جامعة نيويورك ابوظبي
NYU ABU DHABI

3rd NYU Biomedical and Biosystems CONFERENCE

JAN 12 - 14, 2020

ABU DHABI, UAE

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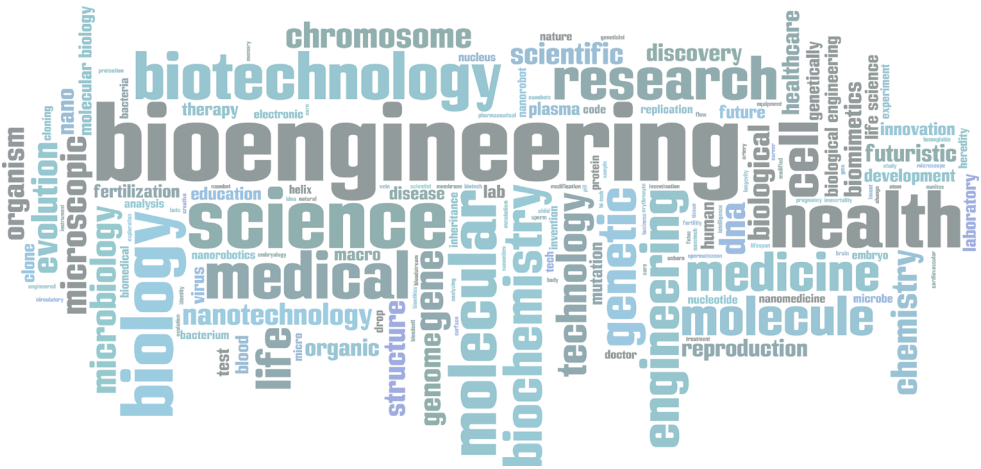
Introduction

The 3rd NYU Biomedical and Biosystems Conference addresses topics at the transdisciplinary interface of engineering, sciences, and medicine, spanning the spectrum from fundamental research to application and translation into practice. Presentations are made by investigators from different disciplines who are creating new conceptual, theoretical, methodological, and translational frameworks and innovations beyond discipline-specific approaches.

The conference brings together engineers, scientists, and medical specialists from the different global sites of New York University, from universities worldwide, from regional government agencies, and from hospitals to discuss this exciting biomedical frontier. Addresses by world-renowned pioneers also present first-hand narratives from around the globe.



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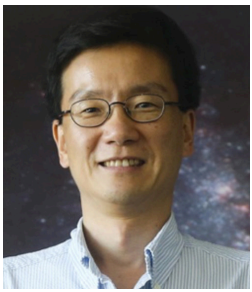

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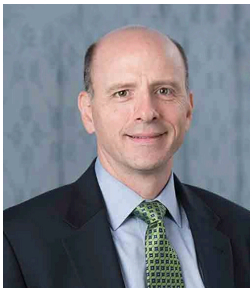


Timothy Dore

Weiqang Chen

Fabio Piano
Provost, NYU Abu Dhabi

Dear friends and colleagues,

NYU Abu Dhabi is excited to be co-sponsoring and organizing the 3rd Biomedical and Biosystems Conference.

Molecular and systems-level mechanisms underlying living systems, arguably the most complex systems on our planet, are now being discovered at an unprecedented rate. Simultaneously, we are at the cusp of a new wave that combines technology and understanding of biological systems to create and build new ways and new devices that can solve among the most important challenges of our time and significantly contribute to building a sustainable future. Indeed the "bioeconomy" is gaining momentum and some predict it will be the most significant growth area for the foreseeable future.

NYUAD is developing both the human capital and the new knowledge needed to advance these areas. The annual biomedical and biosystems conferences are an important platform for us to discuss the state of the art and further our vision of developing into one of the world's great research campuses.

So I welcome you to exchange openly your most visionary ideas and to also think of how we can help shape this discipline for a future that will require new approaches, new thinking, new training, in the hope that NYUAD can become one of the models on how to build the ideal foundation for the future in this field.

Fabio Piano
Provost, NYU Abu Dhabi

Jelena Kovačević
William R. Berkley Professor and Dean of the NYU Tandon School of Engineering

Dear Colleagues,

Welcome to the Third Annual NYU Biomedical and Biosystems Conference, where we will explore the edges of science and engineering in the desire to better the health outcomes for all humankind. I know each of you came to your research field inspired by the promise of discovery, whether you explore something as physically small as the human genome or a technology that reveals new truths about the entire human body. Today's conference illustrates the powerful collaboration that becomes possible at one of the foremost research universities, with its diversity of cultures and fields of scholarship.

At Tandon, we have embraced immense opportunities to collaborate with the many schools of NYU; one of the most fruitful cooperative efforts has been the creation of our Biomedical Engineering (BME) Department, with its strong ties to the School of Medicine, NYU Abu Dhabi, as well as our own Mechanical Engineering, Computer Science and Engineering and Chemical and Biomolecular Engineering Departments.

Within our BME department, students are developing innovative approaches and tools for medical imaging, tissue engineering and repair, bioinstrumentation and biosensors, mechanobiology, robotics and prosthetics, computational medicine, systems genetics, and a wide variety of other applications.

The sheer scope of innovative biomedical research at NYU Tandon, including research with implications for healthcare (even in such areas as cyber security) speaks to the culture of collaboration here: there are BME touchpoints in virtually every department, including electrical and computer engineering, computer science, chemical and biomolecular engineering, mechanical and aerospace engineering; and at centers like NYU WIRELESS, and the Visualization and Data Analytics Research Lab, not to mention, among others, the Laboratory for Biomechanics and Mechanobiology, the Montclare Lab for Protein Engineering, and the Mechatronics Laboratory.

I'm thus excited that today, in one forum, we will hear from a range of NYU Tandon experts about the work they are doing, as well as those from other NYU schools and beyond.

Jelena Kovačević
William R. Berkley Professor and
Dean of the NYU Tandon School of Engineering

Samer Michel Madanat
Dean of Engineering, NYUAD

Dear Participants in the New York University Abu Dhabi Biomedical and Biosystems Conference,

On behalf of my NYUAD Engineering colleagues, I am pleased to welcome you to our campus, and to the third NYUAD Biomedical and Biosystems Conference.

Bio-Innovation is one of the five strategic research themes for NYU-AD, with major activity in both the Sciences and Engineering. In the context of the Engineering strategic plan, Bioengineering is one of our five major research clusters.

There is increasing demand for Bioengineering majors worldwide. Nationally, healthcare systems represent one of the six national priorities of the United Arab Emirates' Vision 2021, is recognized as a key focus sector by the UAE National Innovation Strategy, and signify an important component of the Economic Vision 2030 of the Emirate of Abu Dhabi. Technologies in medicine and healthcare systems clearly represent a vital component of the vision of the UAE and the emirate of Abu Dhabi.

Our vision for the future of Bioengineering at NYUAD includes a new Bioengineering Major, and a research center focused on Bioengineering and Bio-Innovation, located on our campus with participation from faculty in Engineering, Biology, Chemistry, Public Health, Economics, and others. This proposed center would engage in collaborative research with NYU's Tandon School of Engineering and the NYU Medical School, thus taking advantage of the vast array of talent in the NYU Global Network.

I wish a productive Conference and, for those visiting us from outside Abu Dhabi, an enjoyable stay in our beautiful city.

Samer Michel Madanat
Dean of Engineering, NYUAD
Global Network Professor of Engineering,
NYU Tandon School of Engineering

Joel Schuman
Conference Co-Chair
Professor and Chair of Ophthalmology
Director of NYU Langone Eye Center

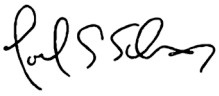
Dear Conference Participants:

Biomedical engineering is a critical discipline focused on creating new technologies to better diagnose, detect and treat disease and improve the health of the population. It Is through biomedical engineering that we achieve new advances leading to tissue and organ regeneration and new cures for diseases that have long plagued humanity.

This is the third international NYU Biomedical and Biosystems Conference, the second at NYU Abu Dhabi. Each conference has built on former meetings, with increased representation from NYU Langone Health, and the creation of new collaborations between the schools at NYU and elsewhere. This meeting is an example of NYU's Global campus. Attendance includes engineers, scientists, clinicians and other medical personnel.

We hope that you will find this meeting both educational and enjoyable, and that you will make new contacts, create new collaborations and revitalize existing ones.

Sincerely yours,



Joel S. Schuman, MD
Conference Co-Chair
Professor and Chair of Ophthalmology
Director of NYU Langone Eye Center
Professor of Neuroscience and Physiology
Professor of Biomedical Engineering, NYU Tandon

Sunil Kumar
Conference Co-Chair
Global Professor of Mechanical Engineering
NYU Abu Dhabi and NYU Tandon School of Engineering

Dear Conference Speakers and Participants,

On behalf of the organizing committee, I welcome you to the 3rd NYU BioMedical and BioSystems Conference, and thank you for taking the time from your busy schedules to present your research and engage in scientific discussions.

Advances in the diagnosis and treatment of disease increasingly require a holistic integration of technology with science and clinical practice. It is the goal of the Biomedical and Biosystems Conference to bring together engineers, scientists, and medical practitioners from the different schools of New York University's Abu Dhabi and New York campuses, from universities across the world, from regional government agencies, and from hospitals to discuss this exciting biomedical frontier. Addresses by world-renowned pioneers also present first-hand narratives from around the globe.

This is the third in a series of the annual conferences with the same title planned to address topics at the transdisciplinary interface of engineering, sciences, and medicine, spanning the spectrum from fundamental research to application and translation into practice. The current conference is being held at the NYU Abu Dhabi Saadiyat Island campus; the previous one was held at NYU Tandon School of Engineering in Brooklyn and the first at NYU Abu Dhabi. The conferences are sponsored by NYU Abu Dhabi Institute. We are also very appreciative of the generous support of the external co-sponsors: Integrated Gulf Biosystems, Lab Technologies Group, and Metrohm Middle East.

I trust that you will be stimulated by the presentations by investigators from different disciplines who are creating new conceptual, theoretical, methodological, and translational frameworks and innovations beyond discipline-specific approaches.

I hope that you will also participate in next conference, the 4th NYU Biomedical and BioSystems Conference, in two years at our campus in Abu Dhabi.

SKumar

Sunil Kumar
Co-Chair, NYU Biomedical and Biosystems Conference
Global Professor of Mechanical Engineering
NYU Abu Dhabi and NYU Tandon School of Engineering

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10:00 to 10:40am	Lead Talk: Abraham Lee Microfluidic Precision Medicine – Identifying the Minimal Representative Unit for top down Diagnostics and Bottom up Treatment	
10:40 to 11:00am	Coffee Break	A6 - Foyer
11:00 to 11:40am	Lead Talk: Zhong-Lin Lu Evaluating Myelin Integrity in the Optic Nerve with Myelin SHIFT MRI	
11:40 to 12:20pm	Lead Talk: Rui L. Reis New Approaches Using Biodegradable Polymers and Stem Cells for Regenerative and Precision Medicine Approaches	
12:20 to 1:20pm	Lunch Break	A6 - Foyer
Biomaterials and Tissue Engineering	**Biosystems, Bioelectronics, and Biosensors**	**Biomedical and Clinical Imaging**
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Ryan Branski The Most Bioactive Organ-biomaterials and Novel Therapeutics for the Vocal Folds	Sameer Sonkusale Flexible Thread-Based Biomedical Diagnostics and Therapy	Joel S. Schuman New Technology for Glaucoma Assessment - Visible light Optical Coherence Tomography
1:40 to 2:00pm		
Mrityunjay Doddamani 3D Printed Heart for Pre-operative Clinical Practice	Sahika Inal Organic Electronics for Biointerfacing	Yao Wang Machine Learning for Medical Image Processing
2:00 to 2:20pm		
Lukasz Witek 3D Printing Strategies for Extensive Bony Defect Reconstructions	Uchechukwu Wejinya Fabrication of Nanosurfaces for Nano-Bio Applications Using Atomic Force Microscopy	James Fishbaugh Time Will Tell: Trajectories of Growth and Disease Progression from Spatiotemporal Analysis of Longitudinal Imaging
2:20to 2:40pm		
Thorsten Kirsch CRLF1 and Cartilage Maintenance and Repair	Tuncay Alan Ultrafast Star-Shaped Acoustic Micromixers for High throughput Synthesis of Functional Nanoparticles	Lama Al-Aswad Detecting Undiagnosed Eye Disease Using Mobile, Real-Time Teleophthalmology in At-Risk Populations

Program

Sunday, January 12, 2020

2:40 to 3:00pm		
Nikhil Gupta Machine learning methods applied to characterization of viscoelastic properties of biomaterials	Deji Akinwande Wearable tattoo sensors based on graphene/2D materials	Hiroshi Ishikawa Artificial Intelligence in Glaucoma
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Homero Rivas Improving Global Access to Healthcare through Digital Health	Shuichi Takayama Microfluidic Studies of Lung Injury, Infection, and Fibrosis	Andreas H. Hielscher Vascular Optical Tomographic Imaging of Peripheral Artery Disease in Patients with Diabetic Foot Syndrome
3:40 to 4:00pm		
Yong Shin Development of Diagnostic Platform using Biomedical Engineering Techniques and its Clinical Applications	Mohammed Zourob An integrated and ultrasensitive Biosensors & Diagnostic tools for Biomedical Applications	Anastasios Hantzakos Imaging of the larynx: What is next?
4:00 to 4:20pm		
Carlos Abril Minimally Invasive Vista: Use of Magnetics in Laparoscopic Surgery	Rong Fan Single-cell BioMEMS tools for monitoring cancer immunotherapy	Osama Abdulla Integrating Advanced MRI-Derived Biomarkers in the UAE Healthy Future Study
4:20 to 4:40pm		
Gehad ElGhazali Precision medicine for treatment of Primary Immunodeficiency disorders	Yanyi Huang Accurately assessing genomic heterogeneity in complex biosystems - from bulk to single cells	Dipesh Chaudhury Effect of Social Stress on Circadian Rhythms and Sleep-Wake Cycle
4:40 to 5:00pm		
Farah Emad Shamout Machine Learning for the Detection of Clinical Deterioration	Weiqiang Chen Engineering an in vitro leukemia niche model for personalized CAR T-cell immunotherapy	Khalil Ramadi Focal Interfacing with the Heterogeneous rain
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6:40 to 8:00pm	Plenary Talk: Wolfgang Drexler Seeing the invisible – Optical Coherence Tomography in Medicine	

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Monday, January 13, 2020 | Institute Conference Center (A6)

A6 - Lecture Hall		
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9:20 to 10:00am	Lead Talk: Amy Herr Precision Medicine: Profiling Cellular-to-Molecular Diversity using Microengineered Tools	
10:00 to 10:20am	Coffee Break	A6 - Foyer
10:20 to 11:00am	Lead Talk: Soren Brage Physical Activity and Metabolic Disease: An Epidemiological Perspective	
11:00 to 11:40am	Lead Talk: Mohamad Sawan Biosystems for the Diagnostic and Treatment of Neurodegenerative Diseases	
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Public Health	**Biosystems, Bioelectronics & Biosensors - Part 3**	**Drug Delivery and Discovery**
A6 - 004	**A6 - Lecture Hall**	**A6 - 005**
1:00 to 1:20pm		
Hussein Saadi Diabetes and Obesity in the Middle East: Challenges and Opportunities	Sindy Tang Microfluidic tools for single-cell wound repair studies	Donna Huryn Academic Drug Discovery: Playing to the Strengths to Address Challenging Targets and Unmet Medical Needs in Cancer and Kidney Disease
1:20 to 1:40pm		
Riad Bayoumi An eight-year population-based study of the glycemic status of women during pregnancy	Je-Kyun Park Simple flow control in paper and PDMS for microfluidic point-of-care applications	David Rottela Discovery and Optimization of Kinase Inhibitors to Treat Parasitic Diseases
1:40 to 2:00pm		
Aiden Doherty Machine learning of wearable sensor data for the early detection of disease	Anas Alazzam Microfluidic systems for manipulation of cells using dielectrophoresis	Michael P. Pollastri Academic drug discovery: discovering neglected tropical disease therapeutics through a combination of lead repurposing and distributed drug discovery

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Monday, January 13, 2020

2:00 to 2:20pm		
Kinda Khalaf The effect of Obesity on plantar pressure variability in young adults using traditional and non-linear dynamic measures	Suman Chakraborty Diagnostics with Blood at Extreme Point of Care	Marc Walters Will Silver Diamine Fluoride Supplant the Dentist's Drill?
2:20 to 2:40pm		
Habiba Alsafar Filling in the Gaps: The 1st Whole Genomes from the United Arab Emirates (UAE)	Yu Shrike Zhang Formulating Bioinks for Tissue Bioprinting	Sunil Kumar Protein Mimetic based structural and functional analysis of amyloid proteins
2:40 to 3:00pm		
Raghib Ali The UAE Healthy Future Study – Opportunities for Collaborative Research	Kalle Levon Biosensing using Hybrid System of Organic Electronics and CMOS technology	Mazin Magzoub Designed cell-penetrating peptide inhibitors of amyloid-beta aggregation and cytotoxicity

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Tuesday, January 14, 2020 | Institute Conference Center (A6)

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8:40 to 9:20am	Lead Talk: E. Murat Tuzcu Transcatheter Treatment of Heart Disease - A century of Innovation	
9:20 to 10:00am	Lead Talk: Emmanuel Delamarche Addressing the Pain Points of Point-of-Care Diagnostics Using Advanced Microfluidic Concepts	
10:00 to 10:20am	Coffee Break	A6, Meeting Room Foyer
10:20 to 11:00am	Lead Talk: Daniela Rhodes Application of Cryo-EM and Correlative Light and EM Methods to Understanding the Structure and Function of Telomeres	
11:00 to 11:40am	Lead Talk: Andrzej Lewenstam Electrochemical Sensors in Routine Clinical Chemistry - Challenges and Perspectives	
11:40 to 12:00am	Sponsor Talk	
12:00 to 1:00pm	Lunch	A6 - Foyer
Quantitative Biology	**Biosystems, Bioelectronics & Biosensors - Part 4**	**Biomaterials and Tissue Engineering - Part 2**
A6 - 004	**A6 - Lecture Hall**	**A6 - 005**
1:00 to 1:20pm		
Giorgio Scita Solid-to-Liquid phase transition in pathophysiology	Daniel Irimia Neutrophilic Chain-Reactions during Infections and Sepsis	Bikramjit Basu Translational Research at the Intersection of Engineering, Biology and Medicine: Opportunities and Challenges
1:20 to 1:40pm		
Amitabha Chattopadhyay Exploring Endocytosis of the Serotonin$_{1A}$ Receptor: Role of Membrane Cholesterol	Stephen Arnold Assembly of a multiplexed & single molecule sensitive nanoplasmonic-WGM Biosensor using light forces	Roger Narayan 3D Printing Approaches for Drug Delivery
1:40 to 2:00pm		
Piul S Rabbani Multipotent mesenchymal cell Exosomes and their application in diabetic wound healing	Wenhui Wang Microfluidic devices for single cell manipulation and analysis	Benjamin Keselowsky Biomaterials and Immuno-Engineering for Tolerance and Suppression
2:00 to 2:20pm		
George Shubeita Navigating the Crowded Cell	Mohamed Abdelgawad Effect of geometrical and flow parameters on nanoprecipitation of polymeric nanoparticles inside Microchannels	Yaser E. Greish Biomimitic deposition of bone-like mineral: towards the regeneration of defective hard tissue

Program

Tuesday, January 14, 2020

2:20 to 2:40pm		
Piergiorgio Percipalle Chromatin and transcriptional regulation during development and differentiation: the role of cytoskeletal proteins	Dan Dongeun Huh Human organs-on-a-chip: Microengineered biomimicry of human physiological systems	Vijay Sanjairaj Electrohydrodynamic-jet 3D-Printed Polycaprolactone/ Polypyrrole conductive scaffolds as potential nerve guide conduits for peripheral nerve injury repair
2:40 to 3:00pm		
Mohamed Al-Sayegh Nuclear β-actin contributes to an open chromatin for activation of adipogenic pioneer factor CEBPA during transcriptional reprograming	Mohammad A. Qasaimeh Advanced Microfluidic Probes for Biomedical Applications	Jeremy Teo (Immuno) Mechanobiology of Antigen Presenting Cells and Implications for Tissue Engineering
3:00 to 3:20pm	Coffee Break	A6 - Foyer
Translational Medicine - Part 2	**Biosystems, Bioelectronics & Biosensors - Part 5**	**Frontiers in Bioengineering and Medicine**
A6 - 004	**A6 - Lecture Hall**	**A6 - 005**
3:20 to 3:40pm		
Matthew Kroh Biomedical Innovation: Development of New Technologies in Academic Medicine	Marcella M. Gomez Prediction and Control of Biological Systems using an NN-based architecture	Sunil K. Agrawal Robotics to Characterize, Retrain, and Restore Human Movements
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Francesco Serino The great long term results with uncertain mechanism of action of Cyanoacrylate in venous surgery	Paul Laibinis Surface Modification for Controlling Biomolecular Adsorption	Peter Yingxiao Wang Molecular and Cellular Immuno-engineering for Cancer Therapy
4:00 to 4:20pm		
Florian Roser From bench to brain – Translational Research in Neurosurgery	Rafael Song Phenotyping of Thrashing Forces Exerted by Partially Immobilized C. elegans using Elastomeric Micropillar Arrays	S. Farokh Atashzar Intelligent NeuroRobotics: From Smart Rehabilitation to Agile Assistance

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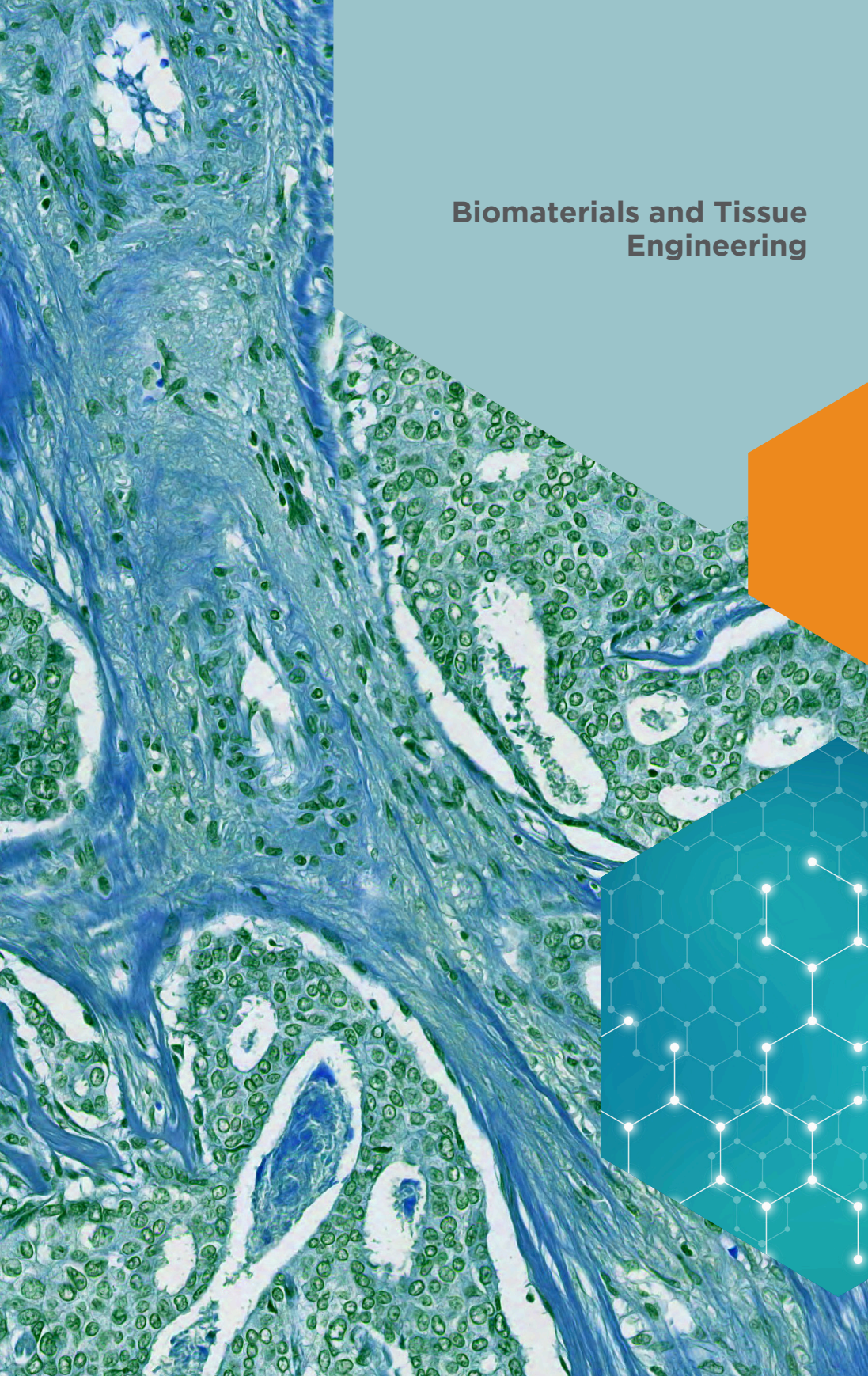
Tuesday, January 14, 2020

4:20 to 4:40pm		
Rihab Nasr Circulating microRNA as potential biomarkers in Early Stage Breast Cancer in Lebanese women	Serdal Kirmizialtin Understanding DNA attraction in divalent ions	Sylvie Coupaud Rehabilitation strategies to reduce or reverse disuse-related bone loss
4:40 to 5:00pm		
Matija Snuderl Machine learning and AI in molecular diagnostics and clinical management of cancer	Andras Gyorgy Competition for shared cellular resources decreases the robustness of toggle switches by pushing them towards monostability	Wael M. Rabeh Glucose Metabolism for the Inhibition of Cancer Growth
5:00 to 5:40pm	Closing Session	A6 - Lecture Hall

Biomaterials and Tissue Engineering



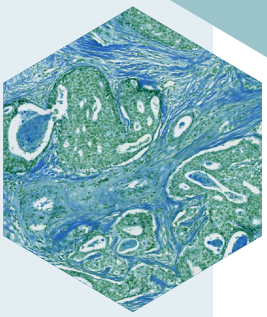
LEAD SPEAKER

New Approaches Using Biodegradable Polymers and Stem Cells for Regenerative and Precision Medicine Approaches

Abstract: The selection of a proper material to be used as a scaffold or as a hydrogel to support, hold or encapsulate cells is both a critical and a difficult choice that will determine the success of failure of any tissue engineering and regenerative medicine (TERM) strategy. The use of natural origin polymers, including a wide range of marine origin materials, is the best option for many different approaches that allow for the regeneration of different tissues. It is of outmost importance the development of processing methodologies that allow for the production of adequate scaffolds/matrices, in many cases incorporating bioactive/differentiation agents in their structures. Furthermore an adequate cell source should be selected. In many cases efficient cell isolation, expansion and differentiation, and in many cases the selection of a specific sub-population, methodologies should be developed and optimized. We have been using different human cell sources namely: mesenchymal stem cells from bone marrow, mesenchymal stem cells from human adipose tissue, human cells from amniotic fluids and membranes and cells obtained from human umbilical cords. The development of dynamic ways to culture the cells and of distinct ways to stimulate their differentiation in 3D environments, as well as the use of nano-based systems to induce their differentiation and internalization into cells, is also a key part of some of the strategies that are being developed in our research group. The potential of each combination materials/cells, to be used to develop novel useful regeneration therapies will be discussed. The use of different cells and their interactions with different natural origin degradable scaffolds and smart hydrogels will be described. Several examples of TERM strategies to regenerate different types of tissues will be presented.

Rui L. Reis, PhD

Vice-President for Research and Innovation and Director of the 3B's Research Group – Institute for Biomaterials, Biodegradables and Biomimetics, University of Minho



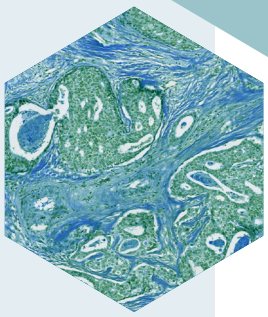
Biography: Rui L. Reis, PhD, DSc, Hon. Causa (MD & PhD), FBSE, FTERM, member of NAE, FAIMBE, FEAMBES, was born in 1967 in Portugal. He is the Vice-President for Research and Innovation of University of Minho, Portugal, Director of the 3B's Research Group - member of the I3Bs – Institute for Biomaterials, Biodegradables and Biomimetics. He is also the CEO of the European Institute of Excellence on Tissue Engineering and Regenerative Medicine, the Coordinator of the Discoveries Centre for Regenerative and Precision Medicine, the Global Past-President of the Tissue Engineering and Regenerative Medicine International Society & the Editor-in-chief of the Journal of Tissue Engineering and Regenerative Medicine. He is a recognized World expert in the TERM and biomaterials fields, that has edited several books and has around 1250 published works listed on ISI WoK. According to Google Scholar his work has been cited more than 50000 times. He has been awarded many important international prizes including the UNESCO- International Life Sciences Award Award and the IET A. F. Harvey Eng Research Prize.

The Most Bioactive Organ-Biomaterials And Novel Therapeutics For The Vocal Folds

Abstract: Voice disorders are the most common communication disorder across the lifespan with significant economic burden on the healthcare system, comparable to chronic obstructive pulmonary disease and asthma. The vocal folds are eloquently architected to withstand vibratory frequencies ranging between 60 to nearly 2000Hz, depending on sex (and vocal training). This stress and resulting strain associated with these extreme biophysical demands as well as exposure to airborne toxins can lead to aberrant alterations of vocal fold structure. This altered structure (i.e., fibrosis) poses the single biggest clinical challenge. Our laboratory takes two broad approaches to address this issue; localized gene therapy and tissue-specific acellular matrices. Both approaches will be presented with an emphasis on our more recent work on acellular matrices. In addition, of particular interest to this audience, our evolution with preclinical outcomes to quantify vocal fold tissue health will be presented. Our group recently described correlative biomechanical testing and histology of the vocal folds ex vivo as the gold standard for data acquisition to support the progression to human trials. In that regard, we also keenly interested in transitioning this technology to a more clinically useful, handheld device to employ in vivo.

Ryan C. Branski, PhD

Associate Professor, Otolaryngology-Head and Neck Surgery and Pathology in the School of Medicine, New York University



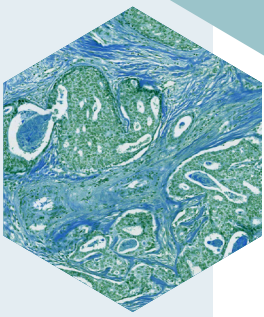
Biography: Dr. Branski is Associate Professor of Otolaryngology-Head and Neck Surgery and Pathology in the School of Medicine at NYU. He also has an affiliate appointment in Communicative Sciences and Disorders in the Steinhardt School of Culture, Education, and Human Development. Dr. Branski is a licensed speech pathologist and serves as the Associate Director of the Voice Center at NYU Langone Health. In addition to maintaining a clinical practice, Dr. Branski runs a productive research enterprise encompassing both clinical and laboratory initiatives. His NIH-funded laboratory primarily focuses on wound healing and regenerative approaches to optimized healing in the upper aerodigestive track. Dr. Branski is one of only a few investigators to be named Fellow of the American Academy of Otolaryngology-Head and Neck Surgery, the American Speech Language Hearing Association, and the American Laryngological Association.

3d Printed Heart For Pre-Operative Clinical Practice

Abstract: The talk discusses challenges and success in 3D printing of an artificial human heart model from CT scan data. 3D printed model can assist doctors in conducting practice for complex Cardio-Thoracic surgical procedures. Fused filament fabrication (FFF) 3D printing method is used for printing the model. CT scan data is first converted to STL file and the model is cleaned up manually to ensure all the structural details are preserved but artefacts are removed. The inner structures are separated from the outer and unified with the inner chambers of the heart and are 3D printed subsequently. Internal structures are 3D printed using commercially available ABS. Support structures are removed and the model is cleaned up. Internal structure is placed in the 3D printed heart mold which is created with the help of exterior surface. Finally, silicone is poured in the spaces for realizing 3D printed heart which facilitates pre-operative planning for medical students/surgeons in performing clinical practices. The research project is moving toward developing filaments of flexible polymers and using multimaterial printing methods to print the entire heart model in a single print run.

Mrityunjay Doddamani, PhD

Assistant Professor, Mechanical Department, National Institute of Technology, Surathkal



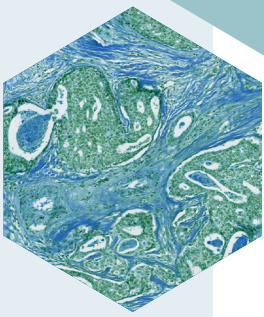
Biography: Dr. Mrityunjay Doddamani is an Assistant Professor in Mechanical Engineering Department at NITK, Surathkal. His research focus is on developing novel feedstock materials for 3D printing and development of lightweight foams at industrial scale for different application. He is author of 55 journal publications and 4 book chapters. He was lead guest editor for JOM Springer issues of June and July 2018. He is an editorial board member of Materials Circular Economy, Springer journal. His research is supported by projects from Department of Science and Technology, Government of India. He is recipient of Young Scientist award and award for research publications by State Government of Karnataka in the year 2017.

3D Printing Strategies for Extensive Bony Defect Reconstructions

Abstract: There are over 2 million long bone defects, alone, treated in the USA annually, of which ~5% will not heal without significant surgical intervention. While autogenous grafting is standard of care in simple defects, a customized scaffold for large defects in unlimited quantities is not available. Recently, a three-dimensionally (3D) printed bioactive ceramic (3DPBC) scaffold has been successfully utilized in the of repair critical sized long bone defects in vivo. Solid Freeform Fabrication (SFF) techniques, such as three-dimensional (3D) printing (3DP) technology/robocasting, allow for designing and fabrication of custom 3D printed scaffolds to be utilized for bony defect rehabilitation. Furthermore, coating these scaffolds with agents designed to promote more rapid and complete bone healing may increase the efficacy of prosthetic scaffolds in healing segmental bone defects. Although currently used to promote bone generation, growth factors such as rh-BMP2 (rhBMP2) are of questionable efficacy and present significant safety issues. Our group has previously reported that adenosine A2A receptor (A2AR) stimulation increases osteoblast number and regulates osteoblast function in a murine model of inflammatory osteolysis and that A2AR stimulation diminishes osteoclast differentiation by inhibiting NFκB activation and nuclear translocation. In a recently published study, our team employed these custom engineered, biocompatible and resorbable, β-TCP scaffolds augmented a bioactive molecule, Dipyridamole (DIPY), in a translational animal model, which demonstrated to have an increased bone regeneration compared to our previous work with untreated β-TCP scaffolds.

Lukasz Witek, PhD

Assistant Professor, Dept. of Biomaterials and Biomimetics, College of Dentistry, New York University



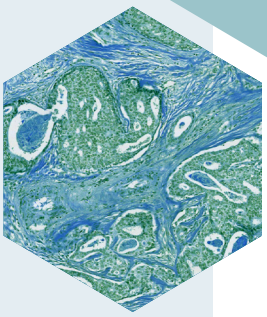
Biography: Dr. Lukasz Witek has been recently appointed as an Assistant Professor at the Department of Biomaterials at New York University (NYU). He earned his BSci in Biology at Temple University in 2008 and MSci in Biomaterials Science from New York University in 2011. Dr. Witek defended his PhD Dissertation in Chemical Engineering in 2015 at Oklahoma State University under the guidance of Prof. James E. Smay. Upon completion of his PhD studies, he re-joined NYU's Department of Biomaterials as a post-doctoral fellow and Director of Craniomaxillofacial Orthopedic Biomaterials Regenerative Applications Lab (Coelho Lab), focusing on 3D printing for regenerative medicine applications. Dr. Witek has authored/co-authored over 45 journal articles, served as guest editor for multiple journals as well served as chair of the individual sessions at International Associate of Dental Research (IADR) and Society for Biomaterials (SFB).

CRLF1 and Cartilage Maintenance and Repair

Abstract: The use of mesenchymal stem cells (MSCs) to improve cartilage repair has been proposed. However, MSCs may undergo terminal differentiation into hypertrophic chondrocytes, and/or form fibrocartilage. Cytokine receptor-like factor 1 (CRLF1) has been suggested to play a role in maintaining articular chondrocyte phenotype. We determined the role of CRLF1 in chondrogenic differentiation of MSCs, maintenance of the chondrocytic phenotype and cartilage repair. The size of pellets of bone marrow-derived MSCs (BMSCs) following AAV transduction with CRLF1 were increased compared to the pellet size of BMSCs following empty AAV transduction. In addition, these pellets showed increased alcian blue staining and mRNA levels of aggrecan and type II collagen. mRNA levels of hypertrophic differentiation markers and type I collagen were decreased in pellets from BMSCs following AAV transduction with CRLF1. Furthermore, transfection of BMSCs with an expression vector containing full-length CRLF1 resulted in increased CRLF1 mRNA levels in extracellular vesicles (EVs) released from these cells compared to EVs released from BMSCs transfected with an empty expression vector. Treatment of IL-1 -treated human articular chondrocytes with EVs from BMSCs transfected with an expression vector containing CRLF1 resulted in a further decrease of catabolic markers compared to EVs isolated from the medium of BMSCs transfected with empty expression vector. Finally, intra-articular injections of BMSCs transduced with AAV containing CRLF1 showed improved cartilage repair in rabbits compared to the injections of BMSCs transduced with empty AAV. In summary, our results suggest that BMSCs overexpressing CRLF1 may provide a novel therapeutic strategy to improve cartilage repair.

Thorsten Kirsch, PhD

Professor, Department of Orthopaedic Surgery, School of Medicine, New York University



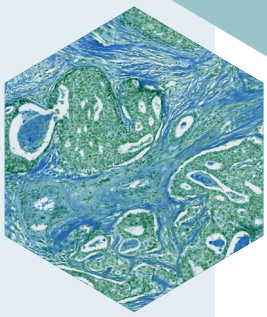
Biography: Thorsten Kirsch, Ph.D., is a Professor of Orthopaedic Surgery at NYU School of Medicine and the Department of Biomedical Engineering at NYU Tandon School of Engineering. In addition, he is Vice Chair for Research in the Department of Orthopaedic Surgery and Director of the Musculoskeletal Research Center. Dr. Kirsch joined NYU School of Medicine in 2008 coming from the University of Maryland School of Medicine, where he was a Professor and Director of Orthopaedic Research. Dr. Kirsch studies mechanisms regulating skeletal cell differentiation and repair during development and pathology. Dr. Kirsch earned his Ph.D. from the Albrecht-Ludwig-University, Erlangen, Germany with summa cum laude in 1992, and completed his postdoctoral training at the University of South Carolina and University of Pennsylvania. Dr. Kirsch has spoken at many national and international meetings, has received numerous awards, and is a grant reviewer for various National Institutes of Health Study Sections and the Department of Defense.

Machine Learning Methods Applied To Characterization Of Viscoelastic Properties Of Biomaterials

Abstract: Rapid developments in machine learning (ML) field have made impact in a wide range of areas. The present work outlines the early stage challenges that exist in applying ML methods to characterization of viscoelastic material properties such as storage modulus, loss modulus, and viscosity. Viscoelastic properties of both soft and hard tissue are widely characterized using methods such as nanoindentation and dynamic mechanical analysis. These properties are measured with respect to the structure of the material structure, temperature and loading frequency and require a significant amount of material and characterization effort. Artificial neural networks are used in this work and the network is trained using data derived from a small set of experiments. The results show that the ML methods are successful in predicting the material properties with high accuracy. ML methods can be applied to process the datasets and drive the experimental campaign using a feed-forward approach that can reduce the overall experimental work.

Nikhil Gupta, PhD

Professor, Mechanical and Aerospace Engineering, Tandon School of Engineering, New York University



Biography: Dr. Nikhil Gupta is a Professor in the Mechanical and Aerospace Engineering Department at the New York University Tandon School of Engineering. He directs the Composite Materials and Mechanics Laboratory. His current research projects are focused on applying machine learning methods to materials characterization and developing cybersecurity methods for additive manufacturing. His research has been supported by National Science Foundation, Office of Naval Research, Army Research Laboratory, and industry. Dr. Gupta has four issued patents and authored over 185 journal papers and book chapters.

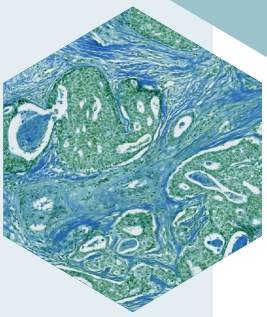
Translational Research at the Intersection of Engineering, Biology and Medicine: Opportunities and Challenges

Abstract: Biomaterials science and biomedical engineering have sustained as one among frontier and growing areas of research and innovation within the engineering science community in the world; considering the number of scientific discoveries and their societal impact. Against the backdrop of the ever-increasing unmet clinical needs, significant efforts have been invested to innovate new bioengineering approaches for medical applications or to develop patient-customized implantable biomedical devices in an accelerated manner, to accomplish the bedside-bench-bedside translation cycle.

Against the above perspective, this talk will describe a few case studies illustrating the most recent research findings from our group to illustrate how to take lab scale research to biomedical device development through collaborative efforts of Academia and National laboratories with intensive-interactive inputs from Clinicians and Industries. In particular, new manufacturing strategies for patient-specific femoral heads/acetabular sockets will be discussed together with our attempts to commercialize those product prototypes in collaboration with Indian industries. While briefly presenting our recent research in this direction, I shall discuss myriad of opportunities and challenges ahead in 3D inkjet powder printing in clinical translation of biomedical engineering. To this end, the clinical outcome of the multicentric trials on customized cranioplasts will be highlighted with post-operative results.

