POSTER ABSTRACTS

Poster # 1

Design and Synthesis of Novel Amphiphilic Macromolecules for Cardiovascular Applications
Dalia Abdelhamid, Minia University, Egypt

Cardiovascular diseases, especially those triggered by inflammatory reactions which lead to atherosclerosis, are a major cause of mortality in developed countries. Accumulation of pathogenic oxidized low density lipoproteins (oxLDL) in vascular intima and their subsequent uptake by macrophages, initiates secretion of inflammatory mediators. Ultimately, the burst of macrophages and the formation of plaque leads to atherogenesis. An innovative way to mitigate this problem is through inhibition of the macrophage scavenger receptors responsible for the uptake of oxLDL. Nanoscale amphiphilic macromolecules (AMs) based on the sugar backbone, aliphatic chains, and hydrophilic polyethyleneglycol (PEG) have shown promising results as anti-atherogenic agents. AMs competitively inhibit binding of oxLDL to scavenger receptors through electrostatic and hydrophobic interactions. This team's studies have shown that seemingly insignificant changes in the relative orientation of the aliphatic chains had a detrimental effect on the bioactivity. Therefore, the effect of chemical modification of key structural motifs, specifically ester linkages which play a great role in molecular stability and binding affinity, was pursued to understand their influence on the bioactivity. The hypothesis was that their replacement by ethers, amines, or amides could reinforce the binding and improve stability. The design, synthesis, and characterization of these modified AMs will be presented. Additionally, their effect on the inhibition of oxLDL uptake and specific binding to scavenger receptors will be discussed. These results provide valuable insights towards elucidation of the structure activity relationship which guides the development of more potent AMs.

Poster #2

Clean Energy Solutions for the Arab World
Ahmed Abdel-Rahman, Clenergy, Kuwait

Developing knowledge management frameworks (taxonomies, ontologies, etc.) to suit the renewable energy sector has become a necessity in today's world. Such customized frameworks for the region are mandatory in order to structure this new industry. This may be further enhanced by leading us to develop a performance assessment model for renewable energy projects. In the reserachers master's degree, he developed a performance assessment model for Canadian infrastructure in which stakeholders may properly assess the performance of infrastructure items in order to allocate the proper funding within the allowed budget. This model may be enhanced to develop a customized performance assessment model for the main renewable energy applications that would apply to the specific region. This would result in regional stakeholders (governments, financial institutions, private entities, etc.) properly valuating and assessing power plants utilizing renewable energy applications before financial integration (funding, mergers, acquisitions, etc.) occurs.

Poster # 3

Mesenchymal Stem Cells; a Past Dream, Current Hype, and Future Myth

Heba Abdelrazik, Cairo University, Egypt

Mesenchymal stem cells (MSC) are a rare stromal cell population that resides primarily in the bone marrow, but can be isolated from other adult and fetal tissues such as adipose tissue, umbilical cord blood, amniotic fluid, and fetal lungs. MSC do not express specific markers, but can be identified on the basis of the absence of hemopoietic cell markers, namely, CD45, CD34, CD3, CD14, and the expression of markers CD29, CD90, CD73, CD105, CD106 and many others. They secrete a number of cytokines, growth factors, and extracellular matrix molecules that play an important role in the proliferation and maturation of hematopoietic stem cells (HSC), thus useful in engraftment of HSC transplantation. MSC are multipoint stem cells, capable of forming bone, cartilage and other mesenchymal tissues. In vitro experiments demonstrated that MSC can differentiate into different lineages including not only osteoblasts, chondrocytes and adipocytes, but also muscle cells, cardiomyocytes, and neural precursors. Another function that has been ascribedis that MSC can inhibit the innate and acquired immune system. The mechanisms underlying such immunosuppressive activity are only partly understood. Thus, recent studies suggested that soluble factors produced by MSC represented key mediators of its inhibition, but cell contact might also be involved.

MSC are a promising tool for novel therapeutic approaches including the prevention/suppression of GvHD or for the treatment of autoimmune diseases. So far, results have revealed the feasibility of MSC isolation, in vitro expansion, and infusion with no reports of major adverse reactions. MSC are affected by exercise, infections and genetic diseases, and tumours.Thus, the clinical use of these cells in novel protocols of adoptive immunotherapy and tumour targeting represent a future opportunity. This team showed that MSCs strongly inhibit DC generation from peripheral blood monocytes. Thus, in the presence of MSCs, monocytes supplemented with GM-CSF and IL-4 did not acquire the surface phenotype typical of immature (CD14-, CD1a+) or mature (CD80+, CD86+, CD83+) DCs. In addition, they did not produce IL-12 nor were they capable of inducing T cell activation or proliferation. Analysis of the molecular mechanism(s) responsible for the inhibitory effect revealed a major role of PGE2. Thus, addition of the PGE2 inhibitor NS-398 restored DC differentiation and function. Moreover, PGE2 directly added to monocyte cultures blocked their differentiation towards DCs in a manner similar to MSCs. Although IL-6 has been proposed to play a role in MSC-mediated inhibition of DC differentiation, our data indicate that PGE2, and not IL-6, represents the key inhibitory mediator since NS-398 inhibited PGE2 production and DC differentiation with no effect on IL-6 production. These data emphasize the role of MSC in the inhibition of DC maturation and identify the molecular mechanisms responsible for the inhibitory effect.

Poster # 4

The Use of Green Nanoparticles as a Biofouling- Resistant Agent in Reverse Osmosis desalination

Muna AbuDalo, Jordan University of Science & Technology, Jordan

Membrane technologies offer great promise to meet increasingly stringent regulatory requirements for potable water production. While other technologies, such as distillation, can achieve similar treatment objectives, membranes offer notable advantages, such as the removal all types of contaminants to some extent (particles, microorganisms, colloids and dissolved inorganics). In particular, reverse osmosis (RO) membranes have made alternative water reclamation (i.e., brackish water and seawater) and wastewater reuse possible solutions to address the growing global scarcity of traditional water sources. Although RO membranes are generally not intended for disinfection, they provide an additional barrier for virus and bacteria removal, which is essential for indirect

potable, wastewater reuse. Consequently, RO can help meet future potable water demands through desalination of seawater and brackish waters. The reduction of specific energy consumption during the last decade make it more competitive than other desalination technolgies

In this research, an international team seeks to address a major technical challenge in membrane technology, mitigation of membrane biofouling due to rejected chemicals and microbes, by impregnating the solutions with cost effective nanoparticles. This will elucidate the mitigation of biofouling, which is the accumulation of microorganisms onto the membrane, through comprehensive experimental analyses and testing. Most of the research and development in the area of biofouling prevention has focused on pretreatment of the feed water, improved cleaning solutions, and cleaning procedures. The research team will develop biofouling-resistant (BRN) nanocomposite membranes loaded with silver ions from synthesis to macro scale production and investigate and test such membranes performance under different operational conditions.

Silver ions are effective disinfectants, having conventionally been added to water electrolytically or as metal salts. However, this is an investigation of using such nanoparticles incorporated directly into the film, and the first exploration of the fabrication of the produced films. These reverse osmosis BRN membranes will be implemented and tested not only in the water scarce regions of the Middle East and Northern Africa; , but also in the United States (US).

Preliminary experiments have shown promising results. Filtration experiments were performed with synthetic brackish water to test regular cellulose acetate (CA) membranes and CA membranes loaded with silver nanoparticles (CA-AgNP). CA-AgNP membranes resulted in lower flux declines and higher flux recovery as well as more effective at mitigating biofouling formation when compared to CA membranes.

Poster # 5

Crop Wild Relatives in Jordan: A Potential Protective Measure Against Climate Change

Khaled Abulaila, National Center for Agricultural Research and Extension, Jordan

As part of the Fertile Crescent, Jordan is located in a major center of origin for many important crop plant species. The highly diverse habitats of the country harbor major wild relatives and ancestors of crop plants that are of great importance globally. Wild relatives of crop variations include of cereal crops like wheat (Triticum and Aegilops spp.) and barley (Hordeum spp.) and pulses such as lentils (Lens spp.); peas (Pisum spp.), and Chickpeas (Cicer spp.), in addition to relatives of many major fruit and vegetable crops. Climate change is expected to cause drought, as well as increasing C02 levels and temperatures, which are expected to result in various changes to habitats and growing conditions of crop plants on a global scale. In spite of this, crop wild relatives (CWR) are facing a dramatic decline as a result of habitat loss and degradation. Many are growing in disturbed habitats side by side with their cultivated relatives, while others are considered ruderal weeds inhabiting road sides and neglected areas. As part of protection measures, some CWR populations were included in natural reserves, as in situ conservation whilst others were conserved ex situ in gene banks. However, much more work should be done, especially in terms of collecting information about geographical localities, areas of occupation, and status of the populations, for the sake of taking quick action for their protection and conservation.

Poster # 6

Assessment of Tsunami Inundation Extent in Wilayat Sur, Sultanate of Oman, Using Geospatial Technology

Hanan Al Hinai, Muscat Municipality, Oman

This research is focused on using geospatial techniques to assess the potential risk of tsunamis hitting Wilayat Sur's coasts in Ash Sharqiyah South Governorate in the Sultanate of Oman. The assessment was conducted using the distance and altitude relationship approach for three scenarios: the minimum potential scenario of 3 m wave height, the most credible potential scenario of 6 m wave height, and the hypothetical scenario of 12 m wave heights and inundates to a distance of 2 km inland. The main outcome of the assessments was determining the geographical extent of tsunami inundation inland. The results showed that a 0.01 % of Wilayat Sur would be flooded under the first scenario, 0.1 % would be flooded under the second scenario, and about 2.3 % would be flooded under the third scenario.

Poster # 7

A Simple and Biocompatible Silver Nanoparticle/Eggshell Membrane Composite for Water Treatment

Aisha Al Washahi, CAS-Sohar Ministry of Higher Education, Oman

An eggshell membrane (ESM) was used as a biotemplate to prepare silver nanoparticles (Ag Nps). The prepared composite of ESM/AgNps was then used as an adsorbent for water contaminants such as bacteria and heavy metals.This simple and economic method is environmentally friendly as it eliminates the need for template removal after AgNps preparation which minimizes the hazard of using mere Nps for water treatment while still retaining their efficiency.

Poster # 8

Selecting Adaptable Jordanian Semi-Dwarf Wheat to Survive Drought Environments and Climate Change

Zakaria Al-Ajlouni, Jordan University of Science and Technology, Jordan

Drought has bene the greatest problem facing Jordan over the past 15 years. In addition, Jordan is among the four most affected countries in the world in terms of water shortages. Furthermore, the increase in the Jordanian population and presence of Syrian refugees will result in higher food and water demands. As a result, screening for wheat varieties that have a high yielding ability and are able to cope with drought is important to fulfill the food demands of Jordan. Reduced plant height genes (most commonly Rht-B1b (Rht1), Rht-D1b (Rh2), and Rht8) decrease lodging and can increase harvest index, biomass, and grain yield in wheat. In this study, the differences in plant height of 21 wheat genotypes were tested in two agricultural stations in Jordan, the Jordan University of Science and Technology (JUST) Campus Research Station located in northern Jordan (a drought area with less than 200 mm rainfall) and the field site of the National Center for Agricultural Research and Extension (NCARE) at Maru (a semi-humid area with around 400 mm rainfall). In both locations, the genotypes were grown under irrigated and non-irrigated conditions using a split plot experimental design. The results show that the location and genotype interaction (L X G) was significant (P less than 0.05) and that there was a significant difference between the irrigated and non irrigated treatments (P less than 0.05). Genotypes also responded differently in terms of plant height. To determine if the semi dwarf genotypes respond differently to the environment, the 21 genotypes will be assayed using molecular markers and the results of this analysis will be analyzed.

Poster # 9

Development of Diabetes Gene Therapy by Inferring the Gene Regulatory Networks from Gene Expression

Fadhl Alakwaa, University of Science and Technology, Yemen

Diabetes mellitus is a disease in the glucose-insulin endocrine metabolic regulatory system, in which the pancreas either does not release insulin, or does not properly use insulin to uptake glucose in the plasma, which is also known as hyperglycemia. Complications of diabetes mellitus include retinopathy, nephropathy, peripheral neuropathy and blindness. Due to the development of high-throughput experimental methodologies such as gene expression microarrays, genomic sequencing, physical and genetic interaction mapping, and tandem mass spectrometry, greater understanding of molecular processes and specific gene functions are growing. This will help researchers in understanding diabetes ontology and drug discovery.

However, despite the fast developments of the above technologies, most of the simple biological process even in prokaryotic cells are not fully understood due to the fact that genes, as well as their products (proteins), do not work independently. They interact with each other and form a complicated network called the Gene Regulatory Networks (GRNs).

In this paper The team tries to construct diabetes gene regulatory networks in order to expand understanding of the etiology of the impaired glucose tolerance test and to determine some of the important factors acting on human systems such as insulin sensitivity and pancreas responsiveness. The long goal is to study the causes of immune-mediated diseases and to develop better means of preventing, diagnosing and treating these illnesses.

