bio-MEMS sensors for use in biomedical applications”. He is an Editorial Board Member of *Journal of International Decision Technologies*.

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Giorgi Shtenberg et al., J Biosens Bioelectron 2017, 8:2(Suppl)
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Water bodies pollutants screening by nanostructured optical biosensors

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[2]Israel Institute of Technology, Israel
[3]Russell Berrie Nanotechnology Institute, Israel

This work presents a generic integrated biosensing platform for real-time optical monitoring of heavy metal pollutants in water bodies by enzymatic activity inhibition. Optical studies exhibit high specificity and sensitivity towards three metal ions ($Ag^{+}>Pb^{2+}>Cu^{2+}$), with a detection limit of 56 ppb. Additionally, we demonstrate detection and quantification of metal pollutants in real water samples (e.g. surface and ground water) with results comparable with gold standard analytical techniques, such as inductively coupled plasma atomic emission spectroscopy (ICP-AES). The main advantage of the presented biosensing concept is the ability to detect heavy metal ions, at environmentally relevant concentrations, using a simple and portable experimental setup, while the specific biosensor design can be tailored by varying the enzyme type.

Biography

Giorgi Shtenberg completed his PhD in 2014 in Biotechnology and Food Engineering at Technion–Israel Institute of Technology. He has expertise in Nanomaterials, Semiconductors, Microfluidics, Photonics and Biological Interfaces for biomedical and environmental monitoring applications. He is currently a Scientist and Head of Bio-Nano-Laboratory at Institute of Agriculture Engineering, ARO-The Volcani Center. He is focusing on the development of novel biosensors/bioassays that will transform from a laboratory-based research into real on-site "lab-on-chip" platforms for addressing problems in fields of agriculture, animal diagnostics, food safety and environmental monitoring and detection.

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Chirasree Roy Chaudhuri et al., J Biosens Bioelectron 2017, 8:2(Suppl)
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Closed solid state nanopore array - A unique device for ultrasensitive label free impedance biosensors

Chirasree Roy Chaudhuri, N Das and **H Ghosh**
Indian Institute of Engineering Science and Technology, India

Various nanostructures like nanowires, nanotubes and nanopores have been extensively explored for label free conductance type biosensors and also for detection of a single molecule in synthesized solutions. However, their major limitation is that the detection limit of biomolecules in physiological fluids like blood is only in the range of few pM. There have been several attempts to push down the detection limit by performing the noise analysis of the conductance fluctuation. But it has failed to differentiate the noise originating due to the specific antibody-antigen binding kinetics from the large magnitude of the device noise for fM or sub fM concentrations. This talk explores the physical origin behind this phenomenon and introduces closed solid state nanopore array as a novel device for ultrasensitive detection. The device is fabricated by electrochemical etching of silicon followed by annealing treatment for coalescence of small pores below 10 nm diameter (usually formed on the top) and subsequent thermal oxidation. This ensures stable and reproducible impedance measurements. Experimental observations reveal the unique presence of resonant peak in the frequency dependent characteristics only in the presence of specific antigen. Further this peak is also concentration dependent and combining the noise analysis at the resonant frequency has enabled the selective detection of Hep-B virus in blood samples down to 1 fM concentration. The physics behind these observations have been interpreted by coupling finite element modeling of the solid and the fluid regions.

Biography

Chirasree Roy Chaudhuri has completed her PhD in 2007 at Jadavpur University, India and is presently an Assistant Professor in Department of Electronics and Telecomm Engineering, IIEST Shibpur, India. Her fields of research interest are “Development of selective electrical biosensors, understanding the physical mechanisms for sub-femtomolar detection and measurement of biophysical properties of cells through distributed models”. She has received Young Scientist Award from National Academy of Science, India and Women Excellence Award from Department of Science and Technology, Government of India and has published around 60 papers in peer reviewed journals and proceedings.