Bikramjit Basu, PhD

Professor, Materials Research Centre, Indian Institute of Science



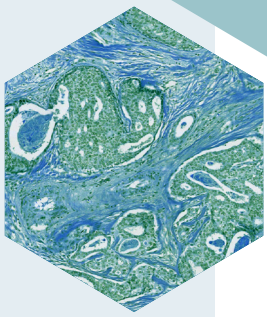
Biography: Bikramjit Basu is a Professor at the Materials Research Center with joint appointment at Center for Biosystems Science and Engineering and Interdisciplinary Center for Energy Research at Indian Institute of Science (IISc), Bangalore. He is also honorary professor at University of Manchester, UK, and Guest Professor at Wuhan University of Technology, China. A distinguished alumnus of National Institute of Technology Durgapur (NITD), he obtained his undergraduate from NITD (1995) and postgraduate degree, both in Metallurgical Engineering from IISc (1997). He earned his PhD in Engineering Ceramics at Katholieke Universiteit Leuven, Belgium (2001). Following a post-doctoral stint at University of California, Santa Barbara, he served on faculty of IIT Kanpur during 2001-2011. Bikramjit received India's most coveted science and technology award, Shanti Swarup Bhatnagar prize (2013). A Chartered Engineer of UK, he is an elected Fellow of the American Ceramic Society (2019), American Institute of Medical and Biological Engineering (2017), Institute of Materials, Minerals & Mining (UK), National Academy of Medical Sciences (2017), Indian National Academy of Engineering (2015), Society for Biomaterials and Artificial Organs (2014) and National Academy of Sciences, India (2013). He is recipient of Robert L. Coble award (2008) and Global Ambassador award (2018) from ACerS.

3D Printing Approaches for Drug Delivery

Abstract: 3D printing, also known as additive manufacturing, is an approach involving additive layer-by-layer fabrication of a three-dimensional structure through selective joining of material; processing of the structure is directed by a computer-aided design (CAD) model. Unlike conventional methods, 3D printing techniques may enable the development of structures for drug delivery with well-defined small-scale features. In recent years, a variety of 3D printing techniques, including fused deposition modeling, inkjet printing, and stereolithography apparatus, have been used to prepare drug delivery devices. Current challenges associated with the use of 3D printing for drug delivery device fabrication include (a) the development of materials that can be processed rapidly, reproducibly, and with high resolution, (b) the development of materials with appropriate biocompatibility over the anticipated lifetime of the medical device, (c) the development of materials with appropriate mechanical and chemical properties over the over the anticipated lifetime of the drug delivery device. This talk will focus on the development of new types of materials for 3D printing of drug delivery devices.

Roger J. Narayan, PhD, MD

Professor, Joint Department of Biomedical Engineering, University of North Carolina and North Carolina State University



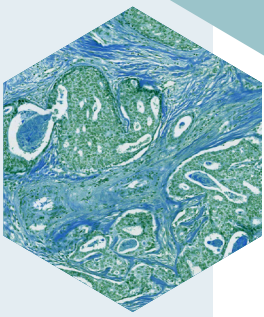
Biography: Dr. Roger Narayan is a Professor in the Joint Department of Biomedical Engineering at the University of North Carolina and North Carolina State University. He is an author of over two hundred publications as well as several book chapters on processing, characterization, and modeling of biomedical materials. He currently serves as an editorial board member for several academic journals, including as editor-in-chief of Medical Devices & Sensors. Dr. Narayan has received several honors for his research activities, including the University of North Carolina Jefferson-Pilot Fellowship in Academic Medicine and the American Ceramic Society Richard M. Fulrath Award. He has been elected as Fellow of the American Ceramic Society, ASM International, AAAS, and AIMBE.

Biomaterials and Immuno-Engineering for Tolerance and Suppression

Abstract: This presentation highlights results from our biomaterials and molecular based approaches to direct the immune system toward tolerance and suppression. Microparticle-based systems have been designed as vaccines to retrain the immune system to correct aberrant activation toward self-antigens. Using a microparticle formulation consisting of a combination of suppressive factors we have demonstrated prevention and reversal of type 1 diabetes in non-obese diabetic mice, as well as treatment of multiple sclerosis in an EAE mouse model. On the molecular scale, we have also developed tissue-anchored enzymes – chimeric enzyme-carbohydrate binding fusion proteins in order to direct localized immunometabolism toward suppression. Specifically, indoleamine 2,3 dioxygenase, which depletes tryptophan through the kynurenine pathway, is fused to galectin 3, which binds extracellular glycans and affords prolonged tissue retention. This approach has provided potent, confined metabolic programming in inflammation models including osteoarthritis and periodontal disease.

Benjamin G. Keselowsky, PhD

Professor, J. Crayton Pruitt Department of Biomedical Engineering, University of Florida



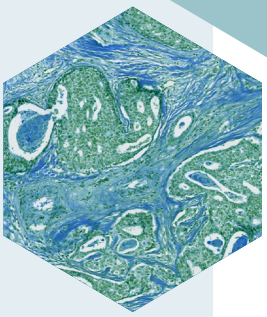
Biography: Benjamin G. Keselowsky is a Professor in the J. Crayton Pruitt Family Department of Biomedical Engineering at the University of Florida. He received his BS Chemical Engineering from the University of South Florida, PhD Bioengineering from Georgia Institute of Technology and joined as faculty at the University of Florida in 2005. He is currently funded by the NIH (R01DE027301, R01AI133623, T32 DK108736), with past funding the National Science Foundation, the Arthritis Foundation, the Juvenile Diabetes Research Foundation and Pfizer. He serves on multiple editorial boards and is an Associate Editor for Nanomedicine: Nanotechnology, Biology and Medicine. He is a standing member on the NIH Biomaterials and Biointerfaces Study Section. He is a recipient of the 2015 University of Florida Research Foundation Professorship Award, the 2016 UF Technology Innovator Award, the 2017 UF Preeminence Term Professorship Award and was inducted as a Fellow of the American Institute for Medical and Biological Engineering (AIMBE) in 2018.

Biomimitic Deposition Of Bone-Like Mineral: Towards The Regeneration Of Defective Hard Tissue

Abstract: Hard tissues, including bone and teeth, are natural composites of collagen nanofibers reinforced with calcium phosphate (namely hydroxyapatite; HAp) nanocrystallites. The mechanical interlocking between these components gives hard tissue their unique biomechanical characteristics. Defective hard tissues due to accidents or diseases should be partially or totally restored using natural or synthetic biomaterials. Biomimitic regeneration of hard tissues is a process in which biomaterial scientists mimic the natural process of biomineralization, which results in the formation of hard tissue. In this regard, materials; ceramics, polymers, or alloys and their composites are used as templates for the formation of bone-like HAp. A successful template is the one that possess functional groups similar to those present in collagen, such as –COOH, -OH, -NH2, and –SO3H groups. These groups could be intrinsic in the templates or created through chemical functionalization of biocompatible templates. In the presence of a protein-free aqueous simulated body fluid that is super saturated with respect to HAp, the later spontaneously precipitate onto the surfaces of the templates and within its open porosity. Upon the achievement of this step, the starting templates are claimed to have a high potential to be used for defective hard tissues restoration. The ongoing research at the UAEU illustrates the biomineralization of different types of biocompatible templates of different origins; ceramics, polymers, alloys and their composites. Fabrication, characterization and evaluation of these templates prior the deposition of bone-like HAp and afterwards will be thoroughly outlined.

Yaser E. Greish, PhD

Professor, Department of Chemistry, College of Science, UAE University



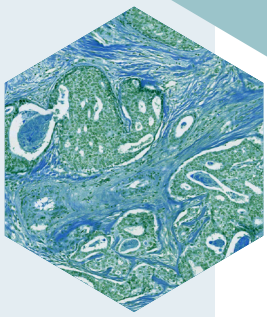
Biography: Dr. Yaser E. Greish is a professor of Materials Chemistry at the UAE University in Al Ain, UAE. Dr. Greish obtained his PhD degree in Materials Science from the Pennsylvania State University (USA) in 2001, continued at Penn State as a postdoc scholar in a NIH-funded project for the use of nanomaterials for the biomineralization of ceramic-polymer composites. Dr. Greish joined the UAE University in 2005 as an Assistant Professor, then promoted to Associate Professor in 2011 then to Professor in 2018. Dr. Greish is the author and co-author of more than 55 peer-reviewed publications, 110 conference presentations, 3 book chapters, and 3 US patents. Dr. Greish has also supervised and co-supervised 9 PhD students and 14 MSc students. Dr. Greish's research interests are in the design and evaluation of novel nanomaterials for biomedical and environmental applications.

Electrohydrodynamic-jet 3D-Printed Polycaprolactone/Polypyrrole conductive scaffolds as potential nerve guide conduits for peripheral nerve injury repair

Abstract: Conductivity is a desirable property of an ideal nerve guide conduit (NGC) that is being considered for peripheral nerve regeneration. Most of the conductive polymers reported in use for fabrication of tissue engineering scaffolds such as polypyrrole (PPy), polyaniline, polythiophene and poly(3,4-ethylenedioxythiophene) are non-biodegradable and possess weak mechanical properties to be fabricated into 3D structures. In this study, a biodegradable and conductive block copolymer of PPy and Polycaprolactone (PPy-b-PCL) was used to fabricate 3D porous NGCs using electrohydrodynamic jet 3D printing process which offers superior control over fibre diameter, pore size, porosity and fibre alignment. PCL/PPy scaffolds with three different concentrations of PPy-b-PCL (0.5%, 1%, and 2% v/v) were fabricated and tested. The mechanical properties of the scaffolds decreased with the addition of PPy-b-PCL which aided the ability to fabricate softer scaffolds that are closer to the properties of the native human peripheral nerve. With increasing concentrations of PPy-b-PCL, the scaffolds displayed a marked increase in conductivity (ranging from 0.28 to 1.15 mS/cm). Human embryonic stem cell-derived neural crest stem cells (hESC-NCSCs) were used to investigate the impact of PPy-b-PCL based conductive scaffolds on the growth and differentiation to peripheral neurons. The hESC-NCSCs were able to attach and differentiate to peripheral neurons on PCL and PCL/PPy scaffolds, in particular the PCL/PPy (1% v/v) scaffolds supported higher growth of neural cells and a stronger maturation of hESC-NCSCs to peripheral neuronal cells. Overall, these results suggest that PPy-based conductive scaffolds have potential clinical value as cell-free or cell-laden NGCs for peripheral neuronal regeneration.

Vijay Sanjairaj, PhD

Assistant Professor, Division of Engineering, New York University Abu Dhabi



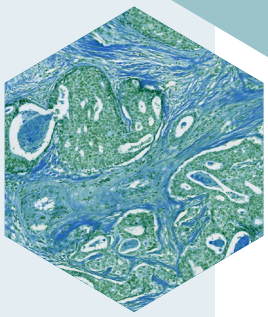
Biography: Dr. Vijayavenkataraman Sanjairaj (Vijay) is an Assistant Professor of Mechanical Engineering at New York University Abu Dhabi. His research interests include Additive Manufacturing, 3D bioprinting, and biomaterials for tissue engineering, regenerative medicine, drug testing, and medical devices applications. He is particularly interested in design and additive manufacturing of three-dimensional scaffolds and bioprinting of cell-laden hydrogels for tissue engineering and regenerative medicine. He has authored more than 30 publications in peer-reviewed international journals. He was also part of several life sciences and biomedical industry-oriented programs such as Singapore Stanford Biodesign (SSB) Innovation Class, NUS Lean Launch Pad Singapore (modelled after NSF I-Corps program), and P&G Serial Innovator Camp.

(Immuno) Mechanobiology of Antigen Presenting Cells and Implications for Tissue Engineering

Abstract: Cells of the body are subjected to external loading as well as inherent physiological forces and they respond to these biomechanical cues. Cells of the immune system are not spared from being exposed to such biomechanical forces that can come in the manner of cell-cell interaction, interstitial fluid shear forces, resistance during migration within tissues, etc. Antigen presenting cells (APC) of the innate immune system are crucial cells that partake in primary defense against antigens (Ag) and also communicate with cells of the adaptive immune system to educate a secondary defense that is more precise and rapid in response. Macrophages and dendritic cells (DC) are present during physiological homeostasis as well as pathophysiological events, each cell is therefore exposed to a spectrum of biophysical signals within their own microenvironment. First, I will report findings on the effects of lab-simulated tissue stiffness on APC immune response. Using collagen hydrogels as a 3D cell culture substrate, we investigated (1) the effects of dimensionality as well as (2) density of collagen on macrophage and DC immune phenotype as well as immune function. We assess APC immune function using a multidisciplinary approach involving conventional immunobiology assays and custom developed computational platforms, yielding results that demonstrated tissue modulation of APC phenotype and function. We will briefly introduce how our findings can be applied to the realm of tissue engineering.

Jeremy Teo, PhD

Assistant Professor, Division of Engineering, New York University Abu Dhabi



Biography: Jeremy Teo received his Bachelor's degree in Mechanical Engineering and Masters degree in Bioengineering from the National University of Singapore in 2001 and 2003 respectively. He went on to earned his PhD in 2008, from the school of medicine in the same university, with primary thesis work developing patient specific spine and bone computational models detailed with inference from radiological images for scientific investigation and translational application.

Jeremy next joined the Institute of Bioengineering and Nanotechnology (2007 - 2009), an A*STAR research institute, as a postdoctoral fellow developing artificial organs with focus on biomaterials optimization for kidney tissue engineering. Subsequently, at the Institute of Bioengineering, Laboratory for Lymphatic and Cancer Bioengineering (2009 -2011) at École Polytechnique Fédérale de Lausanne he pursued further postdoctoral training in immunology and cancer bioengineering.

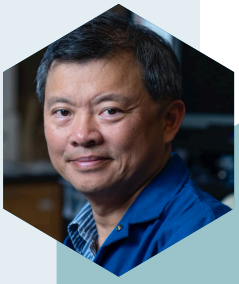
Since Jan 2018, he has been an assistant professor at NYUAD and principal investigator of LIBRA- Laboratory for Immuno Bioengineering and Applications. His research interest is in the domain of immunomechanobiology, which spans the fields of biomaterials, bioreactors, immunology, image-based quantitative biology, and cellular biomechanics.

Biosystems, Bioelectronics and Biosensors

LEAD SPEAKER

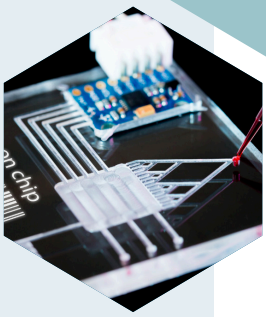
Microfluidic Precision Medicine – identifying the minimal representative unit for top down diagnostics & bottom up treatment

Abstract: Precision medicine is the paradigm to develop treatments for patients based on molecular-targets that are effective in vivo when administered. That is, one must not only be able to identify molecular and cellular targets that are the source of disease but also understand how these targets behave in the body based on physiological principles. Recent developments in microfluidics have contributed to burgeoning precision medicine fields such as liquid biopsy, immunotherapy, single cell analysis, genotyping and gene sequencing, and microphysiological systems. This is due to the fact that microfluidics bridges the scales of molecular, cellular, tissue, and can even recapitulate organ and circulatory functions of the body. In liquid biopsy, microfluidics can analyze biological samples such as blood for the detection of biomolecules or cells that are indicative of disease or physiological state (top down diagnostics). A key bottleneck is to identify the critical subpopulation of cells, often at single cell resolution among billions of cells in circulation. On the other hand, the ability to recapitulate the in vivo physiological system is critical to ensure that the therapy delivered is precise yet holistic. Our 3-D vascularized micro organ (VMO) system connects microfluidic channels to vascularized tissues, forming the basis of the "human body on-chip". Applications for this platform include microphysiological systems for screening of drugs, studying vascular malformations, and understanding immune responses. Ultimately this on-chip microcirculation platform maintains 'microfluidic homeostasis' for studying bottom up treatment options.



Abraham P. Lee, PhD

Professor, Department of Biomedical Engineering, University of California, Irvine



Biography: Abraham (Abe) P. Lee is Professor of Biomedical Engineering (BME) and Mechanical and Aerospace Engineering (MAE) at the University of California, Irvine. He is Director of the NSF I/UCRC "Center for Advanced Design & Manufacturing of Integrated Microfluidics" (CADMIM). Currently Dr. Lee serves as Editor-in-Chief for the Lab on a Chip journal. Prior to UCI, he was a program manager in the Microsystems Technology Office at DARPA (1999-2001) and a group leader with Lawrence Livermore National Lab. Over the years, Dr. Lee has pioneered research in applying microfluidics to biomedical applications, and currently focuses on integrated microfluidic systems for precision medicine. His research has contributed to the founding of several start-up companies. He owns 45 issued US patents and is author of over 100 journals articles. Professor Lee was awarded the 2009 Pioneers of Miniaturization Prize and is an elected fellow of the NAI, AIMBE, RSC, ASME, and BMES.

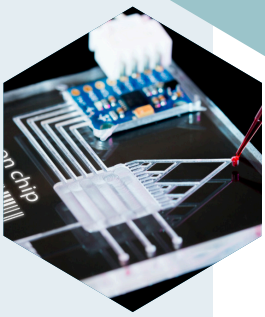
LEAD SPEAKER

Precision medicine: Profiling cellular-to-molecular diversity using microengineered tools

Abstract: Underpinning single-cell measurement tools, microfluidic design offers the throughput, multiplexing, and quantitation needed for rich, multi-dimensional data. Genomics and transcriptomics are leading examples. Yet, while proteins are the dynamic, downstream effectors of function, the immunoassay remains the de facto standard (flow cytometry, mass cytometry, immunofluorescence). We posit that to realize the full potential of high-dimensionality cytometry, new approaches to protein measurement are needed. I will describe our 'electrophoretic cytometry' tools that increase target selectivity beyond simple immunoassays. Enhanced selectivity is essential for targets that lack high quality immunoreagents – as is the case for the vast majority of protein forms (proteoforms). I will share our results on highly multiplexed single-cell western blotting and single-cell isoelectric focusing that resolves single charge-unit proteoform differences. In fundamental engineering and design, I will discuss how the physics and chemistry accessible in microsystems allows both the "scale-down" of electrophoresis to single cells and the "scale-up" to concurrent analyses of large numbers of cells. Precise reagent control allows for integration of cytometry with sophisticated sample preparation – the unsung hero of measurement science. Lastly, I will link our bioengineering research to understanding the role of protein signaling and truncated isoforms in development of breast cancer drug resistance and understanding protein signaling in individual circulating tumor cells. Taken together, we view microfluidic design strategies as key to advancing protein measurement performance needed to address unmet gaps in quantitative biology and precision medicine.

Amy E. Herr, PhD

Professor, Department of Bioengineering, University of California, Berkeley



Biography: Amy E. Herr earned Ph.D. and M.S. degrees in Mechanical Engineering from Stanford University and completed her B.S. in Engineering and Applied Science with honors from the California Institute of Technology. Her research has been recognized by the NIH New Innovator Award, NSF CAREER Award, Alfred P. Sloan Fellowship (Chemistry), DARPA Young Faculty Award, Visionary Award from the City of Berkeley and named to the Analytical Scientist's top 100 most influential people in analytical science. Professor Herr has chaired the Gordon Research Conference (GRC) on the Physics & Chemistry of Microfluidics and will chair μTAS 2020. She is an elected Fellow of the American Institute of Medical and Biological Engineering (AIMBE) and the US National Academy of Inventors. Her research program lies at the intersection of engineering design, analytical chemistry, and targeted proteomics – with a recent focus on cytometry, spanning fundamental biological to clinical questions.

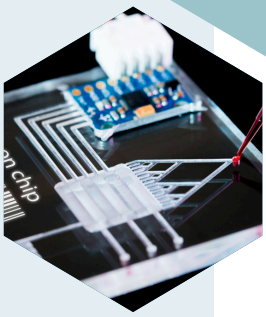
LEAD SPEAKER

Biosystems for the Diagnostic and Treatment of Neurodegenerative Diseases

Abstract: Wearable and implantable Biosystems intended for the diagnostic and treatment of neurodegenerative diseases are promising alternatives to study neural activities underlying cognitive functions and pathologies, and eventually to recover lost neural vital functions. Biosensors and corresponding signal/image processing are a large variety of emerging technologies. However, treatment remains much less developed including drugs, and surgery. This talk covers circuit and system techniques intended to implement smart medical devices, which are System-on-Chip based medical devices dealing with multidimensional design challenges such as power management, low-power high-data rate wireless communication, and reliable harvesting energy methods. Application-specific system architectures, and dedicated building blocks (RF front-end, various load interfaces, active rectifiers, etc) and corresponding experimental results will be demonstrated. Case studies of neurorecording intended for learning about the intracortical vision mechanism, and for spike onset detection of epileptic seizure foci localization and treatment, as well as microstimulation in the primary visual cortex intended to recover vision for the blind will be reported. In addition, lab-on-chip based neurotransmitters detection, manipulation and characterization intended to locate dysfunctions at the neural cells' interconnection levels will be summarized. These devices require wireless power management, packaging, etc, and are built around miniaturized platforms, including capacitive sensing arrays. On the other hand, new generation of devices intended to enhance bladder functions (voiding and/or continence) will be covered. In addition to the estimation of bladder volume/pressure from afferent neural activity, impact of sacral-nerve stimulation will be demonstrated, and an electronic artificial urinary sphincter to manage voiding will be presented.

Mohamad Sawan, PhD

Professor, School of Engineering, Westlake University, Hangzhou



Biography: Mohamad Sawan received the Ph.D. in electrical engineering from Université de Sherbrooke, Canada. He was a Professor Biomedical Engineering in Polytechnique Montréal (1991-2019), and Founder of Polystim Neurotech Labs, was awarded the Canada Research Chair in Smart Medical Devices (2001-2015) and was leading the Microsystems Strategic Alliance of Quebec (1999-2018). He is Founder of NEWCAS and Co-Founder of BioCAS Conferences. He is Chair Professor in Westlake University, China, where he is Founder of the Center for Biomedical Research And INnovation (CenBRAIN). Dr. Sawan will host the 2020 IEEE International Engineering, Medicine and Biology Conference (EMBC). He published more than 800 peer reviewed papers. He is Editor-in-Chief of the IEEE Transactions on Biomedical Circuits and Systems. Dr. Sawan received several awards (Bombardier, Jacques-Rousseau, etc). He is Fellow of the IEEE, of the Canadian Academy of Engineering, and of the Engineering Institutes of Canada, and he is "Officer" of the National Order of Quebec.

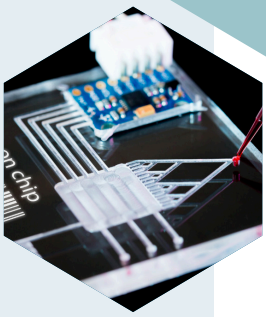
LEAD SPEAKER

Addressing The Pain Points Of Point-Of-Care Diagnostics Using Advanced Microfluidic Concepts

Abstract: Diagnostics are ubiquitous in healthcare because they support prevention, diagnosis and treatment of diseases. Specifically, point-of-care diagnostics are particularly attractive for identifying diseases near patients, quickly, and in many settings and scenarios. However, it can be very challenging to devise precise and error-free portable diagnostic devices that need to remain "minimally instrumented" and operated by non-technical experts. One of our contribution to the field of microfluidics is the development of capillary-driven microfluidic chips for highly miniaturized immunoassays. In this presentation, I will review how to program capillary flow and encode specific functions to form microfluidic elements that can easily be assembled into self-powered devices for immunoassays, reaching unprecedented levels of precision for manipulating samples and reagents. This technology can also be augmented using peripherals and smartphones for flow control and monitoring with sub-nanoliter precision. Finally, counterfeiting of point-of-care diagnostics is an issue, with sometimes dramatic consequences. Using capillary phenomena, we devised a method for producing in chips a complex signal with a "time domain" for authentication of devices. All together, capillary-driven elements can bring extremely high control for manipulating sub-microliter volumes of samples and picogram quantities of reagents and may therefore extend the performances of microfluidic devices for point-of-care diagnostics to a next level of precision.

Emmanuel Delamarche, PhD

Manager, Precission Diagnostics, Science & Technology, IBM Research Zurich



Biography: Dr. Delamarche is leading activities on Precision Diagnostics at IBM Research - Zurich with the goal of using expertise in micro/nanotechnology and biochemistry for solving important problems in biology and medicine. His main projects deal with the development of portable and precise diagnostic devices and the development of a non-contact scanning microfluidic probe for analyzing biological interfaces. He is also a Lecturer at ETH Zurich and a contributor to scientific panels for governmental agencies and research institutions. He published over 120 papers and is co-inventor on more than 70 patent families. He has received numerous awards from IBM, was named "Master Inventor" by IBM, and received the Werner prize of the Swiss Chemical Society in 2006.
Dr. Delamarche studied chemistry and received a degree in supramolecular chemistry in 1992 from the University Paul Sabatier of Toulouse in France and his Ph.D. in biochemistry in 1995 from the University of Zurich.

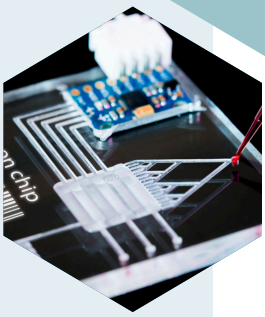
LEAD SPEAKER

Electrochemical Sensors In Routine Clinical Chemistry - Challenges And Perspectives

Abstract: Electrochemical sensors and associated electroanalytical methods are used on a massive scale in clinical analysis, thanks to their attractive functional parameters and the possibility of using them in high throughput random access analyzers as well as in bedside and point-of care testing. In particular, potentiometric and amperometric measurements of pH, gases (O2 and CO2), electrolytes (Na+, K+, Cl-, Ca2+, Mg2+ and HCO3-), glucose and urea (resp. BUN) are frequently employed. Emphasis on the reliability of instruments, traceability of measurements, cost reduction of tests and running costs of the laboratory, and last but not least on automation, have increased the need for improvements and innovations, which take place through the introduction of new materials and manufacturing technology of the sensors. This, in turn, introduces new research and technological challenges, among which – alongside the traditional tasks such as improving the properties of electroactive components and electrodes – are the miniaturization of sensors (nanosensors), their integration (all-solid-state) and the need for direct measurement within a short time, in a small sample volume and a regime of low detection limits and novel concepts for signal interpretation. In the lecture - on the example of measurement standards developed by the International Federation of Clinical Chemistry (IFCC) - the role of world-wide valid recommendations is emphasized. In real life though, both new sensors designs and theoretical interpretations of the response are finally confronted with reasonably conservative regulations concerning the quality of measurements as accepted in medical diagnostic practice.

Andrzej Lewenstam, PhD, DSc

Professor, Abo Akademi University and AGH University of Science and Technology



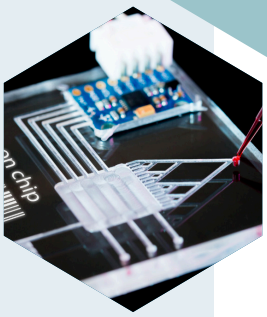
Biography: Andrzej Lewenstam obtained his PhD (1977) and his DSc (1987) from Warsaw University and since 1990 he has been a Professor. Presently he is Professor in Chemistry, AGH University of Science and Technology, Cracow, Poland, Professor of Sensor Technology at Abo Akademi University, Finland and Director of the Center for Process Analytical Chemistry and Sensor Technology 'ProSens' at this University.
For several years he chaired the Selective Electrodes and Biosensors Group of the International Federation of Clinical Chemistry (IFCC). His current fields of interest are chemical sensors and biosensors, clinical chemistry, membrane potential and biomimetics, conducting polymers, hydrometallurgy, and mathematical modelling, as well as methodology of chemistry and philosophy of Science. He is the author of more than 350 papers in chemistry and philosophy of Science, 6 books and 25 patents. He is a member of the editorial board of 6 international journals.

Flexible Thread-Based Biomedical Diagnostics And Therapy

Abstract: This talk will explore the new realm of using threads as an ultimate platform for flexible and stretchable bioelectronics. Threads offer unique advantages of universal availability, low cost, material diversity and simple textile-based processing. In this talk, I will report reel-to-reel fabrication to make functional smart threads for variety of sensing and electronics application. For example, I will report on nanomaterial-infused smart threads for sensing physical biomarkers (e.g. strain, pressure, temperature) and chemical biomarkers (pH, glucose, lactate etc.) of health and wellbeing. Recent work on making electronic devices such as transistors and integrated circuits on threads will be presented. I will show our recent work on using this toolkit of thread-based microfluidics, sensors and electronics for applications as smart surgical sutures and flexible smart bandages for chronic wounds. Our recent work on using threads for closed loop spatiotemporal dosage controlled drug delivery will also be presented.

Sameer Sonkusale, PhD

Professor, Department of Electrical and Computer Engineering, Department of Biomedical Engineering, Tufts University



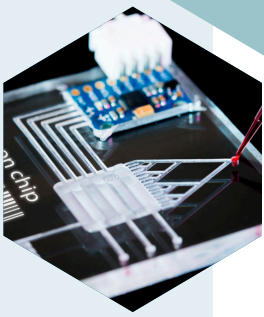
Biography: Sameer Sonkusale is currently a Professor of Electrical and Computer Engineering at Tufts University with a joint appointment in the department of Biomedical Engineering. At Tufts University, Dr. Sonkusale directs an interdisciplinary research group Nano Lab with research focus on flexible bioelectronics, biomedical micro-devices circuits and systems, micro-fabrication and nano-fabrication. Prior to coming to Tufts, he was an Assistant Professor at Texas A&M University from 2002 to 2004. For 2011-2012 and again in 2018-2019, He also held the position of visiting scholar at Brigham and Women's Hospital, Harvard Medical School and the Wyss Institute at Harvard University. Dr. Sonkusale received his MS and PhD in Electrical Engineering from the University of Pennsylvania. He has received several awards including the National Science Foundation CAREER award in 2010. He is an alumnus of the National Academy of Engineering US Frontiers of Engineering in 2015, and the National Academy of Sciences Arab-America Frontiers in 2014 and 2016. Dr. Sonkusale is on the editorial boards of Nature Scientific Reports, IEEE Transactions on Biomedical Circuits and Systems, Journal of Low Power Electronics and Application, and Electronic Letters.

Organic Electronics for Biointerfacing

Abstract: The field of bioelectronics combines the worlds of electronics and biology with the aim of developing new tools for biomedical research and healthcare. The majority of implantable devices are mechanically stiff and the mechanical properties mismatch with soft tissue causes an immune response which results in their rejection from the body. Another limitation is associated with the fact that most devices utilize metal electrodes to record from/stimulate tissue. These electrodes offer limited coupling with ion fluxes used by cells to communicate with each other, resulting in low efficiency. Such challenges can be overcome with the integration of soft, conducting polymers displaying mixed (ionic and electronic) conduction. In this talk, I will present approaches that leverage the properties of organic conducting materials in order to develop bioelectronic devices interfacing with the body. These devices include organic electrochemical transistors for measuring metabolites, neural activity and integrity of cellular layers.

Sahika Inal, PhD

Assistant Professor, Biological & Environmental Sciences & Engineering Division, King Abdullah University of Science and Technology



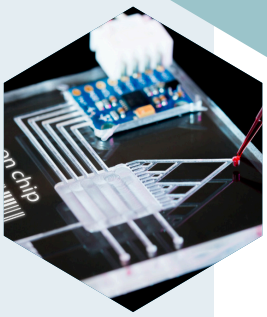
Biography: Sahika Inal is an Assistant Professor of Bioscience with affiliations in Electrical Engineering and Materials Science and Engineering at King Abdullah University of Science and Technology (KAUST). Prior to joining KAUST, she was a postdoctoral fellow in the Department of Bioelectronics at the Center of Microelectronics of Provence of the Ecole Nationale Supérieure des Mines de Saint-Étienne (France). She received her B.Sc. degree in Textile Engineering from Istanbul Technical University, her M.Sc. in Polymer Science and Ph.D. in Experimental Physics from the University of Potsdam (Germany). Her expertise is in polymer science and bioelectronic devices, particularly in photophysics of conjugated polymers, characterization of polymer thin films and the design of biosensors and actuators. She investigates ion/electron conduction in organic electronic materials and designs bioelectronic devices that can record/stimulate biological signals. She leads the Organic Bioelectronics group at KAUST.

Fabrication of Nanosurfaces for Nano-Bio Applications Using Atomic Force Microscopy

Abstract: Among current nanotechnology applications, the design and fabrication of nanochannels are one of the major challenges. To date, the methods for fabricating nanochannels have included bulk nanomachining and wafer-bonding, surface nanomachining, buried channel technology and nanoimprint lithography. Although nanoimprint lithography can fabricate 2-dimensional nanochannels, these channels are all fabricated by complex processing methods that require sophisticated masking and etching. Thus, a means by which nanochannels are able to be fabricated without complex processing and reach nano scale level in 3-dimension becomes necessary. This presentation will address recent progress in AFM-based precision nanomachining on bare silicon surfaces. The results show that this technique can be applied in the fabrication of Ion Sensitive Field Effect Transistor (ISFET) structure, where relatively large nanochannels on the silicon substrate are required. These systems have the potential to significantly impact a broad array of application including and not limited to biosensor, nanofluidics and drug testing.

Uchechukwu C. Wejinya, PhD

Associate Professor, Dept. of Mechanical Engineering, University of Arkansas – Fayetteville



Biography: Uche Wejinya received his B.S. and M.S. degrees in Electrical and Computer Engineering from Michigan State University, East Lansing, MI, USA in 2000 and 2002, respectively. Upon completing his M.S. degree in 2002, he worked at General Motors research and development center located in Warren, Michigan, where he conducted research on Magneto-Rheological Fluid (MRF) clutch system before returning to graduate school. He then received a Ph.D. in Electrical Engineering in August 2007 from Michigan State University. After completing his Ph.D., he held a post-doctoral research position in the Department of Electrical and Computer Engineering at Michigan State University. In February 2008, he joined the Department of Mechanical Engineering at the University of Arkansas – Fayetteville (UAF) where he held a tenure-track assistant professor position until June of 2014. Since July 2014, he has been a tenured associate professor in the Department of Mechanical Engineering at the University of Arkansas – Fayetteville (UAF). His research interests include mechatronics with emphasis on nanotechnology – nanomaterials for nanosensors including biosensors, chemical sensors; nanoelectronics; control systems design and application, robotics, biomechanics, batteries & energy storage devices, micro-tools for handling and manufacturing of micro and nano devices, and modeling and simulation of micro and nano structures. Dr. Wejinya has provided technical advice to many companies and a huge advocate of undergraduate research. Dr. Wejinya is the author and co-author of more than 80 journal and conference articles, and has presented at several national and international conferences.

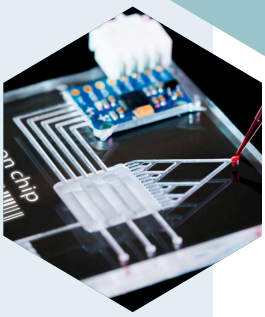
Ultrafast Star-Shaped Acoustic Micromixers For High Throughput Synthesis Of Functional Nanoparticles

Abstract: Acoustically actuated microfluidic mixers provide significant advantages for the synthesis of functional nanoparticles. The presence of ultrasound contributes to fast mixing times and reduces the mean particle size while improving monodispersity. The drawback, however, is that acoustic devices suffer from low throughputs limiting their translation from the lab bench to practical industrial applications. High throughput operation remains a difficult challenge: when the flow rate is increased the introduced disturbance provided by the acoustic actuation must be greater, so that the mixing remains acoustic rather than advection dominated.

Here, we present an acoustically actuated microfluidic system, which combines high precision of ultrasound with high throughput, high-efficiency mixing. We use a star-shaped micromechanical oscillator, which is sandwiched between two polymeric channels, guiding the fluids in and out of the system. When a piezoelectric transducer, attached to the chip, is actuated by a MHz frequency signal, the sharp internal edge of the oscillating structure generates a strong acoustic streaming field. This efficiently perturbs the fluid flow and homogenizes the fluids in under 4 ms, at flowrates reaching 8ml/min. This is an approximately 50-fold improvement in throughput when compared to similar acoustic systems. The flow rate of the new approach matches that of micro stirrers, turbulent passive micromixers and impinging jet micromixers. We demonstrate the system capability by synthesising highly monodispersed nanodrugs, protein-based nanostructures and DNA nanoparticles.

Tuncay Alan, PhD

Senior Lecturer, Department of Mechanical and Aerospace Engineering, Monash University



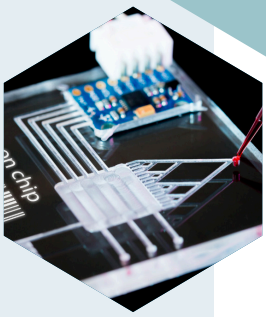
Biography: Tuncay Alan is Senior Lecturer at the Department of Mechanical and Aerospace Engineering at Monash University in Melbourne, Australia. He received his PhD in Theoretical and Applied Mechanics from Cornell University in 2007. He then worked as a postdoctoral researcher at Delft University of Technology in Delft, The Netherlands and University College London in London, UK. In 2016, he was a visiting scientist at the Swiss Light Source, Paul Scherrer Institut in Switzerland. His current research focuses on microfluidics, drug synthesis and delivery and biomedical sensors.

Wearable Tattoo Sensors Based On Graphene/2D Materials

Abstract: This talk will provide an overview of flexible nanotechnology based on atomically-thin two-dimensional (2D) materials such as graphene and describe one of the emerging applications of graphene nanomaterial as wearable electronic tattoos for sensing of parameters related to the human health and physiology. These parameters include vital signals such as blood pressure, heart rate, skin temperature, and electrophysiological signals such as EEG, ECG, and EMG. Graphene electronic tattoos have ushered a new material platform that has highly desirable practical attributes including optical transparency, mechanical imperceptibility, and is the thinnest conductive electrode sensor that can be integrated on skin for physiological measurements. Much of these research achievements have been published in nature and ACS journals, and widely covered by the news media including the BBC, IEEE spectrum, and several dozen media outlets.

Deji Akinwande, PhD

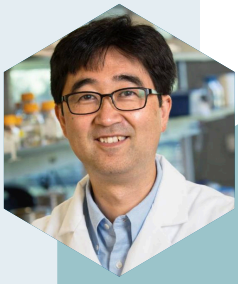
Professor, Electrical and Computer Engineering, University of Texas - Austin



Biography: Deji Akinwande is an Endowed Faculty Professor at the University of Texas at Austin. He received the PhD degree from Stanford University in 2009. His research focuses on 2D materials and nanoelectronics/technology, pioneering device innovations from lab towards applications. Prof. Akinwande has been honored with the 2018 Fulbright Specialist Award, 2017 Bessel-Humboldt Research Award, the U.S Presidential PECASE award, the inaugural Gordon Moore Inventor Fellow award, the inaugural IEEE Nano Geim and Novoselov Graphene Prize, the IEEE "Early Career Award" in Nanotechnology, the NSF CAREER award, and was a past recipient of fellowships from the Kilby/TI, Ford Foundation, Alfred P. Sloan Foundation, and 3M. He serves as an Editor for Nature NPJ 2D Materials and Applications. He Chairs the 2020 Gordon Research Conference on 2D materials, and the 2019 Device Research Conference (DRC). He is a Fellow of the American Physical Society (APS).

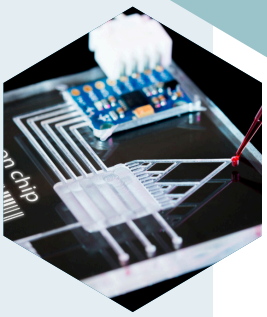
Microfluidic Studies of Lung Injury, Infection, and Fibrosis

Abstract: This presentation will describe microfluidic technologies and their application to in vitro cell culture systems that model lung diseases. Microchannel technologies will be described that produce life-like pulsatile flows for study of lung injury, enhancement of in vitro fertilization, and analysis of frequency-dependent cellular responses. The microchannel technologies include piezo-electric actuator arrays from Braille displays and self-switching microfluidic circuits that switch fluid flow on and off periodically on their own. An inflammatory chromatin biomaterial we call "microwebs" inspired by neutrophil extracellular trap (NET) will also be described. NETs are produced in the lung, urinary tract and other parts of the body when subjected to bacteria invasion. While NETs can be beneficial for fighting bacteria, an imbalance can lead to persistent infection in spite of excess NET production. We use microwebs with defined molecular composition and nanoscale structures to better understand what parameters might impact the effectiveness of NETs in fighting bacteria. For example, E. coli, including clinical isolates and resistant strains, are killed more efficiently by the last-resort antibiotic, colistin, when bound to microwebs. On the other hand, Pseudomonas aeruginosa can be quite persistent despite an excess of microwebs, particularly under conditions that mimic the lungs of cystic fibrosis patients. Finally, the presentation will describe use of aqueous two phase system (ATPS) droplets to bioprint miniature "scars" that represent an aspect of lung fibrosis that can accompany lung injuries.



Shuichi Takayama, PhD

Professor, The Wallace H. Coulter Dept of Biomedical Engineering; Parker H Petit Institute for Bioengineering and Bioscience Georgia Institute of Technology & Emory School of Medicine



Biography: Prof. Shuichi Takayama's research interests (B.S. & M.S. from the University of Tokyo, Ph.D. from the Scripps Research Institute) started with organic synthesis of enzyme inhibitors. Subsequently he pursued postdoctoral studies in bioengineered microsystems at Harvard University as a Leukemia and Lymphoma Society Fellow with goal of developing microsystems to perform bioevaluations of the inhibitor molecules he synthesized. He spent 17 years at the University of Michigan, then moved to the Wallace H. Coulter Department of Biomedical Engineering at the Georgia Institute of Technology and Emory School of Medicine in the summer of 2017. He is an asociate editor of Integrative Biology and on the board of several other journals. Awards and honors include the NSF CAREER award, Pioneers of Miniaturization Prize, and AIMBE Fellow.