Poster # 10

Conjunctive Use of Treated Wastewater and Groundwater in Agriculture

Ahmed Al-Busaidi, Sultan Qaboos University, Oman

To cope with the water shortage, it is necessary to adopt water-saving agricultural countermeasures and look for alternative resources that can replace fresh water such as treated wastewater. Usage of wastewater in agriculture is an age-old practice in many North African and Middle East countries; however, there is lack of systematic information on the subject, particularly on issues such as farmer's needs and preferences and practices related to health and environmental impacts.
This study contributes to the existing knowledge on urban treated wastewater reused for agriculture in selected countries in the MENA region by identifying means to optimize wastewater reuse by taking into consideration various parameters such as return to farmers, groundwater quality, and impacts on soil and groundwater. The study used a combination of research approaches including secondary literature review and extensive field trials to reachthe main goal of the project which was to minimize the amount of treated wastewater being disposed of, maximize the area under irrigation by conjunctive use of groundwater of varying degrees of salinity, and maximizing the net return to farmer. Morover, the project assessed the current practices of farmers in agricultural areas where wastewater is reused for crops irrigation and aimed to optimize the reuse in areas where conjunctive use of groundwater is an alternative, while also taking into consideration the agronomic, environmental, and economic components. Prelimenary good data was found when treated wastewater was used without any sideffect in soil and plant paramerters. Other information is still in progress hoping to finish all analysis by Sptemper 2014.

Poster # 11

Bridging the Generation Gap to Protect Nature in Yemen: Conservation of Nature through Culture

Mohammed Al-Duais, UNESCO Doha Office, GCC and Yemen, Yemen

Those who work in nature conservation in different territories in Yemen see a clear gap between older, more conservative generations, who were taught to live in harmony with nature and use resources sustainably, and younger generations who have different concerns because of dramatic changes to their lifestyles. The negative impact of the latter is continuously increasing, given the high percentage of youth in the population. Despite this, there are creative ways to promote awareness of the need to conserve wildlife and natural resources, especially by drawing connections between conservation principles and certain existing customs and traditions within Yemeni culture. This paper examines the ways in which elements of Yemeni culture can be invoked to involve a wide spectrum of stakeholders in conservation efforts.

Particular focus will be given to a Foundation for Endangered Wildlife (FEW) case study. Over its four-year existence, FEW has organized innovative workshops which address local communities using established traditions and stories from Yemeni culture, including religious texts. It has also worked to sustain traditional organic agriculture through various small-scale agricultural projects, which demonstrate that conservation is a better way of production considering the limited access to resources. FEW has also worked to resurrect old traditional conservation practices from the local culture, like 'marqum' (a kind of social forestry), tree-looping methods, designated hunting periods, and traditional water harvesting and usage. As development means improvement and reorientation, FEW's fourth and most positive contribution is SylviCulture, i.e. a shift from gathering to cultivation and rehabilitation in both private land and 'mashae' (common use land). All these have proved to be very potent methods in bridging the generation gap, building trust, and involving local communities in conservation activities; these methods are potentially replicable models for using cultural means for environmental ends.

Poster # 12

Combined Malonic and Methylmalonic Aciduria: Exome Sequencing Reveals Mutations in the ACSF3 Gene in Patients with a Non-Classic Phenotype.

Ahmed Alfares, Harvard Medical School, United States

Background: Combined Malonic and Methylmalonic Aciduria (CMAMMA) is a rare recessive inborn error of metabolism characterised by elevations of urine malonic acid (MA) and methylmalonic acid (MMA). Nearly all reported cases are caused by malonyl-CoA decarboxylase (MCD) deficiencyand most patients have metabolic acidosis, developmental delay, seizures and cardiomyopathy. CMAMMA was also described in symptomatic patients with normal MCD activity, suggesting heterogeneity in this disorder.

Methods and results: This team identified two probands with a non-classical CMAMMA variant through the Quebec Newborn Urine Screening program. While they share the biochemical phenotype of elevated MA and MMA, the MMA excretion was higher than MA, the clinical courses were benign, MYLCD gene sequencing was normal, and MCD activity, measured in one proband, was normal. Using exome sequencing in the single consanguineous proband, we identified a homozygous missense allele in the ACSF3 gene, encoding an Acyl-CoA Synthetase (ACS) with unknown substrate and function. The second proband was homozygous for a different ACSF3 missense allele. Both substitutions were in conserved residues and were identified in less than 0.5% of their respective ethnic control populations.

Conclusion: These results suggest that ACSF3 is a candidate gene for non-classical CMAMMA observed in our patients and document the value of exome.

Poster # 13

Reversible Polymeric Nano-Beads as a Dynamic Gene Delivery Vehicle in Cancer Therapy
Samer Al-Gharabli, German Jordanian University, Jordan

Cancer is increasing at an alarming rate in Jordan and is the second leading cause of death after cardiovascular disease. a new and promising field is the study of environmental carcinogens cause different DNA mutations that can be treated with gene therapy. Thus far, gene delivery has depended mainly on viral vehicles which bear certain disadvantages such as issues of safety, immunogenicity, mutagenesis, and low gene carrying capacity. This team proposed a new approach where a novel polymeric backbone was grafted with a reversible sulfide bridge to encapsulate gene outside the cell and then released inside under the reduction environment of cytosol. Polymers were tracked by fluorescent labeling and transcription was proved using GFP and RFP in different cancer cell lines. This, in turn, will provide new therapeutics for cancer.

Poster # 14

Implementation of Microfluidic Systems in Biomedical and Life Science Applications
Ala'aldeen Al-Halhouli, German-Jordanian University, Jordan

The rapid development in microsystems technology and its suitability for realizing micro/nanofluidic devices has led to the opening of novel aspects in biomedical and life science applications. Accordingly, miniaturization towards lab-on-a-chip has been of great interest to many researchers. As a result, many miniaturized devices including pumps, bioreactors, cells separators, mixers, and biosensors have been recently presented.

This poster will introduce selected microfluidic systems developed by the research group and will highlight their applications in biomedical/ biotechnological devices. Among these systems are the synchronous micropump, synchronous micromotor, cells separation chip, and bioreactor system. The synchronous micropump works by the synchronized rotation of two polymer magnets in an annular SU-8 microfluidic channel. Magnet rotation is achieved by sequentially activating a set of planar coils to repel or attract the first magnet (traveling magnet) through the channel, while the second one is anchored between the inlet and the outlet ports. At the end of each pumping cycle, the magnets exchange their anchored and traveling functions.

Another interesting theme will be the implementation of the synchronous micromotor as an integrated driving mechanism in microfluidic systems such as a spiral channel viscous micropump and a microstirrer for cells cultivation. These systems prove that synchronous micromotors are well suited to serve as integrated driving mechanisms of active microfluidic components.
In addition, a novel concept of cell separation using microfluidic chip will be presented. The potential implementation of such device in rare-cell separation (e.g. tumor cells) will be given. Lastly, micro-bioreactor system including ethanol and glucose biosensors with a description of system components, recent results, and tests will be reported and explained. The above investigations and interesting concepts offer several advantages for biomedical and life science applications and would provide a great platform for novel research collaboration projects.

Poster # 15

A Nanotechnology Platform "Scano-miR" Detects Clinically Significant Prostate Cancer

Ali Alhasan, University of California, San Diego, United States

Gold nanoparticles functionalized with spherical nucleic acids (SNA-Au NPs) are hybrid materials that exhibit novel detection capabilities and are essential for the management of clinically significant prostate cancer (PCa). These unique properties enable them to address many fundamental challenges associated with biomarker identifications. Specifically, the poster reports the development of a novel Scanometric MicroRNA (Scano-miR) platform for the detection of relatively low abundance microRNAs (miRNA) with high specificity and reproducibility. The Scano-miR system was able to detect 1 fM concentrations of miRNA in serum with single nucleotide mismatch specificity. Indeed, it provides increased sensitivity for miRNA targets compared to molecular fluorophore-based detection systems, where 88% of the low abundance miRNA targets could not be detected under identical conditions. The application of the Scano-miR platform to high density array formats demonstrates its utility for high throughput and multiplexed miRNA profiling from various biological samples. To assess the accuracy of the Scano-miR system, we analyzed the miRNA profiles of samples from men with PCa, the most common noncutaneous malignancy and the second leading cause of cancer death among American men. The platform exhibits 98.8% accuracy when detecting deregulated miRNAs involved in CaP, which demonstrates its potential utility in profiling and identifying clinical and research biomarkers. As a result, the platform was successfully applied in a pilot study and the team has identified circulating miRNAs that are differentially expressed as a novel molecular signature to detect aggressive PCa. Indeed, such biomarkers (miR-605, miR-135a*, miR-495, miR-433, miR-371-3p, and miR-106a) showed significant correlation to high risk PCa progression and can be used to reliably discriminate aggressive forms of PCa. The strong correlation between the overall molecular signature and the high risk of PCa suggests that miR-495 is a very promising non-invasive biomarker to predict the prognosis of PCa. Such a molecular fingerprint can distinguish clinically significant from indolent PCa with high accuracy, which further demonstrates the essential role of the Scano-miR platform for the management of cancer.

Poster # 16

Nano-Coated Heat Transfer Surfaces to Mitigate Fouling in Thermal Desalination Plants

Abdullah Al-Janabi, Dhofar University, Oman
M.R. Malayeri, Shiraz University, Iran and Institute of Thermodynamics and Thermal Engineering (ITW), Germany

Fouling in thermal industrial processes cause enormous energy losses and substantial land and atmospheric pollution due to the use of chemical inhibitors or the release of green-house gases from excessive consumption of energy to offset the impact of fouling. Innovative fouling mitigation techniques have been researched with the goal of developing robust, environmentally-friendly, anti-fouling heat transfer surfaces that will substantially: (i) reduce the design and operation penalties and (ii) provide significant economic and environmental benefits. One of the desired techniques is to modify the surface energy properties of the heat transfer surface to make it less attractive for precursors, which means fouling can easily be removed from the surface. The applied surface treatment technology in this work is non-structured and structured nano-coated surfaces. The experimental work proceeded in two steps: i) a laboratory investigation of the coated surfaces under operating conditions that are likely to occur in a plate heat exchanger of a thermal desalination unit, and ii) field examination of coated plates of the heat exchanger in a thermal desalination plant.
The experimental results demonstrate that such coatings would significantly increase the induction time before fouling starts and also reduce the subsequent fouling rate, in comparison with untreated stainless steel surfaces. In addition, the coated surfaces showed better non-stickiness behaviour, i.e.

the deposits formed on these surfaces could be removed much easier than from the original steel surface. The surfaces with promising laboratory achievements in terms of lower fouling resistance, higher thermal performance, and better thermal and mechanical stability were selected for the field investigation in a thermal desalination plant. The results obtained from the field investigation were consistent with those of laboratory investigation where no sign of fouling on the nano-coated surfaces has been observed.

Poster # 17

Characterization of stormwater runoff generated from residential and commercial areas in Amman-Jorda

Othman Almashaqbeh, Royal Scientific Society, Jordan

Two sites were selected in Amman city representing commercial area (Al-Abdali) and residential area (Um-Alsoumaq). Six storm events were monitored during winter season extended from October 2012 to April 2013 to investigate the stormwater runoff pollutant concentrations generated from commercial and residential sites in Amman city/ Jordan. The average pollutant concentrations of stormwater runoff were significantly different from the commercial and residential site. The results showed that the commercial site generated stormwater runoff with the higher concentrations of organic pollutants COD and BOD5 (1995 mg/L & 732 mg/ L) than those at the residential site (682 mg/l & 149 mg/l). The dissolved heavy metals also has showed similar trend as the concentrations of Zn, Cu, Pb and Mn (1.187 mg/L, 0.02 mg/L, 0.027 mg/L and 0.393 mg/L) at Al-Abdali site are much higher than those measured at the residential site (0.375 mg/l, 0.099 mg/l, less than 0.01 mg/l, 0.352 mg/l respectively). Moreover, Al-Abdali site has generated a higher concentrations of total suspended solids TSS (1828 mg/L), nutrients T-N and T-P (25.1 mg/L & 5.29 mg/L) and fecal bacteria TCC, TFCC and E.coli (5.05E+05, 1.08E+05 & 4.95E+05 MPN/100ml) compared with those generated from Alsoumaq site (total suspended solids TSS (605 mg/L), nutrients T-N and T-P (6.2 mg/L & 1.8 mg/L) and fecal bacteria TCC, TFCC and E.coli (2.5E+04, 1.45E+03 & 4.35E+02 MPN/100ml)). The type of land use for the catchment area is very important factor that can affecting the concentration of pollutants of stormwater runoff generated in the catchment. The results of this study showed that the organic, nutrients , dissolved metal and fecal bacteria loads generated from commercial area are much higher than those generated from residential area. This is mainly due to the high traffic volume at commercial site compared with the residential site. A key constituents of runoff quality (COD, TSS, TKN, T-P, Zn & Pb) from commercial site (Al-Abdali / Amman) are considered very high compared to those reported in other city such as Isfahan/Iran and Guangzhou/China. This study has provided a better understanding of the concentrations and sources of stormwater runoff pollutants generated from commercial and residential sites which is posing a serious threat to water bodies within the Amman city. Therefore, best management practices and proper land management measures should be taken to control the main sources of the pollutants carried by stormwater runoff generated from commercial area.