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Scientific Tracks & Abstracts

DAY 2

Euro Biosensors 2017

Day 2 July 11, 2017

Nanotechnology in Biosensors | Biosensor Applications | Biosensing Technologies | Biochips & Nucleic Acid Sensors | Bioinstrumentation & Equipment's | Bio-MEMS/NEMS | Photonic Sensor Technologies

Session Chair
Session Chair: Andreas Dietzel
Center for Pharmaceutical Engineering (PVZ), Germany

Session Co-chair
Sarmiza Elena Stanca
Leibniz Institute of Photonic Technology, Germany

Session Introduction

Title: **Recent and upcoming potential spacecraft missions requiring biosensor technologies: Current examples, what are we looking for and remaining challenges**
Ike Chi, California Institute of Technology, USA

Title: **Secure accuracy at increased precision of AFM-probe integrated biosensor**
Sarmiza Elena Stanca, Leibniz Institute of Photonic Technology, Germany

Title: **Detection of gold nanoparticles aggregation growth induced by nucleic acid through laser scanning confocal microscopy**
Ramla Gary, University of Calabria, Italy

Title: **Detection of pH/H_2O_2 and prostrate/breast cancer biomarker by using nickel-oxide/iridium-oxide sensing membrane in electrolyte-insulator-semiconductor structure**
Siddheswar Maikap, Chang Gung University, Taiwan

Title: **$Bi_{12}GeO_{20}$ Faraday crystal application in magnetic field measurement**
Slobodan J Petricevic, University of Belgrade, Serbia

Ike Chi et al., J Biosens Bioelectron 2017, 8:2(Suppl)
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Recent and upcoming potential spacecraft missions requiring biosensor technologies: Current examples, what are we looking for and remaining challenges

Ike Chi, Terry J Hendricks and **Keith Chin**
California Institute of Technology, USA

The National Aeronautics and Space Administration (NASA) has upcoming spacecraft missions to Mars (i.e., Mars 2020) and future potential missions (e.g., landers, penetrators) in the planning stages to Mars, Europa, Enceladus and Titan that could require unique biosensor systems to search for critical biomarkers in those environments. *In-situ* sensing capability under extreme environmental conditions is particularly critical for these current and potential NASA space exploration missions. JPL/NASA's future planned Europa Clipper multiple flyby mission and a potential Europa lander or the planned Mars 2020 (ESA ExoMars mission) will encounter extreme environmental conditions. This presentation will report on our to-date accomplishments at the Jet Propulsion Laboratory (JPL) on Mars and potential plans in these other extreme deep space environments. Those missions will need ultra-sensitive sensors capable of reliable operation across a very wide range of temperatures. The applications of the highly sensitive sensor developed can include habitat health monitoring for a space station and/or for life detection on an Earth-like planet. In order to help fulfill scientific needs, we have developed a portable and low power *in-situ* biosensor to detect amino acids using an electrochemical spectroscopy technique. We have also enhanced chemical sensitivity of the sensor to parts-per-billion (ppb) range by integrating novel nanostructured electrode materials with improved surface properties. This novel engineered nanostructured micro-device tailored to sense specific analytes (e.g., amino acids) could be integrated with multiple flight-proven sensing platforms for a wide range of missions. This presentation will report on the progress for validating performance of this multi-platform *in-situ* bio-sensing device developed and tested by JPL.

Biography

Ike Chi is a Materials and Processing Engineer at NASA's Jet Propulsion Laboratory. He is the integrated product team (IPT) lead for Skutterudite Technology Maturation (STM) program and the device development task lead for Advanced Thermoelectric Couples (ATEC) program. He is also currently a member of Multi-Mission Radioisotope Thermoelectric Generator (MMRTG) Pyroshock project. He received his PhD from the Johns Hopkins University in 2014. He had several years of experience in fabricating biocompatible ceramics/semiconductors and ultra-high surface area materials. He is also interested in the area of biomedical implants/scaffolds and biosensing

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Secure accuracy at increased precision of AFM-probe integrated biosensor

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The plasma membrane regulates the selective interchange of matter between the interior and the exterior of the cell. Understanding this complex process requires knowledge of the plasma membrane´s molecular constituents. Topical reports prove the access to the molecular level of the synthetic membrane by atomic force microscopy (AFM). This technique also permits an electrochemical investigation in the immediate vicinity of the tip. An electrochemical and topographic study of the living cell membrane, by the mean of an AFM-probe integrated amperometric biosensor is employed to localize specific molecules in the natural cellular membrane (Figure 1). Several materials and shapes of the AFM probes integrated in different systems are presented. It is underlined that the selection of control experiment is decisive in achieving accurate findings. The central concern of this study is how to preserve the sensor response accuracy while increasing its precision.