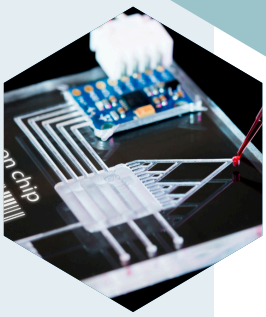
An Integrated And Ultrasensitive Biosensors & Diagnostic Tools For Biomedical Applications

Abstract: The challenges for today's biosensing platforms are numerous: they have to work with real samples, poor detection limit which is far from the infectious dose or the concentrations required by the regulating agencies, suffer from the long analysis time, and use of washing steps and liquids which defeat the purpose of field applications. Another challenge is the stability and availability of highly specific recognition receptors to be integrated with the sensing platform to have a functional device.

The presentation will highlight our recent developments to overcome such challenges for various biomedical related analytes. We developed various optical, electrochemical, colorimetric sensing platforms and integrate it with various natural and synthetic recognition receptors. We integrated a number of techniques with the various transducers to concentrate and enrich the analyte onto the immobilized recognition receptors on the sensor surface. This technique enhanced and improved the detection limit, shortened the analysis time and reduced the non-specific binding, to reduce the false positive results.

Mohammed Zourob, PhD

Professor, Department of Chemistry, Alfaisal University



Biography: Mohammed Zourob got his Ph.D from the Department of Instrumentation and Analytical Science (DIAS) at the University of Manchester in 2003. He did a postdoctoral scientist at DIAS, working in biosensors for biomedical applications. Then, he moved to the Institute of Biotechnology, University of Cambridge, where his research focused on biomemetic materials and cells assays.

Dr. Zourob headed the biosensors division at Biophage Inc, a biotech company based in Montreal. In 2009 he joined GDG Environment Ltd as Director of R&D. In 2010 he joint INRS-University of Quebec as associate professor and then he moved to Cranfield University-UK. Now Dr Zourob is professor of Biosensors at Alfaisal University-KSA. Prof. Zourob now is leading the Bioengineering and Bionanotechnology Lab (BBL). At anytime the BBBL has minimum 20 researchers working in various projects related to biomedical applications.

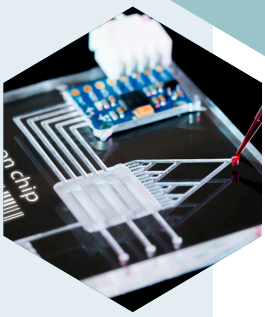
Dr. Zourob has published more than 120 scientific papers in peer-reviewed journals, more than thirteen book chapters, and thirteen patents. He edited 7 books in the area.

Single-Cell BioMEMS Tools For Monitoring Cancer Immunotherapy

Abstract: I will begin with discussing a novel bioMEMS device technology for single-cell immune function profiling, in particular, the co-detection of 40+ cytokines/chemokines at the level of single cells, representing the highest multiplexing recorded to date for a single-cell protein secretion assay. I will describe how this microdevice called IsoCode was conceived at the beginning, evolved over generations, further integrated with a fully automated single-cell processing platform called IsoLight comprising high-resolution optics, precision fluid handling and live cell incubation in the same system to truly enable robust and reproducible functional proteomics data at the single-cell level. It has widely used in immuno-oncology trial centers and pharmaceutical companies like Novartis, Kite Pharma (a Gilead Company), Bellicum, and many others to evaluate their cellular immunotherapy products. This microchip technology allowed for the full-spectrum dissection of T cell functions including genetically engineered chimeric antigen receptor T cells (CAR-T) in the treatment of patients with acute lymphoblastic leukemia or non-Hodgkin's lymphoma. Our data obtained from a medium-scale clinical trial with CD19 CAR-T cells demonstrated strong association between CAR-T cells' polyfunctionality (the ability for a single T cell to co-produce multiple immune effector proteins) and patient response, which opens up new opportunities for predicting not only therapeutic efficacy but also potentially life-threatening immunotoxicity. Recently, we further developed a standalone portable microchip for single-cell mRNA sequencing, which was combined with single-cell protein profiling to further elucidate the activation mechanisms of engineered T cells and facilitate the development of next-generation immunotherapies.

Rong Fan, PhD

Associate Professor, Department of Biomedical Engineering, School of Engineering and Applied Science, Yale University



Biography: Dr. Rong Fan is Associate Professor of Biomedical Engineering at Yale University. He received a B.S. in Applied Chemistry from University of Science and Technology in China, a Ph.D. in Chemistry from the University of California at Berkeley, and then completed the postdoctoral training at California Institute of Technology, prior to launching his own research laboratory at Yale University in 2010. His current interest is focused on developing microfabricated tools for single-cell and spatial omics profiling. He developed a microchip technology that, for the first time, permits simultaneous measurement of 42 immune effector proteins in single cells, representing the highest multiplexing to date for a single-cell protein secretion assay. He is the recipient of numerous awards including the National Cancer Institute's Howard Temin Career Transition Award, the NSF CAREER Award, and the Packard Fellowship for Science and Engineering. He was elected a Fellow of American Institute for Medical and Biological Engineering (AIMBE) and a senior member of the National Academy of Inventors (NAI).

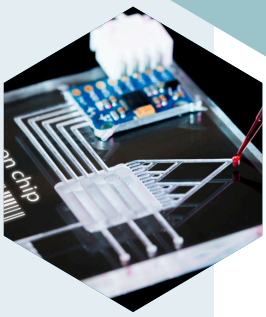
Assembly Of A Multiplexed And Single Molecule Sensitive Nanoplasmonic-WGM Biosensor Using Light Forces

Abstract: I will describe a method that we have put in practice for assembling a multiplexed and single molecule sensitive nanoplasmonic-WGM Biosensor using light forces in a micro-fluidic cell.

Biography: Stephen Arnold is University Professor of Physics and Chemistry and the Thomas Potts Professor of Physics at NYU-Tandon. His CV can be viewed on the web page for the MicroParticle PhotoPhysics Lab (www.mp3l.org).

Stephen Arnold, PhD

Professor, Applied Physics, and Chemical and Biomolecular Engineering, Tandon School of Engineering, New York University

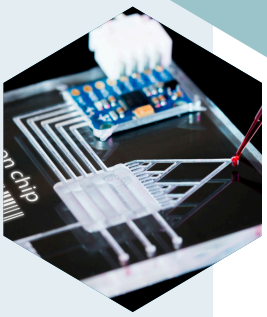


Engineering An In Vitro Leukemia Niche Model For Personalized CAR T-Cell Immunotherapy

Abstract: Adoptive CD19 CAR (Chimeric Antigen Receptor) T-cell transfer has emerged as a successful FDA-approved therapy for relapsed and refractory pediatric B-cell acute lymphoblastic leukemia (B-ALL). However, the durability of patient remission remains unpredictable largely due to CAR T-cell immunological resistance and tumor heterogeneity in the leukemic bone marrow (BM) niche. The ability to dissect these evolving interactions among distinct B-ALL subtypes and the BM niches is limited with current in vivo methods. Herein, we reconstituted an in vitro three-dimensional (3D) organotypic leukemic BM niche model using a 'Leukemia-on-a-Chip' platform and comparatively studied the heterogeneity of the perivascular and immune BM niche in regulating B-ALL therapy resistance. By emulating the leukemia BM anatomy in vitro, we determined that the perivascular niche, through providing cytokine (e.g. CXCL12) and adhesive (e.g. VCAM-1/OPN) signals, differentially enhance downstream leukemia-intrinsic NF-κB signaling to support B-ALL survival and regulate cell cycle-related signaling to promote dormancy. We revealed the heterogeneity across different B-ALL subtypes by mapping subtype-specific leukemia and niche signals with application of single-cell RNA sequencing and analysis. More importantly, we applied this microphysiological system to monitor CD19 CAR T-cell extravasation from perfusable microvessel into the leukemia BM niche, recognition, cytokine secretion, and killing activity of CD19-positive leukemia cells. Together, these results validate that our Leukemia-on-a-Chip allows for real-time and controllable dissection of the dynamic and heterotypic interactions between leukemia and their BM microenvironment, which may translate to personalized therapeutics screening and disease management.

Weiqiang Chen, PhD

Assistant Professor, Department of Mechanical and Aerospace Engineering, Department of Biomedical Engineering, New York University



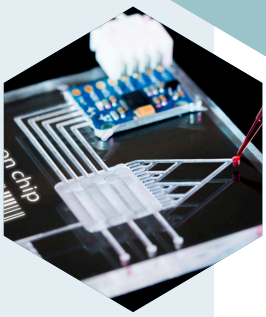
Biography: Dr. Weiqiang Chen is an Assistant Professor in the Departments of Mechanical and Aerospace Engineering and Biomedical Engineering at New York University. He received his Ph.D. degree in Mechanical Engineering from the University of Michigan in 2014. He is the recipient of the Biomedical Engineering Society Young Innovator Award of Cellular and Molecular Bioengineering, the Chroma Young Investigator Award, the National Institute of Biomedical Imaging and Bioengineering Trailblazer Award, the American Heart Association Scientist Development Award, the NYU Whitehead Fellowship, the Baxter Young Investigator Award, and the University of Michigan Richard F. & Eleanor A. Towner Prize for Outstanding PhD Research. Dr. Chen's research interests focus on Lab-on-a-Chip, biomaterials, mechanobiology, stem cell biology, caner biology, and immune engineering.

Microfluidic Tools For Single-Cell Wound Repair Studies

Abstract: Wound repair is a key feature of living systems. At the single cell level, the ability to heal wounds underpins fundamental biological processes from cytokinesis to cancer metastasis. For some organisms, wound repair can occur in two stages: short-term sealing of the plasma membrane opening, and long-term regeneration to rebuild damaged or lost structures. While several model organisms have been developed to study single-cell wound healing, many open questions remain regarding the mechanisms and dynamics of single-cell wound healing. Here we describe a microfluidic "guillotine" as a platform to probe the mechanisms and time scales of single-cell wound healing using Stentor coeruleus, a giant ciliate, as our model due to its extraordinary ability to heal mechanical wounds. Along with our microfluidic tools, we expect to answer key questions on single-cell wound repair.

Sindy Tang, PhD

Associate Professor, Department of Mechanical Engineering and by courtesy of Radiology, Stanford University



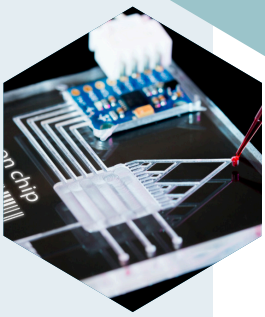
Biography: Prof. Sindy Kam Yan Tang is the Kenneth and Barbara Oshman Faculty Scholar and Associate Professor of Mechanical Engineering and by courtesy of Radiology (Precision Health and Integrated Diagnostics) at Stanford University. She received her Ph.D. from Harvard University in Engineering Sciences under the supervision of Prof. George Whitesides. Her lab at Stanford works on the fundamental understanding of fluid mechanics and mass transport in micro-nano systems, and the application of this knowledge towards problems in biology, rapid diagnostics for health and environmental sustainability. She was a Stanford Biodesign Faculty Fellow in 2018. Dr. Tang's work has been recognized by multiple awards including the NSF CAREER Award, 3M Nontenured Faculty Award, the ACS Petroleum Fund New Investigator Award, and invited lecture at the Nobel Symposium on Microfluidics in Sweden. Website: http://web.stanford.edu/group/tanglab/

Simple Flow Control In Paper And PDMS For Microfluidic Point-Of-Care Applications

Abstract: Microfluidics has recently made technical advances in its applications for life sciencesμchemistry, and bioengineering since the micro total analysis systems (μTAS) was introduced in 1990 as an integrated concept of a miniaturized analytical system that performs various analytical functions such as sample pretreatment, separation, and detection. To foster breakthrough innovations for the bio-health industry, many microfluidic technologies have been developed in the areas of in vitro diagnostics, high-throughput screening systems, and biomedical devices. In addition, microfabrication and assembly technologies play a key role in realizing the point-of-care testing (POCT) device and system for healthcare and environmental food safety applications. However, microfluidic devices or lab-on-a-chips are highly dependent on fluid control with external pumps and continue to challenge the development of user-friendly POCT devices. To date, conventional paper-based lateral flow tests are not sufficient to carry out the sequential delivery of multiple reagents, which is essential to perform multi-step reactions such as a sandwich immunoassay and a number of colorimetric reactions to enhance test results. In this presentation, several approaches for the practical applications of external pump-free microfluidic devices will be introduced and discussed, including paper-fluidic sensors for biochemical compounds such as food-borne pathogens and C-reactive protein, and finger-actuated POCT devices for blood separation and typing.

Je-Kyun Park, PhD

Professor, Department of Bio and Brain Engineering, Korea Advanced Institute of Science and Technology



Biography: Je-Kyun Park is professor of bio and brain engineering at KAIST. He received his BS and MS from Seoul National University in 1986 and 1988, and PhD in biotechnology from KAIST in 1992. Prior to joining KAIST, he worked as a postdoctoral fellow in the Department of Biomedical Engineering at the Johns Hopkins University (1996–1997) and Chief Research Engineer at the LG Electronics Institute of Technology (1992–2002). He served as editorial board members of several international journals, including Lab on a Chip, Biosensors & Bioelectronics, and BioChip Journal. In addition, he served as Conference Chair of the μTAS 2015 and President of the Korean BioChip Society 2016. He is currently Director of the Chemical and Biological Microsystems Society. He is the co-author of 110 patents and more than 160 scientific papers in the field of integrative bioengineering, including nanobiotechnology, bioMEMS, and lab-on-a-chip & microfluidic analytical technologies.

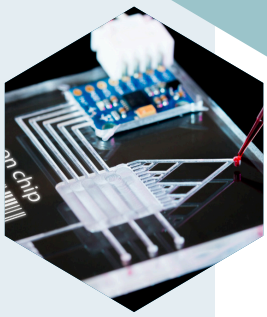
Microfluidic Systems For Manipulation Of Cells Using Dielectrophoresis

Abstract: The talk, will introduce the relevant principles and mechanisms used for separation and manipulation of living cells within fluids using microfluidics. The presentation will include detailed description of mechanisms of separation that are relevant to techniques such as liquid biopsy and count of circulate tumor cells (CTC). These techniques are based dielectrophoresis using metal and nonmetal electrodes. The basic physics will be introduced and different microfluidic systems for manipulation of cells and particles will be discussed. Details and practical results will be discussed in conjunction within the separation of living cells through dielectrophoresis to achieve particles/living cells separation. Other applications and new fabrication techniques for microsystems and microfluidics will be discussed.

Anas Alazzam, PhD

Associate Professor, Mechanical Engineering, Khalifa University

Biography: Dr. Alazzam is an alumna of Concordia University – Montreal. After a brief Post-Doctoral Fellow appointment with the Canadian Space Agency, he joined Khalifa University in 2012. He has research background in microfluidics, Dielectrophoresis, and healthcare applications of microdevices. He has published over 100 peer reviewed papers in journals and conferences. His research in the BioMEMS area has received substantial recognition in the form of awards and media Appearance. In 2015 he received the Research Award from Khalifa University of Science and Technology in recognition of his research work.

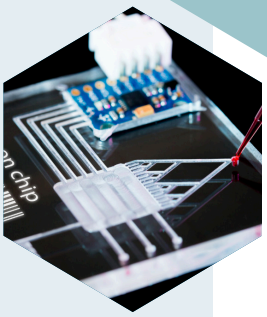


Diagnostics with Blood at Extreme Point of Care

Abstract: Recent initiatives in giving healthcare access to the most downtrodden population have brought in dramatic improvements in the well-being of the developing world. However, such efforts have so far been primarily constrained by the lack of affordable diagnostic technologies that can be deployed on field, under extreme challenging conditions where sophisticated laboratory facilities and specially trained technicians are scarce, and cost-related constraints are ominous. Overcoming these constraints, the speaker delineates the recent development of disruptive diagnostic technologies developed in his group that have successfully been implemented as integral form of recently emerged delivery models of affordable healthcare at extreme resource-limited settings. With a brief depiction of the underlying scientific aspects of capillarity and diffusive dynamics on a paper matrix, illustrative examples are provided for ultra-low cost colorimetric detection of blood-borne parameters using a printed paper strip integrated with a smartphone and a simple plastic box fitted with LED light for holding the same and imaging simultaneously. Insights are provided on further assessments of scenarios such as antibiotic resistance on a simple paper platform. Further, unique perspectives of doing multiple tests by deploying single drop of blood are provided by using the paper-and-pencil microfluidics innovated by this group. Going further forward, validation studies are presented in extreme point of care settings hallmarked by uncontrolled dirt, dust, humidity and temperature in which the traditional diagnostic technologies do not work. These results compare favorably with the pathological diagnostic reports from expensive benchmark laboratory setups. It is envisaged that those days are not far away when such disruptive technology driven unique innovations in public heath will bring in new hopes to millions of poor and deprived people in the underprivileged world.

Suman Chakraborty, PhD

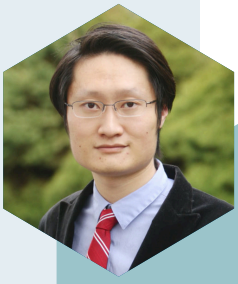
Professor, Department of Mechanical Engineering, Indian Institute of Technology Kharagpur



Biography: Suman Chakraborty is a Professor in the Mechanical Engineering Department as well as an Institute Chair Professor of the Indian Institute of Technology Kharagpur, India, and Sir J. C. Bose National Fellow as bestowed by the Department of Science and Technology, Government of India. He is currently the Dean of Sponsored Research and Industrial Consultancy. Formerly, he was the Head of the School of Medical Science and Technology. His current areas of research include microfluidics, nanofluidics, micro-nano scale transport, with particular focus on biomedical applications. He has been awarded the Santi Swaroop Bhatnagar Prize in the year 2013, which is the highest Scientific Award from the Government of India.

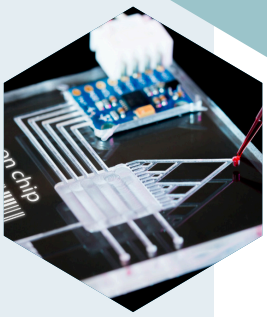
Formulating Bioinks for Tissue Bioprinting

Abstract: Over the last decade, three-dimensional (3D) bioprinting has offered great versatility to fabricate biomimetic volumetric tissues that are both structurally and functionally relevant. It enables precise control over the composition, spatial distribution, and architecture of the bioprinted constructs, facilitating recapitulation of the delicate shapes and structures of targeted organs and tissues. In this talk, I will discuss our recent efforts on developing various cytocompatible and cell-instructive bioink formulations for the fabrication of engineered tissue constructs, using a series of established or customized bioprinting strategies.



Y. Shrike Zhang, PhD

Assistant Professor, Division of Engineering in Medicine, Department of Medicine, Brigham and Women's Hospital, Harvard Medical School



Biography: Dr. Zhang is an Assistant Professor of Medicine at Harvard Medical School and Associate Bioengineer in the Division of Engineering in Medicine at the Brigham and Women's Hospital. Dr. Zhang's research is focused on innovating medical engineering technologies, including 3D bioprinting, organs-on-chips, microfluidics, and bioanalysis, to recreate functional tissues and their biomimetic models. In collaboration with a multidisciplinary team encompassing biomedical, mechanical, electrical, and computer engineers as well as biologists and clinicians, his laboratory seeks to ultimately translate these cutting-edge technologies into the clinics. He is an author of >170 peer-reviewed publications and his scientific contributions have been recognized by >40 international, national, and regional awards. More information can be read on his website (www.shrikezhang.com).

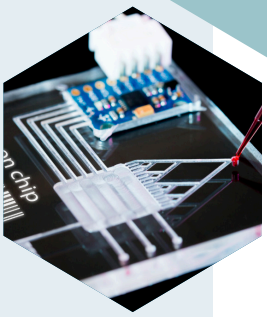
Biosensing using Hybrid System of Organic Electronics and CMOS technology

Abstract: : CMOS based biosensors are accurate with minimal drift and with professional manufacturing systems. Hybrid Organic semiconductors give the advantage of operational flexibility - we show the use of potentiometry as well as extended and floating gate field effect transistors (FET) to demonstrate the benefits of the hybrid structures. Simple potentiometer already demonstrates the elegance of conducting polymer for accurate organic chemical reactions for immobilization of antibodies, aptamers or peptides, the flexibility for embedding additives as amplifying nanoparticles and the aqueous stabilization by the elastomeric doping. The FETs with functionalized gates prove the widening of the water window, and the control of operation as an organic capacitor. For each function, we show immunoassaying examples.

Kalle Levon, Dr. Agr.

Research Professor, Chemical and Biomolecular Engineering, Tandon School of Engineering, New York University

Biography: Kalle Levon, research professor, formerly tenured full professor, department head (1995-2002) and vice provost of R&D (2002-2007). Research interests include polymer science and engineering, charged surfaces, organic electronics, and electrical immunoassays.



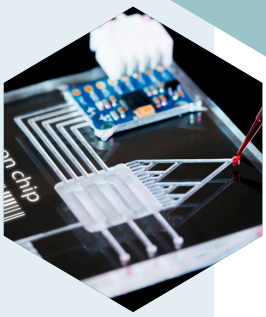
Neutrophilic Chain-Reactions during Infections and Sepsis

Abstract: Neutrophils are the most numerous white blood cells in the circulation. They are also the earliest blood-cell-responders to infections. However, the contribution of neutrophils to inflammation, infections, and sepsis has long been underappreciated. Due to the lack of appropriate tools to study neutrophil phenotype, only neutrophil numbers are currently monitored during health and disease situations. To address these limitations, we are designing microfluidic devices that measure various neutrophil functions in blood samples from patients. These devices work directly with whole blood, measure novel neutrophil functions like swarming and retrotaxis, and help quantify neutrophil-microbe interactions with single-cell resolution. New assays are emerging for the diagnosis of sepsis, measuring the risk to infections in patients after transplant, and monitoring the health of neonates.

Daniel Irimia, PhD, MD

Associate Professor,
Massachusetts General Hospital,
Shriners Burns Hospital, Harvard Medical School

Biography: Daniel Irimia is a bioengineer and a medical doctor by training, doing research in the field of microfluidics. He published more than 100 articles on the application of microfluidics to bio-medical problems in inflammation and sepsis. He was recently awarded the "Pioneers of Miniaturization" prize from the Chemical and Biological Microsystems Society for his work on microfluidic tools for analyzing neutrophils and other leukocytes in health and disease.

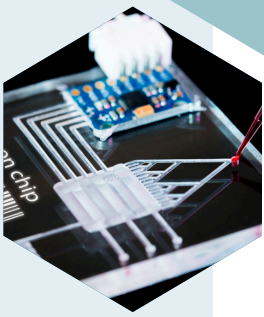


Microfluidic Devices For Single Cell Manipulation And Analysis

Abstract: This talk will present our continuing efforts in developing microfluidic devices to manipulate single cells for biophysical parameter measurement. Leveraging optical stretching and dielectrophoresis, we can achieve mechanical-plus-electrical manipulation on a single cell for deformation and 3D electro-rotation, thus enabling simultaneous in-situ mechanical and electrical property measurement, on top of 3D imaging. Through experiment, we tested five types of cells (HeLa, A549, HepaRG, MCF7 and MCF10A), and obtained five biophysical parameters such as shear modulus, steady-state viscosity and relaxation time from the stretching deformation, and quantified area-specific membrane capacitance and cytoplasm conductivity from the rotation spectra. We also show that by designing proper microfluidic structures, optical and acoustic means can be used to capture and rotate cells. Furthermore, we present hydrodynamic cell trapping devices, and nano-hole-array configured microfluidic plasmonic device for cell adhesion monitoring, and impedance measurement.

Wenhui Wang, PhD

Associate Professor, Department of Precision Instrument, Tsinghua University



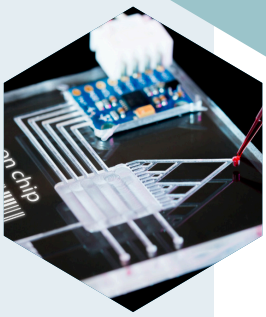
Biography: Wenhui Wang received B.E. in 1998 and M.E. in 2001 from Beijing Institute of Technology; and PhD in Mechanical Engineering from National University of Singapore (2005). He received post-doc training at University of Toronto and then joined the faculty at University of Canterbury in 2007. In 2012 he relocated to Tsinghua under the Chinese Government Young 1000-Talent Plan. His current research interests include BioMEMS and microfluidic devices and systems, aiming for bio-micro-manipulation and analysis of single cells and model organisms.

Accurately Assessing Genomic Heterogeneity In Complex Biosystems - From Bulk To Single Cells

Abstract: Biosystems are intrinsically heterogeneous. Conventional ensemble measurements heavily rely on 'average' values from multiple experimental replicates to study the quantitative difference between samples, or between conditions. However, the heterogeneity at the cellular level make such strategy impossible in many cases. Next generation sequencing technologies allow us to obtain large and informative data-set with relatively low cost and high throughput, and become the key driving force to facilitate our understanding of complex biosystems. However, prevalent methods are still problematic when handle highly heterogeneous samples because of the mix of real biological variations and technical variations or noises. I am going to present recent technology developments in my group, mostly the combination usage of microscopic imaging with microfluidics, to facilitate the approaches using next generation sequencing tools to analyze small number of cells or even single cells.

Yanyi Huang, ScD

Professor, Biomedical Pioneering Innovation Center, Peking University



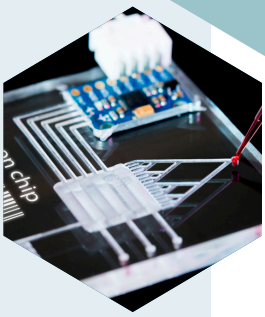
Biography: Dr. Yanyi Huang received his BS (Chemistry) and ScD (Inorganic Chemistry) degrees from Peking University in 1997 and 2002, respectively. He then conducted his postdoc research at Caltech (Applied Physics, 2002-2005) and Stanford (Bioengineering, 2005-2006). He started his independent career at Peking University in 2006 as a Principal Investigator and was promoted to Associate Professor in 2009, and Professor in 2013. He is Professor of Materials Science and Engineering, Principal Investigator in Biomedical Pioneering Innovation Center (BIOPIC), Principal Investigator in Beijing Advanced Innovation Center for Genomics (ICG), Principal Investigator in Peking-Tsinghua Center for Life Sciences, and an Adjunct Professor of Analytical Chemistry.

Effect Of Geometrical And Flow Parameters On Nanoprecipitation Of Polymeric Nanoparticles Inside Microchannels

Abstract:: Polymeric nanoparticles (NPs) are becoming more popular in diagnostics and therapeutics due to versatility of their physicochemical properties and ease of preparation through simple techniques such as nanoprecipitation. Microfluidics offers many advantages in preparation of NPs including the ability to tune particle size, reproducibility, and high throughput. In this talk I will present the effect of different geometrical and flow parameters on size and uniformity of PLGA (poly lactic-co-glycolic acid) NPs prepared inside microchannels via nanoprecipitation in a hydrodynamic flow focusing arrangement. We found that microchannel aspect ratio (H/W) and number of solvent/anti-solvent interfaces inside the microchannel significantly affect particle size. Increasing both these parameters decreases the width of the hydrodynamically focused solvent stream and, therefore, reduces mixing time. Enhanced mixing between the solvent and anti-solvent streams allows for the formation of NPs under constant solvent concentrations resulting in smaller NPs. Theoretical analysis of mass transfer by diffusion in two-dimensional flow inside a rectangular microchannel indeed confirms this effect. Further reduction in particle size can be achieved by introducing additional mixing using Dean flow in a curved microchannel. Increasing the temperature also reduced particle size because of the associated increase in the diffusion coefficient. By careful tuning of all the above-mentioned parameters, consistent achievement of NP size in the order of few tens of nanometers is possible using single-layer microfluidic devices.

Mohamed Omar Abdelgawad, PhD

Associate Professor, Department of Mechanical Engineering, College of Engineering, American University of Sharjah



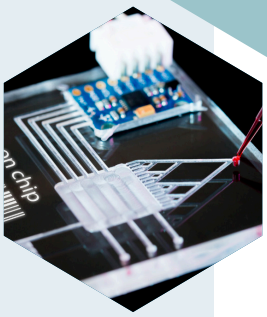
Biography: Dr. Mohamed Abdelgawad received his B.Sc. in mechanical engineering from Assiut University, Egypt, in 1998 and PhD from University of Toronto, Canada, in 2009. After receiving his PhD, Dr. Abdelgawad worked as a post-doctoral fellow with the department of Surgical Oncology at Princess Margaret Hospital in Toronto. Prior to joining the American University of Sharjah in 2018, he worked as an assistant/associate professor in Assiut University where he established the first Microfluidics Lab in Egypt. Dr. Abdelgawad's research interests include mechanical characterization of biological cells, studying sperm swimming behavior, nanoparticle synthesis using Microfluidics, and studying physics of fluid flow on the micro scale.

Human Organs-On-A-Chip: Microengineered Biomimicry Of Human Physiological Systems

Abstract: Remarkable progress in life science and technology in the past century has advanced our fundamental understanding of the human body beyond our imagination. The ever-increasing knowledge of human anatomy and biology, however, has done surprisingly little to improve the way we emulate and probe the complex inner workings of the human body. Even today, our ability to model human physiological systems relies on the century-old practice of cell culture or animal experimentation that has raised significant scientific and ethical concerns. The paucity of predictive and human-relevant model systems is emerging as a critical impediment to our scientific endeavors for a wide variety of biomedical applications. This talk will present interdisciplinary research efforts in my laboratory to develop microengineered in vitro models that can emulate the structural and functional complexity of human organs. Specifically, I will talk about i) bioinspired microsystems that mimic the alveoli and airways of the human lung during health and disease, ii) microengineering of vascularized and perfusable 3D human tissues, iii) a blinking eye-on-a-chip microdevice that emulates the ocular surface of the human eye, and iv) microengineered physiological models of human reproductive organs.

Dan Huh, PhD

Associate Professor, Department of Bioengineering, School of Engineering and Applied Science, University of Pennsylvania



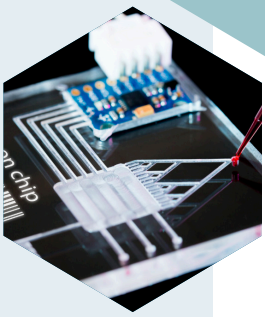
Biography: Dan Huh is an Associate Professor and Wilf Family Term Endowed Chair in the Department of Bioengineering at the University of Pennsylvania. He is a pioneer of organ-on-a-chip technology, and his research group at Penn focuses on developing microengineered models of human physiological systems for biomedical and environmental applications. Dr. Huh has won several honors and awards including the Bernard Langer Distinguished Lectureship, Lush Prize, the McPherson Distinguished Lectureship, CRI Technology Impact Award, John J. Ryan Medal, Design of the Year Award and Best Product of the Year Award from London Design Museum, NIH Director's New Innovator Award, Analytical Chemistry Young Innovator Award, TEDx Fellow, NC3Rs Annual Award, SLAS Innovation Award, Scientific Breakthrough of the Year Award from American Thoracic Society, Best Publication Award and Best Postdoctoral Award from the Society of Toxicology, Wyss Technology Development Fellowship from Harvard, Distinguished Achievement Award from Michigan, Widmer Award from microTAS, and Horace H. Rackham Predoctoral Fellowship.

Advanced Microfluidic Probes for Biomedical Applications

Abstract: The microfluidic probe (MFP) is an open space "channel-less" microfluidic system, which combines the concepts of hydrodynamic flow confinements and scanning probes. The MFP functions as a vertical probe, positioned few tens of micrometers above a substrate immersed in liquid, with injection and aspiration fluidic apertures operating in the push-pull configuration. Main advantage of the MFP lay with its simplicity in overcoming the closed channel restrictions of classical microfluidic devices. With the MFP technology, the fluidic delivery system is decoupled from the biological sample, and thus the device can work in scanning mode across the sample. This opens the door for selective cell processing and precise patterning applications with a large span of area and a high degree of flexibility. MFPs are typically composed of few parts that are manufactured by conventional photolithographic approaches and manually assembled, which limited innovation in the technology and integration with other technologies. Recently, we developed a framework of 3D printing for rapid, easy, and practical microfabrications of integrated MFPs with various multipole configurations. 3D printed MFPs were integrated with plug-and-play micro-to-macro interfaces, built-in reservoirs, hydrodynamic micromixing features, and arrays of micro-hump and micro-pin shaped electrodes. With these advanced and integrated devices, we show different applications in single cell analysis including writing on monolayers of cells, selective cell sorting and patterning, rare cell isolations, and single cell electroporations.

Mohammad A. Qasaimeh, PhD

Assistant Professor, Division of Engineering, New York University Abu Dhabi



Biography: Dr. Qasaimeh is an Assistant Professor of Mechanical and Biomedical Engineering at New York University Abu Dhabi (NYUAD), Abu Dhabi, UAE. He established the Advanced Microfluidics and Microdevices Laboratory (AMMLab) in 2014, and his current research interests include developing microfluidic and MEMS devices for clinical applications and point-of-care diagnostics. Prior to joining NYUAD, he was a Postdoctoral Research Associate at Massachusetts Institute of Technology and a Research Fellow at Harvard Medical School. Dr. Qasaimeh completed his PhD degree in Biomedical Engineering in 2013 from McGill University, where he received several prestigious fellowships and awards including the NSERC Postdoctoral Fellowship, the Alexander Graham Bell Graduate Scholarship, and the FQRNT Researchers Stars Award. Dr. Qasaimeh is actively involved in organizing several local and international conferences, participating in several journals as a reviewer and guest editor, and serving in Editorial Board Member of Scientific Reports, the Nature Publishing Group.

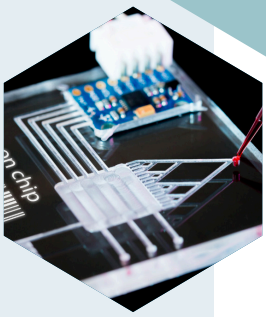
Prediction And Control Of Biological Systems Using An NN-Based Architecture

Abstract: We demonstrate the versatility of a class of artificial neural networks, called Radial Basis Function (RBF) network for applications in biology. Prediction and control of biological systems is challenging due to the presence of uncertainties and complex nonlinearities. We propose two online machine learning-based methodologies leveraging RBFs to be used to control and predict biological systems without a priori knowledge of their dynamical models nor dependency on largescale datasets. The learning capability and low computational complexity of the method makes it a promising approach to be utilized in real-time prediction and control of complex biological systems. In prediction, the satisfactory performance of the presented method is validated by applying it to experimental data from a light induced gene-regulatory network. Current work aims to implement an NN-based controller to direct cellular response in real-time.

Marcella M. Gomez, PhD

Assistant Professor, Applied Mathematics, Baskin School of Engineering, University of California Santa Cruz

Biography: Marcella Gomez is an Assistant Professor in Applied Mathematics at UCSC. Dr. Gomez completed a Ph.D. in Mechanical Engineering at the California Institute of Technology in 2015. She joined UCSC faculty following a postdoctoral research fellowship at UC Berkeley. Her research focuses on mathematical modeling, analysis, and control of biological systems.

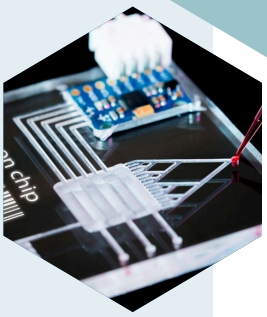


Surface Modification for Controlling Biomolecular Adsorption

Abstract: Robustly anchored thin films provide a general approach for manipulating the properties of interfaces. These films—often with molecular-scale thicknesses—can modulate the adsorptive properties of an underlying physical support. Their behavior toward biological species can be related to local details such as their structure, their composition, their hydrophilicity/hydrophibicity, and their charge. Their robustness is related to their mode of attachment and surprisingly, sometimes to their charge. On silicon substrates, siloxane (Si-O) linkages are commonly used for the attachment of molecular and polymeric films. The ability to use more chemically stable silicon-carbon linkage will be described, using both thermal and photochemical methods. Our approach has been to use these attachments as reactive centers to incorporate additional functionality. Examples include the use of surface-initiated polymerization routes (such as ATRP and ARGET) to generate non-ionic and zwitterionic thin films for use as non-fouling coatings, and for attaching receptors for biosensing. The charged surfaces show unexpected behaviors under mild aqueous conditions. For example, with a goal to provide highly wettable surfaces that could robustly avoid non-specific adsorption, we find that they can instead can serve as sites for the growth of thick silica films in PBS solutions. When used to attach ss-DNA strands for sensing, we find that their charge can accelerate silicon corrosion. Both the growth of thick silica films & the etching of silicon would only be expected under much harsher conditions.
A mechanistic understanding of these processes will be presented along with alternative approaches that provide better functional stabilities.

Paul E. Laibinis, PhD

Professor, Department of Chemical and Biomolecular Engineering, Vanderbilt University



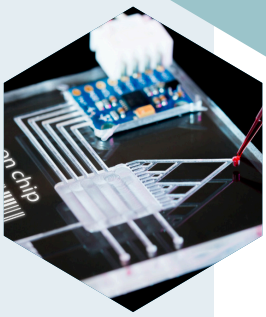
Biography: Paul Laibinis is a Professor of Chemical and Biomolecular Engineering at Vanderbilt University. His research focuses on methods of surface modification, relying heavily on methods of self-assembly, the use of thin organic films, and the determination of relationships between molecular structure and interfacial properties. He has served on the faculties of Vanderbilt, Rice University, and MIT, all in chemical engineering. He has received a Presidential Early Career Award in Science and Engineering, Young Investigator awards from the Office of Naval Research, the Beckman Foundation, and the Whitaker Foundation, a Camille Dreyfus Teacher-Scholar Award, and the Victor K. LaMer Award in Colloid and Surface Science from the American Chemical Society. He received his undergraduate degrees in chemical engineering and in chemistry from MIT, his Ph.D. in chemistry from Harvard working with George Whitesides, and was a post-doc at Caltech with Nate Lewis.

Phenotyping of Thrashing Forces Exerted by Partially Immobilized C. elegans using Elastomeric Micropillar Arrays

Abstract: As a simple model organism, C. elegans plays an important role in gaining insight into the relationship between bodily thrashing force and biological effects, such as disease and aging, or physical stimuli like touch and light. Due to the similar length scale, microfluidic chips have been extensively explored for various biological studies involving C. elegans. However, a formidable challenge still persists due to the complexity of integrating external stimuli (chemical, mechanical or optical) to free-moving worms and their subsequent imaging on chip. We used a microfluidic device to partially immobilize the worm which allows for measurement of the relative change in thrashing force under different assay conditions. Using the device adapted to a natural escape-like coiling response of the worm upon immobilization, we have quantified the relative change in thrashing force of different developmental stages (L1, L3, L4 and young adult) and in response to various glucose concentrations and drug treatment. Our findings showed loss of thrashing force due to introduction of glucose into the wild type worm culture that could be reversed upon treatment with a type-2 diabetes drug, Metformin. A morphological study of actin filaments structure of the body wall muscles provided supporting evidence for the force measurement data. Finally, we demonstrated multiplexing capability of our device by recording thrashing activities of eight worms simultaneously. Its multiplexing capability with facile imaging opens the door for high-throughput neuromuscular studies using C. elegans.

Rafael (Yong-Ak) Song, PhD

Associate Professor, Division of Engineering, New York University Abu Dhabi



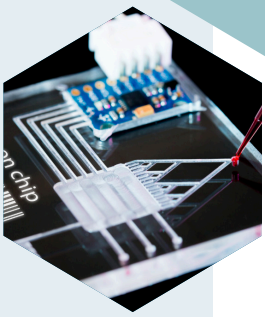
Biography: Yong-Ak (Rafael) Song is the Principal Investigator of the Micro- and Nanoscale Bioengineering Group at the New York University in Abu Dhabi (NYUAD), UAE. His research and teaching interests are interdisciplinary in both engineering disciplines such as multiscale fluid mechanics, and micro/nanofabrication, as well as in biological engineering areas such as Biosensors, Biomechanics and Bioinspiration. He received his B.S., M.S., and Ph.D. in mechanical engineering from RWTH Aachen University, Germany. He worked in the Micro/Nanofluidic BioMEMS Group in the Department of Electrical Engineering and Computer Science at MIT before joining the Division of Engineering at NYU Abu Dhabi in August 2012. Since then, he has been spearheading the research activities in microfluidics. He has received the NYU Whitehead Fellowship for Junior Faculty in Biomedical and Biological Sciences in 2014.

Understanding DNA Attraction In Divalent Ions

Abstract: Ion mediated interactions between nucleic acids helices are essential for their efficient packaging within tight spaces such as viral capsids, sperm heads, nucleosomes, and cell nuclei. Understanding the fundamental rules governing these interactions is key to design engineering tools in different length scales to achieve supramolecular architectures, leading to novel therapeutics, biosensors, and catalysis.
As of being one of the building blocks for biology and biotechnology, DNA deserves special attention. However, the underlying physical principles governing DNA-DNA interactions at the molecular level are still debatable. Here, we combine osmotic pressure experiments and all-atom molecular dynamics simulations to study the interplay between DNA conformations and the ionic environment. We investigate the role of ions in modulating DNA-DNA attraction, and we explore the conformational ensemble of Helix-Junction-Helix (HJH) DNA constructs recently used as bio-sensors. The simulations allowed computing the free energy surface and populations, providing a direct comparison between experiments and simulations. Our analysis revealed a strong correlation between the structure of the counterion atmosphere and inter-DNA interactions. Interestingly, these interactions show differences in the cation valence and DNA sequence. Together, the integrated approach offers unprecedented detail into the thermodynamics and atomic level understanding of the DNA response in different environments. We hope this information help to develop novel DNA based nanotechnology.