Poster # 18

Emerging Pollutants: A Human and Environment Risk and a Challenge to Chemical Analysts

Najat Al-Odaini, Sana'a University, Yemen

Common pollutants including heavy metals, pesticides, polychlorinated biphenyls, and poly aromatic hydrocarbons are known as "conventional pollutants." More recently, the attention of the scientific community has shifted to a new group of pollutants known as "emerging pollutants" such as pharmaceuticals and personal care products (PPCPs). These pollutants are not included in the current legislation, but the scenario has been recognized as a new environmental problem of

interest. Human pharmaceuticals are excreted unchanged through urine and faeces or as metabolites via sewage systems. Given the greater water solubility of pharmaceuticals in general when compared to conventional pollutants, the ultimate fate of these pollutants is probably the aquatic environment. Although some of pharmaceuticals are not persistent enough to cause negative effects, their high transformation and removal rates can be offset by their continuous introduction into the environment, often through sewage treatment works. As opposed to other pollutants currently under investigation, pharmaceuticals are deliberately designed to affect biochemical and physiological functions by either being highly active and interacting with receptors in humans or to be toxic for many infectious organisms, including bacteria, fungi, and parasites. The presence of antibiotic residues in aquatic environment has negative effect on important aquatic ecosystems, which are largely controlled by, and dependent upon, microbial organisms for a suite of crucial processes such as denitrification, nitrogen fixation, and organic breakdown. In addition, the presence of antibiotics in drinking water and exposure of humans could lead to the development of resistant pathogens. The presence of hormones in the aquatic environment has been identified as one of the greatest contributors to the endocrine-disrupting effects observed in aquatic environments as synthetic hormones (oral contraceptives) have adverse effects such as feminization of male fish and hermaphroditism. It has also been hypothesized that increasing incidents of testicular cancer, the decrease in sperm counts over the last decades, and other disorders regarding male infertility may be caused by the intake of estrogens via food or drinking water. Unlike conventional pollutants such as heavy metals, pharmaceuticals usually occur as a mixture of pollutants from diverse chemical classes with different chemical and physical properties, creating a serious challenge for analysis. To date, there is neither a list priority of pharmaceutical pollutants nor universally accepted method for their analysis in different environmental matrices. Usually these pollutants occur in trace levels in complex matrices such as sewage effluents and sediments which require intensive clean up and high sensitivity detection techniques such as tandem mass spectrometry. Therefore, development of analytical methods is an ongoing and challenging task.

Poster # 19

Electrical Properties of Doped UNCD/a-C:H Composite Film Prepared by PVD.

Sausan Al-Riyami, German University of Technology in Oman, Oman

Over the last two decades, ultrananonocrystalline diamond (UNCD)/hydrogenated amorphous (a-C:H) composite films prepared by chemical vapor deposition (CVD) crystalline with diameter less than 10 nm and a-C:H matrix received significant attention due to its unique combination of physical and electrical properties. A remarkable number of studies have been done on doping for UNCD/a-C:H film With Boron being a well known to be a typical donor for p-type. For n-type donors, the recent theoretical and experimental studies prove that nitrogen can be a unique and ideal n-type donor.

Several years ago, undoped and boron doped UNCD/a-C:H films were successfully prepared by pulsed laser deposition (PLD) in the team's laboratory[1,2] .For the first time, to the team's knowledge, researchers succeeded in the formation of nitrogen-doped UNCD/a-C:H films by PLD in nitrogen and hydrogen mixed atmospheres. In order to explain the incorporation effects of nitrogen, the chemical bonding structure, and the electrical properties have been studied in the team's previous work[3,4]. Using X-ray-ray photoemission and near-edge X-ray fine structure (NEXAFS) spectroscopies and the same synchrotron radiation center at beamline 12 (BL12) of Kyushu Synchtrotron Light Research Center/ SAGA Light Source, the existence of the diamond grain was examined by X-ray diffraction (XRD) measurement with 12 KeV X-rays from synchrotron radiation at beamline 15 (BL15).
The aim of this work is to prepare heterojunction diodes comprised of n-type nitrogen-doped UNCD/a-C:H and p-type Si and study the electrical properties as photodiodes. Heterojunction diodes,

wherein n-type 1.6 at .% nitrogen-doped UNCD/a-C:H film with a thickness of 260 nm were deposited on p-type Si substrates with an electrical resistivity and thickness of 10 Ω·cm and 260 μm by PLD in the same manner as our previous study [3], were electrically evaluated. The diodes with an active junction area of $5\times10^{-3}cm^2$ exhibited a typical rectifying action with a rectification ratio of approximately 10^3 at ± 20 V. No break down behavior was observed at applied voltages up to ±100 V. The ideality factor in the forward voltage range from 0.1 to 0.8 V was estimated to be larger than 2. This large value might be attributable to tunneling conduction. The build-in potential was estimated to be 0.65 eV from the C-V curve. The effective carrier density of the UNCD/a-C:H film was approximately estimated to be $0.6 –1.0\times10^{17}$ cm^{-3}.

References:

1. T. Yoshitake, A. Nagano, M. Itakura, N. Kuwano, T. Hara, and K. Nagayama: Jpn. J. Appl. Phys. 46 (2007) L936 .
2. S. Al-Riyami, S. Ohmagari., Appl. Phys. Express, 3 (2010) 115102.
3. S. Al-Riyami, S. Ohmagari, T. Yoshitake: Jpn. J. Appl. Phys. Jpn. J. Appl. Phys. Vol. 50, No. 8 (2011) 08JD05.
4. S. Al-Riyami, S. Ohmagari, T. Yoshitake., Diamond Relat. Mater. 19 (2010) 510.

Poster # 20

Phase Change Materials for Autonomous Energy Storage in Buildings

Saleh Nasser Al-Saadi, Sultan Qaboos University, Oman

Building facades contribute to the overall architectural aesthetic but can be utilized for energy storage when proper systems are incorporated. Latent heat storage, such as using a phase change material (PCM), is gaining more attention recently due to its ability of storing significant thermal energy within a small volume, thus making it one of most promising technologies for developing energy efficient buildings. This research is focused on simulation of PCM when integrated into building facades. A typical residential building with various PCM-enhanced envelope systems is analyzed under the representative hot climates of Omanand the simulation study shows that PCM can reduce energy consumption of buildings. The PCM is found to autonomously store and release thermal energy under desirable environmental conditions. The results show a promising strategy to shave and shift peak cooling loads to less demanding times. The set of simulation runs are used to develop design guidelines and simplified methods for architects and engineers to utilize PCM in their energy efficient designs.

Poster # 21

Design and Implementing of Solar System Cafeteria at the University of Jordan

Ahmed Al-Salaymeh, The University of Jordan, Jordan

The solar cafeteria has successfully demonstrated the effects that renewable energy can have on lifestyles and the environment through its total use of solar power. The creation of the solar cafeteria by the Energy Center at the University of Jordan aims to disseminate knowledge and culture concerning the multiple uses of solar energy to students and the community through the use of different solar technologies. In the solar cafeteria, solar cells are used to generate electricity, solar thermal collectors are used for all heating, and solar ovens with a 15kg capacity, are used for food preparation. The utilization of various solar energy technologies encourages eco-tourism and the fight against desertification, particularly in remote areas where it can replace local dependency on firewood for cooking.The main objective of the project is to show the practical applications of solar energy technologies and to identify the actual impact of these applications. Also, it acts as a prototype to demonstrate that solar energy can be converted into thermal energy for domestic

water heating The use of solar photovoltaic technology for power generation systems, either individually or cross-linked to the national grid, gives another objective for this project. The use of solar cooker technology in the solar cafeteria will give the students a chance to promote the idea especially in remote areas of Jordan where the solar cookers can be used independently. Solar cooking is a healthy, secure, and also retains the most vitamins and nutritional value in food when compared to other forms of cooking. Solar cooking is an excellent alternative to the use of wood and trees in rural and remote areas which should reduce the spread desertification in these areas. The design of the photovoltaic system in the solar cafeteria takes into account the demand of the devices within the cafeteria such as the lights, fridges, and toasters and maintains enough backup power to keep them operational for two successive, cloudy days.

Poster # 22

Creating a Mood and Anxiety Center of Excellence to Serve Unmet Mental Health Needs in Kuwait
Mohammad Alsuwaidan, Kuwait Mood and Anxiety Unit, Kuwait

While Kuwait and other countries of the Gulf Cooperation Council (GCC) have invested significant financial resources in health care systems, mental health care has continued to have significant deficiencies and challenges. While an advanced system such as the Canadian Province of Ontario has one psychiatrist per 7000 citizens, Kuwait has one psychiatrist per 300,000. In light of such a challenge in delivering quality mental health care, innovative solutions were required to maximize efficiency and reach.

This project describes the founding of the Kuwait Mood and Anxiety Disorders Program as the first and foremost specialty program of excellence in the country for mental health care. The strategic directions of the unit in Clinical Care, Advocacy, Research, and Education are described. Community-based participatory action methods are used to asses the effectiveness of the program through collaboration with clients and their families being treated at the center within the first year of initiation.

Poster # 23

Agroecology of Traditional Date Palm Farms in Oman
Rashid Al-Yahyai, Sultan Qaboos University, Oman

Agricultural biodiversity and farming systems have radically changed in recent decades in many parts of Oman and neighboring Arab countries where the national economy has shifted from reliance on traditional farming to oil. The economic boom brought about by oil wealth has impacted the decades-old traditional farming practices, thereby altering the plant biodiversity, sustainable cultural practices, and the ecology of the agricultural-producing regions of Oman. As indigenous knowledge, traditional farming practices and local landraces continue to disappear due to the passing of the elders, there is a pressing need to study the traditional means of cultivation that is largely built around date palm as the main crop in the country. In this study, ten sects were selected, each is one Faddan (4200 m2), and data were gathered about the number of date palms, the cultivars, the understory permanent crops grown, and other plants of economic importance. The data show large diversity in fruit and other perennial crops, medicinal plants, and wild trees on traditional farms compared to a typical modern farm. There is also diverse number of date palm cultivars that varied by governorate. Few locals are working on their own farms and they rely instead on expatriate laborers who introduced changes in the understory crops and local plants to befit their needs and customs. Modern date farms, characterized by monoculture, modern irrigation, and other management practices, are lacking cultivar and crop biodiversity that may, in the long-term, affect the agroecology of entire villages if applied in isolated oases.

Poster # 24

Drawer Compacted Sand Filter: Innovative method for on-site greywater treatment

Almoayied Assayed, Royal Scientific Society, Jordan

This study evaluated the performance of a new treatment method for greywater called the Drawer Compacted Sand Filter (DCSF). This is a modified sand filter design in which the sand filter is broken down into several layers approximately 10 cm high, each of which is placed in a movable drawer that is stacked vertically, with each drawer separated by 10 cm of space. This treatment unit is seeking to overcome the problems commonly found in traditional sand filter designs, such as clogging, emission of bad odours, and need for a large land area to house the filter. Nine pilot DCSF units were operated at different locations in Jordan during the period of 2011-2013. Composite water samples from the inlet and outlets of the DCSF over a period of 16 months were taken periodically and tested for BOD5, COD, TSS, pH, EC and e.coli. A socio-economic study was conducted to evaluate the validity and feasibility of the DCSF. The results showed that DCSF removed 78-96% of BOD5 and COD, 98% of TSS, and up to 6 logs reduction in E.coli. The socio-economic study and the cash flow analysis proved that DCSF unit is a feasible and reliable treatment method for greywater with a very low land footprint and minimal maintenance requirements, thus making it suitable for a wide range of geographical settings.

Poster # 25

Design, Synthesis and Optimization of Antagonists Targeting A2A Adenosine Receptors and A2A/CB1/D2 Heteromeric GPCRs

Younis Baqi, Sultan Qaboos University, Oman

Parkinson’s disease (PD) is a neurodegenerative disorder characterized by the loss of dopamine producing neurons in the substantia nigra, leading to major motor dysfunctions such as bradykinesia, tremors, and rigidity. To date, the most effective therapy for PD is treatment with the dopamine precursor L-3,4-dihydroxyphenyl-alanine (L-DOPA). However, long-term L-DOPA therapy is associated with motor complications such as dyskinesia, "on" phase shortening, occurrence of "on–off" syndromes, and psychotic symptoms.Experimental and clinical data have indicated that adenosine A2A receptor (A2AR) antagonists can provide symptomatic improvement by potentiating the effect of L-DOPA and minimizing side effects, and therefore represent an alternative therapeutic target for drug development in PD. Several studies have reported the existence of functional interactions between A2AR and cannabinoid CB1 (CB1R) or dopamine D2 (D2R) receptors in striatum. Moreover, some data demonstrated that A2AR, CB1R, and D2R may form G protein-coupled receptor heteromers in cotransfected cells and in brain striatum. On this basis, the team synthesized novel xanthine derivatives that were investigated at adenosine receptor subtypes (A1, A2A, A2B, A3).

Poster # 26

Metabolomics Profiling of Biological Samples with Applications for Nutritional and Disease Studies

Thaer Barri, King Fahd University of Petroluem & Minerals, Saudi Arabia

Metabolomics is an emerging and multidisciplinary research area that has found diverse applications in fields such as, and not limited to, environmental science, toxicology, nutrition, medicine, and pharmaceuticals. The team has developed metabolomics profiling approaches, based on liquid chromatography-high resolution mass spectrometry and chemometrics tools, to particularly provide answers in nutrition and health applications. The team investigated the metabolic consequences of different types of nutritional foods (specific meals, rye vs wheat bread, high-fiber vs low-fiber meals)

in urine and blood plasma samples of healthy humans. In addition, metabolic changes in tissues and biofluids were investigated in an animal model with induced metabolic syndrome. In another study, the metabolic response of antibiotic treatment of bacterial infection was profiled in animal model. The principle of metabolomics and the results of the above studies will be the core of this presentation that will definitely stimulate further discussion and potential collaboration with researchers in Arab World and US universities.

Poster # 27

Accumulation of Antimicrobials in Soil and Subsequent Uptake in Lettuce after Wastewater Irrigation

Shannon Bartelt-Hunt, University of Nebraska-Lincoln, United States

With growing stress on the global freshwater supply, recycled wastewater is becoming an important source for irrigation water. The use of recycled wastewater for irrigation may introduce trace levels of antimicrobials and human pathogens into the food supply through vegetative uptake. The objective of this study was to investigate the uptake of three antimicrobials (lincomycin, sulfamethoxazole, and oxytetracycline) in two lettuce cultivars (cv. Salad Bowl and cv. Greenstar). After repeated subirrigation with synthetic wastewater containing the antimicrobials, destructive sampling of lettuce leaves and soil was conducted at 24, 35, and 46 days after seeding. Antimicrobials were extracted from soil and plant materials and analyzed using LC-MS/MS. Of the three antimicrobials investigated, lincomycin and sulfamethoxazole were recovered from lettuce leaves at concentrations as high as 822 ng/g and 125 ng/g on a fresh weight basis, respectively. Generally, antimicrobial concentrations decreased from the first to the third harvest suggesting that the plant growth rate may exceed net antimicrobial uptake rates. Accumulation of antimicrobials in cv. Greenstar lettuce was significantly higher than accumulation in cv. Salad Bowl. indicating that certain lettuce cultivars may be more suceptible to antimicrobial contamination.