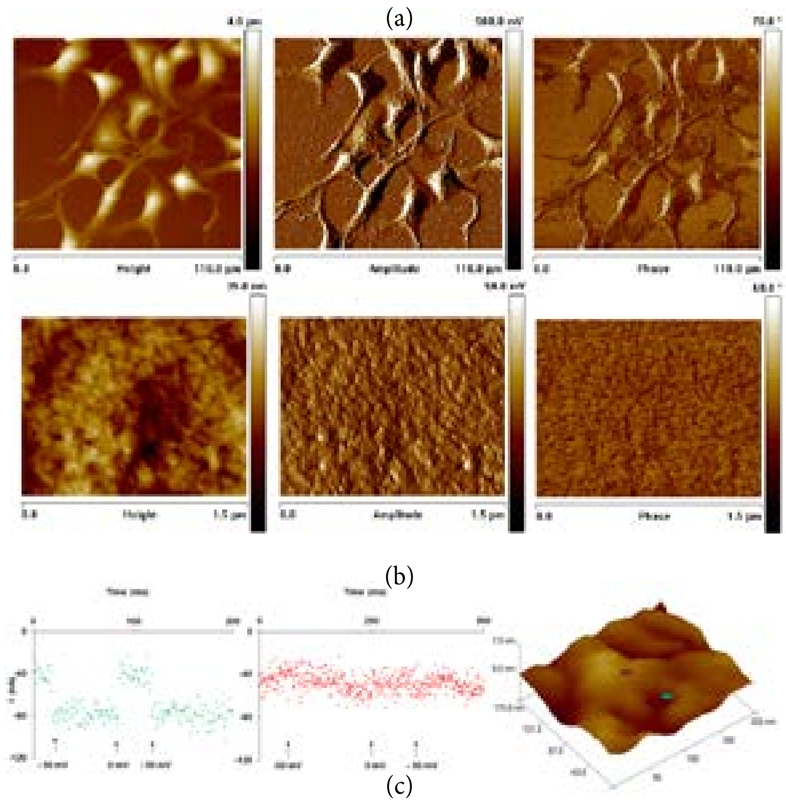

Figure 1: (A) Height, amplitude and phase atomic force micrographs (110 µm x 110 µm) of the cells immobilized on conductive glass; (B) Height, amplitude and phase AFMs in one location of 1.5 µm x 1.5 µm of the plasma membrane; (C) AFM probe integrated sensor signal on two different points: green and red marked on the AFM image (200 nm x 200 nm).

Biography

Sarmiza Elena Stanca has her expertise in electrochemical and optical nanosensors achieved during her research activity at the EPFL Lausanne (Swiss Confederation Fellow), UCD Dublin (Marie-Curie-Fellow), UKJ Jena (Marie-Curie-Fellow), University Babes-Bolyai Cluj-Napoca, Research Centre Karlsruhe and IPHT Jena (DAAD Fellow). She is currently a Scientist at the Leibniz Institute of Photonic Technology, Jena.

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Detection of gold nanoparticles aggregation growth induced by nucleic acid through laser scanning confocal microscopy

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The gold nanoparticle (GNP) aggregation growth induced by deoxyribonucleic acid (DNA) is studied by laser scanning confocal and environmental scanning electron microscope. As in the investigated case, the direct light scattering analysis is not suitable, we observe the behavior of the fluorescence produced by a dye and we detect the aggregation by the shift and the broadening of the fluorescence peak. Results of laser scanning confocal microscopy images and the fluorescence emission spectra from lambda scan mode suggest, in fact, that the intruding of the hydrophobic moiety of the probe within the cationic surfactants bilayer film coating GNPs results in a Förster resonance energy transfer. The environmental scanning electron microscopy images show that DNA molecules act as template to assemble GNPs into three-dimensional structures which are reminiscent of the DNA helix. This study is useful to design better nano-biotechnological devices using GNPs and DNA.

Biography

Ramla Gary has completed her PhD in 2017 from the Laboratory of Liquid Crystals and Interfaces in Physics department in collaboration with the Biological department at University of Calabria, Italy, and Post-doctoral studies from the same university. She has published more than five papers in reputed journals, and has participated in more than eight international and national conferences.