Serdal Kirmizialtin, PhD

Assistant Professor, Chemistry Program, New York University Abu Dhabi



Biography: Dr. Kirmizialtin received his PhD in Physical Chemistry from the University of Texas, Austin in 2007. Upon completion of his doctoral work Dr. Kirmizialtin joined to the Institute for Computational Engineering and Sciences, UT-Austin where he continued his research, first, as a postdoctoral fellow and, later, as a research associate. From 2013 to 2015 Dr. Kirmizialtin worked at the Los Alamos National Laboratories as an Associate Research Scientist in Theoretical Biology and Biophysics. In 2015 Dr. Kirmizialtin joined the NYU, Abu Dhabi faculty as assistant professor in Chemistry. Dr. Kirmizialtin's research has a strong cross-disciplinary approach and draws upon insights from physical chemistry, computational science, soft matter, enzyme actions, and biological machinery of information processing. Using theory and computer simulations, Dr. Kirmizialtin's studies investigate how physical and chemical principles can be applied to understand, predict, and manipulate the behavior of biological macromolecules.

Competition For Shared Cellular Resources Decreases The Robustness Of Toggle Switches By Pushing Them Towards Monostability

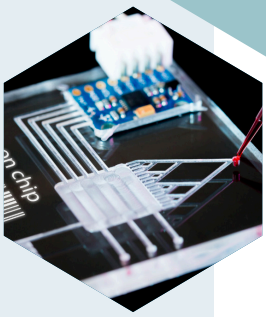
Abstract: Synthetic biology aims to engineer complex cellular systems in a modular fashion. Unfortunately, multiple factors hinder such modular design, thus the scalability of synthetic gene circuits. One major barrier emerges due to the limited availability of shared cellular resources, intertwining the behavior of otherwise disconnected components. However, as it was recently demonstrated, these effects can be accurately predicted both in vitro and in vivo by explicitly accounting for the scarcity of shared resources.

Leveraging this, here we reveal how loading due to competition affects both the robustness and the stability properties of the toggle switch, one of the most widespread genetic modules. In particular, we first show that loading decreases the robustness of the stable equilibria to noise (i.e., the frequency of random switching between stable equilibria increases). Furthermore, exceeding a critical threshold, loading renders the bistable toggle switch monostable, and any parameter asymmetry between the two repressors amplifies this effect (i.e., lowers the critical threshold). Finally, these results hold true not only in case of a standalone toggle switch, but also when multiple orthogonal switches are simultaneously deployed, thus, for instance, a collection of bistable toggle switches can surprisingly become monostable.

In addition to the mathematical analysis, we also present preliminary data supporting the underlying modeling assumptions and hence the conclusions about how competition for shared cellular resources decreases the robustness of toggle switches by pushing them towards monostability.

Andras Gyorgy, PhD

Assistant Professor, Division of Engineering, New York University Abu Dhabi



Biography: Andras Gyorgy obtained his PhD in Electrical Engineering at MIT in 2016. During his graduate studies, he focused on modularity in cellular systems blending theory with experiments in collaboration with Domitilla Del Vecchio, James J. Collins and Ron Weiss at MIT and with Richard M. Murray at Caltech. Following this, he was a postdoctoral researcher at UC Berkeley working with Murat Arcak and Adam Arkin on pattern formation and biological controller design. Since joining NYUAD in 2017, his research focuses on networked dynamical systems, for instance, on the rational forward-engineering of synthetic gene circuits, on the characterization of circuit-circuit and host-circuit interactions both in vivo and in vitro, and on optimal experiment designs.

Translational Medicine

LEAD SPEAKER

Transcatheter Treatment of Heart Disease - A Century of Innovation

Abstract: In mid-twentieth century 1 out of 3 heart attack patients died in the hospital, today less than 1 in 20 does. Valvular heart disease was a death sentence. Today we can replace a diseased heart valve with less than 1% mortality and next day send patient home walking. These incredible advances were possible thanks to dedicated researchers and innovative physicians and surgeons. In this presentation I highlight some of the critical innovations in the field of transcatheter therapeutics, some of the characteristics of the innovators and the lessons I learned. In 1929 Dr. Frossmann started the heart catheterization by a daring experiment on himself. Thirty years later Dr. Sones had the foresight to use an unintended turn of events during a heart procedure and discovered coronary angiography. 20 years later Dr. Gruntzig had the courage to apply a technique used in the safety of leg arteries to the fragile vessels of the heart starting the journey of percutaneous coronary interventions. In 1980s doctors in US, Japan and France used similar techniques in the treatment of valvular heart disease with mixed results. Dr. Cribier persevered and continue his experiments and less than a decade later replaced a heart valve without surgery, a truly revolutionary step. These and many other innovators have some common attributes. They were courageous even daring, who refuse status quo and follow their passions and dreams with incessant curiosity. Journey of innovation goes on with a new generation of innovators.

E. Murat Tuzcu, MD

Professor, Heart and Vascular Institute, Cleveland Clinic Lerner College of Medicine,
Chief Academic Officer, Cleveland Clinic Abu Dhabi

Biography: Professor E. Murat Tuzcu earned his M.D. degree at University of Istanbul in 1977 and completed cardiology training at Cleveland Clinic where he worked for 3 decades until he joined Cleveland Clinic Abu Dhabi in 2015. Currently he is the Chief Academic Officer and the Chairman of the Department of Cardiovascular Medicine and Heart and Vascular Institute. In addition to practicing as a cardiologist he has been a leading clinical investigator. He made seminal contributions to the atherosclerosis imaging. Over the last 20 years he contributed to the field of transcatheter valve repair and replacement. He published extensively and is listed among the top 1% most cited researchers in the world. He is on the editorial board of many leading cardiology journals and serves as associate editor of JACC CV Intervention. He recently completed a 5 year term on the Board of Trustees for the American College of Cardiology.

Improving Global Access to Healthcare through Digital Health

Abstract: The central paradigm in medicine is based on the patient–provider relationship, and its main business model has remained largely unchanged for thousands of years, as it demands interactions of one to one, resulting in great logistic limitations, poor access to care and no scalability. Throughout the last few decades, many new technological solutions have been implemented in medicine, yet its business model and access to care remains greatly unchanged. Digital Health represents an evolutionary adaptation of the art and science of medicine to pervasive information and communication technologies (ICTs). Without a doubt, this represents a phenomenal opportunity for us to scale access to care to any area in the world where connectivity may be available. This talk reviews the ways that healthcare has evolved and its conceivable opportunities, challenges, and socioeconomic consequences. Additionally, it provides evidence of great challenges to adopt new mindsets of Digital Health for conventional physicians.

Homero Rivas, MD, MBA

Professor of Surgery and Associate Dean of Innovation and the Future, Mohammed Bin Rashid University of Medicine and Healthcare Sciences

Biography: Dr. Homero Rivas is a Professor of Surgery, and Associate Dean of Innovation and the Future at the Mohammed Bin Rashid University of Medicine and Health Sciences in Dubai, UAE. Until recently, he was Associate Professor and the Director of Innovative Surgery at Stanford University. He has been involved in Digital Health for many years and has founded and advised many Digital Health startups. As a thought leader in Digital Health, he often collaborates with entrepreneurs and innovators from the Silicon Valley and now in the Middle East. He is strong proponent of novel technologies in healthcare such as wearables, augmented and virtual reality, telemedicine, 3D printing, drones, artificial intelligence, etc. He is a proponent of implementing design thinking in medical education. He is the author of multiple peer-reviewed journals and book chapters. He is the Co-Editor of the book "Digital Health, Scaling Healthcare to the World".

Development of Diagnostic Platform using Biomedical Engineering Techniques and its Clinical Applications

Abstract: Medical device, especially molecular diagnostic, is defined to make immediate and informed decisions about patient for earlier diagnosis and disease management in primary care, which leads potentially to improved patient's management and outcome, cost-effectiveness, and reducing health inequalities. Diagnostic devices incorporate emerging techniques including silicon bio- photonic sensors, electrodes, and solid phase reagents that enable rapid assay reaction, reducing sample and reagent volumes, ease of use, and less technical skill. Recently, we have developed two novel techniques; I) a simple and label-free enrichment via homobifunctional imidoesters using a microfluidic (SLIM) system as a sample preparation technique for pathogen and nucleic acids isolation, and II) an isothermal nucleic acids amplification/detection (iNAD) technique for the detection of biomarkers in human diseases. The SLIM is useful for simultaneous isolation of pathogen and nucleic acids (including cell free DNA) from a variety of clinical samples, including emerging infectious diseases, and human cancers. Specifically, the SLIM procedure does not require a centrifuge and has improved time efficiency (< 30 min), affordability, and sensitivity. In addition, the iNAD can be performed without labeling in real-time by utilizing both silicon microring-based solid-phase amplification and isothermal recombinase polymerase amplification (RPA) within 20 min. We demonstrated that the sensitivity of the iNAD technique was 100-times higher than those of RPA and conventional PCR methods. Therefore, an integrated device of the novel techniques will be useful for diagnosis of various human diseases with simplicity, rapidity, and low-cost.

Yong Shin, PhD

Associate Professor, Department of Convergence Medicine, College of Medicine, University of Ulsan & Asan Medical Center

Biography: Yong Shin received the Ph.D. degree in Max Planck Institute of Experimental Medicine and Georg-August-University Goettingen, Germany in 2008. Now, he is an Associate Professor at University of Ulsan College of Medicine and Asan Medical Center, Seoul, Korea. His research is now focused on development of molecular diagnostic platform based on sample preparation system and bio-photonics system for detection of disease related biomarkers in clinical applications.

Minimally Invasive Vista: Use of Magnetics in Laparoscopic Surgery

Abstract: Surgery is constantly searching for ways to improve procedural outcomes, while also increasing operating room efficiency. Magnetic Surgery (MS) has been developed to increase the benefits of Minimally Invasive Surgery (MIS) as this technology reduces the invasiveness of procedures. Laparoscopic instrumentation in combination with magnetic devices may enhance the surgeon's performance by allowing for shaft-less retraction and mobilization. The movements may generate different angles of traction and reducing the numbers of trocars during the surgeries. This concept is designed to reduce the rates of well-known complications such as incisional pain scaring, infections, bowel and vascular injuries. These expanded surgical advantages can result in better surgical procedures, better patient outcomes and overcoming the limitations of conventional surgical instruments.

Carlos Abril, MD, PhD

Consultant Surgeon, Digestive Disease Institute, Cleveland Clinic Abu Dhabi

Biography: Carlos Abril is a Spanish surgeon, specializing in MIS and Bariatric Surgery currently working at Cleveland Clinic Abu Dhabi as the Chief of the General Surgery and General Surgery Consultant. He received his Medical Doctor (MD) and Doctor of Philosophy (PhD) degrees from University of Valladolid. He completed his General Surgery Residency at the University of Valladolid. He has already authored several book chapters and peer-reviewed publications in high impact factor journals including Obesity Surgery and Surgery for Obesity and Related Diseases (SOARD). He is an active member of the American College of Surgeons (ACS), Society of American Gastrointestinal and Endoscopic Surgeons (SAGES), International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO) and American Society for Metabolic and Bariatric Surgery (ASMBS). His research interests are focused on Minimally Invasive, Bariatric, Robotic surgery and surgical endoscopy.

Precision Medicine For Treatment Of Primary Immunodeficiency Disorders

Abstract: Primary immunodeficiency disorders are a group of inherited diseases that typically present clinically with increased susceptibility to infections and in many cases also have immune dysregulation that manifest as autoimmunity. These disorders represent a range of genetically determined diseases. With the introduction of next generation sequencing, the list of genetic causes associated with Primary immunodeficiency disorders has expanded dramatically. The most commonly seen primary immunodeficiency diseases (PIDs) are due to loss of function gene mutations but recently several primary immunodeficiency disorders were shown to be associated with gain-of-function gene mutations. PIDs caused by gain-of-function mutations are usually associated with overactive cellular signaling pathways and there are potential diseases for targeted therapy to control the overactive mutation gene product. In addition to increased susceptibility to infections, gain of function associated PIDs are usually associated with immune dysregulation and autoimmune manifestations that are difficult to control by conventional therapies. From a Precision Medicine point of view targeted therapy to the specific disease causing abnormalities, instead of non-specific approach, will improve the outcome o0f disease..

Gehad ElGhazali, PhD, MD

Professor, Department of Immunology, Sheikh Khalifa Medical City, SEHA Abu Dhabi

Biography: Gehad ElGhazali, MD, Ph.D., is a Consultant and service lead Clinical Immunologist at Sheikh Khalifa Medical City (SKMC), Abu Dhabi. In addition, he is a Professor of Clinical Immunology. Prof. Dr. ElGhazali joined SKMC in 2013 coming from the King Fahad Medical City, Riyadh Saudi Arabia, where he was a consultant, chair and Professor of Clinical Immunology. He did his clinical training and worked as a Clinical Immunologist at Uppsala university hospital, and earned his PhD in Clinical Immunology from Stockholm University, Sweden (1999). He participated at several national and international conferences as a speaker or chair of sessions and he is a reviewer of papers and proposals for research grants, journals and conferences. He published more the 70 papers in international journals.

Machine Learning For The Detection Of Clinical Deterioration

Abstract: Deterioration of hospitalized patients frequently goes unrecognized, despite the widespread adoption of Early Warning Score (EWS) systems. Such systems often rely on routinely collected vital-sign data and are usually developed through heuristic or univariate methods. This talk will introduce recently developed end-to-end machine learning frameworks for the purposes of early warning systems. It will also highlight the opportunities and challenges of using multi-center electronic health records to train and evaluate such models.

Farah Shamout, PhD

Assistant Professor, Engineering Division, New York University Abu Dhabi

Biography: Farah Shamout completed her doctoral studies in Engineering Science at the University of Oxford as a Rhodes Scholar. Her research focused on developing early warning models to predict in-hospital clinical deterioration. She received her Bachelor of Science cum laude in Computer Engineering from New York University Abu Dhabi.Her current research interests include developing machine learning models to inform decision-making in healthcare, representation learning for large-scale multi-modal data, interpretability, and fairness and ethics of AI.

Biomedical Innovation: Development Of New Technologies In Academic Medicine

Abstract: New technologies have advanced surgical sciences and techniques significantly in the last decade. Improved devices and techniques allow for less invasive and more effective treatments. These advances require collaboration between clinicians, engineers, and industry to bring about new therapies. This talk will focus on identifying examples of device development and innovation in surgery that has resulted in better care for patients. Additionally, baseline steps to design and develop ideas will be reviewed and applied to clinical practice.

Matthew Kroh, MD

Chairman of the Digestive Disease Institute, Cleveland Clinic Abu Dhabi

Biography: Matthew Kroh, MD, FACS, FASMBS, FASGE is Chairman of the Digestive Disease Institute at Cleveland Clinic Abu Dhabi. Prior to coming to Cleveland Clinic Abu Dhabi, Dr. Kroh spent 14 years at Cleveland Clinic, Cleveland, Ohio. He has served as the Section Head of Surgical Endoscopy in the Department of General Surgery, the Program Director for the Advanced Laparoscopic Surgery and Flexible Surgical Endoscopy Fellowship, the Clerkship Director for Surgery in the Cleveland Clinic Lerner College of Medicine, and the Surgical Director of both the Advanced Endoscopy Center and the Esophageal Center. He has also held the position of Director of the Center for Advanced Skills Training in the Cleveland Clinic Simulation Center. He has authored more than 100 peer-reviewed articles, chapters, and textbooks. After earning a Bachelor of Science degree in biology from Boston College and Master's degree from Boston University, Dr. Kroh received his medical degree from the Mount Sinai School of Medicine of New York University. He completed his General Surgery residency at the Cleveland Clinic, Cleveland, where he also underwent fellowship training in Advanced Laparoscopic Surgery and Flexible Surgical Endoscopy. Dr. Kroh is committed to clinical excellence and patient-centered care, with a particular focus on surgical and endoscopic innovation. He is licensed by the State Medical Board of Ohio and board-certified by the American Board of Surgery. His specialty interests include advanced laparoscopic surgery, bariatric surgery, gastrointestinal surgery, surgical endoscopy, endoluminal procedures, and robotic surgery.

The Great Long Term Results With Uncertain Mechanism Of Action Of Cyanoacrylate In Venous Surgery

Abstract: We present the results of 202 consecutive cases treated by cyanoacrylate based saphenous vein obliteration with extended follow up including surveillance ultrasound. Treated segment length varied from 35 to 78 cm and diameter from 4 to 14 mm, performed through release of 0.1 ml of CA every 3 cm . Scheduled follow up was enforced, with good compliance 1 (100%),3 (100%),6 (74%), 12 (54%), 24 (41%), 36 (18%) months. Follow up included visit and venous Doppler ultrasounds evaluation, searching for persistent occlusion, recanalization or recurrent same leg reflux or varicose veins, material reabsorption status and variation of vein shape .

Results : 100% procedural success with occlusion of treated vessels 41% of patients had contemporary additional stab phlebectomies. 7 patients experienced discomfort from transient chemical thrombophlebitis treated by prolongation od anti-inflammatory therapy. Relation of phlebitis with technique and anatomy was performed and will be presented. 0% varicose vein recurrence or treatment segment recanalization, which however persistently present a circumferential shape with hyper echogenic core.

Francesco Serino, MD

Consultant Vascular Surgeon, Cleveland Clinic Abu Dhabi

Biography: Dr Serino MD graduated with honors in 1983 by the Catholic University School of Medicine in Rome and completed his surgical residency in 1987 by the Dept. of Surgery of the University of Rome “la Sapienza”. He became in 1987 Assistant professor of Surgery at the Catholic University, working in the department of Substitutive and Transplantation Surgery of the University Hospital A. Gemelli in Rome, where he started one of the first diabetic foot surgery programs in Italy. From 1989 to 1991 he was Visiting Assistant Professor at the University of Texas of Houston, working in a research and clinical transplantation program. He joined in 1997 the Vascular Surgery department and vascular Pathology Laboratory of the IDI Research Hospital in Rome and set up the endovascular program and launching the first clinical research program on therapeutic angiogenesis. In July 2014 he joined the Cleveland Clinic Abu Dhabi as Consultant Vascular Surgeon and Clinical Professor of Surgery at Lerner College of Case Western Reserve University, Cleveland OH. He is currently founder and director of the vein center at CCAD. On research side, he is Scientific Director of the Explora Research Laboratory in Rome since 2010. He was elected Associate Professor, Biomaterials and Tissue Engineering Institute, Composite and Biomedical Materials CNR National Center for Research in 2013 and served as Adjunct Professor and Visiting Professor at NTU ,School of Material Science and Engineering of Singapore in 2008-2009 and 2013-2014 . He accounted more than 4000 vascular interventions, was site principal Investigator of 12 clinical research projects, completed 230 publications and presented as faculty in 161 national or international meetings.

From Bench To Brain – Translational Research In Neurosurgery

Abstract: Like in any other research, clinical innovation should start by looking at what is needed and how can we achieve it. Do robotic applications in surgery improve outcome? If yes in what way? Is microsurgery the future or how can we overcome the obstacles in microscopic surgery? What if we know before surgery how the tumor looks like, behaves, interacts with the surgeon? Let the cells glow – does it make sense to see all tumor cells? This lectures answers some of the questions and documents recent innovation in Neurosurgery in different areas where improving quality and safety is of clinical importance.

Florian Roser, MD, PhD

Chief of the Neurological Institute, Department of Neurosurgery, Cleveland Clinic Abu Dhabi

Biography: Florian Roser, MD PhD, is Chief of the Neurological Institute at Cleveland Clinic, Abu Dhabi. Prior to joining Cleveland Clinic Abu Dhabi, Dr. Roser served as Chief of Staff in the Department of Neurosurgery and is holding the position of Full Professor of Neurosurgery at the Eberhard-Karls University of Tübingen in Germany. Additionally, he serves as Clinical Professor of Surgery at the Cleveland Clinic Lerner College of Medicine at the Case Western Reserve University in Cleveland, Ohio, US. Dr. Roser has authored over 100 peer reviewed articles and has presented more than 150 invited lectures worldwide. He currently is Editor-in-Chief of Clinical Neurology and Neurosurgery and Editor (Spine) of World Neurosurgery (both Elsevier Journals). Furthermore, Dr. Roser has received several research grants from prestigious research institutions, for basic molecular research on meningioma tissue, clinical research on diagnostics in Syringomyelia and technical innovations in surgical anatomy. Since May 2017 Dr. Roser is Adjunct Professor at Biomedical Engineering Faculty at Khalifa University, Abu Dhabi.

Circulating MicroRNA As Potential Biomarkers In Early Stage Breast Cancer In Lebanese Women

Abstract: Breast cancer is the most prevalent female cancer and has a higher incidence in young Lebanese patients as compared to the West. Interestingly, this particularity of breast cancer in the Lebanese population was not found to be associated with higher BRCA1/2 gene mutations. Hence, our research focuses on investigating molecular mechanisms and associated epigenetic signatures that underlie breast cancer in young patients. We are specifically interested in microRNA (miRNA), small noncoding RNA that are increasingly recognized as potential diagnostic and prognostic biomarkers. We have previously shown that differential expression of certain miRNA in Lebanese breast cancer tissues could be different to what is reported in the West. Hence, we assessed miRNA microarray profile expression in Lebanese breast cancer tissues, performed a comparative miRNA profile analysis with matched American samples and predicted the role of dysregulated miRNA in early breast cancer through mRNA-miRNA integration analysis. Although most of the dysregulated miRNA in Lebanese breast cancer patients are similar to that in American population, differences in miRNA expression exist and can be attributed either to the patient's age at diagnosis or to an ethnic variation. We are currently studying circulating miRNA in the blood of Lebanese breast cancer patients and a dysregulated signature will be presented. Our data provide a basis for further investigation that should be performed to comprehend dysregulated miRNA implication in breast cancer especially in young patients and the role of circulating miRNA as potential biomarkers for breast cancer early detection.

Rihab R. Nasr, PhD

Associate Professor, Department of Anatomy, Cell Biology and Physiological Sciences, Faculty of Medicine, American University of Beirut

Biography: Dr. Rihab Nasr is an Associate Professor in the department of Anatomy, Cell Biology and Physiology, the director of Basic Research Core Facilities, the director of Cancer Prevention and Control Program at the Faculty of Medicine and founding director of AMALOUNA at the American University of Beirut. Dr. Nasr received her PhD in Fundamental basis of oncogenesis from Paris VII University, France. Her major research activities focus on cancer biology and therapeutics and have culminated in more than 55 articles, many in leading scientific journals. Dr. Nasr received the Best Biomedical research award from Qatar Foundation in 2011 and was selected as one of the seven top Arab Women by Sayidati magazine in 2013. She also received UNESCO the L'Oreal "For women in Science" Levant and Egypt fellowship in 2014 and the Franco-Lebanese Scientific Excellence award by the Legion of Honor in Lebanon and the French Institute in 2015.

Machine Learning And AI In Molecular Diagnostics And Clinical Management Of Cancer

Abstract: Molecular diagnostics of cancer has undergone a revolution driven by development of high throughput molecular techniques. It is increasingly recognized that malignant tumors previously considered a single entity are in fact composed of multiple different entities that vary in their molecular genetics, underlying biology and most importantly clinical outcome. Integration of omic- and clinical data into practical classification schemes requires novel machine learning approaches to manage big data in a clinically reasonable turnaround time. Accurate molecular classification will make future clinical trials more informative and lead to development of novel therapeutic strategies. While highly informative, advanced molecular testing is expensive and not widely available. We have developed novel methods to predict mutations directly from histopathological slides using artificial intelligence (AI) and image analysis. Mutations in various genes including EGFR, STK11, and BRAF can be predicted with high accuracy by the analysis of the H&E slide image, which is a standard stain in pathology laboratories across the world. Mutational prediction by AI provides a rapid low-cost method to screen patients for potentially targetable mutations in cancer. Cloud based AI mutational predictors could also bring molecular diagnostics to remote or medically underserved areas.

Matija Snuderl, MD

Associate Professor, Director of Molecular Pathology and Diagnostics, Department of Pathology, School of Medicine, New York University

Biography: Since medical school, I developed a passion for analyzing disease, specifically cancer. This led me to specialize in neuropathology, the study of nervous system diseases. As a neuropathologist at NYU Langone, I diagnose brain tumors and other brain diseases in children and adults. As director of molecular pathology, I oversee molecular and genomic profiling, a laboratory method that allows our team to accurately diagnose all types of brain tumors. My clinical research focuses on identifying novel biomarkers for diagnosis and therapy. My laboratory at NYU Langone studies cancer genetics, genetic heterogeneity and epigenetics and examines the molecular differences between tumors at the cellular level. Our team discovered several novel molecularly defined subtypes of brain tumors and contributed to the development of DNA methylation–based classification of brain tumors, an approach that uses machine learning and epigenetic signatures to more effectively diagnose brain tumors. Our laboratory is the first in the United States to provide this test to people with brain tumors. I am a member of several professional societies, including the American Association for the Advancement of Science and the American Association of Neuropathologists. I also received the Lucien Rubinstein Award for my research in neuro-oncology.

Biomedical and Clinical Imaging

PLENARY SPEAKER

Seeing The Invisible – Optical Coherence Tomography In Medicine

Abstract: In the last 30 years optical coherence tomography (OCT) has established itself as a novel, unique non-invasive, optical medical diagnostic imaging modality, enabling unprecedented in vivo 'visualization of the invisible', i.e. the visualization of internal tissue structure in a variety of biological systems that cannot be seen with the naked eye. Imaging the eye has been the most successful and commercially most active medical field for OCT so far, but several other OCT applications, e.g. in the heart, internal organs, brain or skin are also extremely promising. In addition, improved versions of OCT and combination with other optical imaging techniques are under development that provide information about the function of tissue as well as molecular and chemical information of the investigated tissue which are on the verge of significantly improving diagnosis and therapy control in medicine.

Wolfgang Drexler, PhD

Professor, Center for Medical Physics and Biomedical Engineering, Medical University Vienna

Biography: Wolfgang Drexler, PhD, is a Professor of Medical Physics and the Head of the Center for Medical Physics and Biomedical Engineering at the Medical University of Vienna, Vienna, Austria. He spent 2 years at the Massachusetts Institute of Technology, Cambridge, MA, USA. Prior to his current position, Dr. Drexler was a Professor of Biomedical Imaging at Cardiff University, Wales, UK. Dr. Drexler's main research area is the establishment of a novel generation of optical imaging platforms with the potential to revolutionise fundamental biological research as well as medical diagnosis. Dr. Drexler has authored >190 peer-reviewed publications and >600 conference proceedings or abstracts. He is or has previously held positions as editor or co-editor of 12 books, including 2 editions of Optical Coherence Tomography: Technology and Applications. In addition, he has given >250 invited or keynote presentations since 2000 and accomplished € 16 million research grant income since 2000.

LEAD SPEAKER

Evaluating Myelin Integrity In The Optic Nerve With Myelin Shift MRI

Abstract: We developed a bio-inspired non-invasive imaging technology, "myelin SHIFT MRI" (myelin signal hierarchically isolated as a function of time-to-echo in MR imaging), to obtain MR signatures of myelin-related degeneration in vivo and generate brain maps based on the organization of myelin ultrastructure (Wolfe, et al., 2019). The method combines ultra-short multi-echo T2* contrast, animal models of myelin depletion and toxicity, analytical solution of the relaxation signal in full k-space, and amplified image reconstruction of myelin integrity maps. The enhanced maps show red-SHIFT in regions with degenerated myelin sheaths (0<SHIFT index <1) and blue-SHIFT (SHIFT index > 4) in regions with compact myelin sheaths such as new myelination. In a rodent spinal cord injury model, SHIFT indices between 3 and 4 reflected radial detachment of myelin membranes from axons in axolemma degeneration. In humans, myelin SHIFT maps correlated with known white matter anatomy, and revealed sub-compartments of cortex where cortical and subcortical fiber tracts connect. In addition, an evaluation of tract-specific myelin integrity by SHIFT MRI has revealed weakened cortical connections between regions specialized in complex reasoning and executive functions in aging. Here we evaluated myelin integrity, fractional anisotropy (FA) and radial diffusivity (RD) of the optic nerve of 59 subjects from 20 to 90 years old. We found that both myelin integrity by SHIFT MRI and FA significantly declined with age, although RD did not. Whereas FA is a less specific summary measure of microstructural integrity, myelin integrity obtained from SHIFT MRI revealed an age-related neural decline.

Zhong-Lin Lu, PhD

Professor, Division of Arts and Sciences, New York University Shanghai

Biography: Zhong-Lin Lu is NYU Shanghai's Chief Scientist and Associate Provost for Sciences. He also leads the NYU-ECNU Institute of Brain and Cognitive Science at NYU Shanghai. Lu joined NYU Shanghai in 2019 from OSU, where he was the College of Arts and Sciences Distinguished Professor of Psychology, Professor of Psychology, Optometry, and Translational Data Analytics, and Director of the Center for Cognitive and Brain Sciences and the Center for Cognitive and Behavioral Brain Imaging. Lu is a co-founder of Adaptive Sensory Technology, Inc., a company that is devoted to transforming eye care with precision measurement. He is also a fellow of the Society of Experimental Psychologists and the Association for Psychological Science. A physicist by training, Lu obtained a B.S. in theoretical physics from the University of Science and Technology of China in 1989, and earned his Ph.D. in physics at NYU in 1992.

New Technology for Glaucoma Assessment – Visible Light Optical Coherence Tomography

Abstract: Visible light Optical Coherence Tomography (Vis-OCT) retinal oximetry technology, which provides in vivo and noninvasive information on retinal oxygen consumption both globally and locally, enables novel functional metrics for measurement and basic understanding of glaucomatous tissue damage.

Joel S. Schuman, MD

Professor, Department of Ophthalmology, School of Medicine, New York University

Functional imaging of hemodynamic parameters is an invaluable supplement to anatomical OCT imaging. Because the neural retina has a high metabolic demand, retinal hemodynamics can be an excellent biomarker for retinal diseases, including glaucoma. Oxygen saturation (sO2) difference between the arterial and venous blood vessels indicates oxygen extraction from the circulation. By taking advantage of characteristic differences in light absorption between oxy- and deoxy-hemoglobin at specific wavelengths, Vis-OCT is capable of quantifying sO2 in retinal vessels. The entire spectrum of the Vis-OCT signal is divided into 15nm wide sub-bands to calculate sO2 for each axial scan line. Then, cross-sectional images are generated in each sub-band to form the basis of spectroscopic analysis using short-time Fourier Transform (STFT).
When the OCT probing light is reflected back by scatterers as it passes through the blood vessel, its spectral profile carries different signatures from light reflected by retinal tissues. These spectral signatures are correlated with optical scattering and optical absorption of both oxy- and deoxy-hemoglobin, which can be extracted by spectroscopic analysis. Because oxy- and deoxy-hemoglobin have distinct spectra, the extracted spectral profiles to estimate sO2 can be fit in small animals and humans. Although STFT reduces the axial resolution to ~6 μm (~1 μm at full bandwidth), it is comparable to modern clinical OCTs and sufficient for spectral analysis. Vis-OCT measurements were also calibrated by imaging ex vivo blood samples at different sO2 levels and comparing the measurements with blood gas analyzer measurements. Vis-OCT can accurately perform spectroscopic analysis with a high axial resolution from a particular retinal region of interest, making it superior to other methods for sO2 quantification that rely on diffusive fundus reflectance.

Biography: Joel S. Schuman, MD, FACS is Director of the NYU Langone Eye Center, Professor and Chairman of Ophthalmology and Professor of Neuroscience and Physiology at NYU Langone Medical Center, NYU School of Medicine, Professor of Biomedical, Electrical & Computer Engineering at NYU Tandon School of Engineering and Professor of Neural Science at the Center for Neural Science at NYU. Prior to arriving at NYU in 2016, he was Distinguished Professor and Chairman of Ophthalmology at the University of Pittsburgh School of Medicine and Director of the UPMC Eye Center.

Machine Learning For Medical Image Processing

Abstract: In this talk, I will describe several research projects in my lab in using deep learning networks for medical image processing, including segmentation of high frequency ultrasound images of mouse embryos, prediction of mild traumatic brain injury (concussion) from diffusion MR images, and understanding of interactions across brain regions during cognitive tasks from ECoG recordings of human cortex

Yao Wang, PhD

Professor, Department of Electrical and Computer Engineering, Tandon School of Engineering, New York University

Biography: Yao Wang received the B.S. and M.S. degrees in Electronic Engineering from Tsinghua University, Beijing, China, in 1983 and 1985, respectively, and the Ph.D. degree in Electrical and Computer Engineering from University of California at Santa Barbara in 1990. Since 1990, she has been on the faculty of Tandon School of Engineering of New York University (formerly Polytechnic University, Brooklyn, NY). She currently holds joint appointment in Dept. of Electrical and Computer Engineering and Biomedical Engineering, and has an affiliated appointment with the Department of Radiology in NYU School of Medicine. She is also Associate Dean for Faculty Affairs for Tandon since June 2019. Her research areas include video coding and streaming, multimedia signal processing, computer vision, and medical imaging. She is the leading author of a textbook titled Video Processing and Communications, and has published over 250 papers in journals and conference proceedings. She has served as an Associate Editor for IEEE Transactions on Multimedia and IEEE Transactions on Circuits and Systems for Video Technology. She received New York City Mayor's Award for Excellence in Science and Technology in the Young Investigator Category in year 2000. She was elected Fellow of the IEEE in 2004 for contributions to video processing and communications. She received the IEEE Communications Society Leonard G. Abraham Prize Paper Award in the Field of Communications Systems in 2004, and the IEEE Communications Society Multimedia Communication Technical Committee Best Paper Award in 2011. She was a keynote speaker at the 2010 International Packet Video Workshop, at INFOCOM Workshop on Contemporary Video in 2014, and at the 2018 Picture Coding Symposium. She received the NYU Tandon Distinguished Teacher Award in 2016.

Time Will Tell: Trajectories of Growth and Disease Progression from Spatiotemporal Analysis of Longitudinal Imaging

Abstract: Clinical assessment routinely uses terms such as development, follow-up, aging, degeneration, disease progression, recovery, or prediction. This suggests the use of a longitudinal design with repeated image acquisitions of individuals over time. Longitudinal image analysis is then applied to understand how anatomical structures or organ function changes over time, in response to biological processes including growth, aging, or disease. Image processing of temporal series of 3-D data embedding time-varying anatomical objects or functional measures requires new analysis methods and tools that make use of the inherent correlation and causality of repeated same subject image acquisitions. This talk will discuss progress in the development of advanced 4-D image and shape analysis methodologies that carry the notion of linear and nonlinear regression, now applied to complex, high-dimensional data such as images, image-derived shapes and structures, or a combination thereof.

James Fishbaugh, PhD

Research Assistant Professor, Department of Computer Science and Engineering, Tandon School of Engineering, New York University

Biography: James Fishbaugh is a Research Assistant Professor in the Department of Computer Science and Engineering at NYU Tandon School of Engineering. He received his PhD in Computing: Medical Image Analysis from the University of Utah in 2015. His research is primarily focused on statistical shape analysis, working together with clinicians to better understand dynamic processes such as childhood development and disease progression.

Detecting Undiagnosed Eye Disease using Mobile, Real-Time Teleophthalmology in At-Risk Populations

Abstract: Purpose: This pilot study examined the benefits and feasibility of a mobile, real-time, community-based, teleophthalmology program in high risk & low socioeconomic communities of NYC .
Design: Cross-sectional study. Participants: Individuals ≥18 years of age who desired a general eye screening examination.
Methods: Between 2017-2018, a Wi-Fi–equipped teleophthalmology van toured neighborhoods of NYC. An ocular technician screened study participants, and transmitted the data to the Eye Institute, where an ophthalmologist or optometrist assessed the data in real time and video-conferenced with participants to give recommendations for follow-up care. Main Outcome Measure: Percentage of participants with previously undetected chronic eye disease.
Results: Of 957 adults screened. 33% of the participants had not had an eye examination within the past 2 years, and 6% had never had an eye examination. A sight-threatening eye disease or condition was newly detected in 490 (51%) of the participants: glaucoma suspect, 254 (52%); cataract, 124 (25%); diabetic retinopathy, 29 (6%). Approximately half of the participants diagnosed with eye diseases had an in-person visit with an eye care professional when our staff followed up by phone 2 to 4 months after screening. Eye diseases or conditions detected at screening were confirmed during follow-up and the accuracy ranged from 23% for glaucoma and 1% for angle closure glaucoma. Participants that required treatment ranged from none for diabetic retinopathy and macular degeneration to 14% for cataracts.
Conclusions: Mobile, real-time teleophthalmology was feasible in this urban population and was effective in identifying previously undiagnosed eye diseases and conditions.

Lama A. Al-Aswad, MD

Professor, NYU Langone Eye Center, School of Medicine, New York University

Biography: Lama A. Al-Aswad, MD, MPH is ophthalmologist with subspecialty in glaucoma and cataract with a strong interest in disease prevention and population health management. She professor of ophthalmology and the Vice Chair of Innovations and the Director of Teleophthalmology and Artificial Intelligence. She received her medical degree from Damascus University Medical School and completed her glaucoma research fellowship at the Mass Eye and Ear Infirmary, Harvard Medical School. Subsequently, she completed her residency in ophthalmology at the SUNY Downstate and her glaucoma fellowship at the University of Tennessee. In 2015, Dr. Al-Aswad conferred the degree of Masters of Public Health from Columbia University, Mailman School of Public Health for her work in healthcare policy and management. Dr. Al-Aswad, is the past president of the NY Glaucoma Society and the Women in Ophthalmology. She currently holds an appointment with the FDA as a voting member on the ophthalmic device panel.

Artificial Intelligence in Glaucoma

Abstract: Glaucoma is the second cause of blindness worldwide. Due to the complicated non-linear relationships between structural and functional assessment outcomes together with the large variabilities of disease progression patterns, accurate and reliable clinical assessment is a paramount importance for this slow but irreversible progressing disease. Recent advances in medical applications of artificial intelligence, especially deep learning (DL) approaches, have opened up unprecedented possibilities in computer aided clinical care. I will discuss a variety of DL studies on our large longitudinal glaucoma cohort data in collaborating IBM Watson Research Team. The topics include: 1) estimation of visual field parameters out of raw 3D optical coherence tomography (OCT) image data using a feature agnostic data driven approach, 2) forecasting functional measurements out of clinically available demographic information augmented by OCT feature analysis, 3) generating future 2D biomarker color mapping on OCT image data, and 4) identifying novel biomarkers and exploration of structure-function relationships using a group class activation mapping technique.

Hiroshi Ishikawa, MD

Professor, Department of Ophthalmology, School of Medicine, New York University

Biography: In 1989, Dr. Ishikawa completed medical school at Mie University School of Medicine (Mie, Japan). After completion of glaucoma fellowship in Japan, he became a glaucoma research fellow under Dr. Robert Ritch at New York Eye & Ear Infirmary. He won The David Warfield Fellowship in Ophthalmology of The New York Community Trust and The New York Academy of Medicine in 1997. He was appointed as an Assistant Professor of Ophthalmology at New York Medical College in 1998, at Tufts University in 2002, and at University of Pittsburgh in 2003. He is currently Professor of Ophthalmology at New York University. His research revolves around ocular imaging and processing. His research yielded 19 intellectual properties; 9 US patents allowed, 2 US patents pending, and 8 copy rights. He is recognized as the first inventor of the detailed macular retinal layer segmentation of OCT images.

Vascular Optical Tomographic Imaging of Peripheral Artery Disease In Patients with Diabetic Foot Syndrome

Abstract: We have developed an optical imaging technology that can be employed to diagnose and monitor peripheral artery disease (PAD). PAD is an obstructive atherosclerotic disease in the lower extremities caused by plaque accumulation. It is one of the major complications in diabetic patients and strongly associated with cardiovascular diseases, strokes, and poor quality of life. The disease affects approximately 12 million people in the US and is the leading cause of low-extremity amputations. Mideastern countries have seen a considerable increase in PAD and diabetic foot syndrome. For example, the prevalence of diabetes in the Jordanian population over 60 rose from 24.5% in 1994 to 53% in 2017. The lifetime risk of a diabetic person to develop a foot ulcer in the Middle East is about 25%. Yet currently available methods to diagnose and assess the disease are often unreliable and expensive. Our low-cost vascular optical tomographic imaging system (VOTIS) uses near-infrared light to probe the hemodynamics of the foot. Reflected and transmitted light intensities are recorded at multiple location surrounding the foot. This data then becomes input into an image reconstruction algorithm that generates 3 dimensional maps of oxy, deoxy, and total hemoglobin, and related parameters. We report on results from a 40-subject diagnostic study as well as an ongoing clinical monitoring study. In it, we gather data over a 9 -month period from 100 patients that undergo an endovascular intervention. There is strong evidence that the VOTIS system can diagnose PAD and predict wound healing with high accuracy.