Poster # 28

Applications of Applied Electromagnetics in Telecommunications, Healthcare, and Homeland Security

Nader Behdad, University of Wisconsin Madison, United States

The fields of Electrical Engineering in general and Applied Electromagnetics (EM) in particular have advanced rapidly over the past few decades. Many of the conveniences that we take for granted in our modern lives nowadays are enabled by innovations in these disciplines. Examples range from smart phones and ubiquitous access to the internet via a wide range of different wireless networks to modern medical imaging systems and satellite communications. The Electrical and Computer Engineering Department of the University of Wisconsin - Madison conducts cutting edge research in the field of Applied Electromagnetics and is working towards addressing some of the most challenging problems that are faced in this area. These problems often have significant societal and economic implications. In this poster, the author will present an overview of our research in this area and discuss three specific problem areas that he is trying to address by exploiting recent innovations in the field of Applied Electromagnetics. These three application areas include Wireless Communications, Healthcare, and Homeland Security.

In the area of wireless communications, the author presents the latest results in developing highly-directional, small antennas that mimic the sense of auditory hearing of small animals and discuss how these antennas can be used to dramatically enhance the capacity of future wireless systems and enhance the efficiency with which the EM spectrum is utilized. These antennas are expected to

enable dramatic improvements in the speed with which people access the Internet through wireless networks. the author will also discuss the potential military applications of these antennas in designing small, portable direction finding systems that can be used to localize the location of undesirable electromagnetic emitters (e.g. useful in applications such as detecting Improvised Explosive Devices).

In the area of Healthcare, the author will discuss how two recent innovations in the field of Applied Electromagnetics can help with the detection and treatment of cancer. Specifically, how microwave imaging systems in general and a specific microwave imaging system under development in his group in particular can be used for early detection of breast cancer in women. Furthermore, the author will discuss the applications of the concept of high-frequency microwave ablation as a minimally-invasive method for the treatment of cancer. This new technique, which is pioneered by in his research group, is expected to provide a low cost, less risky, and minimally-invasive alternative to surgical resection, which is currently the preferred method for cancer treatment in most cases.
Finally, in the area of Homeland Security, the author will discuss research activities in designing antennas for military communications systems as well as development of high-power microwave systems that can be used for electronic warfare or electronic defense applications.

Poster # 29

Edible Electronics: Next Generation Medical Devices for Oral Delivery
Christopher Bettinger, Carnegie Mellon University, United States

INTRODUCTION
Edible electronics represents a class of electronically active medical devices that can be deployed orally, reside in the gastrointestinal tract temporarily, and eventually pass through the body harmlessly with the feces. Edible electronics would have far reaching diagnostic and therapeutic applications including devices for in vivo biosensing and controlled release of biologically active macromolecules.

Integrating practical energy sources that are congruent with transient devices remains an unmet challenge for both edible and biodegradable electronics. Energy storage systems pose a feasible solution, but toxic materials and electrolytes present technical and regulatory hurdles for use in temporary medical devices. Aqueous sodium-ion charge storage devices combined with biocompatible organic electrode materials may serve as ideal components to power next generation biodegradable electronics.

EXPERIMENTAL
X-ray photoelectron spectroscopy (XPS) was performed using Kratos Analytical Axis Ultra. Raman spectra were collected using an inverted Raman confocal microscope. A three-electrode cell was configured with melanin as working electrode against platinum counter electrode and Hg/Hg2SO4 reference electrode. Multichannel potentiostat/galvanostat was used to measure cyclic voltammetry (CV) and discharge profiles.

RESULTS AND DISCUSSION
Biologically-derived organic electrodes composed of melanin pigments can serve as biocompatible battery materials for use in biocompatible energy storage devices. Natural and synthetic melanins were both evaluated as anode materials in aqueous sodium-ion storage devices. Na+-loaded melanin anodes exhibit specific capacities of 30.4 ± 1.6 mAhg-1. Full cells composed of natural melanin anodes and λ-MnO2 cathodes exhibit an initial potential of 1.03 ± 0.06 V with a maximum specific capacity of 16.1 ± 0.8 mAhg-1. The performance of natural melanins exceeded that of

synthetic melanins when used as anodes owing to the confluence of desirable chemical, electrical, and physical properties exhibited by the former.

CONCLUSION
Materials for edible electronics would not only be non-toxic and safe for use in the human body, but would also be composed of ingestible materials including the possibility of natural biopolymers. The first application of biologically-derived melanin-based batteries will be in electronically active devices for use in oral controlled release applications.

Poster # 30

Electrical and Optical Properties of Oxide Films Grown by MOCVD

Saud Bin Anooz, Hadhramout University, Yemen
J. Schwarzkopf, R. Dirsyte, M. Schmidbauer, R. Fornari Leibniz Institute for Crystal Growth, Germany
P. Petrik, Institute for Technical Physics and Materials Science, Hungary

Oxide films like SrRuO3 and lead-free ferroelectric compounds represented by the alkaline oxides (like Na1/2Bi1/2TiO3) have attracted large interest from a scientific and applicatory point of view. Annealing and lattice strain effects on the electrical properties of SrRuO3 films and the influence of Na on the structure and optical properties of Bi4Ti3O12 have been systematically investigated by high-resolution x-ray diffraction (HRXRD), Raman spectroscopy, electrical resistivity measurements and spectroscopic ellipsometry. XRD and Raman spectroscopy for the deposited film revealed that the film had c-axis orientation and contained RuO2 as a secondary phase. Single phase SrRuO3 could be obtained by annealing the film at 700 ^{o}C. Annealing at higher temperatures up to 850 ^{o}C leads to ruthenium deficiency. The single-phase, compressively strained, SrRuO3 film is of high structural quality and shows a ferromagnetic transition at a suppressed Curie temperature (Tc) of about 142 K as well as low electrical resistivity. The optical band gap and the refractive index of Bi4Ti3O12 are dependent on the sodium content.

Poster # 31

Monitoring of Land Degradation and Environmental Changes from Space

Moncef Bouaziz, Technical University of Dresden, Tunisia

Arid and semi-arid regions are particularly affected by land degradation. Irrigated regions and oases in Southern Tunisia are such areas where the excessive content of salt in the soil and desertification are a challenging phenomenon. Land degradation engenders several environmental problems such as limiting plant growth and reducing crop productivity.

This work benefits from the combination of remote sensing and ground-truth measurements to monitor land degradation and environmental changes in southern Tunisia. Soil samples from the upper 10 cm top-soils were collected in southern Tunisia and analyzed to provide information on the soil fertility and stability. Land use was then classified using supervised and unsupervised classifications. A database was built under the shape of WebGIS which gathers all the information, data, inputs, and outputs of this research project. Furthermore, the team placed the causal factors underlying dry land degradation into a Geographic information (GIS) database which permits a rapid diagnosis of the causes of land degradation for the purpose of designing intervention strategies. The present study also highlights that classes of extreme and high saline soils are predominantly represented by gypsum rich soils.

Poster #32

Environmental As_2O_3 and $NaAsO_2$ Induce EBV Induced Lymphoma Demise by Disrupting LMP1 and PML Dynamics and Different Cell Death Mechanisms

Mehdi Bourouba and Abderezak Zebboudj, Universite des Sciences et de la Technologie Houari Boumediene (USTHB), Algeria

Arsenical compounds (As_2O_3 and $NaAsO_2$) have been incriminated in the induction of several diseases including cancer. Interestingly, recent findings have suggested their potential anti-tumoral effect against solid and myeloid tumors. Arsenic trioxide was previously shown to induce a cytotoxic effect on nasopharyngeal cancer cells by down-regulating expression in the latent Epstein Barr Virus (EBV) immortalizing protein LMP1 (latent membrane protein type 1). However, the effect of arsenic on EBV-associated lymphoproliferative malignancies has been less studied. Here we characterized the mechanistic process by which these environmental pollutants eliminate the P3HR1 cells, an Epstein Barr Virus (EBV) induced Burkitt lymphoma. Both compounds inhibited cell growth and induced cell death. By flow-cytometry and Western blot analysis, we provide evidence that NaAsO2 induced caspase-dependent apoptosis whereas As2O3 triggered autophagic cell death. Furthermore, we show that NaAsO2 treatment led to a dramatic transcriptional repression of LMP1 and depletion of cellular LMP1 pools. Importantly, this down-regulation was associated with abrogation of the viral latency program and reactivation of EBV lytic cycle through the induction of immediate-early proteins Zta and Rta. These results are in agreement with a model in which LMP1 maintains EBV in a latent state by stabilizing PML expression. Altogether, our results suggest that environmental $NaAsO_2$ would represent a better therapeutic candidate than As_2O_3 in EBV-induced B lymphoma for its capacity to promote viral reactivation.

Poster # 33

Crowdsourcing Water Quality: Using Mobile Technology and Rapid Microbiological Tests to Assess Drinking Water Risks

Joe Brown, Georgia Institute of Technology, United States

Newly proposed international drinking water safety metrics envision a global scale-up of microbiological testing. Currently accepted, standardized methods are expensive and require functional laboratories and trained technicians, which may not be widely accessible in the places where water safety monitoring is most needed. This team has developed a promising new method for crowdsourcing microbial water quality data at community and larger scales. The team combines accurate, low-cost, quantal, ambient temperature-incubated, single use *E. coli* tests with reporting by mobile phones to collect, aggregate, and rapidly interpret water data. The tests are conducted and reported by water users, with automatic data aggregation and statistical analysis of the data via an Android app in Python. This presentation focuses on laboratory and field-based proof-of-concept testing currently in progress in India.

Poster # 34

An Arabian Coral Reef Research & Monitoring Network

John Burt, New York University Abu Dhabi, United Arab Emirates

The Arabian peninsula is bordered by three distinct seas that contain some of the most unique and scientifically interesting coral reef ecosystems in the world. To the north, the Arabian Gulf represents the world's hottest sea where summer sea temperatures regularly exceed 35 C, a

temperature that is not expected to be experienced by most tropical coral reefs for at least a century under climate change. Despite these extreme conditions coral reefs occur in all eight countries bordering the Gulf, offering an opportunity to understand how corals and other reef fauna survive extreme conditions and how coral reefs in other regions may respond to future climate change. In contrast, the adjacent Arabian Sea is among the coolest coral reef ecoregions in the world due to the summer monsoonal upwelling in the Indian Ocean. This results in an unusual pseudo-high-latitude ecology on reefs in southwestern Arabia, yet the importance of this unique ecology has been little studied and represents a valuable resource for informing science about the patterns and processes structuring dynamics on marginal reefs elsewhere in the world. To the west, the Red Sea contains one of the most diverse and extensive coral reef ecosystems in the world, yet much of the area (particularly on the Saudi Arabian coast) has until recently received relatively limited scientific attention. As a result of these unique features, there has rapid growth in regional and international scientific attention on regional coral reefs in recent years and research on Arabian reefs is burgeoning. In order to foster dialogue among individual and institutional stakeholders engaged in regional reef studies, an "Arabian Coral Reef Research & Monitoring Network" is proposed which would serve as a catalyst for communication, collaboration, and knowledge exchange among the international and regional scientists engaged in research on these important and unique ecosystems. Results of recent efforts by this author to establish a regional network will be discussed, including the largest ever regional coral reefs conference (Coral Reefs of the Gulf, 2012), the establishment of the Mideast Coral Reef Society (2013), delivery of capacity-building workshops aimed at Arabian nationals (example: Conserving Coral Reefs in the Arabian Gulf: A Capacity Building Workshop, 2014), and an upcoming region-wide conference (Coral Reefs of Arabia, March 2015). These past efforts will be put in the context of future directions aimed at enhancing engagement and communication, with the larger goal being improved conservation and management of these important Arabian coral reef ecosystems.

Poster # 35

Global-Local Nonlinear Model Reduction for Flows in Heterogeneous Porous Media

Victor Calo, King Abdullah University of Science and Technology (KAUST), Saudi Arabia

In this talk, the poster describes local and global-local model reduction techniques for nonlinear flows. This is achieved using proper orthogonal decomposition and dynamic mode decomposition techniques on a coarse grid for global model reduction and the generalized multiscale finite element method (GMsFEM) for local model reduction. The resulting reduced-order approach enables a significant reduction in the flow problem size while accurately capturing the behavior of fully resolved solutions. To further reduce the computational cost associated with nonlinear flows in highly-heterogeneous porous media, the team uses discrete empirical interpolation techniques, global mode decomposition methods, and local multiscale methods. To solve the nonlinear governing equations, the team employs the GMsFEM to represent the solution on a coarse grid with multiscale basis functions and apply proper orthogonal decomposition on a coarse grid. Computing the GMsFEM solution involves calculating the residual and the Jacobian on the fine grid. As such, local and global empirical interpolation concepts we used to circumvent performing these computations on the fine grid. The resulting reduced-order approach enables a significant reduction in the flow problem size while accurately capturing the behavior of fully-resolved solutions. We consider several numerical examples of nonlinear, multiscale, partial differential equations that are numerically integrated using fully-implicit time marching schemes to demonstrate the capability of the proposed model reduction approach to speed up simulations of nonlinear flows in high-contrast porous media. A variety of high-contrast coefficients were considered and the poster presents the corresponding numerical results to illustrate the effectiveness of the proposed technique.