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Detection of pH/H_2O_2 and prostrate/breast cancer biomarker by using nickel-oxide/iridium-oxide sensing membrane in electrolyte-insulator-semiconductor structure

Siddheswar Maikap
Chang Gung University, Taiwan

Quantification of pH/H_2O_2 attracts a lot of attention due to its importance in chemical industries as well as biomedical diagnostic. For the detection of pH and H_2O_2, using electrolyte-insulator-semiconductor (EIS) is preferred due to label-free detection, easy fabrication process, and low cost. The NiO_x based sensor has shown good pH sensitivity of 50.25 mV/pH. X-ray photo-electron spectroscopy of Ni $2p_{3/2}$ has shown two different oxidation states of NiO_x membrane and those are Ni^{2+} and Ni^{3+} having binding energy 854.5 eV and 856.5 eV, respectively. Existence of these two oxidation states resembles the reduction-oxidation (redox) characteristics of NiO_x membrane toward the electroactive species like H_2O_2. A reference voltage shift of 41 mV is obtained for H_2O_2 concentration of 10 µM and has shown good linearity up to 100 µM for the first time. In addition, the IrO_x membrane shows a record pH sensitivity of 150.4 mV/pH for the first time. This IrO_x sensor demonstrated good catalytic behavior as well as the breast cancer biomarker LOXL2 with a concentration of approximately 150 nM is detected. This IrO_x nano-net sensor demonstrates good catalytic behavior for H_2O_2 reduction with a concentration of 100 fM because the oxidation state changes from Ir^{3+} to Ir^{4+}, whereas a pure SiO_2 membrane could not sense H_2O_2. The oxidation states are confirmed by X-ray photo-electron spectroscopy (XPS). Similarly, prostate cancer is also detected by using NiO_x membrane. Therefore, good pH response and redox characteristics of the IrO_x/NiO_x sensing membrane allow it to diagnose human disease in future.

Biography

Siddheswar Maikap has completed PhD in Department of Physics and Meteorology at IIT Kharagpur in February, 2003. He is Professor at Chang Gung University, Taiwan, since August 2014. He is the holder of three US patents on memory/bio-sensor, eight US/Taiwan patent files, and has more than 100 SCI journal papers, more than 150 international conference papers, 26 keynote/invited talks, and four best paper awards. His recent research focuses on cross-point resistive switching memory for high-density memory as well as bio-sensor applications.

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Slobodan J Petricevic et al., J Biosens Bioelectron 2017, 8:2(Suppl)
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$Bi_{12}GeO_{20}$ Faraday crystal application in magnetic field measurement

Slobodan J Petricevic and **Pedja M Mihailovic**
University of Belgrade, Serbia

Faraday crystals (FC) have been under intense investigation in magnetic field sensing applications for several decades due to several desirable properties, but mostly due to low interaction with magnetic field that does not disturb the field during measurement. FC requires an optical carrier to sense the magnetic field since interaction of the field and light in the crystal affects the state of polarization of the light. Development of production technology for optical fibers for mass use in telecommunication industry has made design of fiber-optic magnetic field sensor (FOMS) based on Faraday crystal an interesting research field. A class of diamagnetic materials known as sillenites of which BiGeO is an interesting example has been used to sense magnetic field in optical sensor in various configurations and adopted to various applications. This paper will discuss an extrinsic, fiber optic, magnetic field sensor, designed for direct point magnetic field measurement constructed using $Bi_{12}GeO_{20}$ crystal. A configuration suitable for measurement will be presented together with analyses of the test results obtained from a calibrated magnetic field setup. Compensation of temperature effect on magnetic field measurement will be presented and its implication will be discussed.

Biography

Slobodan J Petricevic completed his BSc in Electrical Engineering (EE) in 1996; MSc in EE in 2001 and; PhD in EE in 2007 at School of Electrical Engineering, University of Belgrade, Serbia. His field of research is Optoelectronic and Fiber Optic Instrumentation. He has published 18 scientific papers in SCI listed journals with 105 citations and two patents. He is currently employed as an Associate Professor at School of Electrical Engineering since 2008.

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Umut Kokbas et al., J Biosens Bioelectron 2017, 8:2(Suppl)
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Detection of β-thalassemia IVSI-110 mutation by using piezoelectric biosensor for non-invasive prenatal diagnosis

Umut Kokbas and **Levent Kayrin**
Cukurova University, Turkey

Statement of the Problem: β-thalassemia is one of the most monogenic autosomal recessive disorders characterized by defective production of the β-chain of hemoglobin. Definition of the β-globin genotype is necessary for genetic counseling in the carriers, and for predicting prognosis and management options in the patients with thalassemia. DNA-based prenatal diagnosis of β-thalassemia routinely relies on polymerase chain reaction (PCR) and gel electrophoresis. The aim of this study is to develop a new procedure, a DNA-based piezoelectric biosensor, for the detection of β-thalassemia IVSI-110 mutation fetuses cell free DNA from maternal blood, the most common β-thalassemia mutation in Turkey.