Andreas H. Hielscher, PhD

Professor, Department of Biomedical Engineering, Columbia University

Biography: Andreas H. Hielscher received his PhD degree in Electrical and Computer Engineering from Rice University, Houston, Texas, in 1995. After spending 2 years as Postdoctoral Fellow at the Los Alamos National Laboratory in New Mexico, he joined the faculty at the State University of New York Downstate Medical Center in Brooklyn, New York. In 2001 he moved to Columbia University in New York, where he is now the Director of the Biophotonics and Optical Radiology Laboratory. He holds appointments as Full Professor in the Departments of Biomedical Engineering, Electrical Engineering and Radiology. Dr. Hielscher's work focuses on the development of state-of-the-art systems for optical tomography. He applies this emerging medical imaging technology to diagnose and monitor arthritis, vascular diseases, breast cancer and early childhood cancer. He has published over 200 scientific articles and was recently elected to the College of Fellows of the American Institute for Medical and Biological Engineering.

Imaging of the larynx: What is next?

Abstract: Accurate imaging plays an important role in the early diagnosis of malignancies of the larynx. The evolution of high-definition imaging has helped tremendously in the proper identification of laryngeal pathologies; however, that alone is not enough. Special imaging modalities, such as contact endoscopy, narrow band imaging, videostroboscopy, high-speed videoendoscopy, and optical coherence tomography are some that have been used for the identification of both premalignant and malignant conditions, but some lack practicality and are, therefore, used only for research purposes. This presentation aims to bring light to the existing imaging modalities, and to identify future trends. It also aims to propose areas of improvement that will facilitate training among young laryngologists.

Anastasios Hantzakos, MD, PhD

Consultant Head & Neck Surgeon, Director of the Voice Clinic, Cleveland Clinic Abu Dhabi

Biography: Dr. Hantzakos is a Consultant Otolaryngologist – Head & Neck Surgeon and the director of the Voice Clinic at Cleveland Clinic Abu Dhabi. He served as a Consultant at the 1st Department of Otorhinolaryngology – Head & Neck Surgery (AORL) of the National & Kapodistrian University of Athens (NKUA) in Athens, Greece. He received his Medical Degree in 1991 from the NKUA. He completed his basic surgical training at Emory University in Atlanta, USA, and received his Specialist Certification in Otorhinolaryngology from the AORL. He received additional training as a Senior Registrar in the East Anglia Deanery Training. He has obtained a fellowship in Phonosurgery and Laryngeal Laser Surgery in 2006 from the Department of Otorhinolaryngology – Head & Neck Surgery of the University of Louvain at Mont-Godinne University Hospital in Belgium. Dr. Hantzakos holds a Ph.D and a Master's degree in Health Administration. He is also appointed as Clinical Assistant Professor of Surgery at the Cleveland Clinic Lerner College of Medicine of Case Western Reserve University, Cleveland, USA, since 2016.

Integrating Advanced MRI-Derived Biomarkers in the UAE Healthy Future Study

Abstract: Despite its relatively young population, epidemiological studies in UAE nationals reported high incidence of diabetes mellitus (DM) and cardiovascular diseases (CVD). DM and CVD are strongly associated with brain atrophy, hypometabolism, cognitive decline, and an increased risk of developing Alzheimer's disease. The UAE Healthy Future Study (UAE-HFS) is a prospective cohort study of 20,000 UAE nationals aged 18-40 years that aims to determine how their health is affected by their lifestyle, environment and genes. In this project, quantitative multi-modal and multi-organ MRI will be used to generate imaging-derived biomarkers in the brain using structural, diffusion, resting state functional MRI, cerebral blood flow as well as abdominal (visceral) fat measurements. Our methods will allow the study of imaging-derived biomarkers in tandem with non-imaging phenotyping and genotyping, including baseline questionnaires and physical measures, as well as stored blood and urine samples that allow different types of assay (e.g. genetic, epigenetic, proteomic, metabolomic, biochemical, hematologic, microbiome, etc.). Integration of imaging data from one part of the body (e.g. brain) with other parts (e.g. visceral fat) as well as non-imaging data would support a unique approach to the investigation of biological mechanisms of common disease in the UAE nationals. The inclusion of imaging-derived biomarkers in the UAE-HFS is both transformative and paradigm shifting, because imaging measures quantitatively define phenotypes that are closely related to disease, providing substantial power for detecting associations with incident health outcomes occurring during follow-up for UAE nationals. Initial optimization studies will be presented from the proposed acquisition and processing pipeline.

Osama Abdullah, PhD

MRI Physicist, Core Technologies Platforms, New York University Abu Dhabi

Biography: Osama Abdullah currently works as the MRI Physicist in the Core Technology Platforms at New York University Abu Dhabi leading the development of the first research dedicated brain MRI facility in the Middle East. Osama's research interests focus on developing noninvasive imaging biomarkers in animals and humans, which resulted in more than 17 peer-reviewed publications, several dozens of conference abstracts, and one book chapter. Osama received his BSc. in Electrical Engineering from University of Jordan, MSc in Bioengineering from University of Illinois at Chicago, and PhD in Bioengineering from University of Utah. He received two merit awards from the Society for Magnetic Resonance in Medicine for his work on modeling vascular flow and myocardial growth with diffusion MRI (2013 and 2016).

Effect of Social Stress on Circadian Rhythms and Sleep-Wake Cycle

Abstract: Though it is known that daily rhythms are disrupted in patients suffering from mood disorders, the molecular mechanisms linking aberration in circadian / sleep rhythms and mood disorders is still not well understood. Observations that brain regions associated with mood regulation have robust neural connections, and overlapping molecular pathways, with regions that regulate biological rhythms suggest that there is a functional role of these pathways in integrating mood and biological rhythms. We are using a combination of a rodent behavioural model of stress together with electrophysiological and molecular approaches to investigate changes in physiological and molecular dynamics between brain regions that encode mood, circadian rhythms and sleep/wake cycle mice that are resilient and susceptible to chronic social stress.

Dipesh Chaudhury, PhD

Assistant Professor, Biology, Division of Science, New York University Abu Dhabi

Biography: I am interested in understanding pathophysiological changes in neural circuit functions that lead to mood disorders and the associated changes in circadian rhythms and sleep-wake cycle. I received my bachelor's degree from the University of London (UK) and PhD from the Open University (UK) under the supervision of Prof. Steven Rose. I have has held various post-doctoral and associate scientist positions at UCLA (USA), CNRS in Marseille (France), Cornell University (USA) and Mount Sinai School of Medicine (USA). In Spring 2015 I joined the Biology faculty of NYU Abu Dhabi. My lab in NYUAD uses a multidisciplinary approach combining rodent behavioural models of stress, optogenetics, in vitro and in vivo electrophysiology, viral tracing, pharmacology, imaging and molecular techniques to systematically investigate functional changes in cellular and molecular mechanism in neural circuits connecting the circadian and sleep/wake centers of the brain to regions associated with mood regulation.

Focal Interfacing With The Heterogeneous Brain

Abstract: The brain is an extremely heterogeneous organ where cell types and functions vary on scales from sub-millimeters to centimeters. This heterogeneity presents a major obstacle for targeted modulation and interrogation of specific brain structures. Many neuropsychiatric disorders arise from pathologic signaling from a single brain region. Patients often fail to respond to oral medication therapy due to poor control over biodistribution of medication, and off-target effects. This talk will describe a microinvasive toolkit for high spatial and temporal resolution targeting of neural structures. This toolkit includes modular multi-modal probes, steerable microneedles, electrodes for simultaneous recording and marking, as well as a computational framework for multi-point targeting of irregular brain structures. These developments could enable localized nervous system modulation approaches for more efficacious treatment of neurologic and neuropsychiatric disorders.

Khalil Ramadi, PhD

Postdoctoral fellow, Department of Mechanical Engineering, MIT, Brigham and Women's Hospital, Assistant Professor of Engineering, New York University Abu Dhabi

Biography: Dr. Ramadi is a Postdoctoral fellow in Mechanical Engineering at MIT and Brigham and Women's Hospital, Harvard Medical School. His research interests center around novel technologies for targeted and improved drug delivery. His work has been published in Science Translational Medicine, PNAS, and IEEE Journal of Translational Engineering in Health and Medicine. He has received multiple honors including the MRS Silver Graduate Student Award, Stanford Medicine X Healthcare Design Award, MIT IDEAS Global Challenge award, and a NASA Aeronautics Scholarship. Khalil served as director of MIT Hacking Medicine, a student group dedicated to enhancing healthcare entrepreneurship, and was named a MIT Sandbox Innovation Fellow and Faculty Mentor of the MIT IDEA2 incubator. He holds a PhD in Biomedical Engineering and Medical Physics from MIT, M.S. in Mechanical Engineering from MIT, and B.S. in Mechanical Engineering and Bioengineering from the Pennsylvania State University. In fall 2020, he will join the faculty of engineering at New York University Abu Dhabi.

Public Health

LEAD SPEAKER

Physical Activity And Metabolic Disease: An Epidemiological Perspective

Abstract: Prevalence of non-communicable diseases is increasing worldwide and lifestyle factors such as habitual physical activity are thought to play a crucial role in prevention. From a thermodynamic perspective, it appears almost trivial to explain the global obesity pandemic as an imbalance between energy intake and expenditure. Yet, issues of measuring physical activity at population level leave major uncertainties in our understanding of the scale of the problem, ie the prevalence, and the dose-response relationships between physical activity exposures and disease traits, including whether these relationships are the same in all populations. In this talk, I will highlight how advances in measurement methodology and the implementation of these in large-scale studies are transforming our understanding of the composition of human energy expenditure, its distribution in the population, and its relationship to metabolic disease traits in diverse populations.

Soren Brage, PhD

Programme Leader, MRC Epidemiology Unit, University of Cambridge

Biography: I lead the Physical Activity Epidemiology Programme in the MRC Epidemiology Unit. We focus on the development of methods for assessing physical activity and fitness in population studies, the descriptive epidemiology of these traits, and their association with metabolic disease outcomes. We designed the two enhancement packages in the UK Biobank project which introduced objective assessment of physical activity and fitness in 100,000 participants and have led efforts to turn these measures into summary variables which have epidemiological utility. We are setting up similar studies in Africa, Asia, and the Middle-East and supporting the WHO to incorporate objective measurement of physical activity into routine global surveillance systems for non-communicable diseases.

Diabetes and Obesity in the Middle East: Challenges and Opportunities

Abstract: Upon completion of this activity you will be able to understand the:

- Factors contributing to the rising prevalence of diabetes and obesity in the Middle East.
- The relationship between diabetes and obesity.
- The opportunities for reducing the burden of diabetes and obesity in the Middle East.

Hussein F. Saadi, MD

Clinical Professor of Medicine, Chair of Medical Subspecialties Institute, Cleveland Clinic Abu Dhabi

Biography: Dr. Saadi earned his medical degree from the American University of Beirut in 1985. He subsequently trained in Internal Medicine and Endocrinology at Case Western Reserve University in Cleveland, Ohio. He is currently the Chair of the Medical Subspecialties Institute of Cleveland Clinic Abu Dhabi and Clinical Professor of Medicine at Cleveland Clinic, Ohio. Dr. Saadi has over 100 publications including peer-reviewed articles, abstracts, letters, and book chapters and has presented his work at several international meetings. He is a recipient of several awards for his distinguished performance in Research, Education and Clinical Service. He was elected to membership of the Alpha Omega Alpha Honor Medical Society (AOA) at American University of Beirut School of Medicine in 2015. He was also selected as the 2016 recipient of the American Association of Clinical Endocrinologist Gulf Chapter Ibn Sina Distinguished Service Award in recognition of his outstanding contribution to the field of diabetes and endocrinology.

An Eight-Year Population-Based Study Of The Glycemic Status Of Women During Pregnancy

Abstract: Women with GDM are likely future candidates for developing diabetes when they are not pregnant. However, a sizable proportion of women convert to DM; but not all. This study aim to assess the outcome of women who experienced GDM to develop DM, later in life. The study considered a cohort of 7463 Emirati and expatriate women who delivered during January-December 2007, in Latifa hospital, Dubai UAE, and their glycemic status was assessed in 2007 and again in 2016. IADPSG glycemic criteria (2010) were employed, using routine OGTT testing. In the cohort of Emirati pregnant women (n=4660), using the IADPSG criteria, hyperglycemia during pregnancy rose from 13% to 28% in 8 years. DM rose from 1.4% to 5%; while GDM rose from 11.7% to 23%. Similar results were obtained in expatriate women. In conclusion, the rate of change [(new-old)/old] during a span of 8 years, in FBG levels in both the Emirati and Expatriate cohorts was 3.4-4.9 times; while change in PPBG level was negligible during the same 8-year period. Most patients with abnormal FBG converted to DM in a span of 8 years, in contrast to those with abnormal PPBG.

Riad Bayoumi, PhD, MD

Professor, Basic Medical Sciences
Mohammed Bin Rashid University of Medicine and Health Sciences

Biography: Riad A.L. Bayoumi was educated in Khartoum and the UK. He obtained his Medical Degree (MB BS) in 1967, his PhD (Biochemistry) in 1973, his MRCPath (Clinical Biochemistry) in 1975 and FRCPath in 1995. He is currently Professor of Basic Medical Sciences in Mohammed Bin Rashid University of Medicine and Health Sciences, Dubai Healthcare City, Dubai, UAE. His previous positions included: Assistant, Associate and Full Professor at the University of Khartoum, Sudan from 1977-91; Professor of Biochemistry at United Arab Emirates University from 1991-98. Head of Clinical Biochemistry in the College of Medicine at Sultan Qaboos University in Muscat, Oman from 1998-2014. He has made important contributions to human genetics research in the Sudan, UAE and Oman. In the study of genetic diseases, he was instrumental in mapping of Joubert Syndrome, Hereditary Spastic Paraplegia and Multiple Epiphyseal Dysplasia. He is currently involved in the study of genetic susceptibility to obesity, diabetes mellitus and the evolution of lactase persistence among large extended Arab pedigrees. Professor Bayoumi also has extensive academic and administrative experience in medical education and accreditation of institutions of higher education.

Machine Learning Of Wearable Sensor Data For The Early Detection Of Disease

Abstract: Most people with cardiovascular and many other health problems are identified too late. This means lost opportunities for prevention and unpredictable presentations with advanced complications such as heart attack, heart failure or death; even though the underlying disease develops over many years. Risk prediction models are typically used in primary care, but in the case of cardiovascular medicine 50% of events are in patients not classified as high-risk by these models. For the early detection of cardiovascular and other diseases, there is a need to augment in-clinic measures with other inexpensive measures of health status in patients' everyday lives. In this talk I will share my groups work on wearable sensors such as wrist-worn activity trackers which can continuously, and objectively, measure health status in patients' everyday lives. We have worked closely with UK Biobank to carefully develop machine learning methods to measure physical activity, sleep, and circadian rhythm status in over 100,000 participants who agreed to wear a wrist-worn accelerometer for seven days. Our measures are now actively used by health researchers worldwide to demonstrate cross-sectional associations between sensor-measured physical activity and over 50 chronic diseases. We have also conducted genetic discovery, finding 14 loci associated with device measured sleep and physical activity in a genome wise association study (GWAS). The growing availability of wearable sensors has led the FDA Clinical Trials Transformation Initiative to develop a set of guidelines on the use of wearable sensors in clinical trials, which I will discuss.

Aiden Doherty, PhD

Group Leader, Big Data Institute, Nuffield Department of Population Health, University of Oxford

Biography: I am a group leader in biomedical data science at the University of Oxford. Our group develops reproducible methods to analyse wearable sensor data in very large health studies to better understand the causes and consequences of disease. In 2015 I was fortunate to be one of only three Marie Sklodowska-Curie Actions COFUND Award winners (selected from ~9000 EU Marie-Curie fellowship holders between '07-'13) for contributions to health sensor data analysis. I have also contributed to the creation of guidelines on the use of mobile devices in clinical trials, in collaboration with the US Food and Drug Administration (FDA) supported Clinical Trials Transformation Initiative on "Mobile Clinical Trials".

The Effect Of Obesity On Plantar Pressure Variability In Young Adults Using Traditional And Non-Linear Dynamic Measures

Abstract: Background: Despite evidence suggesting that excess weight is linked to gait alterations and foot disorders, its effect on peak plantar pressure (PPP) variability during walking remains poorly understood. This study aimed to examine the effects of overweight (BMI ≥ 25) on the dynamic PPP distribution during gait using traditional and nonlinear dynamic measures in young Emirati college students. Research Design and Methods: 52 overweight (BMI ≥ 25) and 64 control college students (BMI<25) (18-25 years), walked across a Tekscan multisensory gait assessment system at preferred speed. A T-test or a Mann Whitney U test was used for analysis, subject to data normality (Significance defines at P<.05). Traditional (kinematic, kinetic, spatiotemporal) and GaitEn, a novel non-linear entropy measure, were used to explore the impact of BMI on PPP variability.
Results: The overweight group exhibited significantly higher mean PPP, maximum force (right and left feet), and lateral foot angle. The PPP under the forefoot region was also significantly higher for the overweight group compared to the midfoot and heel. Step length was significantly lower in the overweight group
Conclusions: GaitEn, and kinematic/kinetic measures, were significantly affected by overweight, indicating the feasibility of assessing the impact of increased BMI using pressure platforms in clinical settings. Compared to conventional measures, GaitEn had no significant correlation with body or fat mass, suggesting its potential value as a novel clinical measure for quantifying the influence of excess weight on gait, while shedding light on intrinsic sensorimotor feedback mechanisms invoked by overweight individuals to regulate their locomotion.

Kinda Khalaf, PhD

Associate Professor, Biomedical Engineering Department, Khalifa University

Biography: Dr. Kinda Khalaf received her B.S. (Summa Cum Laude, Distinction) and M.S. (Honors) degrees in Mechanical Engineering from Ohio State University. Her Ph.D., also from OSU, is in Biomechanics/Computational Biomechanics and Dynamic modeling/control. Dr. Khalaf has held faculty appointments in Engineering and Medicine at several prestigious institutes and currently serves as associate chair of Biomedical Engineering at Khalifa University in Abu Dhabi. She has over 155 publications in the areas of Biomechanics/computational Biomechanics, and neuromusculoskeletal modeling/control. Dr. Khalaf is on the list of International Who's Who of Professionals. She has received multiple honors/awards including the prestigious National Merit Scholar and the Khalifa Award for Education. She is one of the founders of the UAE branches of ASEE, and IEEE-EMBS and sits on research boards of local hospitals and the editorial boards of journals in her field. She also regularly engages in conferences as organizer, chair and keynote locally and internationally.

Filling in the Gaps: The 1st Whole Genomes from the United Arab Emirates (UAE)

Abstract: Discoveries from the human genome, HapMap and 1,000 genome projects have collectively contributed towards the creation of a catalogue of human genetic variations that has improved our understanding of human diversity. Despite the collegial nature of many of these genome study consortiums, which has led to the cataloging of genetic variations of different ethnic groups from around the world, genome data on the Arab population remains overwhelmingly underrepresented. The Khalifa University UAE Genome project in the United Arab Emirates (UAE) aims to address this deficiency by using Next Generation Sequencing (NGS) technology to provide data to improve our understanding of the Arab genome and catalogue variants that are unique to the Arab population of the UAE. The study was conceived to shed light on the similarities and differences between the Arab genome and those of other ethnic groups.

Habiba S. AlSafar, PhD

Associate Professor, Genetics and Molecular Biology, College of Medicine and Health Sciences, Khalifa University

Biography: Director of Biotechnology Center and an Associate Professor of Genetics and Molecular Biology at the College of Medicine and Health Science at Khalifa University in Abu Dhabi, UAE. Habiba is an Emirati research scholar who has a wealth of professional and educational experience that includes a Doctorate in Philosophy in Forensics and Medical Sciences from Western Australia, a Master Degree in Medical Engineering from United Kingdom and a Bachelor of Science in Biochemistry from United states of America. Her research interest is constructing the genomic structures of individuals of Arab descent to identify genomic segments that carry gene(s) that predispose to disease. Specifically, addressing diseases that are increasing in prevalence amongst the local communities of the UAE. Habiba was one of outstanding Arab women scientists to win the International L'Oréal-UNESCO Fellowship for Women in Science. Alsafar was awarded the UAE first honor model from His Highness Sheikh Mohammed bin Rashid Al Maktoum for being one of the pioneers in her field. Alsafar is a member of UAE science Council since 2016.

The UAE Healthy Future Study – Opportunities for Collaborative Research

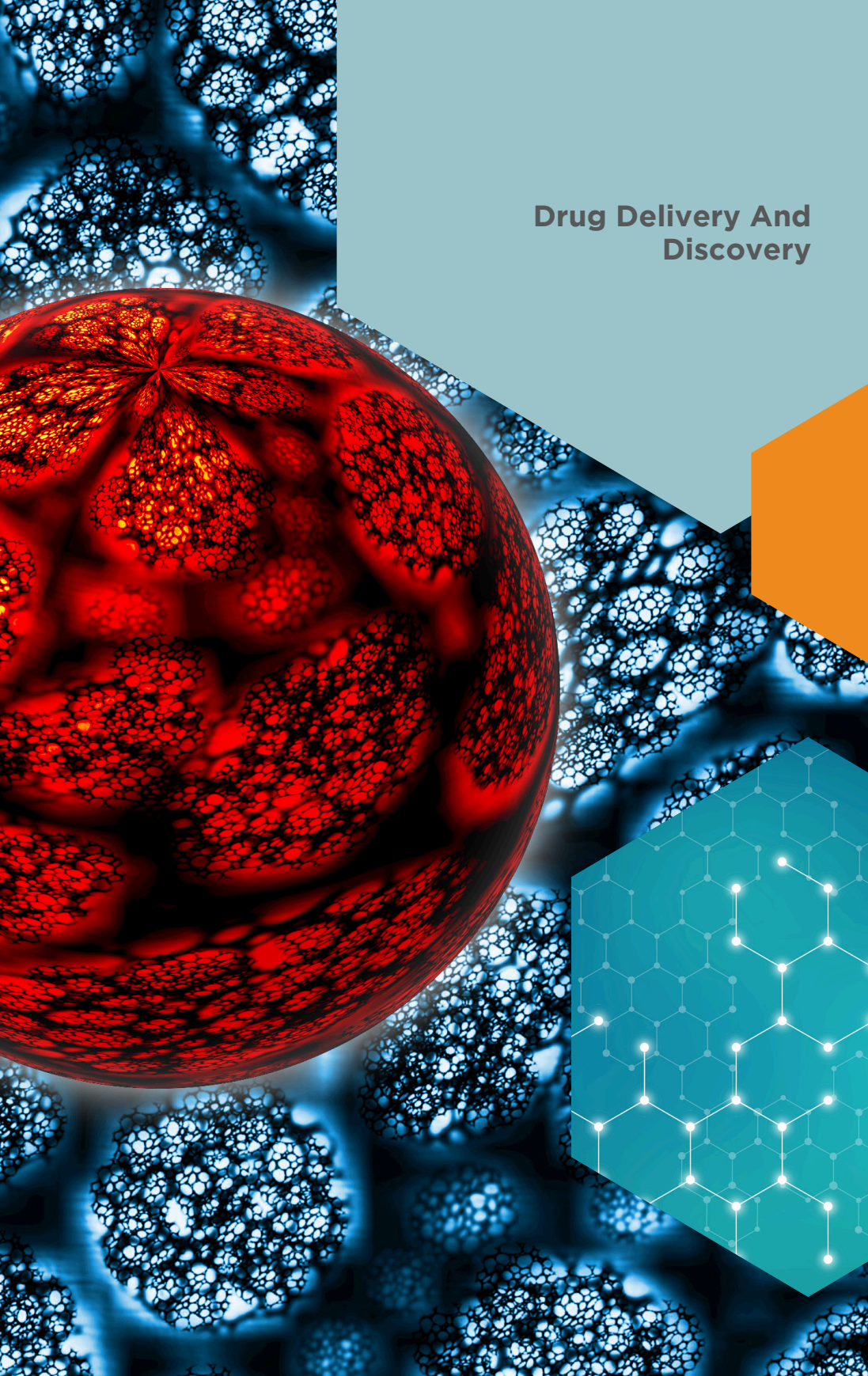
Abstract: Obesity, Diabetes and Cardiovascular disease are extremely common in Abu Dhabi and throughout the Arab World. While cohort studies have made tremendous contributions to scientific knowledge of the epidemiology and determinants of cardiovascular disease, none have been done in Arab populations. To study the causes of these diseases and other diseases common to the Abu Dhabi, we have established a prospective cohort study (The UAE Healthy Future Study) for epidemiologic research. The study will examine the association between multiple exposures ((including environmental, lifestyle and genetic risk factors) and multiple outcomes - focusing on obesity, diabetes and cardiovascular disease. We are recruiting 20,000 adult subjects from multiple sites including primary health care centers, universities, workplaces and blood collection centers. After providing informed consent, participants complete a 30 minute survey, administered via tablet computer. The questionnaire will cover lifestyle, health habits (tobacco use, diet, physical activity), health status and other factors. Biological samples are collected, including blood, urine and an oral wash. Physical measurements include blood pressure and anthropometric measures including weight, height, waist & hip size and percent body fat. Objectives measurements of physical activity are also being made using accelerometers. Study subjects also provide consent for long-term follow-up to determine health outcomes and related health determinants through annual questionnaires. 7000 participants have been recruited to date and recruitment is due to be completed by 2021. This presentation will give an overview of the UAE Healthy Future study and discuss the potential opportunities for collaborative research projects in bio-engineering

Raghib Ali, MD

Director, Public Health Research Center & Associate Research Professor, New York University Abu Dhabi

Biography: Raghib Ali is the Director of the Public Health Research CenterRaghib Ali is the Director of the Public Health Research Center and Associate Research Professor at New York University Abu Dhabi and Adjunct Associate Professor in Population Health at New York University. He is also a Visiting Research Fellow at the University of Oxford & Honorary Consultant in Acute Medicine at the Oxford University Hospitals NHS Trust. He graduated in Medicine from Cambridge University in 1999 and was elected a Fellow of the Royal College of Physicians in 2013. His main research interests are the etiology, prevention & treatment of non-communicable diseases in Middle Eastern and South Asian populations and he has published 100 papers with over 30,000 citations and an H index of 42. He is the Principal Investigator for the UAE Healthy Future Study, the first prospective cohort study in the UAE investigating risk factors for obesity, diabetes and Cardiovascular disease in 20,000 adults.

Drug Delivery And Discovery



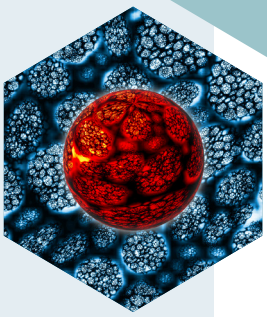
LEAD SPEAKER

Heterofunctionalized Proteomimetic Foldamer Libraries for Biomolecular Recognition

Abstract: Molecular recognition is a critical component of biological processes. Aberrant biomolecular interactions are often a determining factor in disease. Receptor structures in nature generally complement the size, conformation, and chemical features of the target molecule. Accordingly, small molecules typically bind to deep, structured protein pockets, whereas proteins interact with other proteins via comparatively shallow, broad, and dynamic surfaces. Proteomimetics are synthetic structures that mimic broad protein surfaces, and therefore are of interest in targeting protein-protein interactions. We report the synthesis and screening of a series of proteomimetic foldamer libraries for protein surface binding. The libraries comprise cyclic and acyclic oligoamides of functionalized dialkoxy-meta-aminomethylbenzoic acid (MAMBA) monomers. The MAMBA oligomers are structurally constrained by intramolecular bifurcated hydrogen bonds and dipolar repulsion forces. Lateral scaffold flexibility allows side chain functional groups to be displayed over a broad surface area. Ten MAMBA monomers were synthesized with linear and branched alkane, polar uncharged, cationic, anionic, and aromatic side chain functionalities. Solid-phase synthesis techniques were employed to generate a plate-based 100-member dimer library and a bead-based 10,000-member tetramer library. Macrocyclic libraries were prepared by on-resin cyclization methods using an endocyclic glutamic acid for resin attachment through the side-chain carboxylate. Bead-based libraries were screened for protein binding and hits were isolated using magnetic bead pull-down and fluorescence microscopy methods. Identification of hits was determined by sequencing data from MALDI-TOF/TOF mass spectrometry fragmentation of the foldamer backbone. This work provides a general approach for the rapid preparation of proteomimetic foldamer libraries to target biomedically relevant protein-protein interactions.

Andrew D. Hamilton, PhD

Professor of Chemistry,
President, New York University



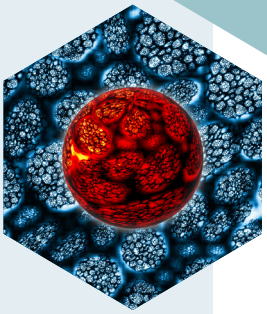
Biography: Professor Andrew Hamilton has been President and Professor of Chemistry at New York University since January 2016. After a PhD from Cambridge and a post-doc in Strasbourg he moved in 1981 to the US and held academic positions at Princeton, Pittsburgh and Yale, where he was Provost from 2004-08. He returned to the UK in 2009 to become Vice-Chancellor of Oxford University, a post he held until the end of 2015. He combines administrative duties at NYU with research on the chemical basis of biological function. He is a winner of the Izatt-Christianson Award for Macrocyclic Chemistry and the Arthur C. Cope Scholar Award from the ACS. He was elected a Fellow of the Royal Society as well as the American Academy of Arts & Sciences.

Academic Drug Discovery: Playing to the Strengths to Address Challenging Targets and Unmet Medical Needs in Cancer and Kidney Disease

Abstract: The academic setting provides unique opportunities, as well as some challenges, to drug discovery scientists compared to the more traditional pharma or biotech model. This talk will highlight two drug discovery projects – one targeting cancer, the other acute kidney injury - that take advantage of and try to capitalize on the characteristics of an academic drug discovery environment. Through the National Cancer Institute's Chemical Biology Consortium, a team of scientists representing multiple institutions designed and optimized novel allosteric inhibitors of the AAA ATPase p97 (VCP), an exciting, emerging target in cancer. The team's efforts have not only provided starting points for the development of new experimental therapeutics, but also generated valuable tool molecules that are being used to decipher the complex biological pathways regulated by p97. In addition, observations made in the course of the project led to uncovering a previously unrecognized protein motif, a bis-threonine turnstile. In a second project, we relied on expertise in developmental biology, nephrology and medicinal chemistry to identify and optimize small molecules that have the potential to treat acute kidney injury, a condition for which there is no effective therapy, and for which specific therapeutic targets are elusive. While on the surface very different, both projects exploit the uniqueness of the academic drug discovery environment – they are relatively high risk, rely on a depth of expertise, and have the potential to deliver not only valuable therapeutics for difficult to treat diseases, but also basic scientific knowledge to the biomedical community.

Donna M. Huryn, Ph.D.

Professor, School of Pharmacy, University of Pittsburgh



Biography: Donna M. Huryn received her B.A. (Chemistry) from Cornell University, and Ph.D. in Organic Chemistry from the University of Pennsylvania. She started her professional career at Hoffmann-La Roche, Inc, where she contributed to drug discovery efforts in inflammation, HIV and cancer. She moved to Wyeth Research, where she held a number of positions, including Director of CNS Medicinal Chemistry and Director of the Chemical Sciences Interface Department; under her leadership, compounds entered clinical trials for asthma, Alzheimer's disease, schizophrenia and depression. In 2004, she left industry to join academia and is currently Professor at the University of Pittsburgh's School of Pharmacy. She is a Fellow of the American Chemical Society, Associate Editor of ACS Medicinal Chemistry Letters and recipient of the ACS Philadelphia Local Section Award. Professor Huryn's research focuses on the design and synthesis of small molecule probes and drugs to treat cancer, neurodegenerative and infectious diseases.

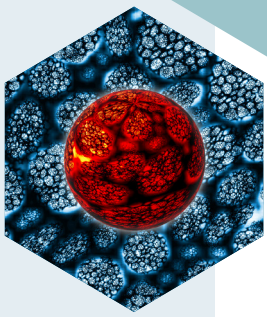
Discovery and Optimization of Kinase Inhibitors to Treat Parasitic Diseases

Abstract: Parasitic diseases such as malaria and lymphatic filariasis are widespread, leading to significant morbidity and mortality in affected populations. Collaborative research in our laboratory aims to investigate new targets for these disorders to address the urgent need for improved treatments. This lecture will describe discovery of potent inhibitors of a new kinase target for potential treatment of lymphatic filariasis and a novel chemotype as potent inhibitors of a recently validated antimalarial kinase. This research was carried out in collaboration with both academic and industrial partners.

David P. Rotella, PhD

Professor, Department of Chemistry and Biochemistry, Montclair State University

Biography: David P. Rotella earned a Ph.D. in medicinal chemistry at the Ohio State University under Donald T. Witiak. Following postdoctoral research in organic chemistry at Penn State University with Ken S. Feldman, he accepted a faculty position at the University of Mississippi School of Pharmacy where his research focused on discovery of novel enzyme inhibitors for inflammation and cancer applications. In 1991, he moved to the pharmaceutical industry where he led projects in a range of therapeutic areas including neurodegeneration, metabolism, psychiatry and cardiovascular disease at both large and small companies. In 2011, he returned to academia as the Margaret and Herman Sokol Professor of Chemistry at Montclair State University. His research is focused on discovery of kinase inhibitors, enzyme inhibitors and GPCR ligands for parasitic disease, neurodegeneration and drug addiction.

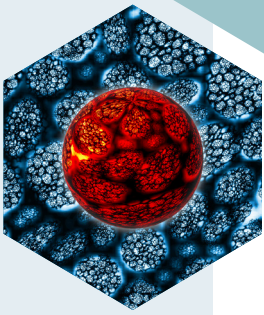


Academic Drug Discovery: Discovering Neglected Tropical Disease Therapeutics Through A Combination Of Lead Repurposing And Distributed Drug Discovery

Abstract: Many current therapies for neglected tropical diseases (NTDs) have significant shortcomings and are often highly toxic, yet improved drugs are slow to be developed as there is no financial incentive to do so. Recognizing the financial pressures inherent in NTD drug discovery, we utilize a method for repurposing classes of established inhibitors of enzymes and pathways in humans as starting points for inhibitor discovery for the pathogens that cause NTDs. Following a high-throughput screening campaign against Trypanosoma brucei cells performed at the GlaxoSmithKline OpenLab, we have undertaken hit-to-lead medicinal chemistry optimization of several clusters of potent inhibitors identified in the HTS. This Lead Repurposing effort will be described, highlighting progress made in multiple chemotypes to identify potent, non-toxic, in vivo efficacious lead compound for human African trypanosomiasis. Our implementation of a 'distributed drug discovery' network that involves investigators from industry, academia, and government laboratories will also be highlighted.

Michael P. Pollastri, PhD

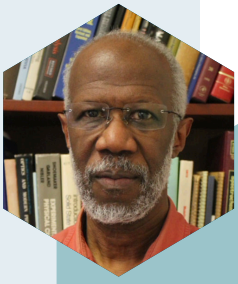
Professor, Department of Chemistry & Chemical Biology, Northeastern University



Biography: Before beginning his academic career, Dr. Michael Pollastri worked at Pfizer in hit-to-lead and lead optimization medicinal chemistry for nearly ten years. In 2007 he accepted a research faculty position in the Boston University Department of Chemistry, where he led the establishment of the Center for Molecular Discovery, a University resource that encompassed a combination of high-throughput screening and medicinal chemistry optimization capabilities. In 2009, he joined the faculty in the Department of Chemistry and Chemical Biology at Northeastern University, where he was appointed department chair in 2015 and was promoted to full professor in 2017. He has been serving the College of Science as Interim Dean since early 2019. His research has been focused on discovery of new therapeutics for neglected tropical diseases. Dr. Pollastri earned his bachelor's degree from the College of the Holy Cross, a master's degree from Duke University, and his doctorate from Brown University.

Will Silver Diamine Fluoride Supplant the Dentist's Drill?

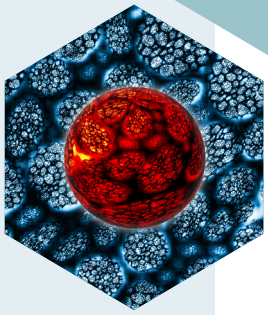
Abstract: Silver diamine fluoride (SDF) has been promoted for the treatment of tooth sensitivity. It's off-label use however is in the treatment of dental caries, a widespread disease that is essentially universal. Diseased tissue is normally treated by removal by means of the redoubtable dentist's drill. With SDF the process requires a simple small brush to apply a solution to carious tissue perhaps twice per year. The painless treatment with SDF is of proven efficacy but of limited use because it produces a significant stain on carious tissue, which is aesthetically undesirable. The known electronic structure of silver and mixed metal phases that contain silver provide clues to approaches that might greatly attenuate or eliminate the formation of stain. In addition, the details of tooth microanatomy, and phosphate molecular structure are important with regard to metal ion retention and residence. The source of staining and routes to its elimination will be discussed supported by SEM, EDS, and XPS data.



Marc A. Walters, PhD

Associate Professor, Department of Chemistry, New York University

Biography: Marc Walters is a graduate of the City University of New York (B.S.) and Princeton University (Ph.D.) Postdoctoral work at MIT was followed by a faculty appointment at New York University where he is currently an Associate Professor. His work has focused on bioinorganic chemistry of electron transfer metalloproteins, hydroxyapatite surface science and the development of MRI contrast agents.

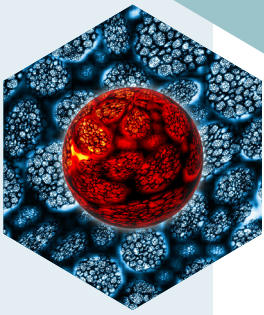


Protein Mimetic Based Structural And Functional Analysis Of Amyloid Proteins

Abstract: The aggregation of α -Synuclein, a synaptic protein is associated with the progression and early-onset of Parkinson's disease (PD). Under pathological conditions, the partitioning of α -synuclein between membrane-bound and biological millieu gets disturbed, which results in the multimerization of α-synuclein on the membrane. It has been suggested that there is strong link between the onset of PD and membrane-potentiated oligomerization of α-synuclein. Therefore, strategies that prevent their formation or disrupt these abberrent protein-protein interactions on the membrane could lead to potential therapeutic interventions toward PD. We have designed and synthesized protein mimetic libraries to target the membrane-induced oligomerization and fibrillation of α-synuclein. We have identified multiple antagonists of the membrane-bound α-synuclein aggregation. The potent antagonists were distinct in their surface chemical fingerprints, which suggest that they bind to different sequences of the membrane associated α-synuclein. Using 2D NMR, we have demonstrated that they interact at the N-terminus of α-synuclein, modulate α-synuclein-lipid interaction, and thereby inhibit the aggregation of α-synuclein. One of the most effective ligands has been tested in C elegans model of PD (strain: NL5901), where the age-related formation of fluorescent inclusions (YFP-α-synuclein) in the muscle cells and their subsequent paralysis have been indicative of PD. The ligand displayed significant decrease in the α-synuclein inclusions in C elegans. The presentation will demonstrate the interaction of protein mimetics with α -synuclein using various in vitro and in vivo assays.

Sunil Kumar, PhD

Assistant Professor, Department of Chemistry and Biochemistry, The University of Denver



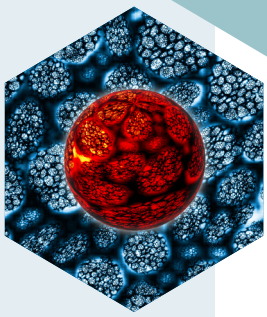
Biography: PhD: Department of Chemistry, Clemson University, SC, USA.
Postdoc (1): Biophysics/Chemical Biology, Department of Molecular Biology and Biophysics, Yale University, New Haven, CT, USA.
Postdoc (2): Department of Chemistry, New York University, NYC, NY, USA.

Designed Cell-Penetrating Peptide Inhibitors Of Amyloid-Beta Aggregation And Cytotoxicity

Abstract: Amyloid proteins and peptides are a major contributing factor to the development of a number of neurodegenerative disorders, including Alzheimer's and prion diseases. Previously, we introduced a novel treatment strategy for prion diseases that is based on designed cell-penetrating peptides (CPPs). These CPPs comprise two segments: a hydrophobic signal sequence followed by a polycationic nuclear localization signal (NLS)-like sequence. Significantly, the combination of the signal sequence of the neural cell adhesion molecule-1 (NCAM1) and the prion protein (PrP)-derived NLS-like sequence, denoted NCAM1-PrPNLS, was found to have potent anti-prion properties. Here, we have extended the approach towards the amyloid-beta (Aβ) peptide amyloid formation and neurotoxicity, which is associated with Alzheimer's disease. We characterized the interactions of NCAM1-PrPNLS with Aβ and investigated the aggregation and cytotoxicity of the resulting complexes, using complementary in vitro and in silico techniques. We report that NCAM1-PrPNLS stabilizes Aβ in a non-amyloid state and protects neuronal cells against Aβ-induced neurotoxicity. Moreover, we show that replacing the PrP NLS-like sequence with a corresponding segment from Aβ results in a construct, denoted NCAM1-AβNLS, with similar CPP functionality and antagonism of A β aggregation and neurotoxicity. Our findings reveal a general underlying principle for the inhibition of pathogenic protein aggregation that will facilitate the design of CPP-based therapeutics for amyloid diseases.