Poster # 36

Assessment of Surface Water – Groundwater Connectivity for Sustainable Water Resources Management in arid and semi-arid environment of Tunisia

Anis Chekirbane, Water Researches and Technologies Center, Borj Cedria Technopark, Tunisia, Tunisia

Independent management of ground and surface water was usually performed in the Cap-Bon area. Therefore, pumping from an aquifer near a river can dramatically change the amount of stream runoff. In contrast, if the river water is salty or contaminated, increased recharge can have a negative effect on the groundwater quality. Understanding the extent of groundwater-surface water connectivity is crucial for the sustainable management of overall water resources.

The study area is Al Ayn watershed, a small coastal plain, which includes one of the most vulnerable parts of the aquifer due to its sandy lithology and the presence of several points of contamination. The team's objectives are to explain the point contamination processes of groundwater in Al Ayn plain, to assess stream – aquifer connectivity, and to propose a management approach that can integrate surface water – groundwater interaction into an actual management plan in the Ca-Bon area. For this reason, two field surveys were conducted in the study area in which water temperature, stream flow rate, pH, electrical conductivity and water table depth were measured. Laboratory analysis of the water samples included major ions and stable isotopes. The observed water table variations, stable isotopic content, and hydrochemical data show that the stream water of Wadi Al Ayn seems to have a notable contribution on groundwater recharge. The stream – aquifer connectivity was mapped. In fact, upstream, Al Ayn River is playing the role of the gaining/losing stream. In the middle, its recharging function is ensured by a bank storage process. However, in the downstream portion, the losing function seems to be dominant. Regarding the degree of connectivity between stream and aquifer, the team proposed an adoptive management zone approach:

1. Gaining stream: no active management relating aquifer pollution by river water infiltration is required
2. Losing stream/bank storage: preventive measures (law delineating the sensitive area and penalizing the polluter) and curative measures (law and restriction enhancing remediation processes) are required

Poster # 37

Pan-Sharpening Techniques Based on the NSCT and the IHS Transforms Applied to High Resolution Images

Miloud Chikr Elmezouar, Laboratory of Communication Networks Architectures and Multimedia, Algeria

There are currently several satellites that provide images from different spectral bands at the same time, but with various resolutions and at different frequencies. In practice, there is an image captured over a wide spectral band which is known as a panchromatic (PAN) image. Besides this image there are several multispectral (MS) images captured over narrower spectral bands. Commonly, MS images have lower spatial resolution than that of PAN image. Even though today's sensors can produce multispectral images with higher spatial resolution than before, it is still desirable to enhance their resolution in order to approach that of the PAN image. The process of generating high resolution color images from MS and PAN images is known as pan-sharpening. This process fuses the low-resolution MS images with the higher-resolution PAN image so that the resulting images corresponding to MS images are of the same resolution as the PAN image. This helps to obtain color images with higher spatial resolution for better visualization of remote sensing, color images.

In this work, two pan-sharpening methods are presented and evaluated. In the first method, a simple, generalized IHS method is applied. Then, the two bands, Green and Blue, are tunedon vegetated areas, which are detected using the proposed HRNDVI index. The tuning parameter depends on the considered application. A value of 12% is used for pan-sharpening purposes and a value of 25% must be used for vegetation visualization. This method performs well on the images containing mixed or mostly vegetated areas. It gives very good visual results and produces non-distorted and perfectly natural image colors. In addition of its performance, this method remains as simple as the other IHS based techniques.

In the second method, the standard NSCT-based pan-sharpening is improved by considering a different number of decomposition levels and the placement of the interpolation method based on NSCT. Each original MSi band is decomposed, using NSCT, into one coarse level and one fine level, while the Pan image is decomposed into one coarse level and three fine levels. The obtained MSi coefficients are then up-sampled. The coarse level of the pan-sharpened MSi band is the up-sampled coarse level of the MSi band. Fine levels 2 and 3 of the pan-sharpened MSi band are set to fine levels 2 and 3 of the Pan image. Fine level 1 of the pan-sharpened MSi band is obtained by fusing the coefficients of the same level obtained from both the MSi band and the Pan image. The fusion rule uses the local energy of each coefficient. Finally, the inverse NSCT is performed to provide the pan-sharpened image MSi. The obtained results confirm the added-value of using an adequate number of decomposition levels and up-sampling after the NSCT decomposition.

Method 1 can be used to pan-sharpen images issued from Ikonos or Quickbird satellites. Method 2 is more suitable for pan-sharpening MS images produced by WorldView-2 satellite.

Poster # 38

Could Hydraulically Fractured Shales Represent a Viable Repository for Geologic Carbon Sequestration?

Andres Clarens, University of Virginia, United States

Oil and gas production from hydraulically fractured shale formations is an abundant new source of domestically available energy for the United States,but will also result in significant CO2 emissions with important climate implications. Several studies have suggested that fractured shale formations could be used to permanently store CO2 once they are depleted of hydrocarbons. Many of the largest shale formations being developed in the United States have temperature and pressure profiles that are similar to those of saline aquifers being widely studied for geologic carbon sequestration. Here, a modeling framework was developed that can be used to estimate the sequestration capacity for a shale formation based on historical CH4 production. The model is applied to those portions of the Marcellus formation found in Pennsylvania because reliable data on well production is readily available for this state. Production data from over 300 wells was compiled and used to estimate historical production and to extrapolate projected production. In shale, much of the CO2 would be sorbed to the pore and fracture surface and so this model considers sorption kinetics as well as total sorption capacity.

The results suggest that shale formations could represent a significant repository for geologic carbon sequestration. The Marcellus shale in Pennsylvania alone could store between 10.4 and 18.4 Gigatonnes of CO2 between now and 2030. This would be over 50% of total annual US CO2 emissions from stationary sources. The mass transfer and sorption kinetics results indicate that CO2 injection proceeds several times faster than CH4 production. Model estimates were most sensitive to the permeability of the formation and assumptions about the ultimate ratio of adsorbed CH4 to CO2. CH4 production is a useful basis for calculating sequestration capacity because gas mass transfer out of the formation will be impacted by the same factors (e.g., temperature, pressure, and moisture content) influencing gas injection. The differences between horizontal and non-horizontal wells were taken into account to understand how well structure would influence gas transport kinetics. It was assumed that only the sorbed CO2 would stay in the formation over time.
These estimates for sequestration capacity suggest that the approach merits further study to understand the viability of this approach and opportunities to leverage existing infrastructure. Other synergies could exist in terms of monitoring. Related impacts associated with induced seismicity and leakage would need to be explored to understand the full potential of this approach. The sequestration capacity estimated using this model supports continued exploration into this pathway for producing carbon neutral energy.

Poster # 39

Nanoscale (Thermal) Energy Engineering from Discovery to Applications

Baratunde Cola, Georgia Institute of Technology, United States

After nearly 25 years of intensive development of science at the nanoscale, marked by numerous important discoveries, researchers now have a tremendous amount of knowledge and tools to exploit nanoscience in applications. Applications in energy and microelectronics, foundations of modern society, are uniquely positioned to benefit from the different physics at the nanoscale, which, with continued efforts, may bring the miracles we need to solve some of societies most pressing challenges. The poster will discuss this lab’s contributions to this journey through the lens of the following specific applications.

Thermal Interface Materials: Thermal management is a critical challenge for electronics. It can limit performance and operational life, and, today, poor heat transfer at the material contacts is the major problem in many commercial packages. The team has developed vertically aligned carbon nanotube (CNT) and pure polymer nanotube (PNT) arrays to achieve reduced thermal contact resistance in electronic packages. This work has discovered critical bottlenecks to heat transfer and new modes of enhanced thermal transport in these materials, and has allowed us to engineer new material combinations to mitigate thermal contact resistance in a reliable way. These efforts are enabled by precise thermal metrology – photacoustic and time-domain thermoreflectance – and expertise in nanomaterials synthesis and characterization. Thermo-electrochemical cells: Heat is wasted nearly everywhere and sums to many terawatts annually. Converting just a small fraction of this heat to electricity could save and preserve natural and financial resources for generations to come. Thermo-electrochemical cells or thermocells, as well as other important electrochemical energy technologies, are limited by the low effective electrical conductivity of electrolytes. This team has developed CNT mixtures in ionic liquids that increase the electrical conductivity of electrolytes while remaining below the threshold for CNT percolation. This has allowed the manufacture of thermocells that convert heat to electricity with about an 80% increase in efficiency. The team's efforts are enabled primarily by detailed electrochemical impedance studies. The poster will also briefly discuss the use of the PI's research results to engage the public and build collaborative communities that expand beyond the academic campus.

Poster # 40

Confined Transport of Complex Particulate Fluids

Jacinta Conrad, University of Houston, United States

Applications in materials engineering, natural resource extraction, drug delivery, environmental remediation, and water treatment require transport of particles dispersed in complex fluids through microscale and nanoscale geometries. As one class of examples, feedstocks for three-dimensional printing, which must be rapidly extruded through fine nozzles during printing, contain both particles to impart functionality as well as polymers to act as binders and rheology modifiers. Similarly, attaining the unique thermal, mechanical, and electrical properties of polymer nanocomposites requires uniform dispersion of nanomaterials in polymer resins. Finally, viscosifiers, gellants, and proppants flowed through narrow pore throats to enhance the recovery of hydrocarbons from reservoirs of low permeability typically contain both polymers and particles of a broad size range. As a second class of examples, nanoparticles formulated as cancer therapeutics, drug delivery vehicles, and imaging agents must be transported through the vascular and lymphatic systems and the extracellular matrix prior to reaching targeted tissues. Conversely, small particles transport contaminants in saturated soils and exacerbate environmental damage, and biological particles such as viruses and bacteria contaminate drinking water aquifers and aid the spread of disease between humans. The common feature uniting these examples is the transport of submicron particles in non-Newtonian fluids through confined geometries.

This research focuses on identifying the mechanisms by which surfaces modify the transport properties of particles in complex fluids, with three main areas: (1) structure, dynamics, rheology, and flow of colloid-polymer mixtures in microfluidic geometries; (2) transport of nanoparticles through hard and soft porous media; and (3) near-surface motility and adhesion of bacteria on engineered surfaces prior to biofilm formation. The team uses bulk and microrheology to characterize the viscoelastic properties of our suspensions; microfabrication and microfluidics to create microchannels and three-dimensional porous media; brightfield, fluorescence, reflectance, and confocal microscopy to image colloids, nanoparticles, and bacteria during transport near surfaces; and high-throughput image analysis techniques, including particle-tracking, particle-

imaging velocimetry, and differential dynamic microscopy, to quantify the transport properties of the particles. In addition to the main focus areas, the team collaborates with a biodetection group to develop diagnostic assays for viruses, with a cell biology group to characterize collective migration of cells on substrates, and with a protein crystallization group to quantify diffusion of liquid protein clusters. The goal is to uncover fundamental parameters that enhance or inhibit the transport of these distinct particulate systems in complex fluids and thereby enable the rational design of materials for transport in confined settings.

Poster # 41

Are unconventionals too dirty to develop?

Rosa Dominguez-Faus, University of California Davis, United States

The shale revolution is providing U.S. domestic natural gas at extraordinary low prices. The emergence of natural gas as an abundant, inexpensive fuel in the United States has raised the possibility of a momentous shift in the level of natural gas utilized in the transportation sector, manufacturing, power generation, and energy exports. Unconventionals broad geographic distribution across the United States helps shore up supply resiliency in contrast to imported oil and traditional U.S. domestic oil reservoirs and oil refining infrastructure, which are heavily concentrated in the Gulf of Mexico and interruptible by severe storms. Shale gas is, in fact, ushering in a changed paradigm where consuming countries like the United States will increasingly be able to source their supply at home, lowering geopolitical and extreme weather-related risks and enhancing economic benefits. Strategic and economic benefits of developing domestic shale resources can be substantial but public opinion worries over environmental impact associated with the development of these resources. In this poster we describe the latest scientific understanding of water pollution from fracking operations and climate effects of methane leakage from natural gas and oil systems, as these issues could determine the fate of unconventional development in the US.

Poster # 42

Frontiers of High Performance Buildings

Bryan Eisenhower, UCSB, United States

Buildings consume about 40% of energy in industrialized countries which leads to a significant amount of pollution. Often, much of this energy consumption is wasted due to poor design or operation strategies. In this work the team discusses new design tools for high performance buildings that take into account the balance of energy consumption and comfort. The poster also overviews advanced diagnostics and operational approaches that address these concerns in the presence of varying climate and uncertain occupancy patterns.

Poster # 43

Transplantation of Autologous Bone Marrow Induces Improvement in Canine Model of Spinal Cord Injury

Zeinab El Maadawi, Cairo University, Kasr Alainy Faculty of Medicine, Egypt

Introduction: Spinal cord injury (SCI) results in demyelination of surviving axons, loss of oligodendrocytes, and impairment of motor and sensory functions. The use of adult bone marrow cells in a cell therapy strategy might augment remyelination and improve neurological functions in SCI.

Aim of the work: To evaluate the possible therapeutic effect of autologous adherent bone marrow cells (ABMCs) on a canine model of induced spinal cord injury.