Methodology & Theoretical Orientation: Cell-free fetal DNA was taken from maternal whole blood. Bioactive layer was constituted by binding 2-hidroxymetacrilate metacriloamidoscystein (HEMA-MAC) nano-polymers on the electrode's surface. Single oligonucleotide probes specific for IVSI-110 mutation of β-thalassemia were attached to the nano-polymer. The measurements were executed by piezoelectric resonance frequency which is caused by binding of the cell-free fetal DNA in media with single oligonucleotide probe on the electrode surface. The results were confirmed by the conventional molecular method as ARMS.

Findings: The piezoelectric resonance frequencies obtained by hybridization of the cell free fetal DNA on bioactive layer were found to be 216±12, 273±6, and 321±9 Hz for the samples of normal β-globin, heterozygote, and homozygote of IVSI-110 mutation, respectively.

Conclusion & Significance: The developed biosensor serves as a specific result to IVSI- 110 mutation. It could accurately discriminate between normal and IVSI-110 mutation samples. Because of low costs, fast results, specificity and high detection/information effectiveness as compared with conventional prenatal diagnosis methods, we can offer this technique as an alternative to conventional molecular methods.

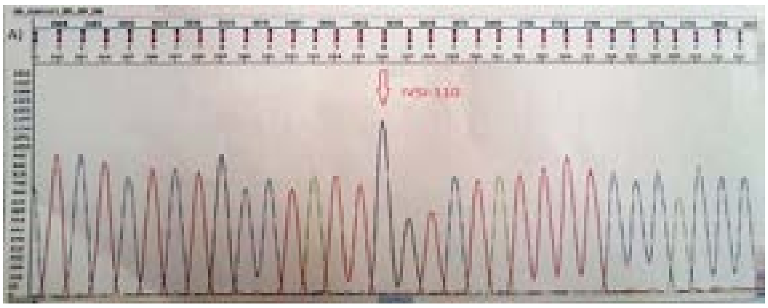

Figure 1: Conventional molecular methods a) sequencing b) gel electrophoresis

Biography

Umut Kokbas has studied Biotechnology and Biochemistry at Ege University. He is a Research Assistant in Medical Biochemistry department at Cukurova University, working on Thalassemia, which is the most common genetic disorder in Turkey. He is also pursuing PhD in the same department.

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Application of twin-working electrode cell in characterizing biological electron mediators

Mahamudul Hassan[1,2], **Ka Yu Cheng**[1,3], **Goen Ho**[1] and **Ralf Cord-Ruwisch**[1]
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Electron mediators often play a key role in facilitating microbial extracellular electron transfer (EET) to oxygen or insoluble compounds. This study aims at developing a novel electrochemical cell consisting of two closely (250 µm) mounted working electrodes (WEs), hence Twin-WE; to detect and quantify redox active compounds in a micro-scale (304 µL) environment. A fixed voltage window between two WEs using common counter and reference electrodes was maintained and the individual currents of both WEs were monitored. To detect electron mediators, an optimized voltage window (50 mV) was shifted through a defined potential range (between –1 V and +0.5 V vs. Ag/AgCl) by changing a fixed voltage step (12.5 mV) after the establishment of steady equilibrium current in both WEs. When the voltage window was maintained at the midpoint potential of a mediator, concurrent oxidation and reduction of the mediator occurred as evidence by the concurrent maximal anodic and cathodic current recorded at the two WEs. The electrical current difference plot against the potential scale enabled the identification (by peak location in the potential scale) and quantification (by peak height) of the mediators tested. Our technique enabled a precise determination of riboflavin, anthraquinone-2, 6-disulfonate (AQDS) and two mediators from a pyocyanin producing *Pseudomonas aeruginosa* (WACC 91) culture both individually and from their mixture. The described Twin-WE cell device is suitable for studying microbial electron transfer processes under a simulated redox environment which prevails in natural habitat. The bio-electrochemical principle underpinning this new method may also be useful for advancing biosensor development.

Biography

Mahamudul Hassan has completed his BSc (honors) and MS in Microbiology from University of Chittagong, Bangladesh. Currently, he is pursuing his PhD at Murdoch University and he aims to investigate the role of electron mediators in microbial extracellular electron transfer (EET) processes.

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