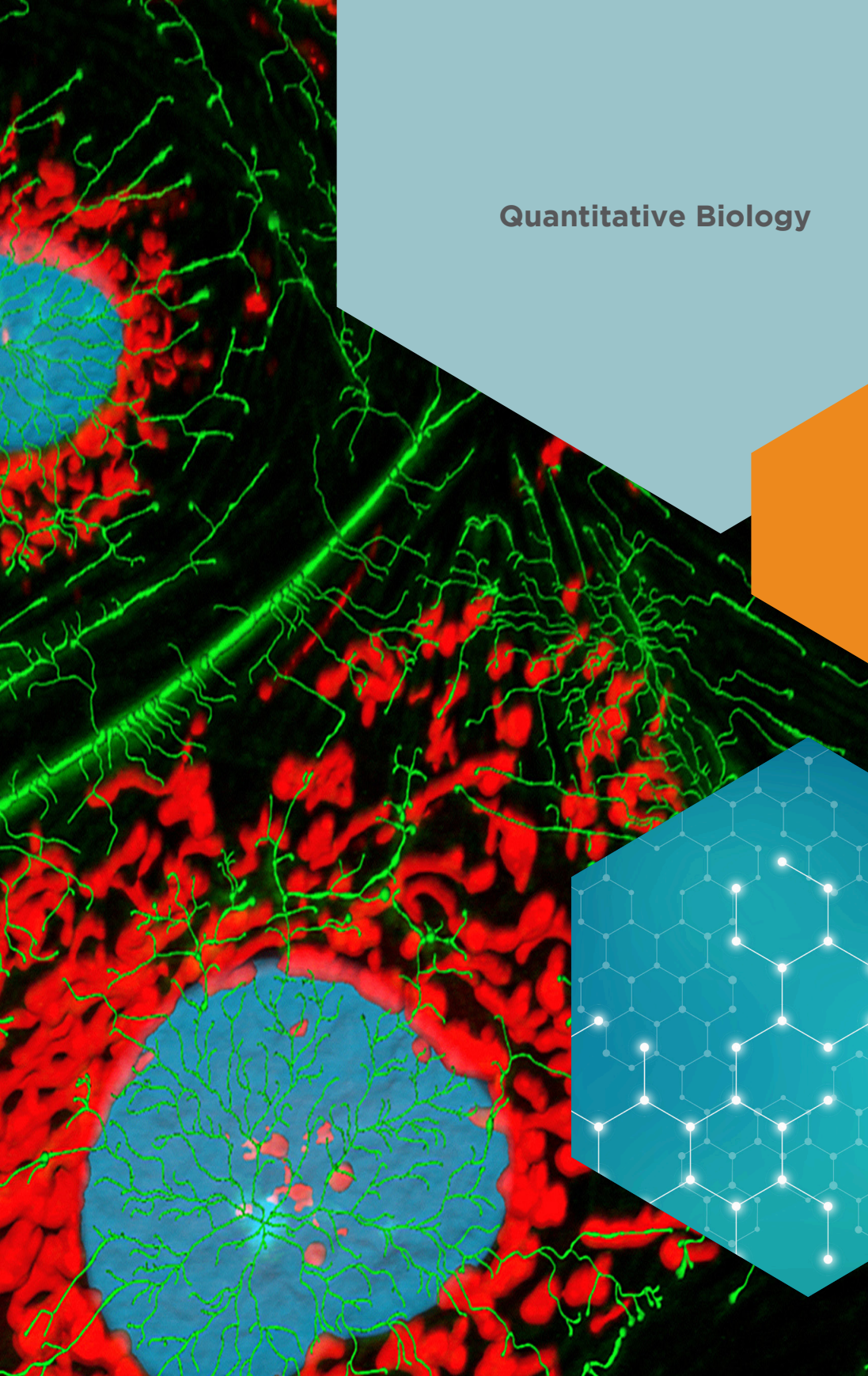
Mazin Magzoub, PhD

Assistant Professor, Biology Program, New York University Abu Dhabi



Biography: I am a biophysicist specializing in the development of novel methods for the delivery of antitumor agents and therapeutics for amyloid diseases (e.g. Alzheimer's and prion diseases). Prior to joining NYUAD, I was a postdoctoral scholar at the University of California, San Francisco, where I developed novel biophysical methods for measurement of macromolecule diffusion deep in tissues such as tumors and brain. Subsequently, as an Associate Research Scientist at Yale University, I worked on elucidating the molecular mechanisms underlying type 2 diabetes. I received my Ph.D. in biophysics from Stockholm University in 2004, where I studied the biophysical properties of cell-penetrating peptides, a class of peptides with the ability to mediate the cellular import of therapeutic compounds with high efficiency and low toxicity.

Quantitative Biology



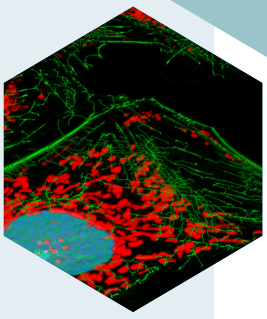
LEAD SPEAKER

Application of Cryo-EM and Correlative Light and EM Methods to Understanding the Structure and Function of Telomeres

Abstract: In recent years there has been a "Resolution Revolution" in Electron Microscopy (EM). The most significant advances that made this revolution in structural biology possible was the development of direct electron detectors as well as novel computational approaches to particle analyses. These advances permit us to determine three-dimensional structures of proteins and protein complexes at atomic resolution using single-particle cryo-EM. At the same time there have been exciting developments in imaging structures directly inside cells using Correlative Light and Electron Microscopy (CLEM). I will describe how we established state-of-the-art cryo-EM at NTU in Singapore and how we have applied both single-particle cryo-EM to determine the structure of the capping complex of telomeres and the enzyme telomerase, as well as CLEM to determine the structure of telomeres in situ in cells. We have focused on telomere structure because telomeres are biologically and medically very important. They protect the ends of eukaryotic chromosomes from inappropriate DNA repair and degradation and control terminal replication of chromosomal DNA. The telomerase reverse transcriptase that adds telomeric DNA repeats to telomeric ends is active in stem cells, inactive in somatic cells and upregulated in 90% of human cancers, imparting immortality to cancer cells.

Daniela Rhodes, PhD

Professor, Institute of Structural Biology, Nanyang Technological University



Biography: Before joining Nanyang Technological University (Singapore) in September 2011, Prof. Rhodes spent all of her research career at the world-renowned MRC Laboratory of Molecular Biology in Cambridge, UK. After studying for a PhD with Nobel Prize winner Aaron Klug, she obtained a Research Scientist Position in 1983, tenured in 1987, and achieved Special Appointment in 1994 (equivalent to Full Professor). Prof. Rhodes served as Director of Studies 2006 – 2009 and have been Visiting Professor at both the Rockefeller University in NY and La Sapienza in Rome, Italy. Amongst other activities, Prof. Rhodes chaired the European Molecular Biology Organization (EMBO) Fellowship Committee (2000 – 2006), and was chair of EMBO Council (2010 – 2012). She chair the European Research Council (ERC) Advanced Grants LS1 Committee since 2010 and also chair the External Advisory Committee of both the Centro de Investigaciones Biologicas in Madrid, Spain and the Consiglio Nazionale delle Ricerche Institute in Napels, Italy. Her research has centered on uncovering nucleic acid structure and function and how DNA is packed into chromatin and how DNA is recognized sequence specifically by proteins such as transcription factors, using structural methods ranging from NMR to x-ray crystallography to EM.

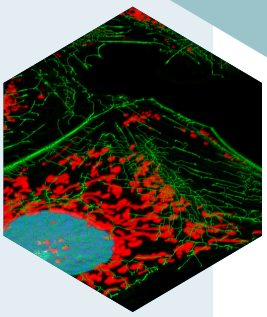
Solid-To-Liquid Phase Transition In Pathophysiology

Abstract: During wound repair, branching morphogenesis and carcinoma dissemination, cellular rearrangements are fostered by a solid-to-liquid transition, known as unjamming. The biomolecular machinery behind unjamming, its pathophysiological relevance remains, however, unclear. Here, using a combination of physical approaches, 3D matrix, ex vivo and in vivo model systems we will address these issues and discuss whether the transition between "solid" and "liquid" locomotory states is a complementary gateway to epithelial-to-mesenchymal transition (EMT) to account for the plastic remodeling of epithelial tissues in physiology and pathology, focusing specifically on epithelial morphogenesis and progression early breast cancer lesions.

Giorgio Scita, PhD

Professor, Institute of Molecular Oncology & Department of Oncology and Hemato-oncology, University of Milan

Biography: Giorgio Scita obtained his Ph.D. in Food Chemistry and Technology at the University of Parma, Italy. He received his first postdoctoral training at the University of California, Berkeley and National Cancer Institute (NCI) of the National Institutes of Health (NIH). After returning to Italy to the European Institute of Oncology (IEO), Milan, he then became Principal Investigator at the IFOM Foundation, the FIRC Institute of Molecular Oncology, Milan and Professor of General Pathology at the School of Medicine of the University of Milan. His primary research interest is on biochemical and physical mechanisms of single and collective tumor cell migration.

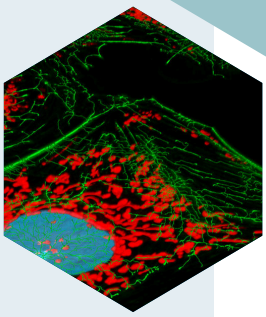


Exploring Endocytosis Of The Serotonin1a Receptor: Role Of Membrane Cholesterol

Abstract: G protein-coupled receptors (GPCRs) seven transmembrane domain proteins that transduce signals across the plasma membrane. Endocytosis is a key regulatory mechanism adopted by GPCRs to modulate downstream signaling responses within a stringent spatiotemporal regime. The serotonin1A receptor is a representative GPCR involved in neuronal development and in neuropsychiatric disorders such as anxiety and depression. Extensive work by us and others has addressed the role of membrane lipids in the function, organization and dynamics of GPCRs. However, the role of membrane lipids in GPCR endocytosis and intracellular trafficking remains largely unexplored. Cholesterol, the predominant sterol in higher eukaryotes, plays a crucial role in maintaining the structure and organization of cell membranes, and is involved in essential cellular processes in health and disease. We recently combined quantitative flow cytometric and confocal microscopic approaches to demonstrate that the serotonin1A receptor undergoes clathrin-mediated endocytosis upon agonist stimulation, and subsequently traffics by endosomal recycling. We further explored the role of membrane cholesterol in the endocytosis and intracellular trafficking of the serotonin1A receptor by depleting cholesterol in a chronic fashion using the best selling cholesterol lowering drug, statin. Our results show that cholesterol depletion induces a switch in the endocytic pathway of the serotonin1A receptor from clathrin- to caveolin-mediated endocytosis. Interestingly, under these conditions, a significant proportion of endocytosed receptors is rerouted toward lysosomal degradation. These results enhance our overall understanding of the modulatory role of membrane lipids on GPCR endocytosis and trafficking, and could provide novel insight in developing therapeutic interventions targeting GPCR signaling.

Amitabha Chattopadhyay, PhD

Distinguished Fellow, CSIR-Centre for Cellular and Molecular Biology



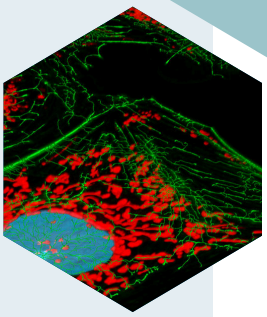
Biography: Prof. Amitabha Chattopadhyay is a SERB Distinguished Fellow at the Centre for Cellular and Molecular Biology in Hyderabad, India. A seminal work of Prof. Chattopadhyay focuses on the role of membrane cholesterol in the organization, dynamics and function of G protein-coupled receptors. A translational extension of this work provided novel insight in the role of membrane cholesterol in entry of pathogens into host cells. His work has been recognized by TWAS Prize, Shanti Swarup Bhatnagar Award, Ranbaxy Research Award, and G.N. Ramachandran Gold Medal. He is an elected Fellow of TWAS, Royal Society of Biology, Royal Society of Chemistry, and all the Indian Academies of Science. Prof. Chattopadhyay has served on the editorial boards of a large number of reputed journals. He has authored ~300 research publications (citations > 11,900, h-index 57). He has delivered close to 600 invited lectures all over the world including keynote, plenary, and colloquium lectures.

Multipotent Mesenchymal Cell Exosomes And Their Application In Diabetic Wound Healing

Abstract: The treatment of chronic diabetic wounds is an unsolved social, clinical and financial dilemma that results in an amputation every 30 seconds around the world, among the 500 million patients diagnosed with diabetes. In addressing this issue, multipotent mesenchymal cells (MMCs) have attracted much attention for their capacity to accelerate wound healing by generating a potent secretome. Non-cellular biologics, like exosomes, which harness the power of the MMC secretome may hold the key to translating these therapies to the bedside. Exosomes are nanosized cell-derived extracellular vesicles that function as signaling molecules endowed with an impressive ability to influence cell behavior. Exosome studies are changing the paradigm of intracellular communication and wound therapy, but the mechanisms mediating their bioactive cargo and subsequent effects in destination cells are not well understood. We found that Nrf2-mediated redox regulation determines MMC multipotency and enables their participation in wound healing. Exosomes from these Nrf2-stable MMCs significantly decreased pathological wound healing time, gave rise to neovascularization and improved histological wound healing parameters in pre-clinical diabetic wound models. We are exploring engineering of MMCs to produce exosomes with specified cargo, targeted towards the complex pathology of diabetic wound chronicity. Our work ties together a widespread clinical need, and regulation of intercellular communication in wound tissues. Our results can pave the way to effective therapeutic modalities that can offer predictable outcomes and reassurance to patients suffering from diabetic and chronic wounds.

Piul S. Rabbani, PhD

Assistant Professor, Plastic Surgery, School of Medicine, New York University



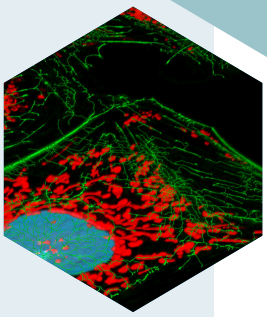
Biography: Dr. Piul Rabbani is a Research Assistant Professor at New York University School of Medicine, in the Hansjörg Wyss Department of Plastic Surgery. She is also director of the Research Fellowship for medical students. Dr. Rabbani performed her doctoral work with Dr. Mayumi Ito, focusing on melanocyte stem cell regulation. She trained under Dr. Daniel Ceradini as a post-doctoral fellow, prior to being recruited as faculty to the department. Her research laboratory focuses on the role of adult stromal progenitor cells, and their heterotypic cellular interaction during wound healing and tissue regeneration, particularly in mammalian skin. Dr. Rabbani is interested in the deficiencies in cellular interaction underlying pathological diabetic and chronic wounds, as well as development of therapeutic strategies. She is also an advocate for diversity and inclusion in the sciences, and actively engaged in science education outreach.

Navigating The Crowded Cell

Abstract: To move organelles and vesicles over long distances, the cell employs molecular motor proteins that shuttle cargo along the cytoskeletal filaments – microtubules and actin. However, motors in the cell are presented with many challenges that are not present in the purified in vitro setting they are often studied in. How do motors 'know' where to take a cargo to, how do motors manage to move through the crowded cell, and how do they manage to deliver cargo when the filaments they walk along are randomly oriented. In this talk I will present a sensor we developed to 'measure' how crowded the different regions of the cell are. I will then describe imaging and optical tweezers measurements in living cells and in biomimetic media that allowed us to tease out how the function of the motor kinesin is regulated physically by crowding and biochemically by motor co-factors.

George Shubeita, PhD

Assistant Professor, Division of Science, New York University Abu Dhabi



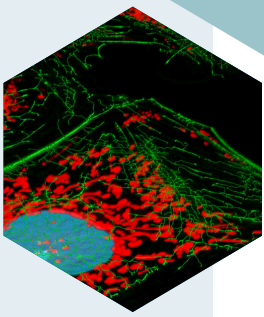
Biography: George Shubeita is assistant Professor of Physics at New York University Abu Dhabi. He graduated with a BSc degree in physics from Birzeit University in Palestine in 1995 and completed his PhD work in physics from the University of Lausanne in Switzerland in 2002. It was during his postdoctoral work at the University of California Irvine that he started working in the field of biological physics studying molecular motor-based intracellular transport. In 2015 he moved his laboratory to NYU AD from the University of Texas at Austin. The general theme of research in his laboratory is in the area of cell physics, where the synergy between physics and biology leads to concurrent advancement of our understanding of biological function and the physical principles governing it.

Chromatin And Transcriptional Regulation During Development And Differentiation: The Role Of Cytoskeletal Proteins

Abstract: Actin and myosin play essential functions in the cell nucleus, including chromatin and transcription regulation, synergizing with the polymerase machinery. Because of these global roles, nuclear actin and myosin are also emerging as regulators of genome organization. Actin is involved in heterochromatin segregation at the nuclear lamina and controls the levels of heterochromatin inside the nucleus for sustained gene expression regulation during development and differentiation. Actin performs these tasks by controlling deposition of the ATPase Brg1, a subunit of the chromatin remodeling complex SWI/SNF (BAF). These mechanisms appear to regulate gene programs required for key differentiation pathways. We recently reported that β-actin null embryonic fibroblasts can be directly reprogrammed to bona fide neurons but these neurons develop into different neuronal subtypes compared to the wild-type condition, exhibiting an increased number of inhibitory synapses. Here, I will show evidence that nuclear actin plays an important role also in other differentiation pathways, including adipogenesis and osteogenesis. Altogether, these results suggest that by regulating the functional architecture of the genome, nuclear actin is emerging as a key factor in development and differentiation..

Piergiorgio Percipalle, PhD

Associate Professor, Division of Science, New York University Abu Dhabi



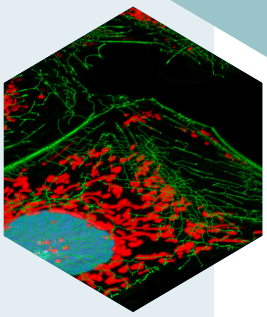
Biography: Dr. Percipalle has a chemistry degree and PhD in Molecular Genetics from the International School for Advanced Studies, Trieste, Italy. As PhD student he trained at the International Centre for Genetic Engineering and Biotechnology (ICGEB), Trieste. For postdoctoral training he worked at the Medical Research Council Laboratory of Molecular Biology, Cambridge, UK, and at the Karolinska Institute, Department of Cell and Molecular Biology, Stockholm. At the Karolinska, Dr. Percipalle joined the same Department as Group Leader and, then, as Associate Professor of Cell Biology with external funding from Swedish Research Council and Cancer Society (Cancerfonden). His research focuses on regulation of gene expression and genome organization during development and differentiation. In 2015 he joined New York University Abu Dhabi as standing faculty and he is currently tenured NYU professor of biology. He holds an appointment as Guest Professor in the Department of Molecular Biosciences, The Wenner Gren Institute, Stockholm University.

Nuclear β-Actin Contributes To An Open Chromatin For Activation Of The Adipogenic Pioneer Factor Cebpa During Transcriptional Reprograming

Abstract: Adipogenesis is regulated by a cascade of signals that drives transcriptional reprogramming into adipocytes. Here, we report that nuclear actin is important in regulating the chromatin states that establish tissue specific expression during adipogenesis. To study the role of β-actin in adipocyte differentiation we conducted RNA-Sequencing on wild-type (WT) and β-actin knockout (KO) mouse embryonic fibroblasts (MEFs) after reprograming to adipocytes. We found β-actin depletion affects induction of several adipogenic genes during transcriptional reprograming. This impaired regulation of adipogenic genes is linked to reduced expression of the pioneer factor Cebpa and is rescued by reintroducing NLS-tagged β-actin. ATAC-Seq revealed that reduced Cebpa expression correlates with decreased chromatin accessibility at the transcription start site and promoter proximal region of the Cebpa gene in KO MEFs, concomitant with loss of chromatin association of the ATPase Brg1. We propose a novel role for nuclear β -actin in maintaining open chromatin for transcriptional reprogramming during differentiation.

Mohamed Al-Sayegh, PhD

Research Assistant Professor, Science Division, New York University Abu Dhabi



Biography: Dr Mohamed Al-Sayegh is a Research Assistant Professor at the Biology Division who manages the Stem Cell Biology laboratory at New York University Abu Dhabi (NYUAD). Prior to joining NYUAD, Al-Sayegh held a postdoctoral position in the Mazzoni lab at Biology Department at NYU Washington Square campus. During his Postdoctoral training, Al-Sayegh developed an interest into next generation sequencing applications, specifically transcriptomics, by studying the effects of direct programming mouse embryonic stem cell with pioneering transcription factors into specific subtypes of motor neurons. Since then, Al-Sayegh has also developed interest in understanding cell differentiation of various cell types including adipocyte differentiation. Mohamed received his BA in Biology from Valparaiso University in 2005 (Valparaiso, Indiana, USA); MSc in Molecular Genetics from the University of Leicester in 2006 (Leicester, UK); and PhD in Molecular and Cell Biology from the University of London in 2012 (St Georges Medical School, London, UK).

Frontiers in Bioengineering Medicine

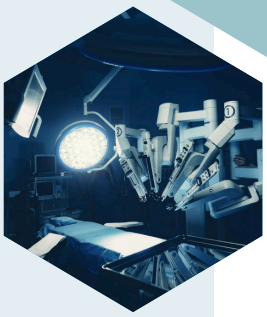
LEAD SPEAKER

Biomedical and Health Related Research at NYU Tandon

Abstract: In this talk, I will present the state of research within the NYU Tandon School of Engineering in the areas of biomedical engineering and other health-related branches. At Tandon, we have embraced immense opportunities to collaborate with the many schools of NYU; one of the most fruitful cooperative efforts has been the creation of our Biomedical Engineering (BME) Department, with its strong ties to the School of Medicine, NYU Abu Dhabi, as well as our own Mechanical Engineering, Computer Science and Engineering, and Chemical and Biomolecular Engineering Departments. Within our BME department, students are developing innovative approaches and tools for medical imaging, tissue engineering and repair, bioinstrumentation and biosensors, mechanobiology, robotics and prosthetics, computational medicine, systems genetics, and a wide variety of other applications.

Jelena Kovačević, PhD

William R. Berkley Professor and Dean, Tandon School of Engineering, New York University



Biography: Jelena Kovačević became the Dean of the NYU Tandon School of Engineering in August 2018. She is the first woman to head the school since its founding in 1854 as the Brooklyn Collegiate and Polytechnic Institute. She received the Dipl. Electrical Engineering degree from the University of Belgrade, Yugoslavia, in 1986, and the MS and Ph.D. degrees from Columbia University in 1988 and 1991, respectively. From 1991-2002, she was with Bell Labs, Murray Hill, NJ. She was a co-founder and Technical VP of xWaveforms, based in New York City, NY. In 2003, she joined Carnegie Mellon University, where she was the Hamerschlag University Professor, Head of Electrical and Computer Engineering, and Professor of Biomedical Engineering. She is a Fellow of the IEEE and EUSIPCO, and a coauthor of the book Wavelets and Subband Coding (1995) as well as a coauthor of Foundations of Signal Processing (2014) and Fourier and Wavelet Signal Processing (2015). She served as the Editor-in-Chief of the IEEE Trans. on Image Processing from 2002-2006, Associate Editor of the IEEE Trans. on Signal Processing, and was Guest Co-Editor of IEEE Special Issues on Wavelets, on Transform Coding, and on Molecular and Cellular Bioimaging. She was on the Editorial Boards of the Springer-Birkhauser Applied and Numerical Harmonic Analysis, Foundations and Trends in Signal Processing, SIAM book series on Computational Science and Engineering, Journal of Applied and Computational Harmonic Analysis, Journal of Fourier Analysis and Applications and the IEEE Signal Processing Magazine. Jelena's research interests are biomedical imaging as well as multiresolution techniques such as wavelets and frames.

Robotics to Characterize, Retrain, and Restore Human Movements

Abstract: Neural disorders and old age limit the ability of humans to perform activities of daily living. Robotics can be used to probe the human neuromuscular system and create new pathways to characterize, relearn, or restore functional movements. Dr. Agrawal's group at Columbia University Robotics and Rehabilitation (ROAR) Laboratory has designed innovative technologies and robots for this purpose. These technologies have been tested on subjects in a variety of studies to understand the human cognitive and neuro-muscular response. Human experiments have targeted patients with stroke, cerebral palsy, Parkinson's disease, ALS, Vestibular disorders, elderly subjects and others. The talk will provide an overview of some of these technologies and scientific studies performed with them.

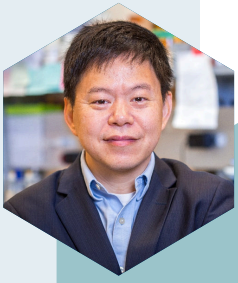
Sunil K. Agrawal, PhD

Professor, Department of Mechanical Engineering and Department of Rehabilitation and Regenerative Medicine, Columbia University

Biography: Sunil K. Agrawal received a Ph.D. degree in Mechanical Engineering from Stanford University in 1990. He is currently a Professor and Director of Robotics and Rehabilitation (ROAR) Laboratory at Columbia University, located both in engineering and medical campuses of Columbia University. Dr. Agrawal has published more than 500 journal and conference papers, three books, and 14 U.S. patents. He is a Fellow of the ASME and AIMBE. His honors include a NSF Presidential Faculty Fellowship from the White House in 1994, a Bessel Prize from Germany in 2003, and a Humboldt US Senior Scientist Award in 2007. He is a recipient of 2016 Machine Design Award from ASME for "seminal contributions to design of robotic exoskeletons for gait training of stroke patients" and 2016 Mechanisms and Robotics Award from the ASME for "cumulative contributions and being an international leading figure in mechanical design and robotics". He is a recipient of several Best Paper awards in ASME and IEEE sponsored robotics conferences. He has also held international visiting positions that include Technical University of Stuttgart, Hanyang University in Korea, University of Ulster in Northern Ireland, Biorobotics Institute of SSSA in Pisa, Peking University in China. He has successfully directed 28 PhD student theses and currently supervises the research of 10 PhD students at ROAR laboratory. He is the founding Editor-in-Chief of the journal "Wearable Technologies" from Cambridge University Press.

Molecular and Cellular Immuno-engineering for Cancer Therapy

Abstract: While cell-based immunotherapy, especially chimeric antigen receptor (CAR)-expressing T cells, is becoming a paradigm-shifting therapeutic approach for cancer treatment, there is a lack of general methods to remotely and non-invasively regulate genetics in live mammalian cells and animals for cancer immunotherapy within confined local tissue space. To address this limitation, we have developed a new blue light-mediated light-inducible nuclear translocation and dimerization (LINTAD) system for gene regulation to control cell activation, by integrating a LOV2-based nuclear localization signal with the CRY2-CIB1 dimerization inducible by light. We demonstrated light-controllable gene expression and functional modulation in HEK 293T and Jurkat T cell lines. We further improved and applied the LINTAD system in primary human CAR T cells and showed that the light-stimulated cells possessed a strong cytotoxicity against target cancer cells, both in vitro and in vivo. We have also identified a mechanically sensitive Piezo1 ion channel (mechanosensor) activatable by ultrasound stimulation and integrated it with engineered genetic circuits (genetic transducer) in live HEK cells to convert the ultrasound-activated Piezo1 into transcriptional activities. With engineered Jurkat T cell line and primary T cells, the remote ultrasound wave can be perceived and transduced into transcriptional activation for the CAR expression to recognize and eradicate target tumor cells. Our approaches are modular and can be extended for remote-controlled activation of different cell types with a high spatiotemporal precision for therapeutic applications.



Peter Y. Wang, PhD

Professor, Department of Bioengineering, University of California San Diego

Biography: Dr. Peter Yingxiao Wang obtained his bachelor's and master's degrees in Mechanics and Fluid Mechanics from Peking University, Beijing, P.R. China, in 1992 and 1996, respectively. He received his Ph.D. degree in Bioengineering from the University of California, San Diego Jacobs School of Engineering in 2002 and continued his postdoctoral work at UC San Diego working under Bioengineering Professor Shu Chien and Professor Roger Y. Tsien in the Department of Pharmacology. He is current a professor at the department of Bioengineering at UCSD and a fellow of American Institute of Medical and Biological Engineering (AIMBE). Dr. Wang is the recipient of the Wallace H. Coulter Early Career Award (both Phase I and Phase II), the National Science Foundation CAREER Award, and National Institutes of Health Independent Scientist Award. His research is supported by the National Institutes of Health, National Science Foundation, and private foundations.

Intelligent NeuroRobotics: From Smart Rehabilitation to Agile Assistance

Abstract: Interactive robotic technologies have revolutionized the field of sensorimotor rehabilitation and have been successful in accelerating neural recovery and motor restoration through augmenting the engagement and, ultimately, promoting plasticity, for patients living with post-stroke disabilities. In addition, robots, interfaced with the human neural system, have been successfully utilized in the past decade to augment motor capabilities of disabled individuals for performing a number of activities of daily living and to enhance independence. Although neurorobotic systems have shown a great potential for delivering rehabilitation and assistance, there still exist several challenges and need to make the technology (a) more adaptable to and compatible with the variable biomechanical characteristics of the user, (b) more responsive to the intended movements, (c) more accessible, and (d) more intelligent in delivering assistance. This has led to active research in the fields of robotic rehabilitation and assistive prosthetic technologies. Motivated by the notes above, this talk aims to report on recent developments covering multiple topics technically related to human-robot tele-interaction, stability and compatibility of rehabilitation robots, machine learning in telerobotic rehabilitation systems, and intelligent bio-signal processing and control for myoelectric prostheses.

S. Farokh Atashzar, PhD

Assistant Professor, Electrical and Computer Engineering & Mechanical and Aerospace Engineering Departments, Tandon School of Engineering, New York University

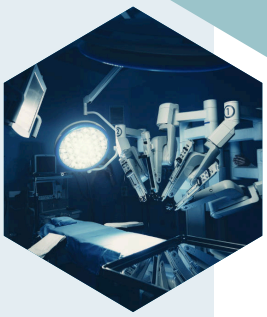
Biography: S. Farokh Atashzar is an Assistant Professor at New York University Prior to joining NYU, Atashzar was a senior postdoctoral scientist in the Department of Bioengineering, Imperial College London, UK. From February 2017 to August 2018, he served as a postdoctoral research associate at Canadian Surgical Technologies and Advanced Robotics (CSTAR) center. His field of research is human-computer interaction for surgical and neurorehabilitation robotics systems. His awards include the NSERC Post-Doctoral Fellowship (PDF) in 2018. He was ranked among the top "5" applicants in Canada for the 2018 NSERC PDF competition in the Electrical and Computer Engineering sector. Atashzar leads the Medical Robotics and Interactive Intelligent Technologies (MERIIT) Laboratory, at NYU. The lab hosts state-of-the-art human-machine interface technologies to exploit bidirectional interactions that allow humans to overcome natural, physiological, and pathological barriers. Atashzar is the publication chair of the 2020 International Symposium on Medical Robotics (ISMR), Georgia Institute of Technology, Atlanta, USA.

Rehabilitation Strategies To Reduce Or Reverse Disuse-Related Bone Loss

Abstract: Irrespective of the specific cause of severe bone loss (ranging from post-menopausal osteoporosis to long-term immobilization) a fracture prevention approach would be to intervene to: (i) reduce bone loss if can be detected early, or (ii) reverse established osteoporosis in the chronic phases. Rehabilitation alternatives to pharmacological interventions for treating osteoporosis are needed, as the most commonly prescribed anti-resorptive agents (bisphosphonates) are of limited effectiveness in some patient groups, need to be taken lifelong, and have undesirable side-effects. Physical interventions have therefore been designed to stimulate bone formation in the affected parts of the skeleton. In postmenopausal osteoporosis, the bone loss is systemic, but in disuse-related osteoporosis (e.g. after spinal cord injury), it is confined to the bone regions that no longer experience normal levels of loading from weight-bearing or from muscles pulling on the bones via tendons to achieve movement. Disuse osteoporosis therefore lends itself to targeted rehabilitation interventions aimed at stimulating specific regions of the skeleton. In collaboration with the Queen Elizabeth National Spinal Injuries Unit in Glasgow, we are developing and evaluating the effectiveness of vibration-based interventions and other modalities based on the electrically-stimulated recruitment of paralyzed muscles. The interventions are targeted at stimulating bone formation around the knee and ankle joints, which are the fracture-prone sites in this patient group. Data will be presented from studies in paraplegic and tetraplegic patients undergoing rehabilitation intervention to attenuate bone loss in the first year of injury, and from other studies aimed at reversing osteoporosis in the chronic stages.

Sylvie Coupaud, PhD

Lecturer, Department of Biomedical Engineering, University of Strathclyde



Biography: Sylvie Coupaud obtained a BA in Biological Sciences (University of Oxford, 1999), MRes in Biomedical Engineering (University of Strathclyde, 2001), and PhD in Rehabilitation Engineering (University of Glasgow, 2005). Upon completing her post-doctoral research program, she was appointed as Faculty staff in the Department of Biomedical Engineering at the University of Strathclyde, in November 2015. Dr Coupaud's research focus is on long-term health consequences of disuse and immobilisation, and on rehabilitation interventions to tackle them. She is also a Clinical Scientist, and maintains strong clinical collaborations through patient-based studies at the Queen Elizabeth National Spinal Injuries Unit (Glasgow, U.K.). She has recently held a Solomons Award (2015-18) from the International Spinal Research Trust, to support her clinical research activity, and has ongoing research grants with the Science and Technology Facilities Council (UK) and the medical charity INSPIRE (UK), to develop and evaluate rehabilitation interventions for patients with disuse osteoporosis.

Glucose Metabolism For The Inhibition Of Cancer Growth

Abstract: Cancer cells utilize glucose at elevated levels to support their growth and proliferation, historically known as the "Warburg effect". Targeting glucose metabolism in cancer cells is innovative strategy for the inhibition of cancer growth. Hexokinase, the first enzyme in the metabolism of glucose, catalyzes the phosphorylation glucose to glucose 6-phosphate (G6P) using ATP as a phosphate donor. G6P is the activated form of glucose that is important to initiate the metabolism of glucose. Hexokinase is the major step in regulation of glucose metabolism and can be used to inhibit the inhiation of any cell. However, to specifically inhibit cancer growth and not that of normal cells, we need to specifically inhibit the metabolism of glucose in cancer but not in normal cells. This can be achieved by targeting the second isozyme of hexokinase. In human, four isozymes of hexokinase have been identified with isozyme 2 is highly expressed in cancer. Gene expression profiling experiments on different types of cancer showed high expression levels of hexokinase 2 (HK2) in comparison to other human isozymes. The use of HK2 as target for the development of cancer drugs will ensure high specific to cancer drug that will ensure low side effects. The crystal structure of human HK2 that is a homodimer with catalytically active N- and C-terminal domains linked by a seven-turn α-helix. We revealed the role of the linker helix-α13 in maintaining the activity of the N-terminal domain of HK2. Further mutagenesis studies identified site that can directly inhibit the N-terminal domain of HK2.

Wael M. Rabeh, PhD

Assistant Professor, Science Division, New York University Abu Dhabi

Biography: Prof. Wael Rabeh received his PhD in 2004 at the Biochemistry Department, University of Oklahoma, where he carried the mechanistic characterization of the last enzyme in the cysteine biosynthetic pathway in Salmonella typhimurium. In 2005, Dr. Rabeh joined the Structural Genomic Consortium (SGC) at the University of Toronto as a post-doctoral fellow, where he characterized the 3D structure of human proteins with medical relevance using X-ray crystallography. To further expand his expertise in the filed of protein chemistry, in 2007, Dr. Rabeh joined the lab of Prof. Gergely Lukacs at McGill University in Montreal Canada for the characterization of a membrane channel that is the main cause of Cystic Fibrosis. In 2010, Prof. Rabeh joined the faculty of chemistry at New York University Abu Dhabi to establish the chemistry and biochemistry teaching and research program. Currently, his research is devoted for the characterization of proteins' structure and mechanism to understand their biological function.

Posters

The Protein Dynamics of the Luciferase reaction for Red and Green Emission

Abstract: The different light emitted colors by bioluminescent beetles ranging from yellow-green to red are related to slightly different enzymes (luciferases) that catalyze the same two-stage chemical reaction of converting luciferin to oxyluciferin in the presence of ATP and oxygen. To investigate the mechanism of the color tuning in beetle luciferases, the crystal structures of several luciferases that emit light at different wavelengths was determined. Several mutations were introduced in two loops that may affect the color emission and support emission mechanism. Loop$^{346–361}$, which is at the bottom of the active site, was found to have an effect on the energy of the emitted light. The loop contains a few amino acid substitutions that are different between the green- and red-emitting luciferases. The emission of the green-emitting wild-type enzyme was red-shifted from 539 nm to 580 nm. Similarly, the emission of the red-emitting wild-type enzyme was blue-shifted from 623 nm to 603 nm. Currently, we are using Hydrogen/Deuterium-Exchange--Mass Spectrometry (HDX-MS) to study protein dynamics in solution at different conformational states induced by the binding of substrates or products. In this study, a comparative analysis is conducted on the wild-type enzyme, as well as mutants that red shifted the emission of green luciferase, or blue-shifted the red-emitting luciferase. The HDX data reveal high dynamic on the loop for the green luciferase mutant, while less dynamics was observed in the red luciferase. In addition, the rate of HDX increased for the green mutant compared to the red luciferase wild-type. However, the green wild-type was more stable at half of the rate of dynamics.

Abdul-Rahman Khrbtli

Supervisor/PI: Wael Rabeh
Affiliation: Chemistry, Science Division, New York University

Biography: Abdul-Rahman received his bachelor in engineering from the University of Sharjah in 2017. His background was more focused on energy and sustainability research, where he worked on synthesizing and developing third-generation solar cells and ferric materials for environmental applications using XRD and SEM. He extended his research to work in Nano-Technology and develop new Nano-Fluids with enhanced thermo-physical properties by dissolving Nano-Particles into base-fluids via several techniques. In January 2018, he joined NYU Abu Dhabi as a Research Technician at Wael Rabeh Lab in Chemistry Division, where he started a new challenge to work in biochemistry. His work is mainly on applying HDX Mass Spectrometry on several enzymes to investigate the dynamics at the different areas of enzyme folding.

Design Of A Novel Biochip For Multiaxial Stretching Of Cancer Cells

Abstract: Studying the effect of mechanical forces on the migratory and biological responses of cancer cells is of interest to several fields including drug delivery, mechanobiology, and metastasis. Several stretching devices have been designed and implemented to study functional responses of various cells by inducing elastic deformations on them. However, despite being very helpful in our current understand of cellular mechanobiology, they entail various limitations.

Adnan Ali-Hassan, Amr Elashmouny, and Gladys Tarisai Mwedzi

Supervisor/PI Name: Mohammad A. Qasaimeh
Affiliation: Engineering Division, New York University Abu Dhabi

This senior undergraduate capstone project aims to develop a custom-made stretching device that fits in an incubator as well as on a microscope stage, yet offers various stretching scenarios during the same experiment.

Our device constitutes a PDMS chip with multiple wells of different shapes including circular, square, rectangular, and oval. A thin PDMS membrane covers the wells-chip and stretches upon pressurizing the wells. Our study considered optimizing the wells' sizes and shapes, and results show that the membrane stretches differently corresponding to each well geometry. Therefore, cancer cells seeded on the PDMS membrane can experience different stretching magnitudes, directions, and distributions, within the same setup and during the same experiment.

Next steps include building and testing the biochip, followed by studying the response of cancer cells under these different multiaxial stretching scenarios.

Biographies:

Adnan Ali-Hassan: Adnan is a student from Beirut, Lebanon, currently completing his undergraduate degree in Mechanical Engineering with a focus on Bioengineering. He is planning to pursue further studies in Biomedical Engineering.

Amr Elashmouny: Amr is an undergraduate Mechanical Engineering student from Alexandria, Egypt. He is intending to pursue a career in business management.

Gladys Tarisai Mwedzi: Gladys is a senior Mechanical Engineering student from Zimbabwe. She is interested in Public Health, a field she is planning to pursue after graduation.

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Exploring The Conformational Ensemble Of DNA Construct In Presence Of Cations: MD Simulations And FRET

Abstract: Many complex nucleic acid structures contain rigid base-paired regions connected by flexible linkers. Helix-Junction-Helix (HJH) DNA constructs are ideal systems to study the tertiary folding of these structures. Experimental studies show that the conformational ensembles sampled by these constructs show differences depending on the counter ion valence and its concentration. However, atomic detail necessary to understand these differences, as well as nucleic acid folding, in general, is lacking. Here, we combine fluorescence resonance energy transfer (FRET) measurements and all-atom molecular dynamics simulations to study the interplay between DNA conformations and ionic environment.

The conformational ensemble of the DNA was explored by both conventional molecular dynamics and metadynamics simulations. HJH structure is dominated by two conformational sub-states defined as open and closed states. Metadynamics simulations allowed computing the free energy surface and populations of these states, providing a direct comparison between experiments and simulations. Molecular simulations showed good agreement with FRET measurements in the presence of both monovalent and divalent ions. Together, the integrated approach offers unprecedented detail into the energetics and atomic level mechanism of the conformational preferences of HJH constructs that help to understand the physical principles governing nucleic acids interactions and folding.

Amit Srivastava, PhD

Supervisor/PI: Serdal Kirmizialtin
Affiliation: Chemistry Program, Science Division, New York University Abu Dhabi

Biography: Dr. Amit Srivastava is Research Scientist at Science Division, New York University, Abu Dhabi. He received his PhD in Physical Sciences from Institute of Science, Banaras Hindu University, India.

How Does Cation Size Impact RNA Mechanical Stability? - A Computational Study

Abstract: The folding and subsequent stabilization of functional RNA structures depend strongly on the electrostatic-screening of its negative charges by alkali and alkaline earth metal ions. Such cations can either bind to structurally well-defined RNA sites or form a so-called ion cloud around the RNA. However, direct observation of these ions and their interplay with RNA conformations is a prohibitive task experimentally. Indirect measurements (i.e., mechanical pulling experiments) revealed that sodium ions are better for RNA-structure stabilization than potassium ions, that possess the same valance but a larger hydrodynamic radius. The physical principles governing extra stability due to ion size are lacking. Here, we performed all-atoms molecular dynamics (MD) simulation to investigate this finding in detail.