Material & Methods: Twenty four adult male dogs were divided randomly into three groups; control group, SCI group, & SCI with ABMCs injected group. The last two groups were subjected to a clipping contusion of the spinal cord. ABMCs were isolated from the femurs of adult dogs for in vitro studies. ABMCs were subjected to flow cytometry, green fluorescent protein (GFP) labeling, and neural induction was performed. Intra-thecal transplantation of canine GFP-labeled ABMCs was performed two weeks after SCI. The safety and efficacy of autologous ABMCs therapy were investigated using functional neurological scoring. Furthermore, the differentiation and integration of ABMCs into injured spinal cord were examined using histological and immunohistochemical investigations. Dogs were scarified after 16 weeks & paraffin embedded spinal cord sections were subjected to routine hematoxylin and eosin (H&E) staining for histological evaluation. For immunohostochmistry the following primary antibodies were used to evaluate cell differentiation; glial fibrillary acidic protein (GFAP), platelet-derived growth factor receptor-alpha (PDGFR), nestin, neurofilament 70 (NF70) & myelin basic protein (MBP). Moreover, electron microscopic study of sections from spinal cords was performed. For quantitative analysis the number of transplanted GFP labeled ABMCs in the spinal cord was counted. Myelinated areas and mean area of cavitations from the epicenter of the damaged spinal cord were calculated using image analyzer. All recorded data were subjected to statistical analysis.

Results: We demonstrated the presence of a substantial number of GFP-labeled cells in the injured spinal cord up to 16 weeks after transplantation. Less cavitation in the gray and white matter was noticed in ABMCs-treated sections. Numerous GFP positive cells were widely distributed from the epicenter only in ABMCs injected group. Moreover, ABMC-derived cells positive for both GFP and either the neural progenitor marker nestin, the oligodendrocyte precursor marker PDGFR, or the astrocyte precursor marker GFAP in nerve bundles was demonstrated. Re-myelination was also observed in electron micrographs of sections from autologous ABMCs transplanted dogs
Conclusion: ABMCs therapy in canine SCI model enhanced remyelination and augmented neural regeneration resulting in improved neurological functions. Therefore, autologous ABMCs injection might be a safe and promising therapy for spinal cord injuries.

Poster # 44

Balancing Rheology and Filtration for Enhanced Flow Control in Porous Media and Fractures
Chadi El Mohtar, The University of Texas at Austin, United States

Drilling muds have been used for decades in petroleum applications (along with several other applications in the fields of geotechnical engineering, tunneling, etc.). Despite their significant impact on the success of the drilling, LOT, LC, and crack tip propagation/sealing and near-well formation properties, the characterization and design of the appropriate drilling fluid mostly relies on field experience and rules of thumb. While plenty of work has focused on characterizing the formations, the understanding of the drilling muds has lagged behind and therefore, very empirical approaches and testing methods have been used to characterize these complex, visco-elastic, shear-rate, time, pressure, and temperature dependent materials.

The current research looks into the rheological properties of suspension such as yield stress (as a parameter for static conditions),apparent viscosity (as a parameter for flow conditions that varies depending on the expected shear rates), and physical properties (particle size, concentration/density,...) to investigate how these properties can be related to the interaction between the drilling mud and the formation. The experimental results help evaluate the

performance of different grouts based on their rheological and physical properties through a micro-mechanics approach that evaluates the stress-strain rate relationships governing the behavior of the grouts within the pores/cracks. These tests look at chemically modifying suspensions at similar concentrations to isolate rheological properties from physical properties and vice-versa which help establish new drilling fluid design criteria based on true engineering properties that represent the state of the fluid during field operation.

Poster # 45

Capillary Electrophoresis Method with Fluorescence Detection for Simultaneous Determination of Polyamines and acetylpolyamines in Human Urine

Abdalla Elbashir, University of Khartoum, Sudan

There has been evidence linking elevated polyamines (PAs) and acetylpolamines (AcPAs) levels with cancer which has lead the simultaneous analysis of these compounds becoming an important task for cancer diagnosis and antitumor drug monitoring. A simple, fast, and inexpensive CZE-LIF method has been developed for the determination of cadaverine (CAD), putrescine (PUT), spermine (SPM), spermidine (SPD) , acetylspermine (ASPM), and acetylspermidine (ASPD) in human urine using 4-chloro-7-nitro-2,1,3-benzooxadiazole (NBD-Cl) as a fluorescent reagent. Labeling reaction conditions were systematically investigated and found to be 20 mM borate buffer at pH 7.4, labeling reaction time 10 min and, labeling reaction temperature 70 ºC. Under these optimized conditions, the four PAs, two AcPAs, and the internal standard were separated in 6 min. An Exactive-MS with an electrospray ionization source (ESI) was used for identification of the bis-derivatized of the ASPM. The method was validated in term of precision, linearity, selectivity and, limits of detection. The limits of detection for CAD, PUT, SPM, SPD, ASPM, and ASPD were found to be 7.6, 10.0, 9.0, 8.8,7.8, and 3.3 nM, respectively. This method was successfully applied for the analysis of PAs and AcPAs in healthy human urine samples.

Poster # 46

Research on the Morphodynamics of Barchan Dunes: Towards New Techniques Against Sand Encroachment

Hicham Elbelrhiti, Institut Agronomique et Vétérinaire Hassan II, Morocco

Techniques currently used to fight silting and sand encroachment are not particularly effective. Aside fromareas occupied by longitudinal dunes (in southeastern Morocco, for example) where these techniques give satisfactory results, it is inefficient in areas covered by barchans dunes. This constitutes a challenge for researchers in this field. In this context, This presentation highlights a new method to fight sand encroachment caused by barchans. Instead of stopping and fixing dunes, this new method aims to destroy momentary barchans when they overcome protected obstacles (road for example) before they auto-reconstruct. This requires exploitinga theory of waves that was developed in a preveous paper (Elbelrhiti et al., 2005) and predicted the nucleation of waves on the windward side to destroy barchans. These waves are the general response of barchans to agitations and they finish by ejecting patches of sand from their horns. These ejected patches disappear momentary into free flux (safe movement of sand grain by grain) if they have a size less than the critical length at nucleation of small dunes, otherwise they transform into small barchans (Elbelrhiti, 2012). Understanding the factors that control the length of these patches could be of paramount importance in developing a new technique against sand encroachment. The team demontstrated with field measurments that the bulk flux, which constitutes a permanent threat, can be transform naturally to free flux (Elbelrhiti et al, 2008). For the moment, the mechanism behind this

transformation is still not understood. The understanding of this transformation of bulk flux into free flux will be an important step in fighting effectively against sand encroachment.
References:

1. Elbelrhiti, H. Claudin, P. and Andreotti, B. 2005. Field evidence for surface-wave induced instability of sand dunes. Nature vol 437, 04058.
2. Elbelrhiti, H. Claudin, P. and Andreotti, B. 2008. Barchan dunes corridors: Field characterization and investigation of control parameters. J. Geophys. Res. Vol. 13. F02S15.
3. Elbelrhiti, H. 2012. Initiation and early development of barchan dunes, a case study of the Morooccan Atlantic Sahara desert. Geomorphology, vol. 138, p 181-188.

Poster # 47

Bentonite in Sudan

Abusabah Elemam, SudanUniversity of Science and Technology, Sudan

In the oil and gas industry, drilling is a complicated and expensive operation compared with other activities in well program. Drilling fluids are considered important components of drilling wells using rotary drilling method used and date back to 1900. Bentonite is an important element in water based drilling fluid. Sudan imports its supply of bentonite from foreign nations such as India, Egypt and Libya. This presentation gives an overview about bentonite in Suadan. Samples collected from Al Fao and Umm Ali to investigate the properties of clay as bentonite in water based mud.

Poster # 48

Tunable Release and Detection of Multiplex Biochemicals by Plasmonic Nanomotor Sensors

Donglei (Emma) Fan, University of Texas at Austin, United States

It is highly desirable to tune the release rate of biomolecules from the surface of nanoparticles for cancer therapy and system biology. This presentation reports on innovative plasmonic rotary nanomotor sensors and their applications in multiplex biochemical release and detection with Raman spectroscopy. The nanomotors were assembled from nanoscale building blocks consisting of plasmonic-sensitive nanorods as rotors, patterned nanomagnets as bearings, and microelectrodes as stators. They were precisely positioned at designated locations and rotated with controllable speed and chirality. Both single and multiplex biochemicals, attached to the surface of nanorotors, can be released in a tunable fashion by controlling the rotation speed of the nanomotors. The chemical structures as well as the release rates of individual chemicals can be revealed by in-situ Raman spectroscopy. The fundamental mechanism of the tunable release was modeled quantitatively and attributed to the fluidic convection induced boundary-layer reduction. As far as the team understands, such an effect is observed on micro/nanoscale devices for the first time. This research, which explored the synergistic attributes of surface enhanced Raman spectroscopy (SERS) and nanoelectromechanical systems (NEMS), could inspire a new paradigm of robotized nanosensors relevant to biochemical detection, cell-cell communication, and drug delivery.

Poster # 49

Enhancing Sustainability through Simulation: Drought Tolerant Crops, Green Buildings, and Clean Energy

Baskar Ganapathysubramanian, Iowa State University, United States

The past decade has seen rapid improvements in cyber infrastructure along with concurrent advances in computational sciences. This has greatly enabled the scope of simulation techniques to model, control, and design complex systems. In particular, leveraging computational science

progress has substantially enhanced sustainability efforts. The poster illustrates three such examples where high performance computing, applied mathematics, and data-driven analysis enabled breakthroughs in food, energy, and building sustainability efforts. All examples involve extensive collaborations with experimental colleagues.

Drought Tolerant Crops: The traditional approach of genetic hybridization of superior crop varieties to improve drought tolerance is time consuming and costly. Furthermore, there is no explicit direction from physiological hypotheses. In contrast, simulation based analysis allows for "ideotype breeding" which is hypothesis driven. "Ideotype breeding" is the process of first defining what an ideal plant should look like (the "ideotype") and then creating such a plant. The team develops a model-based approach to identify the traits of better crops. The computational model relates physiological water use traits with photosynthetic activity and thus, productivity. By integrating this with a high throughput optimization framework, the numerical model is used to design plant traits that are field-testable and that perform well under different conditions.

Green Bbuildings: In this example the team shows how a collaborative effort between an architect, a computational scientist and a control theorist enabled the vision of enhancing the use of naturally occurring energy flows within buildings to achieve thermal comfort and air quality, while minimizing fossil fuel consumption. The team developed advanced computational techniques using high performance computing to predictively model green buildings (that seek to leverage as much of natural ventilation as possible while gracefully coupling with active conditioning strategies) and design optimal sensor placement strategies. This has resulted in next generation control algorithms and building design guidelines that substantially reduce the building energy footprint.

Clean Energy: Organic solar cells (OSC) represent a promising low-cost, rapidly deployable strategy for harnessing solar energy. A key technological bottleneck to widespread use of OSC is the unclear link between processing conditions and how it affects morphology and performance. This is further complicated by the large set of solvents, substrates, and fabrication conditions available to fabricate OSCs. This serves as compelling reasons for developing material informatics tools to be used as virtual manufacturing tools for accelerated design. The team has developed computational strategies that predictively link fabrication process, nanostructure and property of thin film solar devices to rapidly explore the manufacturing space.

Poster # 50

Iraq's First Research Experiences for Undergraduates Program: Interdisciplinary Learning & Innovation

Christy Geraci, The American University of Iraq, Sulaimani, Iraq

The US National Science Foundation's Research Experiences for Undergraduates (REU) program is very effective in engaging American undergraduate students in scientific inquiry. Undergraduate research is an extremely valuable pedagogical tool because it allows students to implement the scientific method rather than merely reading about experiments in textbooks. While various public and private funding programs support graduate training and professional development for Iraqi scientists, few are available at the undergraduate level. For the past year, faculty members in the natural and social sciences at The American University of Iraq, Sulaimani, have been building Iraq's first REU program with funding from USAID's "Partnerships for Enhanced Engagement in Research" (PEER) program. Ten undergraduates from Business, Engineering, International Studies, and Information Technology participated in an interdisciplinary Learning Community focused on freshwater science and policy in the Tigris River Basin. Upon completing the LC, students developed original research projects ranging from evaluating failure potential of the Mosul dam, to testing for

coliform bacteria in drinking water, to using DNA barcoding to quantify biodiversity in Iraqi streams. This poster describes the preliminary results of AUIS PEER student research projects and also discusses ways that the REU model can be applied elsewhere in the Middle East to build capacity for interdisciplinary research and innovation.

Poster # 51

Concurrent Recovery of Water & Energy from Food Waste and Wastewater through Anaerobic Co-Digestion

Sophia Ghanimeh, Notre Dame University - Louaize, Lebanon

While the MENA countries are the least to be blamed for climate change impacts, they are among the first to suffer its consequences. Drought occurrences are expected to increase, putting pressure on the already stressed water resources. Reduced precipitation, coupled with a decrease in water availability, limits dilution effects and forces communities to use contaminated waters which results in a significant increase in water-borne illnesses. The agricultural sector, being a major water consumer, is the first to suffer. During drought periods, which are becoming increasingly common in the region, groundwater and surface water are depleted and farmers often divert wastewater streams to irrigate their crops. In order to cope with water scarcity, it seems that most MENA countries continue to rely on conventional water solutions such as building more dams and diversion canals, extracting more groundwater, or taping non-renewable fossil water. Alternatively, non-conventional options, such as wastewater reuse, with potentially lower impacts, may become more effective. Another potential unexploited source of recycled water is the high proportion of moisture (~80%) present in food waste, the main component (60-70%) of the total waste stream in most developing countries.Historically, wastewater and food waste have been treated using aerobic biological methods. These are energy-intensive processes during which a considerable part of the water is lost by evaporation or converted into a high strength leachate and is difficult to treat and may end up in evaporation ponds where all the water is lost into the atmosphere. In comparison, anaerobic methods produce a biogas consisting of ~ 60% methane – a source of renewable energy. The resulting liquid is more than 99% pathogen free and can, in most cases, be considered for direct land application.

A previous, extensive (four years) experiment showed that wet AD of food waste alone, diluted with water, produces 320-390 liters of methane per kg of volatile solids fed into the digester. Based on these results and local needs for water recovery and energy saving, a new research plan is currently being developed to substitute dilution water with raw wastewater in order to achieve the following improvements:

1. Better water conservation and recovery: no clean water addition is needed and all the moisture in wastewater and food waste can be recovered in the form of a wet (low-solids) fertilizer.
2. Better system stability: the addition of wastewater should have a continuous re-seeding effect which helps in maintaining a healthy microflora and providing a stable biogas production, which results in a reliable source of renewable energy.
3. Improved feasibility of wastewater and solid waste treatment: total and operating costs are reduced for treatment of both wastewater and solid waste streams. Also, small-scale facilities become more feasible.

Poster # 52

Toward Sustainable Removal of Water Micro-Contaminants Using Persulfate Technology: Application to Pharmaceutical Active Ingredients

Antoine Ghauch, American University of Beirut, Lebanon

In this work, the team is emphasizing the importance of the use of Persulfate (PS) Technology for the sustainable remediation of water containing traces of organic molecules that are of concern to environmental health. Two PS activation methods were used so as to generate powerful Sulfate Radicals (SRs) and Hydroxyl Radicals (HRs) for micro-contaminants oxidation: Method 1 is based on PS Thermal Activation, and Method 2 on PS Chemical Activation. Experiments undertaken in Method 1 on Pharmaceutical Active Ingredients (PAIs) like Bisoprolol, Ibuprofen, and Naproxen showed successful degradation of selected PAIs with an advanced mineralization rate reaching 100% as per PS increasing concentration. The Reaction Stoichiometric Efficiency (RSE) calculated under particular conditions was more than 100%. Method 1 was applied to a hospital effluent and showed full degradation of Naproxen spiked effluent as well as a high mineralization extent. Method 2, however, was applied on different PAIs (Sulfametoxazole and Ranitidine) using iron particles for PS activation. Upon corrosion in water, the system generated nascent iron corrosion products (ICPs) of excellent catalytic properties for PS activation into SRs. The metallic systems used were either commercial or industrial and originated from the waste of a mechanical car workshop. The results demonstrated the high potential of such PS/Fe based systems in fully degrading PAIs and their transformation products. The degradation of PAIs took place under reasonable conditions and dissolved oxygen played an essential role in improving mineralization. Finally, based on the chemical structure of the PAI under study, the oxidation process will be more or less driven by SRs in solution rather than by HRs indirectly generated in the medium. Such an Advanced Oxidation Process can be easily applied and performed, at least on hot spot effluents, with a minimum cost.

The ubiquitous searches for innovative methods for water treatment applicable on a large scale basis remain a challenge for the international scientific community. Population growth, urbanization and industrial development among other anthropogenic activities contribute to an increasing demand of water and energy consumption. Water availability is mainly dependent on natural resources becoming unfortunately limited in due to increasing climate change. Accordingly, efforts in this direction have to be done in order to preserve natural water resources by accompany water treatment by water reuse. Such processes need significant promotion in countries of the devleoping world including in the MENA region in which water scarcity becomes more evident year after year. Since the MENA region is very rich in natural minerals and has abundant solar energy, one should take advantage of those resources and develop new water treatment technologies able to be sustained accordingly.

Poster # 53

Effect of Application Load on Sewage Sludge Vermicomposting

Maha Halalsheh, The University of Jordan, Jordan

Different management options are currently applied for sludge produced by WWTPs in Jordan. Referring to Jordanian standard No. 1145/2006, sludge produced at all treatment plants are class C biosolids, which are only allowed to be disposed at landfills. Upgrading sludge quality to biosolids that can be used for land application entails, among other requirements, achieving at least class B biosolids and solids content higher than 50%. Upgrading biosolids to class A and a solids content of 90% necessitates even more investigations especially during winter periods. Low cost ecological treatment options are favorable in view of high costs of conventional treatment methods. Vermicomposting can be an attractive option for sludge reduction, biotransformation of organic

pollutants, and pathogens reduction (Contreras- Ramos et al., 2005; Yuansong and Junxin, 2006). Vermicomposting can be defined as the digestion of organic matter by earth worms and microorganisms. The earthworms provide aerobic conditions as they move around and enhance growth of aerobic microorganisms (Cardoso et al., 2008). Vermicomposting reduced 58% of organic carbon in cow manure and 55% of organic carbon in horse manure (Garge et al., 2009) after 90 days of operation. The worms use large portion of carbon as source of energy to build up their cells (Ndegwa et al., 2000; Yadav et al., 2011). Other important advantages of vermicomposting include their ability for removing pathogens and organic pollutants like hydrocarbons and PHAs (Contreras-Ramos et al., 2006). Vermicomposting was also reported to decrease the salinity of the final product compared with raw wastes (Elvira et al., 1998; Tajbakhsh et al., 2008; Garg et al., 2009). The final product is a stable granular soil that smells moist ande can be applied without creating a nuisance with respect to smell and vectors (Cardos et al., 2008). The success of vermicomposting depends on the substrate quality, moisture content of the substrate, pH, temperature, aeration, light, C:N ratio, earthworm stocking density, microorganisms present, and enzymes produced by the worms and microorganisms. Earthworms are rich in protein and can be used as a source of amino acids for animals and fish. Very little literature is available about biosolid vermicomposting and further research is obviously needed especially with respect to the rate of degradation of different sludge qualities.

This paper presents results related to lab experiments designed to investigate the effects of sludge loading rate on vermicomposting using a mixture of earth worms. Moreover, vermicomposting was conducted on two sludge types, mechanically dewatered sludge and sludge obtained directly from drying beds. The quality of the end product will be described in the full paper.

Poster # 54

Changes in the Coastal Salt Marsh Distribution as an Indicator of Climate Change
Marwa Halmy, Alexandria University, Egypt

Changes in the distribution of the coastal salt marshes is considered an important indicator of environmental change and has been recently proposed as an indicator of global warming. In the current study, the distribution of salt marshes over the northwestern coast area of Egypt over the last three decades was mapped. Landsat Thematic Mapper (TM 5) and Landsat 8 imagery are used to map the extent of salt marshes. The study area in northern Egypt suffers a marked increase rising sea levels. Therefore, the team tested the hypothesis that this might have resulted in changes in saltmarsh distribution. The results indicate that global warming has already caused marked changes in the distribution of saltmarshes in the coastal part of Egypt. The study emphasizes the importance of monitoring the rates of the change in the distribution of salt marshes and its relation to the rate of the sea level rise for the development of any future management plans. The study provides baselines to be used as reference against which future changes can be assessed.

Poster # 55

Creating a Sustainable Approach to World Agriculture in a Changing World
James Harwood, University of Kentucky, United States

Agroecosystems contain complex networks of interacting organisms and these interaction webs are structured by the relative timing of key biological and ecological events. Recent intensification of land management and global changes in climate threaten to desynchronize the structure of interaction webs and disrupt the provisioning of biological control by natural enemies. To develop a sustainable approach to agriculture, it is therefore critical to recognize the central role of temporal and spatial dynamics in driving predator-prey interactions in agroecosystems. The relative timing

and the degree of overlap among ecological cycles and within space determine the nature and magnitude of the ecological interactions among organisms, and ultimately determine whether ecosystem services, such as biological control, can be provided. Additionally, the ecological dynamics in many cropping systems are characterized by a pattern of frequent disturbances due to management actions such as harvest, sowing and pesticide applications. These disturbance cycles cause agroecosystems to be dominated by dispersal and repopulation dynamics. However, they also serve as selective filters that regulate which animals can persist in agroecosystems over larger temporal scales.

Central to understanding the interplay between predator and prey populations and their importance in sustainable pest management is characterizing the corresponding trophic interactions between them. This presentation examines this complex interplay and characterizes the importance of spatial and temporal relationships between predators and prey in agricultural systems. Drawing on research from agricultural systems around the world and using ecological and molecular tools, the intensity of these interactions will be identified and a framework to guide biological control strategies for sustainable pest management in a changing world will be presented.

Poster # 56

Venomics: Harvesting Nature's Deadliest Cocktail

Mandë Holford, Hunter College/American Museum of Natural History, United States

Snakes, scorpions, sea snails, and leeches are not what come to mind when thinking of the products that stock a doctor’s office or your local drug store. However, these animals produce a staggering amount of compounds in their venom that are directly applicable for novel drug discovery. Encouraged by the substantial medicinal and fiscal success of the Bristol-Myers Squibb ACE-inhibitor, Captopril, and Elan’s analgesic, Prialt® (Ziconotide), used to alleviate chronic pain in HIV and cancer patients, many pharmaceutical companies are investing heavily in venom-based drug discovery programs. Due to ease of access, the majority of currently approved products were developed from snake venom proteins with distinct cardiovascular specificities, particularly those that target thrombin, fibrinogen and integrin receptors ,but rapid advances in proteomics, genomics and transcriptomics have leveled the playing field, providing affordable technology platforms that enable mining of venom proteins/peptides for drug discovery from species such as predatory marine snails, and spiders, which produce venom in very small quantities. The venom of spiders and predatory marine snails are estimated to contain more than 10 million compounds available for drug discovery and development. On our best day, synthetic chemists can not come close to this level of diversity that nature produces effortlessly. New analgesics, anti-tumor agents and even agricultural pesticides are awaiting discovery and can be achieved through an integrated approach combining genomic, proteomic, and transcriptomic data, which is being referred to as "venomics." Drug discovery and development activity will likely continue to rise as largely unstudied venomous animal lineages are investigated for novel lead compounds. This poster will investigate integrated strategies necessary to harness the cornucopia of venom compounds found in marine snails using mass spectrometry, sequencing, and synthetic chemistry.

Specifically, the discovery of novel peptide toxins from terebrid snails will be highlighted, such as Tv1 from Terebra variegata, and functional activity of Tv1 and other venom snail peptides will be described pertaining to manipulating cell signaling in the nervous system to alleviate pain or to surpress tumor proliferation.

Poster # 57

Earth Observations and Climate Science for Sustainable Development: A Capacity Building Approach

Alaa Ibrahim, American University in Cairo, Egypt

Among the most pressing challenges that face national development projects in Egypt and the region is the sustainable development of unpopulated desert regions and mitigating the negative effects of climate and global change over heavily populated areas and coastal regions. These require extensive exploration of natural resources and accurate monitoring and modeling of regional climate change due to urbanization by well-educated graduates as well as a competent workforce, interested society, and informed decision makers.

The space technology of remote sensing has been recognized as an indispensible tool for Earth observation and climate science that offers valuable tools for viewing, analyzing, characterizing, and decision making about the environment and the impacts of climate and global change. Climate monitoring and modeling are also important components in determining natural resources (e.g. rainfall rate, available solar energy, wind power, sustainability of coastal areas, etc.) and the impact of urbanization plans on air quality and climate.

Although a demand for capacity building in these fields has been identified in Egypt and the region and the fact that it address a range of national priorities, no formal, up-to-date academic programs have been established and sustained. This has been reflected in the under-utilization of available NASA Earth observations and climate data.

This proposal aims to develop the educational and training programs required to develop expertise and a competent workforce in these fields to directly serve the ambitious endeavours for national development through project-based and community-based learning. The project will introduce new undergraduate and graduate training courses and programs at select universities and professional training programs in order to qualify graduates and the existing workforce to work competitively on Earth observation and climate applications. A strategy to bridge between academic institutions, government authorities, and the industrial sector will be emphasized to guarantee the development of efficient educational programs that respond to national needs and market demands. The project will establish collaboration between regional and U.S. scientists to facilitate the exchange of knowledge and expertise.

The programs will be oriented to serve applications that are directly related to national development programs and priorities which include: (1) water resources management (with the impact of climate change scenarios on resources from rivers and rainfall), (2) ecosystem change and ecosystem services, (3) urban planning, particularly developing and populating the vast desert areas, (4) impact of urbanization on climate, (5) impact of climate change on coastal areas and human activities, (6) mutual impact of climate and agriculture yields, and (7) human health, settlements and impact assessments.

Poster # 58

Application of Renewable Energy Technologies in the Agricultural Sector

El Mostafa Jamea, MENA Renewables and Sustainability - MENARES, Morocco

The agricultural sector has always been assured an energy function mainly by providing residues, which are used for biomass energy. Biomass energy contributes 14% of the global energy production, and more than 90% of energy use in some developing countries (Best, 2003). In

Morocco, biomass remains the most used form among renewable energies, mainly in form of wood and charcoal, which are used for heating and cooking purposes.

The term Agro-energy describes the energy function of the agricultural sector. The agricultural sector supplies energy in the form of green biomass and liquid bio-fuels. This function, with the use of renewable energy technologies, is being extended to integrate other forms of renewable energies that the sector could supply by exploiting the available spaces such as roofs of buildings, greenhouses, and the multi-use land. In other words, due to the technical progress in renewable energy technologies, agriculture will play more important role in supplying different forms of renewable energy. In fact, renewable energy is already cost competitive with conventional energy and presents great opportunities for the agricultural sector in Morocco, such as supplying the required energy for in-farm use, water resource mobilization and other agri-food operations, and for commercial use.

This paper explores potentialities and discusses the challenges and opportunities in integrating renewable energy technologies in the Moroccan agricultural sector.