The energy landscape of the mechanical pulling reaction coordinate was studied via MD simulations employing umbrella sampling and milestoning approaches. We explored the transition states and compute the rupture times as a function of applied force to the termini atoms. By comparing the mechanical response of TAR HIV-1 hairpin in NaCl and KCl we could confirm the higher RNA stability in the presence of sodium ions. Our extensive analysis of the structural and energetic details of RNA–ion interactions unveiled electrostatic screening as the reason for this mechanism. We uncovered the physical principles governing this low-screening due to ion size. Overall, our results provide a high-level understanding of the interaction of monovalent cations with RNA molecules. In addition, we propose an explanation on how ion size modulates the mechanical energy landscape of RNA–ion complexes.

Anja Henning-Knechtel, PhD

Supervisor/PI: Serdal Kirmizialtin
Affiliation: Chemistry Program, Science Division, New York University Abu Dhabi

Biography: Dr. Anja Henning-Knechtel is working currently with Prof. Serdal Kirmizialtin (NYUAD, UAE) towards a deeper understanding of nucleic acids interacting with ions and proteins, using computer simulations. She obtained her MSc in nanobiophysics and PhD in chemistry from TU Dresden, Germany, both with focus on structural and functional DNA nanotechnology. The accompanied experimental research work was pursued in the labs of Prof. Michael Mertig (TU Dresden) and Prof. Itamar Willner (Hebrew University of Jerusalem, Israel). Thereafter she worked as postdoctoral researcher in the lab of Prof. Hagan Bayley (Oxford University, UK) on novel DNA-based design strategies for nanopores, and collaborated with the group of Andrew D. Hamilton (NYU, US) on the development of inhibitors against amyloid-beta aggregation and cytotoxicity.

Rapid And Spatially Separated Heterogenous 3D Cellular Patterning Using Electro Hydrodynamics

Abstract: We present an electrically actuated approach for creating heterogeneous 3D micro-tissues using HeLa cancer cells and human foreskin fibroblasts models. In this methodology, we sequentially assemble cell types to ensure distinct spatial positioning for forming a dense heterogeneous cluster. An optimized sinusoidal voltage of 50 kHz was applied to the interdigitated electrode chip for inducing fluid flow to carry cells and deposit them in the center of the sessile droplet. This method is rapid, robust, and can provide repeatable cell micro-tissues using various cell concentrations and cell types.

Anoop Menachery, PhD

Supervisor/PI: Mohammad Qasaimeh
Affiliation: Division of Engineering, New York University Abu Dhabi

Biography: Anoop Menachery has several years of academic and industry experience in the fields of AC electrokinetics and microsystems. His expertise lies in the development of microfluidic devices and in the design and execution of technical concepts for device integration. Dr. Menachery has previously worked as a senior engineer at Apocell, where he was involved in the development, validation and commercialization of an automated product to isolate circulating tumor cells from patient blood.
He also previously worked as a post-doctoral researcher in the bio-electronics group at the Universities of Glasgow and Edinburgh in the area of microfabrication technologies applied to the detection and isolation of embryonic stem cells and parasites. Dr. Menachery obtained a Master's degree in Nanotechnology and Microfabrication and a PhD in Electronic Engineering from Bangor University, UK.

Mimicking of Biomechanical Interactions of Immune Synapse in vitro

Abstract: Recent advances in therapeutic response to cancer have led to the development of immunotherapy, the ex vivo modification of T cells through the introduction of genetic material followed by the expansion of the cells upwards of billions of cells. The expansion of T cells requires their activation, which is triggered by two main signals initiated by the formation of the immunological synapse, a complex structure formed by the T cell recognizing its' cognate antigen on antigen-presenting cells (APC).

Aseel Alatoom

Supervisor/PI: Jeremy Teo
Affiliation: Division of Engineering, New York University Abu Dhabi

In this we work, we study an artificial system of polyacrylamide hydrogel for mimicking the interaction of APC with Jurkats (immortalized T cell line). The polyacrylamide (PA) gels prepared had a range of stiffness that correspond to APC's (0.2 Pa, 2 kPa, 10 kPa, and 25 kPa), and were subsequently coated with varying concentrations of anti-CD3 and anti-CD28 antibodies to study their significance in Jurkat proliferation. The binding of antibodies was confirmed using fluorescent spectroscopy. CFSE-stained Jurkats were seeded on PA gels for three days, cell proliferation was elucidated by measuring the CFSE fluorescent signal and quantified with NXT Flow Cytometer. The results of this study show enhanced Jurkat proliferation on stiffer gels, with T cell receptor is postulated to be the major stiffness receptor; inducing stronger signaling when CD3 is fixed on a stiffer substrate.

Biography: Aseel graduated from American University of Sharjah with M.Sc. in Biomedical Engineering, she is continuing her research in biomaterials the division of engineering in LIBRA Lab.

Stress-Susceptible Mice Exhibit Blunted Daily Rhythms In Firing In Lateral Habenula Projections In Stress-Susceptible Mice And Delayed Photoentrainment

Abstract: Daily rhythms are disrupted in patients suffering from mood-disorders. The lateral habenula (LHb) and dorsal raphe nucleus (DRN) contribute to circadian timekeeping and regulate mood. Thus, pathophysiology in these nuclei may be responsible for aberrations in daily rhythms during mood disorders. Using the chronic social defeat stress (CSDS) paradigm and in-vitro slice electrophysiology, we measured effects of stress on diurnal rhythms in firing of LHb cells projecting to DRN (cells$^{LHb\rightarrow DRN}$). We also performed optogenetic experiments to investigate if increased firing in cells$^{LHb\rightarrow DRN}$ during subthreshold social defeat stress (SSDS) induces stress-susceptibility. Last we investigated whether exposure to CSDS affected the ability of mice to phototentrain to either a new LD cycle, or a single light-pulse (15 minutes) in continuous dark (DD). The cells$^{LHb\rightarrow DRN}$ of susceptible-mice express elevated firing in both, day and night. In contrast, control and resilient-mice exhibit daily rhythms in firing with low activity in day and high at night. Optogenetic activation of cells$^{LHb\rightarrow DRN}$ during SSDS induces stress-susceptibility which shows direct correlation between increased activity in this circuit and putative mood disorders. Finally, we found that susceptible-mice are slower, while resilient-mice are faster, at photoentraining to either a new LD cycle or after a single light-pulse in DD.
Our findings suggest that CSDS induces blunted daily rhythms in firing in cells$^{LHb\rightarrow DRN}$ and slow rate of photoentrainment in susceptible-mice. In contrast, resilient-mice may undergo homeostatic adaptations that maintain daily firing rhythms in cells$^{LHb\rightarrow DRN}$ with showing rapid photoentrainment to both, in a new LD-cycle and in DD after a single light-pulse.

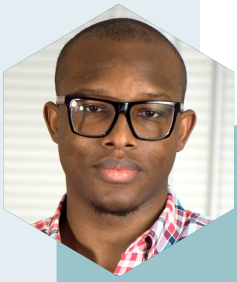
Ashutosh Rastogi, PhD

Supervisor/PI: Dipesh Chaudhury
Affiliation: Division of Science, New York University Abu Dhabi

Biography: Ashutosh Rastogi did his PhD (2012, India) in the neurobiology of bird migration, where he trained in neuroanatomy and studied role of olfactory/ visual sensory systems and seasonal clock of migration. After his PhD, he did his postdoctoral training (2013-2018) under the mentorship of Prof. Eric Mintz at Kent State University, USA, where he was involved in projects on circadian clock and neural basis of food anticipatory activity (FAA) in mice. Specifically, he investigated the sexually dimorphic nature and ontogenic differences in FAA, and how limited food availability affects estrous cyclicity and shifts peripheral circadian clock in ovaries in relation to master circadian clock (suprachiasmatic nucleus, SCN). In early 2019, he joined Dr. Chaudhury's group at NYUAD as a research associate, where he is investigating neural circuitry of depression and how these mood disorders compromise the circadian clock, using a combination of behavioral, neuroanatomical, electrophysiological and optogenetics tools.

Selective Gene Transfer into Single Adherent Cells using the Micro-electro-fuidic Probe

Abstract: This work presents the development of a 3D printed micro-electro-fluidic probe (MeFP) for a highly reproducible, affordable, and yet efficient microfluidic tool for the transfection of single adherent cells via electroporation. The MeFP builds on the concept of hydrodynamic flow confinement (HFC) to enable the application of microfluidic systems in biology while cells remain cultured in their conventional macro scale environment. The setup constitutes of a 3D printed MeFP -- gold coated MFP with an array of pin shaped microelectrodes integrated on its tip -- and an ITO coated glass slide. By culturing cells on the ITO coated glass slide, and placing the MeFP-based electrode a 10 µm a top of the target, cells are sandwiched by highly concentrated electric field for brief opening of the pores in their membrane. The setup, and submicron feature size of the MeFP, allows for a selective exposure of the targeted cell to both the electric field and HFC of an intercalating agent, to demonstrate transmembrane crossing through electroporation. Results show successful transfer of propidium iodide (PI) and plasmid DNA through the membranes of single HeLa cells. By adjusting the size of the HFC (varying injection and aspiration flow ratio), the cell target area can be dynamically increased from the single cell footprint by a factor of 10. These results demonstrate the MeFP as advancement to the currently available transfection technologies for gene therapy, delivery DNA vaccines, in vitro fertilization, cancer treatment, regenerative medicine, and induced pluripotent stem (iPS) cells.



Ayoola Brimmo

Supervisor/PI: Mohammad A. Qasaimeh
Affiliation: Engineering Division, New York University Abu Dhabi

Biography: Ayoola is a Ph.D. candidate in the Department of Mechanical and Aerospace Engineering at NYU. He works in the Advance Microfluidics and Microdevices Laboratory (AMMLab) at NYU Abu Dhabi. His research focuses on the development of open fluid microfluidic “lab on tip” devices for isolating and manipulating single mammalian cells, as potential point-of-care diagnostics tools. Before commencing his Ph.D. at NYU, Ayoola was a Research Engineer at Masdar City working on sustainable technologies mostly with the aid of numerical tools. In 2013, he obtained his M.Sc. in Mechanical Engineering at Masdar Institute in collaboration with Massachusetts Institute of Technology (MIT), and has since been involved in non-profit ventures aimed at proffering sustainable solutions to energy and environmental problems in developing countries.

Open Microfluidics A Multiplexed Capture Of Circulating Tumor Cells

Abstract: Circulating tumor cells (CTCs) are well known to hold valuable information that could potentially aid early diagnosis, and timely treatment of cancer patients. To facilitate clinical examinations of CTCs, compact methods for capturing and analyzing CTCs are required. Here, we build up on our previously demonstrated 3D printing of microfluidic probes (MFPs) and we develop a new MFP integrated with herringbone micro-mixing features on its tip (HB-MFP). Being a contactless technology, the HB-MFP allows activating the substrate with multiple affinity molecules for a multiplexed capture of CTCs. Experiments are carried out with three different types of samples -- PC3 spiked in buffer, PC3 spiked in healthy blood, and clinical blood samples from prostate cancer patients with various medical records.

The HB-MFP provides high throughput, high capture efficiency, and multiplexing immunocapture capability. The introduced technology could serve as a feedback system on the efficacy of implemented treatment strategies, as a mean for in vitro drug testing, or simply for diagnosis.

Ayoub Glia

Supervisor/PI: Mohammed A. Qasaimeh
Affiliation: Division of Engineering, New York University Abu Dhabi

Biography: Mr. Ayoub Glia joined the AMMLab at NYUAD in July 2017 to work on the blending of Atomic Force Microscopy and Microfluidics capabilities into a prospective tool for cell analysis.

Before NYUAD, Ayoub was working for the military survey department for two years in the area of hydrography whereby Lidar signals are processed for sea bed modeling. He was then assigned to aerial trigonometry through satellite, aerial imagery and lidar signals. Digital terrain modeling and the production of topographic orthophotos for the whole UAE were also part of his missions during his two year career in the military. Before that, he obtained his Master's degree in Material Science and Engineering from Masdar Institute of Science and Technology, where his research domain was ranging from materials characterization to the development of vital AFM techniques, especially, in situ control and interpretation of AFM tip`s geometry for grasping better understanding of tip-sample interactions.

Development And Performance Analysis Of A Novel MOF-Based Composite For MEMS Chemical Sensing Applications

Abstract: Aquaculture production contributes significantly to the total world production of aquatic animals. Numerous environmental pollutants may reach coastal waters where marine aquacultures are established via several sources such as coal-burning electric utilities, manufacturing plants and mining activities. Mercury is one of the most hazardous environmental pollutant due to its health implications on humans. As such, there is a need to assess the contamination of sea water to ensure the safety of seafood and effectively prevent health deterioration due to Mercury absorption through seafood consumption. This research aims at developing and evaluating a chemical sensor comprising of an electrically-actuated microbeam coated with Metal Organic Framework (MOF)-based polyacrylamide composite to selectively sorb Mercury. This MEMS device is expected to be deployed for real-time monitoring of Mercury concentration in marine aquacultures (open water). The main focus of the present research work is the development of novel facile MOF-based composites for detection and removal of Mercury (Hg^{2+}) ions from aqueous solutions and saline water samples.

This research will utilize the microwave-assisted synthesis procedure to produce the MOF in an inexpensive and less time-consuming method. This will further enhance the abilities of the sensing device to become commercially attractive and more feasible for industrial use. NH2-H2BDC-Cd novel MOF was synthesized in this research along with NH2-MIL-88(Fe) and Cd-H3TATAB.
The three MOFs were tested for Mercury detection at a concentration of 1000 µM. The three MOFs showed adequate ability of detection with the NH2-H2BDC-Cd achieving the highest detection of 87.6%.

Bassam J. ElTaher

Supervisor/PI: Mehdi Ghommem, Rana Sabouni
Affiliation: Biomedical Engineering, American University of Sharjah

Biography: Bassam Jihad ElTaher is a graduate student, currently doing his Master's degree in Biomedical Engineering in the American University of Sharjah. Bassam has a bachelor's degree in Chemical Engineering from the American University of Sharjah and has graduated with Cum Laude Honors. Bassam's achievements include, shortlisted as a finalist with his group, in the 6th Undergraduate Research Competition, achieved Dean's List twice in 2015 and 2017, as well as being a member in the Engineering Honor Society at the American University of Sharjah due to his excellent academic performance. Bassam Jihad ElTaher lives in Sharjah, United Arab Emirates.

Micropatterned Paper Platform For 3D Cancer Models

Abstract: Three-dimensional (3D) cell culture gained increased attention in life-sciences applications, including tissue engineering and drug development. Various microfabricated scaffolds have proven to be effective in growing 3D cell culture, however their fabrication is complex, time-consuming, and expensive. In our previous work, we utilized filter papers as platform to grow and cryopreserve mammalian cells with no significant effect on their viability and metabolic activity. In this work, we further created an array of micropatterns on papers (221 distinct hydrophilic regions per 9 cm2 area) to generate 3D cancer models. Using breast MCF-7 cancer cell line, we show that cells can be cultured within circular regions of 400 µm diameter separated by 700 µm distance. The developed platform simplifies the process of patterning 3D cell cultures, and opens the door for high-throughput, cost-effective biological assays.

Bisan Samara

Supervisor/PI: Mohammad A. Qasaimeh
Affiliation: Engineering Division, New York University Abu Dhabi

Biography: Bisan is a Research Assistant in the Advanced Microfluidics and Microdevices Laboratory (AMMLab) at NYU Abu Dhabi. Her research focuses on developing three-dimensional cell culture platforms, and methods to detect cancer cells in bodily fluids. Prior to joining AMMLab, Bisan worked as Research Assistant at Khalifa University of Science and Technology (Biomedical Engineering Department), and at Mohammad Bin Rashid University of Medicine and Health Sciences (College of Medicine). She obtained her B.Sc. in Biomedical Engineering (with high honor) from Khalifa University.

A Novel Molecular Diagnostic Platform Based On Combination Of A Simple Sample Preparation Technique And A Bio-Optical Sensor Technique

Abstract: Diseases caused by pathogenic microorganisms including bacteria and viruses can cause serious medical issues including death and result in huge economic losses, so rapid identification of pathogens is crucial for preventing public health threats. Various pathogen diagnosis techniques have been introduced; however, multi-target detection in large volume clinical samples with a low concentration of pathogens is long turnaround time, lack sensitivity and specificity for clinical use. Here, we developed a rapid and accurate multi-target diagnostic platform conjugated homobifunctional imidoesters (HIs) based microfluidic system as sample preparation and silicon microring resonators (SMRs) based bio-optical sensor as detection technique for diagnosis of various diseases. This microfluidic system consists of an assembled double microfluidic chip for streamlining large volume processing and HIs for capturing pathogens and isolating nucleic acids by both electrostatic and covalent interaction.

The system significantly increases the enrichment and extraction rate of pathogens (up to 80% at 10 CFU in a 1 mL volume within 50 min) and we demonstrated its clinical utility in large sample volumes from 46 clinical specimens including environmental swabs, saliva, and blood plasma. Further, the SMR based bio-optical sensor allowed for sensitive and specific multi-target detection of human coronavirus (hCoV), Middle East respiratory syndrome (MERS), Zika virus, and Ebola virus down to several copies. The sensor also simultaneously distinguished between MERS and hCoV from clinical specimens within 20 min. Therefore, we believe that this novel molecular diagnostic platform could be changed the paradigm of disease diagnosis with rapidity and high sensitivity in various clinical applications.

Bonhan Koo

Advisor/PI: Yong Shin
Affiliation: College of Medicine, University of Ulsan

Biography: Bonhan Koo received the M.S degree in University of Ulsan College of Medicine in 2018. Currently, he is a Ph.D student of Prof. Yong Shin's laboratory at University of Ulsan College of Medicine and Asan Medical Center, Seoul, Korea. His research is focused on development of molecular diagnostic platform based on optical biophotonics for detection of disease related biomarkers.

A FRET-Based Probe for High Throughput DNA Intercalator Drug Discovery and In Vivo Imaging

Abstract: Molecules that bind DNA by intercalating its bases remain among the most potent cancer therapies and antimicrobials due to their interference with DNA-processing proteins. To accelerate the discovery of novel intercalating drugs, we designed a Fluorescence Resonance Energy Transfer (FRET)-based probe that reports on DNA intercalation, allowing rapid and sensitive screening of chemical libraries in a high-throughput format. We demonstrate that the method correctly identifies known DNA intercalators in approved drug libraries, and discover previously unreported intercalating compounds. When introduced in cells, the oligonucleotide-based probe rapidly distributes in the nucleus allowing direct imaging of the dynamics of drug entry and its interaction with DNA in its native environment. The combined ability of the single probe to identify intercalators in vitro and follow their function in vivo can play a momentous role in accelerating the discovery of novel DNA-intercalating drugs or repurposing approved ones.

Chandrashekhar Murade, PhD

Supervisor/PI: George Shubeita
Affiliation: Physics Program, Science Division, New York University Abu Dhabi

Biography: Chandra Murade completed his Master's degree in Physics at Pune University, India, in 2003. He then moved to the University of Twente in the Netherlands to pursue his PhD in Biophysics, where he developed combined optical tweezers and line scanning fluorescence microscopy to study DNA intercalation at the single molecule level. He obtained his PhD in the year 2010. He then switched gears and worked in the field of opto-fluidics in the Physics of Complex Fluids Group at Twente. He subsequently moved to the Institute Jacques Monod in Paris, where he developed maskless photolithography using Digital Micro Mirror Device to create 2D and 3D biocompatible patterns. In 2016 Chandra moved to NYUAD to join George Shubeita's group as Research Scientist, where he developed various molecular sensors to probe cellular organization, function and interactions.

Nuclear β-Actin Contributes To An Open Chromatin For Activation Of The Adipogenic Pioneer Factor CEBPA During Transcriptional Reprograming

Abstract: Adipogenesis is regulated by a cascade of signals that drives transcriptional reprogramming into adipocytes. Here, we report that nuclear actin is important in regulating the chromatin states that establish tissue specific expression during adipogenesis. To study the role of β-actin in adipocyte differentiation we conducted RNA-Sequencing on wild-type (WT) and β-actin knockout (KO) mouse embryonic fibroblasts (MEFs) after reprograming to adipocytes.

We found β-actin depletion affects induction of several adipogenic genes during transcriptional reprograming. This impaired regulation of adipogenic genes is linked to reduced expression of the pioneer factor Cebpa and is rescued by reintroducing NLS-tagged β-actin. ATAC-Seq revealed that reduced Cebpa expression correlates with decreased chromatin accessibility at the transcription start site and promoter proximal region of the Cebpa gene in KO MEFs, concomitant with loss of chromatin association of the ATPase Brg1. We propose a novel role for nuclear β-actin in maintaining open chromatin for transcriptional reprogramming during differentiation.

Chanyong Tina Kim

Supervisor/PI: Mohamed Al Sayegh
Affiliation: Biology, New York University Abu Dhabi

Biography: Tina is from South Korea and graduated with a BS in Biology from New York University Abu Dhabi in 2018. She is currently working as a research assistant in the Al Sayegh lab, with a particular interest in gene control of the adipogenic differentiation program in the mouse stem cell model.

MechanoCellCAD - A Generalized Automated Design Tool for Analyzing Cell Traction Forces and Thrashing Forces on a Soft Micropillar Array

Abstract: Soft pillar microarrays are extensively used in experiments to quantify cellular traction forces and locomotory forces of disease model organisms such as Caenorhabditis elegans. In order to obtain high sensitivity measurements, the problem arises where the traditional beam bending equations are not sufficient to capture the force-deflection relationship of micropillars. We present a generalized automated finite element model analysis tool for analyzing traction forces at cellular focal adhesions on a micropillar substrate. The analysis tool automates the finite element model development, analysis, and post-processing of the experiments that are performed with micropillar arrays. First, this model was used to examine the sources of error in traditional methods such as flexibility of the substrate. Second, parametric analyses were performed on micropillar array geometry, modelling assumptions, and mesh density. Lastly, a case study is presented that demonstrates the capabilities of this approach in practical experimental applications. Results showed that the automated modelling is performed in seconds and models were analyzed and post-processed within few minutes. The resulting data was found to be more accurate than data obtained through traditional methods. We demonstrated that this approach provided increased levels of accuracy over traditional methods and allowed researchers the freedom to both: (1) design micropillar arrays that would not provide reliable data with traditional methods and, (2) visualize the resulting data in novel and pedagogical ways.

Christopher Stubbs, PhD, and Samuel Sofela

Supervisor/PI: Yong-Ak Song
Affiliation: Division of Engineering, New York University Abu Dhabi

Biography (Christopher J Stubbs) : A biomechanical researcher with expertise in nonlinear finite element modeling of biological structures. His PhD at New York University focused on applying these state of the art finite element modeling techniques to computational biomechanics. Examples include developing parametric models of maize stems, finite element models of biomechanical structures in bone, and computationally simulated experiments of C. elegan thrashing forces.

Biography (Samuel Sofela): A bioengineering researcher with expertise in biophysical phenotyping of disease model organisms using microfluidic techniques. His expertise includes designing and fabrication of high-throughput microfluidics devices for phenotyping and imaging model organisms. He is currently a PhD student at the New York University with research in the Abu Dhabi campus.

Functional Validation of Candidate Causal Genetic Variants using the CRISPR/Cas9 system

Abstract: The application of the CRISPR/Cas9 system in genome editing has revolutionized the field of genetics. The system can be used to edit genomes and to perform gene knockdowns, knock-ins and activation among several other applications. The system has great potential to enable testing of cellular and molecular effects of genetic variants that have been discovered in genome-wide associations studies (GWAS) and surveys of regulatory genetic variants (eQTL studies). Here we show the application of the CRISPR/Cas9 method to test causal effects of genetic variants associated with important molecular and cellular traits using single base editing and knockout experiments. Specifically, we tested the system on nuclear genetic variants that have previously been associated with mitochondrial function. We performed quality control procedures at various steps of the process and describe the results of these experiments.

Fatima AlJallaf

Supervisor/PI: Youssef Idaghdour
Affiliation: Science Division, New York University Abu Dhabi

Biography: Fatima earned her BSc in Biotechnology from the University of Sharjah and her MSc in Water and Environmental Engineering from Masdar Institute. During her masters, Fatima has successfully isolated and characterized native and novel microbial strains in the UAE with promising agricultural applications. Currently, Fatima is working on population genetics of the UAE populations and on applications of CRISPR technology in genome engineering.

The Epidemiology and Burden of Cardiometabolic Risk factors in a Young Emirati

Abstract: Introduction: The UAE experienced a rapid economic growth that was paralleled with a drastic rise in non-communicable diseases (NCDs); primarily cardiovascular disease and diabetes. These NCDs are caused by the accumulation of cardiometabolic risk factors (CRFs) including obesity, dysglycemia, dyslipidemia, hypertension and central obesity. The CRFs are associated with other factors like sociodemographic status, physical inactivity, smoking, and heredity.

Objective: Our objective was to investigate the burden of CRFs and their interrelationship, and to estimate the association with other underlying determinants.

Methods: Data was drawn from the UAE Healthy Future Study participants aged 18 to 40. Demographic, health and behavioral information was collected through questionnaires. Anthropometric data and blood pressure were measured, and blood samples were extracted.

Results: In a sample of 5,126 eligible participants, the prevalence rates were 26.5% for obesity, 11.7% for dysglycemia, 62.7% for dyslipidemia, 22.4% for hypertension and 22.5% for central obesity. Obesity had the strongest interrelationship with other CRFs. Education, employment, smoking and family history had significant associations with some metabolic markers. Forty-percent of the population had ≥2 CRFs, and the accumulation was higher in men. The burden of ≥2 CRFs was significantly affected by age, education, and family history.

Conclusion: Cardiometabolic abnormalities are highly prevalent in young adults in the UAE. These risk factors are accumulating and are affected by sociodemographic, lifestyle and familial history determinants. Obesity is highly associated with having other metabolic risk factors simultaneously. This should be taken into account in the design of target-group-specific measures for the prevention of NCD development.

Fatima Mezhal

Supervisor/PI: Raghib Ali
Affiliation: Public Health Research Center, New York University Abu Dhabi

Biography: Fatima Mezhal is a PhD candidate in Public Health and Epidemiology. Her passion is in improving health by understanding the health profile and improving it in the United Arab Emirates. She has a growing expertise and knowledge in non-communicable diseases and associated risk factors, which is an improving field in the region. She is currently a Research Associate at the Public Health Research Center working on the UAE Healthy Future Study, which is the first cohort study in Abu Dhabi that is established to address non-communicable diseases in UAE.

Fighting Parasitic Nematodes With Natural Products And Microbial Crystals

Abstract: The discovery of new broad-spectrum anthelmintics to target parasitic worms, which affect 24% of humans, crops, and livestock, remains a challenge. We are using small molecule and natural products to identify novel compounds that affect nematodes and study their modes of action. We established a high-throughput automated platform for chemical and functional genomic screening that accommodates both cell-based and whole-organism assays. We are using the free-living nematode models C. elegans and the distantly related P. pacificus as model organisms.

Hala Fahs, PhD

Supervisor/PI: Kristin Gunsalus
Affiliation: Center for Genomics and Systems Biology, New York University Abu Dhabi

Given the short life cycle of the worm, our platform enables one person to screen 20,000 chemicals per week and perform one genome-wide RNAi screen every three weeks. We validated our approach in a pilot screen of an FDA-approved drug library, which confirmed the effects of known anthelmintics and revealed novel anthelmintic compounds. We screened a library of 32,000 small molecules, selected using a computational approach to predict bioavailability in nematodes and identified numerous candidate molecules that will be assayed for toxicity in mammalian cells. We have also screened a Bacillus thuringiensis library of 300 uncharacterized strains to identify Cry proteins showing toxicity against nematodes. We found 95 strains that hinder the development of worms, and among them 50 strains that act through a Cry5-independent mechanism.

Tests in the plant root-knot parasite Meloidogyne and the veterinary parasite Haemonchus contortus revealed 20 strains with variable severity effects. Virulence factors of these strains are being characterized by DNA sequencing combined with proteomics and functional genomic assays to elucidate their mechanisms of action.

Biography: Hala Fahs is a Senior Research Scientist in the Chemical Genomics Laboratory at New York University Abu Dhabi where she participated in the establishment of an automated high-throughput drug screening platform. Her work focuses on screening large libraries of chemical and biological reagents in whole animals for bioactive compound discovery, toxicity studies, and cell biology research. This includes the identification of new potential disease therapeutics such as broad-spectrum anthelmintics and the use of CRISPR to study the role of cellular components such as germ granules. She participates in outreach activities to stimulate interest and passion for science in UAE youth.

Hala was a Clinical Project Manager at the INSERM in France. She holds a Clinical Trial Investigator Diploma from Pierre and Marie Curie University in Paris. She received her Ph.D. in 2007 in Molecular and Developmental Biology from the University of Strasbourg in France.

Introduction of an Intramural Endoscopy Program at a New Tertiary Referral Center in the Middle East

Abstract: *Introduction*: New endoscopic techniques have led to less invasive therapies to treat gastrointestinal disorders including achalasia, gastroparesis, Zenker's diverticulum, and submucosal tumors. Intramural surgery (IMS) is a novel approach to perform muscular division, submucosal dissection, and tumor removal. IMS procedures include per-oral esophagomyotomy (POEM) and per-oral pyloromyotomy (POP). We evaluate safety and complications after POEM and POP at a tertiary referral center in the Middle East.

Methods: All patients who underwent POEM or POP for the treatment of achalasia and gastroparesis at our institution from January 2016 through May 2019 were retrospectively reviewed. Demographics and surgical outcomes were analyzed.

Results: Thirty-nine patients underwent IMS procedures. 26 (66.6%) were POEM and 13 (33.3%) were POP. The cohort was 54% female with a mean age of 46 years. Among POEM patients, types of achalasia were Type 1 (n=4, 15.3%), Type 2 (n=16, 61.5%), Type 3 (n=2, 7.6%) and unspecified (n=4, 15.3%). Etiology of gastroparesis were idiopathic (n=7, 53.8%), diabetes (n=3, 23.0%) and postsurgical (n=3, 23.0%). All cases were successfully completed endoscopically. The median operative times were 90 minutes for POEM and 41 minutes for POP. Complications within 30 days included bleeding ulcer requiring endoscopic re-intervention (n=1, 2.5%) and nausea/vomiting requiring readmission (n=1, 2.5%). At a median follow-up 6 months there was one mortality, unrelated to the procedure.

Conclusion: IMS procedures are safe and technically feasible with low complication rates. Early data suggest that clinical success in a new center in the Middle East is comparable to larger international published series.

Juan S. Barajas-Gamboa, MD

Supervisor/PI: Matthew Kroh
Affiliation: Digestive Disease Institute, Cleveland Clinic Abu Dhabi

Biography: Juan S Barajas-Gamboa is a Colombian-Born physician scientist currently working at Cleveland Clinic Abu Dhabi. He received this Medical-Doctor degree with honors from the Universidad Autonoma de Bucaramanga. He completed a Postdoctoral Research Fellow in clinical and translational research at the UCSD Moores Cancer Center followed by a Postdoctoral Research Fellow in Minimally Invasive Surgery, Robotic and Bariatric surgery at the UCSD Center for the Future of Surgery. He has already authored clinical textbooks, several book chapters, and has had numerous peer-reviewed publications in high impact factor medical journals including the New England Journal of Medicine (NEJM), Cancer Research, SOARD, Obesity Surgery and Surgical Endoscopy. Moreover as a testament of his devotion to research, he serves as a reviewer, editorial board member, associate and senior editor for several international journals. Research interests are focus on Minimally Invasive/Surgical Endoscopy, Bariatric and Robotic Surgery; including basic sciences/translational research and clinical outcomes research.

Non-Active Site Residues of the Linker Helix Inactivate the N- Half of Human Hexokinase 2

Abstract: The high proliferation rate of tumor cells demands high energy and metabolites that are sustained by a high glycolytic flux known as the "Warburg effect", the hallmark of cancer metabolism. The activation and further metabolism of glucose is initiated by hexokinase, a focal point of metabolic regulation.

Juliana Ferreira, PhD

Supervisor/PI: Wael Rabeh
Affiliation: Science Division, New York University Abu Dhabi

The human hexokinase 2 (HK2) is overexpressed in all aggressive tumors and predominantly found on the mitochondria, where interactions through its N-terminus initiates and maintains tumorigenesis. The human HK1, HK2, HK3 and the recent HK5 isozymes are composed of two halves, where the structural fold of the N-terminal half is similar to the C-terminal half. Each half is composed of a large and small-subdomain that enclose the active site for the binding of glucose and ATP. Despite the high similarity of the active sites in the N- and C-terminal halves of the human hexokinase isozymes, the N-terminal half of HK2 is catalytically active but not that of HK1, HK3 and HK5.

We found previously the linker helix-α13 that protrudes out of the N-terminal half to link it to the C-terminal half of HK2 to be important in maintaining the catalytic activity of the N-terminal half. Here, we identified the interaction of the linker helix-α13 with the catalytic helix-α5 and loop66-77. Even though residues in these areas are not directly involved in bind of the substrates, but still they affected the catalytic activity of the N-terminal half of HK2.

Biography: Juliana is brazilian, and received her PhD in biochemistry from the Universidade Federal de Sao Paulo (UNIFESP) in 2014. Her background was more focused on oxidative process research, where she worked on oxidative stress and characterization of hemeproteins in that. She extended her research to work in biochemistry and biophysics characterization of the thimet olipetidase via several techniques. In April 2015, she joined NYU Abu Dhabi as a PostDoc Associate at Wael Rabeh Lab in Chemistry Division, where she have been working with kinases, with more focus in hexokinase 2.

Identification And Characterization Of Sodium Selenite As A Novel Ferroptosis Inducing Agent

Abstract: Sodium selenite (SS), a commonly used dietary form of selenium, has been previously reported to exhibit anticancer effects through induction of apoptosis and/or autophagy in several cancer cell types. In this study, and for the first time, we report supranutritional doses of SS selectively induces ferroptosis (an iron-dependent oxidative cell death) in human cancer cell lines derived from tumors of breast, prostate, and malignant glioma. We have found that SS activates, system Xc– down-regulation, glutathione (GSH) depletion, glutathione peroxidase 4 (GPX4) degradation, iron oxidation, reactive oxygen species (ROS) generation, and lipid peroxidation (LPO). These are considered as the most validated markers for ferroptosis. Furthermore, the SS-induced ferroptosis was effectively inhibited by the classical ferroptosis inhibitor ferrostatin-1 (Fer-1), iron chelator deferoxamine (DFO), and ROS scavengers such as glutathione (GSH), and N-acetyl cysteine (NAC), superoxide dismutase (SOD), trolox and tiron. Overall, our findings unveil a novel antitumor mechanism of SS in various cancer cells, hence, opening up the exciting possibilities of using SS based pro-ferroptotic drug in cancer treatments.

Karthikeyan Subburayan, PhD

Supervisor/PI: Sehamuddin Galadari
Affiliation: Division of Science, New York University Abu Dhabi

Biography: Karthikeyan Subburayan received his PhD in Biochemistry (2013) from the Annamalai University, India. His PhD was focused on the development of anticancer nanoparticles in drug delivery system, characterizations and their biological evaluations. During 2013-2015, he worked as a Postdoctoral researcher at the National Institute of Traditional Medicine (ICMR), India focused on the multidrug resistant cancer, modulating chemoresistance and cell death pathways. In 2015, he joined as a Postdoctoral researcher in the laboratory of Professor Sehamuddin Galadari, College of Medicine and Health Sciences, the United Arab Emirates University. As Research Associate at NYU Abu Dhabi, Karthik's research is currently focused on elucidating the mechanisms involved in the tumor suppression mediated by a number of anticancer agents including natural compounds.

Deciphering The Molecular Clock Controlling The Neurogenesis Diversity In Drosophila's Medulla

Abstract: The Drosophila eye is composed of 800 unit eyes; each contains 8 photoreceptors (PRs). The visual information collected by the PRs is transferred to the 4 visual processing centers of the optic lobe : lamina, medulla, lobula and lobula plate. The medulla is the most complex structure of the optical lobe. It consists of 40,000 neurons belonging to more than 80 different cell types. These neurons are the progeny of 800 medulla NeuroBlasts (NBs) that derive from a larval neuroepithelium, the Outer Proliferation Center (OPC). The OPC's NBs divide asymmetrically to self-renew and to produce a Ganglion Mother Cell (GMC) that will produce two different medulla neurons. It was shown that the sequential expression of 6 temporal transcription factors (tTF) in NBs generates neuronal diversity. Although the tTF cascade was identified, we don't have dynamic information about the timing mechanisms, the duration and how the transition occurs between tTFs.

The general aim of my work is to develop an ex-vivo NBs primary culture to define the molecular clock of the tTF cascade using live-imaging (L-I) to test if the transition between tTFs cascade is intrinsic to the NB. Then,I will record by L-I, the transition between pairs of tTFs and quantify the duration of each competence window, the number of cell division as well as the duration of the transitions.
These dynamic data will allow us to decipher the molecular clock of tTF and provide essential information about the mechanisms responsible for the neuronal diversity in the Drosophila optic lobe.

Khaled Ben El Kadhi, PhD

Supervisor/PI: Claude Desplan
Affiliation: New York University Abu Dhabi

Biography: Completed my M.Sc and Ph.D in Molecular biology at the university of Montreal. During my PhD I mainly studied an orphan disease : the Lowe Syndrome. My work allowed a better understanding of this disease (PMID: 21658948, 31118240, 30799246) and the discovery of a potential therapeutic strategy to treat it (patent WO/2019/060994).

In 2017 I joined the Desplan lab, first in NYU-NY and then in NYU-AD, to study the mechanisms responsible for the neuronal diversity in the Drosophila brain.

The Optimization of a Modified Organoclay Complex as a Novel Approach to Dental Hygiene

Abstract: Oral diseases have always been a challenge to contend with in the modern world, especially with the adoption of unhealthy lifestyles. These habits have contributed to the growth of S. mutans, P. gingivalis, and H. pylori, among other oral bacteria that encourage the development of dental caries, periodontal diseases, and cancer. To battle these diseases, conventional methods such as toothpastes and mouthwashes have been used and unconventional methods such as carbon compounds and nanoparticles have been developed. The complexation of cationic surfactants and smectite clays has been explored and an example of such an organoclay is the one made of cetylpyridinium chloride (CPC) and montmorillonite (Mt).

In this study, the aforementioned organoclay was prepared and optimized with respect to CPC uptake by varying the contact time between 1 hour and 3 days, varying the CPC concentration between 5.11×10^(-3)M and 4.52×10^(-2)M, and varying the temperature between 25°C and 55°C. The experiments showed that shaking the complex was a better approach to intercalation than using the magnetic stirring plate, and that a 24-hour contact period at a moderate concentration of 1.44×10^(-2)M at 25°C provided the highest level of intercalation and relatively low levels of desorption. Additionally, UV radiation had no effect on the intercalation extent of CPC with montmorillonite. The prepared solids were then tested on saliva samples plated in nutrient agar. These experiments showed that the prepared complex retained its antibacterial behavior through a likely combination of adsorption and lysis.

Marah Mahmoud

Supervisor/PI: Taleb Ibrahim and Sarah Dalibalta
Affiliation: College of Engineering, American University of Sharjah

Biography: Marah Mahmoud was born in 1996 and spent her life in Abu Dhabi, UAE. She went to Abu Dhabi International School and graduated with distinction in 2013. Afterwards, she obtained a Bachelor of Science in Chemical Engineering from the American University of Sharjah and graduated Magna Cum Laude in May 2017. In September 2017, she joined the Chemical Engineering Master's program at the American University of Sharjah as a graduate teaching assistant.

Marah also has some industrial experience. She was a process engineering intern at Sharjah National Oil Corporation in the summer of 2017 and a research & development intern at Lubrex during the summer of 2016. She was also a student assistant in the university library for 2.5 years during her undergraduate studies. Currently, she works in the Assurance: Digital Trust business unit at PwC.

Nuclear Actin Deletion Leads To Decreased Levels Of Replication-Related DNA Damage

Abstract: β-actin is present in the cell nucleus both in G and F forms. Recent studies suggest that nuclear actin and actin binding proteins are involved in heterochromatin regulation and in different steps of DNA damage repair, including relocalization of double-strand breaks and DNA end resection. We have used β-actin knock-out mouse embryonic fibroblasts to further our knowledge of the interplay between genome organization and DNA repair. Using a High Content Screening platform we have quantified the phosphorylation of the histone variant H2Ax in Ser139 (γH2Ax), a central factor in the detection and repair of DNA damage, and found that KO cells show a less prominent γH2Ax signal after etoposide treatment. This is partially explained by the reduced expression of H2Ax, confirmed by RNA-seq and western blot. However, comet assay experiments prove that the reduction of γH2Ax is also due to a reduction of DNA damage in KO cells, an effect that disappears when nuclear actin is reintroduced in the KO background. Moreover, RNA-seq data from WT and KO cells treated with etoposide shows differences in the expression levels of other genes involved in DNA repair. Our findings indicate that loss of nuclear actin may protect from DNA damage caused by etoposide, and at the same alters the expression patterns of DNA repair pathways.

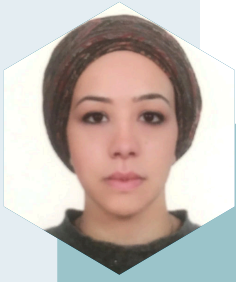
Martin Endara-Coll

Supervisor/PI: Piergiorgio Percipalle
Affiliation: Science Division, New York University Abu Dhabi & Department of Molecular Bioscience, The Wenner Gren Institute, Stockholm University

Biography: Born in Montevideo, Uruguay. I later moved to Catalonia, where I got my Bachelor in Biochemistry and my MSc in Genetics and Genomics. I did my master's thesis in a laboratory in Stockholm University. There, I became interested in DNA damage and repair. After finishing my masters I joined the same laboratory for my PhD, which I do in collaboration with NYUAD.

Comprehensive Transcriptome Analysis of Mouse Embryonic Fibroblasts Undergoing Adipogenesis

Abstract: Adipose Tissue (AT) is a complex organ that develops from a mesodermal lineage and is made up of a wide variety of cell types including adipocytes (fat cells), immune cells, fibroblasts, neurons, endothelium and stem cells. AT is an important organ that is involved in thermoregulation by acting as energy storage as well as providing insulation. AT also acts as an endocrine organ that releases a variety of cytokines and other molecules such as adiponectin, leptin and resistin that are collectively termed "adipokines". In addition to these biological processes, AT and it's development is linked to a variety of chronic obesity related diseases such as diabetes, cardiovascular diseases and cancer. Many models have been used to study adipogenesis such as 3T3-L1 and mesenchymal stem cells. In addition, mouse embryonic fibroblasts (MEFs) have been used to understand adipogenesis because of their capability to acquire genetic material while still maintaining their pluripotency features. Adipogenesis and adipocyte differentiation are dynamic processes involving various signaling cascades that affect gene regulation at a genome wide level. However, a more comprehensive transcriptome analysis of MEFs undergoing adipogenesis is yet to be elucidated. Here, we report a preliminary and broad transcriptome (RNA-Seq) analysis of MEFs during adipocyte differentiation in vitro.



Mei ElGindi

Supervisor/PI: Mohamed Al-Sayegh
Affiliation: Biology Program, New York University Abu Dhabi

Biography: Mei ElGindi is a research assistant in the Al-Sayegh Lab. She has a bachelor degree in Biology from Carnegie Mellon University and has a Masters of Science in Immunology from Yale University.

A Fully Differential Potentiostat Circuit with Integrated Time-based ADCs

Abstract: A fully differential CMOS analog front-end circuit for electrochemical sensing is presented. Its first stage is based on a differential transimpedance amplifier (TIA) with an input common-mode feedback to maintain the potentials at the differential working electrodes. The differential output of the first stage is further amplified at the second stage to resolve a smaller range of current differences down to less than 100 fA. The proposed potentiostat incorporates two ADC stages, one for each stage. While the outputs of the first stage are compared with a threshold voltage, the whole integration time for both the currents is converted to digital by counters. When difference between the two inputs is too small to be resolved by this ADC, the second stage now becomes a dual slope ADC to quantize the amplified difference. The ADC in the second stage incorporates a charge/discharge current source, which allows a time-domain measurement of the amplified signal. The proposed potentiostat circuit is designed in 180nm CMOS SOI process technology. Simulation results show that this architecture can accurately measure the differential input current from 1 pA to 1 µA. The minimum input referred integrated current noise in 1 Hz to 10 kHz bandwidth is less than 100 fA with power consumption of 15 µA from ±1-V supply. This fully differential design is adequate to be integrated in an implantable amperometric electrochemical sensing device with low area and power requirements while offering robustness to background current variations.

Muhammad Abrar Akram, PhD

Supervisor/PI: Sohmyung Ha
Affiliation: Engineering Division, New York University Abu Dhabi

Biography: Muhammad Abrar Akram received the B.S. degree in electrical engineering from the University of Punjab, Lahore, Pakistan, in 2013, and the M.S.– Ph.D. combined degree in electrical & medical convergent engineering from the Kangwon National University, Chuncheon, South Korea, in 2019. During his stay at Kangwon National University, he was working with the Integrated Circuits and Systems Laboratory as a full-time graduate research student. He is currently, a Post-Doctoral Associate with the Integrated Bioelectronics Laboratory, New York University Abu Dhabi. His current research interests include the design of integrated bioelectronics circuits, low-power circuits, digital low-dropout regulators, variation-aware unified voltage and frequency regulators. Dr. Akram is the recipient of the President Award and the Company Special Award in 2016 and 2018, respectively, from the Korea Semiconductor Industry Association.

Capture And Mechanophenotyping Of Circulating Prostate Tumor Cells Using Combined Microfluid-Afm Platform

Abstract: Prostate cancer is among the leading causes of death worldwide, and in the UAE, it is the fourth most common cause of maladies in men. In recent times, more attention has been directed toward the capture of peripheral blood circulating tumor cells (CTCs) as liquid biopsy procedure. The research on mechanical phenotyping of CTCs, however, is still in its infancy. In this work, we have developed a novel microfluidic platform that 1) captures, through anti-EpCAM, anti-PSA, and anti-PSMA antibodies, CTCs from whole blood samples of prostate cancer patients with localized and metastatic cancer and 2) enables their nanomechanical characterization using atomic force microscopy (AFM). We show that when nanomechanically characterized, CTCs from metastatic cancer origin demonstrate a decreased elasticity and increased deformability compared to ones from localized cancer origin. While in both groups the average adhesion of CTCs to AFM tip surface remains the same, the presence of multiple adhesion events in metastatic CTCs are lesser compared to their counterparts. These findings can be utilized in the search of potential metastatic biomarkers of cancer.

Muhammedin Deliorman, PhD

Supervisor/PI: Mohammad A. Qasaimeh
Affiliation: Engineering Division, New York University Abu Dhabi

Biography: Muhammedin Deliorman works as a research scientist at the Advanced Microfluidics and Microdevices Laboratory (AMMLab) at New York University Abu Dhabi, where his current research interests focus on the recognition, manipulation, and phenotyping of clinical prostate cancer cells using micro- to nano-biotechnologies. Prior to joining AMMLab in 2016, he worked as a postdoctoral research associate at Washington State University in Pullman, WA, USA, and at the Laboratoire de Physique des Solides, a research institute associated with the French National Center for Scientific Research (CNRS) in Orsay, France. He earned his MSc and PhD degrees in Physics from Montana State University in Bozeman, MT, USA, in 2009 and 2012, respectively, and his BSc in Physics from Yeditepe University in Istanbul, Turkey, in 2005.

Effects Of Nuclear β-Actin Depletion On Epigenetic Reprogramming Of Mouse Embryonic Fibroblasts (MEFs) To Induced Pluripotent Stem Cells (IPSCs)

Abstract: β-actin is one of 6 different functional isoforms of actin that is uniquely found in the nucleus. However, addressing the defined function of β-actin in reprogramming has been lacking due to the absence of a suitable experimental model system allowing for loss of function experiments of the nuclear actin in living cells. Additionally, the function of the nuclear β-Actin during reprogramming and pluripotency has not been addressed yet. Studies in mouse embryonic fibroblasts (MEFs) from our lab show β-Actin as an essential component of both RNA polymerase and chromatin remodeling complexes whose absence leads to defects in proliferation and differentiation. We have shown evidence that by regulating genomic deposition of the SWI/SNF ATPase subunit Brg1, beta actin controls the levels of and organization of heterochromatin through several epigenetic mechanisms. Induced pluripotent stem cells (iPSCs) provide a favorable model system that can be induced from somatic cells and provide an unlimited resource for cellular differentiation to study diseases and be used in regenerative medicine. IPSCs mimic stem cells in their gene expression and epigenetic profiles and have the capacity to differentiate to multiple cell types. In this project we aim to characterize the effects of β-actin knockouts in the ability of mouse embryonic fibroblasts (MEFs) to reprogram to induced pluripotent stem cells (iPSCs). This will potentially allow studying the role of β-Actin in pluripotency as well as in neurogenesis, adipogenesis and osteogenesis.

Nadine H. El Said, PhD

Supervisor/PI: Piergiorgio Percipalle
Affiliation: Biology Program, New York University Abu Dhabi

Biography: Nadine graduated with Excellent and highest honors from the Faculty of Pharmacy, Ain Shams University, Cairo, Egypt 2008. Followed that by a MSc in Biotechnology from the American University in Cairo (AUC) in 2012, after working on a partnership thesis project with KAUST and a KAUST fellowship in her last year of MSc. Earlier this year She got her PhD in environmental epigenetics from King Abdullah University of Science and Technology (KAUST) Where she was studying Polycomb proteins and lncRNA Roles in plasticity of myogenesis and somatic cells response to oxidative stress. Her PhD work was chosen to be presented as a talk at the "Transcription, Chromatin and epigenetics FASEB conference", 2018 in Florence, Italy. Nadine joined NYUAD mid-September 2019 and is interested in working on actin and its Role in chromatin remodeling and organization, how it may affect reprogramming and differentiation and its possible therapeutic impact.

Tmy Neurons: Targeting Multiple Neuropils In The Visual System

Abstract: Drosophila visual system has proved to be a useful model to study how neuronal diversity and wiring are generated. The optic lobe is one of the largest structures in the Drosophila brain comprising of 60,000 neurons. Interestingly, a large number of specialized neurons innervating the optic lobe terminate in the appropriate neuropil layer, following a consistent neuronal topology- a process known as retinotopy. However, the molecular cues involved in the proper targeting of neurons to their final site remain unknown. To answer some of these questions, we focused our studies on a particular cell type called transmedullary (TmY) neuron, which connect the medulla (the most complex optic lobe ganglion) to the lobula and the lobula plate. Very little is known about these neurons and our goal is to characterize in detail their morphology. In addition, we aim to determine the genetic program underlying their dendritic and axonal growth and pathfinding throughout development. Furthermore, we are presenting data for a specific subset of TmY neurons, termed TmY14, which project to the central brain in addition to targeting the lobula and lobula plate.

Najate Benhra, PhD

Supervisor/PI: Claude Desplan
Affiliation: Center for Genomics and Systems Biology, New York University

Biography: Najate is a Research Scientist in the CGSB at NYU Abu Dhabi. She obtained her Master's degree in Genetics and Physiology at the University of Clermont-Ferrand, France. Najate then earned her PhD. in Biology from the University of Rennes 1, France, in 2010. During her PhD, she characterized how the clathrin adaptor complex AP-1 regulates Notch signaling during asymmetric cell division in Drosophila sensory organs. She then moved to the IRB Barcelona in Spain for a post-doc during which she used the Drosophila wing epithelium as a cancer model and characterized the molecular mechanisms underlying the invasive behavior of chromosomal instability-induced aneuploid cells. At NYUAD, Najate studies a class of neurons of the visual system of the fruit fly with the aim of understanding how these neurons find their path and stop to their final site.

Investigating the Effect of short Mindfulness Interventions on Stress, Mental Health and Sleep Among College Students: An Exploratory Study

Abstract: Due to increasingly busy lifestyles, performance expectations and workloads "Stress" and "Mindfulness" have become buzz words in most societies. Adolescents are especially susceptible to perceived stress during university years. Based on this background, different stress reduction programs, such as Mindfulness Meditation, general relaxation and breathing protocols have been quantified for their effectiveness in stress reduction with multiple populations. This study investigated the effects of Mindfulness sessions on perceived stress, mental health and sleep with a group of college students. 20 students participated in the cross-over design study and partook in 10 short (5 min) mindfulness sessions over 3 weeks during the intervention phase. In the control phase, the subjects received emails with mindfulness exercises. Participants received a self-reported survey three times throughout the data collection phase via email (e.g., baseline, after crossover, and after experiencing both intervention and control). The questionnaire focused on measuring different domains, such as perceived stress, quality of sleep and overall life quality. 12 students further participated in a focus group discussion, exploring possibilities and benefits of inclusions of mindfulness exercises into academic classes. Significantly different scores were found only in the perceived stress and anxiety rating (measured via DASS – 21) when comparing pre- and post-intervention scores. This was also reflected in the focus group discussion, where participants reported a lessened stress perception during the rest of the day after the interventions and a feeling of heightened control over their emotional state. The findings of this study should be expanded upon in further research, to verify the benefits of even very short mindfulness interventions.

Natascha Enriquez

Supervisor/PI: Dipesh Chaudhury
Affiliation: Wellness Department, New York University Abu Dhabi

Biography: Natascha Enriquez has over 15 years' experience within the Fitness and Wellness Industry. Her areas of expertise include Wellness Coaching, Sports & Exercise Science and Rehabilitative Training. She is currently completing an MSc in Sports and Exercise Science and Medicine with the University of Glasgow. At NYUAD, she is establishing a Sport and Wellness Science Lab with Dipesh Chaudhury and Kartik Sreenivasan.

Human-Skin Inspired Micromechanical Interlocking Structures For Enhanced Adherence Between Soft Layers

Abstract: Human skin's dermal-epidermal layer uses a micro-mechanical interlocking strategy to impart remarkable adherence between the soft tissue layers that are critical for providing flexibility while maintaining connectivity. Despite intensive use of this strategy in electronic skin development, precisely how these soft tissue layers accomplish such an impressive feat has retained some mysteries. Bioinspired from this, we studied the underlying fracture mechanism that enables these extraordinary interlocks using a fully physics-based cohesive zone finite element model. The model was developed to visualize a single microinterlock fracture between two soft polydimethylsiloxane layers. Using microfabrication techniques, we fabricated a highly-dense two-dimensional array of spherical microstructures (microbumps) of radius ≈50 μm without and with undercuts (≈70 degrees of undercut angle) for creating microinterlocks. A displacement-controlled (strain rate of 5 μm/s) single bend cantilever fracture peel test set-up was designed, which was connected to a load cell (50 N) on Instron® universal testing machine. As per the experiments' results, the use of these highly dense micromechanical interlocks without and with undercuts enabled increased adhesion strength between the two layers significantly by ≈4, ≈5-fold, respectively, as compared to the plain layers. Critical visualization of single microinterlock fracture from the simulation revealed contact interaction-based phenomena where the primary propagating crack was arrested and the secondary crack was initiated in the microinterlocked area. The above mentioned mechanisms vouched for the difference in the experimental results obtained for different interfacial topologies. The model could prominently help in rationale e-skin design, especially in determining an optimal location to place a mechanical sensor for highly sensitive tactile sensing.

Navajit Baban

Supervisor/PI: Rafael Song
Affiliation: Engineering Division, New York University Abu Dhabi

Biography: Born in 1989 in Sitamarhi, Bihar, India. I graduated VIT Vellore University with a Bachelor of Technology in mechanical engineering in 2012. In 2014, I graduated with a Master of Technology in materials science from IIT Kanpur. From 2014 to 2016, I worked as an assistant professor of mechanical engineering at Lovely Professional University, Punjab, India. Presently, I am working as Global PhD fellows at New York University Abu Dhabi/ Tandon School of Engineering NYU with Prof. Rafael Song. I am working on bioinspired soft fracture mechanics to solve adhesion problems in soft systems related to e-skin, biofabrication and bioadhesion applications.

Magnetically Balanced Wireless Power and Data Telemetry for mm-scale Neural Implants

Abstract: Millimeter-sized implants for neural interface have been of great interest in the neuroengineering field due to their minimal invasiveness and great potential as an alternative to conventional bulky neural interfacing systems. However, their size poses great challenges not only on wireless power transmission, but also on uplink (implant to outside) data communication. One of most feasible data communication methods is load-shift keying based on the backscattering principle utilizing the existing inductive power link. This method consumes minimal power inherently, but its achievable modulation index is infinitesimal so that it is greatly challenging to detect the transmitted data on the outside. In this paper, we explore new schemes using a separate data reception coil that is magnetically balanced with the power coil. Due to its minimal crosstalk between the power transmission coil and data coil, a much higher data modulation index can be achieved. In addition to circular coils, we also present elliptical magnetic-balanced coil structures. According to finite element model stimulations with a realistic brain tissue model in Ansys HFSS and time domain simulation in Cadence, up to 15X improvement in data modulation index can be achieved compared to conventional methods.

Neeraj K. Mandloi, PhD

Supervisor/PI: Sohmyung Ha
Affiliation: Engineering Division, New York University Abu Dhabi

Biography: Neeraj K. Mandloi received B.E. (Hons.) degree in Electronics and Communication engineering from RGPV University, Bhopal, India, in 2006, and the M.Tech. degree in interdisciplinary programme in Systems and Control engineering from the Indian Institute of Technology Bombay, Mumbai, India, in 2009. He received joint-PhD from Italian Institute of Technology (IIT), University of Genova, Italy, and the Institute of Neuroinformatics, University of Zurich, Switzerland in 2014-2015.

He was a Postdoctoral researcher in Vision Institute, Pierre and Marie Curie University (UPMC), Paris France 2017 and in New York University Abu Dhabi (NYUAD) UAE between March 2016 and April 2019. Since April 2019 he is a Research Associate in in New York University Abu Dhabi (NYUAD) UAE. His research interests are in wireless implantable brain machine interfaces, Neuromorphic systems and analog and mixed signal IC design.

Low-Cost Glucose Sensor Using Compact Disc Substrates

Abstract: A low-cost microfluidic chip has been developed for glucose sensing applications based on the refractive (RI) index changes provided by glucose samples. The sensor chip was developed on a compact disc (CD) substrate by constructing a microfluidic flow-cell on top of it. The chip consists of a microfluidic channel for the transport of liquid samples under observation on the CD substrate. The proposed sensor chip used commercially available CD pieces as transducing element making it very cost-effective and quick sample preparation. The developed sensor chip has high sensitivity, ideally suited for low-cost sensing and quality control applications.

Nityanand Kumawat, PhD

Supervisor/PI: Sunil Kumar
Affiliation: New York University Abu Dhabi

Biography: Dr. Nityanand Kumawat is working as a research scientist at the New York University Abu Dhabi. He is working in the area of label-free bio-sensors based on surface plasmon resonance, diffractive interferometry and thin film interference. He works towards the development of low-cost microfluidic techniques for point of care applications based on the above mentioned techniques

pH Responsive Upconversion Mesoporous Silica Nanoparticles for Targeted Photodynamic and Photothermal Cancer Therapy

Abstract: In recent years, photodynamic therapy (PDT), a non-invasive treatment modality for a cancer treatment have received much attention. To upgrade the PDT treatment modality, herein, we designed a mesoporous silica (MSN) nanospheres with sodium-yttrium-fluorine-yetterbium-gadolinium (NaYF4:Yb,Gd) upconversion nanocrystals (MSN@UCNPs) entrapped in their porous structure via a hydrothermal synthesis method, as a nanotransducer to convert deeply penetrating near-infrared light to visible wavelengths. The presence of Gd facilitates the contrast imaging using the magnetic resonance imaging (MRI) to reveal the real-time tumor targeting capability of the designed nanoparticles. The pores of MSNs were encapsulated with photosensitizer (PS), Chlorin e6 (Ce6) for the production of reactive oxygen species (ROS, by multicolor emission of UCNPs) and to enhance the photothermal treatment along with UCNPs. In order to stably hold the Ce6 inside the pores of MSNs, lipid-polyethylene-glycol (DSPE-PEG-maleimide) layers were capped over the surface. The maleimide group were used to functionalize with low-pH sensitive, affinity triggered rational membrane peptide (ATRAM) to target the cancer cells. The ATRAM targets the cancer cells by undergoing conformational change (transmembrane alpha helix formation) at the acidic pH conditions of the peritumoral region. The advantage of the ATRAM functionalization overcomes non-specific interaction and exocytosis by the drug-efflux pumps. We showed a highly efficient cancer treatment therapy by the combination of photodynamic and photothermal technique with enhanced generation of singlet oxygen, heat and reduced cancer cell viability upon tuning the laser light irradiation and time. We propose that the combination of high efficacy and reduced non-specific interaction with ATRAM-MSN@UCNPs as a first line of therapeutics for photodynamic and photothermal cancer therapy.

Palanikumar Loganathan, PhD

Supervisor/PI: Mazin Magzoub
Affiliation: Biology Program, New York University Abu Dhabi

Biography: Dr. Palanikumar's research focuses on the development of stimuli-triggered targeted drug delivery platforms for cancer therapy. Dr.Palanikumar reported a redox responsive drug delivery system utilizing the unmodified pores of mesoporous silica as a biocompatible platform for targeted delivery of chemotherapeutics to cancerous cells and tissues. During the course of his postdoc, he gained extensive experience in chemical synthesis of nanoparticles and in vitro and in vivo toxicology studies pertaining to cancer therapy research. He joined New York University Abu Dhabi, where he is continuing his passionate pursuit of nanomedicine cancer research by developing highly stable and pH responsive drug delivery platforms under the supervision of Prof. Mazin Magzoub

Central Localization Of Single Immune Cells In Rectangular Microwells Using In Situ Generated Air Plugs

Abstract: solation of single cell per microwell in a massive array of microwells is of interest to several applications including sensing cytokines released by immune cells. T cells show heterogeneity in the immune response, thus cytokine profiling at the single cell level is vital in many fields including precision medicine. Here, we developed a massive array of rectangular microwells to isolate, and centralize, single cell per microwell. We show that there is a bias in cytokine detection when cells are decentralized and the bias is minimal when cells are centralized using the developed in-situ generated airplugs method. The presented platform can be utilized for precise (unbiased) cytokine profiling to study their functional signatures in immune cells.

Pavithra Sukumar

Supervisor/PI: Mohammad A. Qasaimeh
Affiliation: Engineering Division, New York University Abu Dhabi

Biography: Pavithra Sukumar joined the AMMLab in June 2016 as Research Assistant to develop microfluidic-based biosensors for immune cell phenotyping. Earlier, she was working as a researcher at Korea Institute of Science and Technology Europe Branch Lab for 2 years and at the Centre for Bio-Micro-Systems at Korea Institute of Science and Technology for 1.5 years. She has experience in microfabrication for template-based self-assembly of lipid tubes. She has received her MTech degree in Nanoscience and Technology from Anna University Coimbatore, India, her MSc degree in Biotechnology from Vellore Institute of Technology, India and her BSc in Biotechnology from Dr. G. R. Damodaran College of Science, India.

β-Actin Mediated Chromatin Remodeling Regulates 3D Genome Architecture

Abstract: β-actin is known to be a component of several important chromatin remodeling complexes (such as the BAF, TIP60 and Ino80 complexes in yeast, flies and humans) that play an important role in development and differentiation. Recent work from our lab has shown that β-actin knockout cells exhibit genome-wide loss of chromatin binding of BAF complex subunit Brg1.

This induces widespread changes in the heterochromatin landscape and impacts the cell's ability to undergo transcriptional reprogramming into neurons, adipocytes and osteocytes.

To study these epigenetic changes in detail and investigate their impact on 3D genome organization, we have analyzed β-actin KO cells using ChIP-Seq, ATAC-Seq and Hi-C Seq. Our results show that β-actin KO cells exhibit significant changes in 3D genome organization at the level of genomic compartments, reduced accessibility of promoters involved in differentiation and development and genome-wide increase in histone methylation.

Preliminary results point towards a mechanism where β-actin linked Brg1 loss induces changes in 3D genome organization by modulating recruitment of polycomb proteins.

Raza Mahmood

Supervisor/PI: Piergiorgio Percipalle
Affiliation: Biology Program, New York University Abu Dhabi

Biography: Raza is a PhD candidate working jointly in the labs of Dr. Kristin Gunsalus and Dr. Piergiorgio Percipalle. His research focuses on understanding the role of cytoskeletal and nuclear pore proteins in regulating 3D genome architecture.

Before joining NYU, he completed his MS in Cell and Molecular Biology as a Fulbright scholar at the University of Arkansas.

High-Throughput Mechanical Phenotyping of C. elegans Diabetes Models Using Elastomeric Micropillar Arrays

Abstract: As a simple model organism, Caenorhabditis. elegans allows gaining insight into the degradation of muscular forces. Driven by the hypothesis that there could be a correlation between muscle atrophy and diabetes, we quantified the muscle atrophy of C. elegans diabetes models at hyperglycemic conditions and analyzed the impact of glucose stress in diabetic mutants on thrashing force using flexible micropillars. When applying our device to hyperglycemic worms which were cultured on agar plates seeded with high glucose concentration, we observed muscle force atrophy between control and diabetic worms. This result supports the clinical findings that patients with type II diabetes lose their muscle much faster than those without. Our studies on the effects of hyperglycemic conditions revealed that worms showed an increasing loss of thrashing force with increasing glucose concentration, up to ~52% for worms seeded in 400 mM glucose. We correlated this thrashing force loss with a change in the sarcomere morphology through examining the actin filament structures of body wall muscles. The worms seeded with glucose exhibited more cytoskeletal defects compared to worms seeded without glucose. In the same device, the efficacy of metformin, could be quantified in the case of C. elegans using wild type worms and diabetic models. Finally, a multiplexed design with 8 parallel channels allowed for improved throughput. In sum, we have demonstrated a scalable mechanical phenotyping chip to quantify thrashing force degradation in diabetic as well as hyperglycemic C. elegans in a multiplexed high-throughput fashion.

Samuel Olufemi Sofela

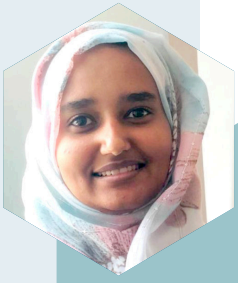
Supervisor/PI: Yong-Ak Song
Affiliation: Division of Engineering, New York University Abu Dhabi

Biography: Samuel Sofela is a bioengineering researcher with expertise in biophysical phenotyping of disease model organisms using microfluidic techniques. His expertise includes designing and fabrication of high-throughput microfluidics devices for phenotyping and imaging model organisms, and developing experimental procedures for drug screening. He is currently a PhD student at the New York University with research in the Abu Dhabi campus.

Adsorption of Amino-Acids at GaAs Device

Abstract: Current techniques for analyzing amino acids require significant instrumentation and sample pre- processing. However, with the advancement of semiconductor-based devices, the complexity could be tremendously reduced allowing the development of handheld biosensor devices. Among the different semiconductor materials, Gallium Arsenide (GaAs) is a highly preferable candidate due to it is high mobility and small dielectric constant. In this work, we have engineered GaAs Schottky diode to distinguish between three different amino acids: Glycine, L-Cysteine and L-Histidine. The modulation doped GaAs Schottky diodes were fabricated into multiple pillars with intentional rough side surface to allow better interaction with the tested amino acids.

The electrical conductance for the amino-acids measured using scanning tunneling microscope was previously reported to have unique distinctive features. Here, we show that measuring differential conductance at the macroscopic scale can still convey information usually only observed at the nano- scale. The stochastic nature of the measured conductance requires the use of data analysis techniques to draw out the unique features of each amino acids. We have applied principle component analysis (PCA) and Fisher Discriminant Analysis (FDA) on the measured differential conductance to distinguish between the different amino-acids. The developed model achieved a 99% accuracy despite the measurements was conducted at different pH levels. Through the use of density functional theory (DFT) technique, we have confirmed that the adsorption of amino acids at GaAs surface induces variation in the electron transmission coefficients, which is responsible for the different features seen in the measured conductance. In this perspective, quantum transport conductance was simulated using Landauer–Büttiker formalism.



Tamador Alkhidir, PhD

Supervisor/PI: Abdel Isakovic
Affiliation: Khalifa University

Biography: Tamador Alkhidir received her PhD, Msc and Bsc from Khalifa University in 2013, 2015, 2019 respectively. Her research interests include: electrochemical sensing, semiconductor devices, bio-sensors and signals, spintronics and nuclear magnetic resonance. Her thesis was mainly about the use of spintronic devices on sensing bio-relevant materials through electrochemical and hyperfine nuclei-electrons interaction.

Role Of β-Actin In Transcriptional Reprogramming Of Embryonic Fibroblasts To Osteoblasts

Abstract: Accumulating evidence highlight novel functions of actin in the nucleus, such as transcription control, chromatin and epigenetic regulation, nuclear reprogramming and DNA damage response. Our lab recently showed that the loss of β-actin in mouse embryonic fibroblasts (MEF) obtained from an embryonic lethal β-actin knockout mouse leads to differential expression of gene programs related to development and differentiation, including neurogenesis. In this study, we performed direct reprogramming of MEFs to osteoblast-like cells to find out the role of nuclear actin in osteogenesis and bone morphogenesis. Firstly, we developed a protocol for direct reprogramming of MEF to chemically-induced osteoblast-like cells (CiOsteo). Using this protocol, we showed that mineralization of the extracellular matrix is correlated with β-actin levels: β-actin-/- KO cells show mineralization after 4 days, whereas β -actin+/-HET and β-actin+/+ WT cells require 8 and 14 days, respectively. Using Scanning Electron Microscopy, we also observed hydroxyapatite-like polycrystalline structures secreted exclusively by KO cells on day 4. We also performed RNA-seq analysis on all the CiOsteo cells, and found that certain genes related to osteogenesis and bone morphogenesis were dysregulated between WT and KO CiOsteo cells. Lastly, we identified increased heterochromatization at the loci of key regulatory genes that are downregulated in KO CiOsteo (compared to WT CiOsteo). In summary, we propose that β-actin is required for regulating the chromatin accessibility during direct reprogramming: in the absence of β-actin, key regulatory genes such as Msx1 and Mmp13 remain heterochromatinized and thus not transcribed, resulting in a hypermineralization phenotype.

Tami Gjorgjieva

Supervisor/PI: Piergiorgio Percipalle
Affiliation: Division of Science, New York University Abu Dhabi

Biography: Tami Gjorgjieva graduated from New York University Abu Dhabi (NYUAD) with a B.S. in Biology in May 2019. Her undergraduate research trajectory began in Chemistry, where she worked on self-healing crystals in Naumov group. She then became interested in Molecular Biology, and worked on beta actin and genome organization in Percipalle Lab, where she also completed her senior thesis. The diverse academic and research experience at NYUAD has led Tami to discover her passion at the intersection of human genetics and law. She is currently pursuing a Postgraduate Research Fellowship in Biology and Legal Studies, and is a member of Idaghdour Lab and the UAE Healthy Future Study research team. Tami hopes to do a PhD in Quantitative Genetics and Law School and build her career as a future geneticist and an advocate for proactive and responsible legislation around incoming genetic technologies.

Nuclear Myosin I Activates P21 Gene Transcription In Response To DNA Damage Through A Chromatin-Based Mechanism

Abstract: Nuclear myosin 1 (NM1) has been implicated in key nuclear functions. Here, using primary embryonic fibroblasts from an NM1 Knockout (KO) mouse we found NM1 depletion leads to constitutive DNA damage due to chromatin and transcription dysregulation. Results from high-content phenotypic profiling and RNA-Seq on NM1 KOs show extensive epigenetic alterations and differential expression of DNA damage and cell cycle genes compared to WT. NM1 KO cells exhibit elevated number of γ-H2AX foci and increased proliferation, consistent with a DNA damage phenotype resulting from impaired p53 target genes. Upon DNA damage induction, we found that NM1 binds to p53 and it is required for Cdkn1A (p21) activation. In NM1-depleted cells subjected to DNA damage, Cdkn1A inactivation results from impaired PCAF and Set1 recruitment to promoter for histone H3 acetylation and methylation. We propose a role for NM1 in the transcriptional response to DNA damage implying a role in genome stability.

Tomas Venit, PhD

Supervisor/PI: Piergiorgio Percipalle
Affiliation: Biology Program, New York University Abu Dhabi

Biography:
> 2016-present – PostDoc, NYUAD, Abu Dhabi, United Arab Emirates
> 2013-2016 – PostDoc, Institute of Molecular Genetics, Czech Academy of Sciences, Prague, Czech Republic
> 2009-2013 – PhD in Molecular biology, Institute of Molecular Genetics, Czech Academy of Sciences, Prague, Czech Republic
> 2004-2009 – MSc in Genetics of microorganisms, Comenius University, Bratislava, Slovakia

Effects of Chronic Social Stress on Diurnal Rhythms of Body Temperature

Abstract: Circadian temperature from patients diagnosed with major depressive disorder show significant blunting in amplitude and in some cases, shifts in phase of oscillation, impacting body metabolism. These disturbances are corrected by the administration of the antidepressant ketamine, yet, the relationship between rhythms in core body temperature and depression remain unclear.

We are investigating a putative molecular mechanism regulating core body temperature changes in resilient and susceptible-mice before, during and after chronic social defeat stress (CSDS), a rodent model of depression-like behavior. We use wireless telemetry system to record continuous body temperature. Additionally, wheel running activity is employed as a second independent measure of circadian rhythms. To investigate the observed differences in physiological and behavioral circadian data, RT-qPCR will be used to measure temperature-sensitive, cold-inducible RNA-binding protein mRNA (Cirp) and its downstream targets Clock and Per1 in the suprachiasmatic nucleus, lateral habenula and dorsal raphe nucleus. As a translational activator of the key circadian gene Clock, CIRP has been shown to influence the timing and robustness of circadian rhythms in response to body temperature fluctuations. Therefore, Cirp could explain the effect temperature disturbances have on clock-related gene expression and ultimately, depression-like outcomes.

We hypothesize that blunting of diurnal temperature amplitude will be more severe in susceptible compared to resilient mice, decreasing CIRP availability. In turn, low CIRP levels further blunt circadian gene expression in central and peripheral clocks, potentially worsening depression-like symptoms. Consequently, both temperature rhythms and Cirp expression could be used as crucial markers for the diagnosis of depression.

Vongai Christine Mlambo

Supervisor/PI: Dipesh Chaudhury
Affiliation: Biology Program, New York University Abu Dhabi

Biography: Vongai Mlambo is a Senior from Zimbabwe majoring in Biology with a research focus in neuroscience at New York University Abu Dhabi. Vongai has used her professional experience interning in clinical environments such as New York University Langone Hospital and Learning Spring, a school for children with autism, to foster a more integrative understanding of the gaps that exist in clinical medicine for neurological and psychiatric disease. She hopes to close these gaps by actively thinking about how they can be addressed through translational approaches in neuroscience research. She is currently working on her senior Capstone project which seeks to characterize changes in circadian rhythm during depression and their underlying molecular mechanism.

Tissue Density Regulates Macrophage-Mediated Inflammatory Microenvironment and Monocyte Infiltration

Abstract: Macrophages are versatile and plastic cells, and the function and phenotype of these cells are regulated by biophysical cues from the microenvironment they reside in. In response to physical and biochemical microenvironmental signals, infiltrating monocytes can differentiate into proinflammatory (M1) or anti-inflammatory (M2) macrophages. Besides the detailed knowledge on single molecular regulators of macrophage function, a full understanding of combined molecular mechanisms and their interplay with the surrounding extracellular matrix (ECM) is not available. In order to better support progress in challenging therapeutic situations like the early stages of wound healing and the termination of tissue repair, in-depth in vitro studies in engineered biomimetic ECM microenvironments are suggested to elucidate macrophage behavior to such multiparameter microenvironmental conditions. In this work, we utilized 3D collagen matrices to mimic in vivo tissue density during the early stage of wound healing to study monocyte infiltration, fate regulation and secretion of pro- inflammatory mediators of macrophages. Our result suggest that macrophages are instructed to produce low pro inflammatory cytokines in denser matrices under inflammatory conditions. Interestingly, we found a linear dependency of secreted pro-inflammatory cytokines with the matrix density.

Walaa Kamal Eldin Mohamed

Supervisor/PI: Jeremy Teo
Affiliation: Division of Engineering, New York University Abu Dhabi

Biography: Walaa Mohamed is Ph.D. visiting scholar registered in Universitat Autonoma de Barcelona, she is studying and screening the human genetics disorders and as part of her Ph.D. activity, she is working in the division of engineering in LIBRA lab.

Double-Stranded RNA Resists Condensation

Abstract: Counterion specificity of DNA condensation is rationalized from a theory of electrostatic interaction between helical molecules that accounts for different charge distribution patterns. Experimental and theoretical studies have proved that Magnesium(II) ions can condense DNA and also showed that in certain specific condition, double-stranded RNA helices resist condensation while DNA duplexes not.

For instance, in vitro experiments on NA in aqueous solution revealed that Cobalt(III) hexammine (CoHex) induced DNA condensation but not RNA condensation. Here, Molecular Dynamics simulations have been performed to mimic the different behaviors of DNA and RNA with the existence of Magnesium(II) ions in the same aqueous condition with the Well-tempered Metadynamics method.

Weiwei He

Supervisor/PI: Serdal Kirmizialtin
Affiliation: Chemistry Program, Science Division, New York University Abu Dhabi

Biography: I am 2nd year PhD student in Kirmizialtin Group. My interest is the MD simulations of molecular materials and bio-molecular interactions and my current research lies in the mechanism of RNA folding and molecular motor, like DNA motors. During my free time, I enjoy exploring new places and photography.

Mitochondria-localized β-actin is essential for priming innate antiviral immune signaling by regulating IRF3 protein stability

Abstract: Mitochondria is a cellular organelle involved in a broad spectrum of cellular pathways and processes. Using WT and β-actin knockout mouse embryonic fibroblasts (MEFs), we recently shown that β-actin resided in the mitochondria and is required for maintaining mitochondrial activity. Through transcriptome analysis, we further identified a novel role of mitochondria-targeted β-actin in priming innate antiviral immune signaling.

The lack of β-actin not only causes the systematic downregulation of genes involved in antiviral innate immune pathways, but also impairs the induction of antiviral response genes upon viral mimic stimulation. This effect seems to result from the instability of the key transcription factor IRF3 in β-actin KO cells. Specifically, we showed that the mitochondrial pool of β-actin, which is essential for mitochondrial quality through maintaining mitochondrial membrane potential, is required for the stability of IRF3. Indeed, reintroduction of β-actin into mitochondria of KO cells rescues IRF3 stability and leads to activation of antiviral genes. We, therefore, propose that mitochondria-targeted β-actin is essential for IRF3 protein stability and the effective activation of antiviral immune responses by controlling mitochondrial quality. Future studies should focus on the mechanistic basis of the link between mitochondrial quality and IRF3 stability.

Xin Xie, PhD

Supervisor/PI: Piergiorgio Percipalle
Affiliation: Biology Program, Science Division, New York University Abu Dhabi

Biography: Dr. Xin Xie studied a PhD in molecular immunology, which focused on the mechanisms of transcriptional regulations by the regulatory T cell transcription factor Foxp3. In 2016, he joined NYUAD in Dr. Piergiorgio Percipalle's lab to investigate the novel roles of cytoskeletal protein beta-actin in nuclear genome control, as well as other unexplored functions in the cytoplasm. Several interesting findings were reported, such as the involvement of beta-actin in nuclear chromatin organization, gene program expression regulation, the role of beta-actin in regulating neuronal reprogramming as well as the novel function of beta-actin in mitochondrial quality control. Dr. Xin Xie recently joined the group of Dr. Kris Gunsalus as a research scientist. Using high-content profiling platform, his current research is related to functional characterization of chemicals, the discovery of novel bioactive compounds from marine bacteria and chemical-genetic interactions.

High-Content Phenotypic Profiling For The Discovery Of Novel Bioactive Molecules From Natural Resources

Abstract: Natural products are an important source of medically active compounds. The Arabian Gulf is a largely untapped and a biologically uncharted source of bioactive molecules. Its semi-isolation, extreme seasonal water temperature fluctuations, high salinity, as well as high intensities of solar radiation represent a unique ecosystem for evolutionary adaptations, which may be associated with previously unidentified bioactive molecules. We have collected about 300 marine bacteria in Abu Dhabi region for the search of bioactive products. We also established a pipeline to fractionate the compounds from bacterial culture. Nowadays, High-Content Phenotypic profiling (HCP) has emerged as a method for the functional characterization of compounds in cell culture. We have set up a broad-spectrum HCP platform that employs an array of cellular markers and pathway-reporters in human cell lines to identify bioactive compounds from our bacterial collections. Core panels include markers for major organelles, cytoskeleton, plasma membrane, nuclear features, cell cycle progression, as well as signaling pathway such as P53 and NFkB. We are also interested in screening novel compounds using whole organism such as pathogenic bacteria and worms. Potential bioactive molecules are identified by distinct phenotypic effects and, in a second step by generating high-resolution cytological profiles (CPs)—unique fingerprints of cellular perturbations generated by combining distinct features derived from spatially resolved measures of fluorescence intensities, relative to control treatments. Our HCP technology is integrated into a High-Throughput Screening Platform with advanced robotics and lab automation technology designed and implemented at NYU Abu Dhabi.

Yanthe Pearson, PhD and Xin Xie, PhD

Supervisor/PI: Kristin Gunsalus
Affiliation: Center for Genomics and Systems Biology, New York University Abu Dhabi

Biography (Yanthe Pearson): Dr. Pearson completed her PhD in Mathematics in 2009, where she developed Discrete and Continuous Stochastic Models for Neuromorphological Data. She spent one year at New York University Langone School of Medicine as a postdoc in the department of theoretical immunology and two years at the University of Maryland College park in the department of Biology. In the fall of 2017, she joined the functional genomics group in the center for genomics and systems biology at NYUAD as a research data scientist.

Biography (Xin Xie): Please see page 167.

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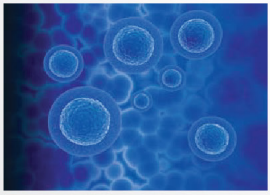

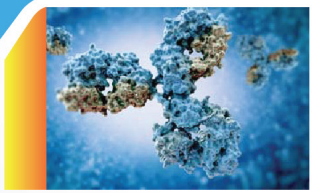

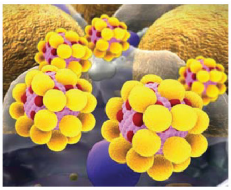
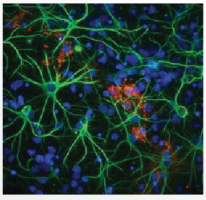
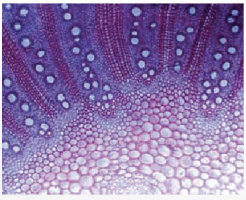

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- Reproductive Genomics
- Cancer Personalized Genomics
- Infectious Disease Research

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- Animal Health
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