Poster # 59

Multi-Functional, Stimuli-Responsive Virus/Polymer Hybrid Nanomaterials for Synergistic Therapy

Young Jik Wwon, University of California, Irvine, United States

The high complexity of pathological processes underlying the development and progress of diseases (e.g., cancer) is a fundamental challenge in developing effective and safe therapies and necessitate novel strategies to tackle multiple molecular targets. Employing nanomaterials for administrating diagnostic and therapeutic modalities in a desirable manner (i.e., nanomedicine) has been popularly investigated. In this study, the advantages of naturally occurring (e.g., viruses) and synthetic (e.g., polymers) nanomaterials are combined in a way that their limitations compensate each other. Such materials are designed to achieve multi-modal and synergistic therapies. Adeno-associated virus (AAV), which has recently been approved for clinical uses in Europe, is synthetically engineered to be shelled with a stimuli-responsive polymeric layer in order to achieve shielded circulation from the immune response and facilitated intracellular trafficking. In addition, the polymeric shell is used to co-deliver anti-pro-survival siRNA while the AAV core encodes pro-apoptotic signals. Therefore, the novel virus/polymer hybrid core-shell nanoparticles can induce synergistically improved cell death. As a disease model, BCR-ABL+ chronic myelogenous leukemia (CML) is targeted by the virus/polymer hybrid core-shell nanoparticles consisting of the BIM (pro-apoptotic)-expressing AAV core and a MCL1 (pro-survival) siRNA-encapsulating polymeric shell. Results demonstrated: 1) efficient eradication of human CML cells by the BIM-AAV/MCL1 siRNA hybrid core-shell nanoparticles, 2) targeted apoptosis of BCR-ABL+ cells but no effects on BCR-ABL- cells by the nanoparticles, and 3) an avoided immune response and immunogenicity of the nanoparticles, both in cell culture and pre-clinical animal models. This study provides paradigm-shifting insights in developing effective and safe therapies for highly challenging diseases using interdisciplinary tools.

Poster # 60

How Crowdsourcing and Human Computation are Revolutionizing our World

Matthew Lease, University of Texas at Austin, United States

Global growth in Internet connectivity and participation is driving a renaissance in human computation: the use of people rather than machines to perform certain computations for which human competency continues to exceed that of state-of-the-art algorithms (e.g. AI-hard tasks such as interpreting text or images). Just as cloud computing now enables us to harness vast Internet computing resources on demand, crowdsourcing lets us similarly call upon the online crowd to manually perform human computation tasks on-demand. As crowd computing expands traditional accuracy-time-cost tradeoffs associated with purely-automated approaches, the potential to achieve these enhanced capabilities has begun to change how we design and implement our computing systems. While early work in crowd computing has focused on generating more data to train automated systems, we are increasingly seeing a new form of hybrid, socio-computational system emerge which harnesses collective intelligence of the crowd in concert with automation at run-time to better tackle difficult processing tasks. As such, we find ourselves today in an exciting new design space, where the potential capabilities of tomorrow's computing systems is seemingly limited only by our imagination and creativity in designing new algorithms to compute with crowds as well as silicon. Use of human computers naturally poses a variety of new challenges, such as incentivizing participation, managing non-determinism, and implementing quality assurance mechanisms. While the human-computer interaction (HCI) community has a long history of considering human-centered computing issues, crowd-based system architecture poses distinct challenges vs. a traditional user-centered design. The exciting potential of crowd computing has also attracted the interest of many researchers and practioners from outside the HCI-community, who now find themselves confronting a range of practical HCI issues they must address in system building. In the bigger picture, placing people at the center of this new computing frontier introduces a range of serious economic, social, ethical, and legal questions. If our era of crowd computing is to be humane as well as human-powered, we must consider issues such as compliance and fairness alongside traditional computing concerns such as efficacy and efficiency.

Poster # 61

Ionic Polymer Metal Composite (IPMC) Actuator based on a Non-perfluorinated Polymer

Mohammad Luqman, A'Sharqiyah University, Oman

Kraton based nonperfluorinated IPMCs membranes were examined for tip displacement, proton conductivity, current density, water uptake, and ion exchange capacity and the results were compared with those of Nafion. The water holding capacity and ion-exchange capacity of Kraton membranes as compared to those of Nafion were found to be significantly higher. SEM studies revealed that the morphology of the Nafion membrane was negligibly affected after performing the actuation experiment while the Kraton membrane ruptured and notable spaces at the joints was observed. The current density date revealed better actuation performance of the Kraton membrane. The tip displacement for the Nafion and Kraton membranes was also carried out at 3 V DC electrical voltages. The Kraton membrane showed larger displacement, and hence, better actuation compared to that of the Nafion membrane.

Poster # 62

On-Farm Demonstration of Integrated Aqua - Agriculture Systems in Arid and Semi-Arid Areas

Dionyssia Lyra, Ismail, S., Rahman Butt K. and Al'raj B., International Center for Biosaline Agriculture, United Arab Emirates

The ability of rural communities in arid areas to maintain food production is critical to their overall resilience and sustainability. It is a known fact that a considerable number of farms in the United Arab Emirates remain unproductive when salinity of groundwater increases above 15 dS/m. This is not related to the performance of existing crops but mainly due to their poor establishment. Field irrigation is also costly and over-fertilization of farmland can lead to high groundwater nitrate levels in dry regions. As a result, alternative water systems need to be applied and integrated solutions sought. In some cases, small-scale reverse osmosis (RO) plants are installed by farmers, but good management practices need to be formulated. The integration of aquaculture with agriculture (IAA) constitutes a promising solution as it allows the reuse of water and nutrients to offset production costs while promoting greater sustainability in desert areas. Such systems seem to be easily adopted by farmers since input cost decreases and revenues are raised through both marine and agricultural productdevelopment. The study looks into a complete on-farm management system that uses several types of water for irrigation purposes. The three types of irrigation systems applied are drip irrigation systems, sprayers and bubblers. The objectives of the study are: a) seed production of asparagus, maize, quinoa, eggplant, and okra with freshwater, b) brine water from the RO unit, aquaculture effluents and mixed brine water with groundwater are used to grow different salt-tolerant annual and perennial forages such as Sporobolus arabicus, Distichlis spicata, Sporobolus virginicus, and Passpalum vaginatum, c) the monitoring of soil and water for salts and other heavy metals or residues, d) based on investment costs and revenues (yield in this case), a cost benefit analysis will be conducted to examine the economical feasibility of a land-based IAA applied in a marginal environment, and e) selected Salicornia bigelovii populations are evaluated under two water regimes, RO- and aquaculture-brine, and irrigation systems,bubblersand sprinklers. The aquaculture set-up comprises of fish, sedimentation and seaweed tanks in sequential manner. The aquaculture system operates as follows: the brine water from the RO-unit is directed to fish tanks. Then, fish wastewater flows to sedimentation tanks so that suspended solids can be removed naturally with gravity. This partially filtered wastewater flows into the tanks where seaweed grows. The Seaweed filters these effluents from dissolved remnants of nutrients which they use for their own growth. The water derived from the seaweed tanks is then directed for irrigation purposes.

Poster # 63

Mitigating Health and Environmental Impacts in Wastewater Reuse for Agricultural Irrigation in Tunis

Olfa Mahjoub, INRGREF, Tunisia

Wastewater reuse for irrigation in agriculture is an old practice in Tunisia. Tunisia has always pioneered the Arab countries in this field, but environmental and health risks are still not well assessed by the scientific communities. In addition, they are not appropriately perceived by stakeholders nor by the end-users.

Wastewater reuse policy and promotion of agricultural irrigation using reclaimed water is set by the decision-makers. This has proven to be inefficient in closing the gap between the supply and the demand, qualitatively and quantitatively, and has resulted in several persisting economical, technical, and environmental hurdles in addition to the clear reluctance of farmers in many areas. Consequently, only 20% of treated wastewater is reused currently.

The objective of the present study, undertaken within the Further Advancing the Blue Revolution Initiative (FABRI) program and funded by USAID, is to evaluate the management of the available water resources and the agricultural practices while considering the impacts of reclaimed water reuse and its perception by farmers, stakeholders and decision-makers in Oued Souhil, a region in the Peninsula of Cab Bon (Nabeul, Tunisia) that has been irrigated for more than 30 years. The region is well known for its touristic activity, citrus production and distilled orange flower extracts.
The project is meant to involve different actors: decision-makers at national and regional levels, stakeholders at regional level (regional Department of Agricultural Development, Water Users' Association and Extension Service), farmers, and researchers who will make the link between all these actors. The work will consist of identifying the agricultural pattern and crops grown on the irrigated land, agricultural practices related to reuse, management of water resources encompassing groundwater and treated wastewater according to quality and availability, perception of reuse and water quality, and finally, the perception and implications of water reuse for agricultural, environmental, and human health. The final step of the project is building a decision support tool that could help decision-makers in optimizing the reuse of wastewater while minimizing the environmental and health impacts. An attempt within this framework is the introduction of participatory approach to involve farmers in looking for innovative, simple, and accessible solutions that could be adapted to their agro-ecological environment.This will bring their voices to decision-makers through a bottom-up approach so that their priorities will be taken into consideration during the planning of future wastewater reuse projects in the region.

Poster # 64

Ultrasensitive Antimicrobial Peptide-Based Impedimetric Sensor for the Detection of Bacteria

Mouna Marrakchi Sellami, ISSBAT, Tunis El Manar University, Tunisia

The development of label-free, rapid, and sensitive biosensors for bacteria detection is still of great interest in biology, biomedical, and environmental fields. The team reports development of an ultrasensitive, label free biosensor with impedimetric detection for the detection of pathogenic bacteria. The sensor is based on the use of antimicrobial peptides (AMP) that have unique recognition properties against a variety of bacteria. The sensor was able to detect different gram positive and gram negative bacteria with a detection limit as low as 102 CFU/mL, and was also able to differentiate between live and dead bacteria. The presentation will highlight the development and analytical characterization of the sensor and describe a procedure to achieve control over the immobilization of the antimicrobial peptide on the sensor surface for enhancing detection sensitivity. Control measurements with peptide and without antimicrobial activity showed no significant variation in impedance. This study demonstrates the potential of antimicrobial peptides as promising alternative bioreceptors to antibodies in the construction of sensitive and robust impedimetric biosensors.

Poster # 65

New Drugs for Bad Bugs: Design and Synthesis of Mycobacterium Tuberculosis Acetyltransferase Eis Inhibitors

Abdelrahman Mayhoub, Al Azhar University, Egypt

Multi- and extremely-drug resistant tuberculosis (MDR-TB & XDR-TB) are growing global health concerns due to the dearth of effective clinically approved antimicrobial agents. In 2011, the WHO estimated that 650,000 individuals infected by MDR-TB and that count is under constant inflation. One key enzyme that confers extensively resistant characteristics to TB strains is Eis, which works to deactivate a wide variety of antitubercular therapies including the last line KAN and AMK. In order

to combat this daunting challenge, This poster presents a comprehensive study to neutralize the Eis enzymatic activity and revive AGs as the drug of choice in treating all types of TB. This work closely follows the example of b-lactamase inhibitors and their role in preventing deactivation of the b-lactam antibiotics. A lead compound 38b with good Eis inhibitory activity was obtained by HTS that contained two basic structural elements: 1) a fused triazinoindole three-ring system and 2) a tertiary ethylamine. The diethylaminoethyl moiety seemed to play an important role in the Eis inhibitory properties of the lead compound 38b. In this regard, the research comprehensively addressed:1) the proper linker length between the terminal nitrogen and the fused aromatic system, 2) side chain flexibility, and 3) bulkiness around the terminal nitrogen atom. The conformationally restricted analogues were found to be more potent as Eis inhibitors than the diethylamine.
TB Assay. Compounds that showed minimal Eis inhibitory activity were further tested in vitro against TB, where the MIC values of KAN were determined in the presence of the Eis inhibitors. The MIC value of KAN with Mtb H37Rv was found to be 2.5 μM, and is eight times higher in Mtb K204, an XDR strain, where the Eis enzyme is over-expressed. Besides the lead compound, five other derivatives had the ability to restore KAN activity and decrease its MIC value against XDR-TB to normal levels. However, the direct tubercular inhibitory activity was observed to contribute in lowering KAN MIC values in case of the indole-5-propyl analogues. So far, compound 36b, that carries the conformationally restricted propylamine side chain, displayed Mtb toxicity in addition to its potent Eis inhibitory property. This mutual mode of actions reduced the MIC value of KAN to below its normal level. Compound 36b was found to be more active than the lead compound 38b by using serial dilution assay. The criteria of ameliorating the antitubercular activity of KAN at lower concentration and reasonable partition coefficient value (cLogP = 3.562), in addition to good solubility characteristics, the absence of metabolically-vulnerable moieties and 3-steps scalable synthetic pathway make compound 36b ideal candidate for pre-clinical studies.

Poster # 66

Sustainable Polymers from Agricultural Waste
Stephen Miller, University of Florida, United States

Worldwide efforts have increased greatly to identify polymeric building blocks that are not derived from fossil fuels and to employ these monomers to create polymers that readily degrade in natural environments. The Miller Research Group has developed novel methods for synthesizing linear thermoplastic polymers from a variety of biogenic feedstocks, including sugars, triglycerides, lignin, and C1 feedstocks obtained from trees. By controlling the polymer microstructure, the thermal and mechanical properties of the polymers can be finely tuned. This approach has led to several novel biorenewable polyacetals, polyesters, polycarbonates, and polyoxalates that mimic the properties of conventional packaging plastics. Moreover, these polymers are generally amenable to biodegradation or water-degradation, affording benign metabolites already present in nature. A commercial venture (U.S. Bioplastics) has already targeted the team's technology to convert sugarcane bagasse waste into replacements for polyethylene terephthalate (PET) and polystyrene (PS).

Poster # 67

Rift Valley Fever Associated with Abortion in Red Sea State in Sudan.

Nahla Mohamed, Princess Nora bint Abdul Rahman University, Saudi Arabia

Rift Valley fever (RVF) is an emerging and neglected mosquito borne zoonosis with a negative impact on human and animal health and economy. The causing virus, RVF virus, (RVFV) is a member of the genus Phlebovirus, Bunyaviridae. RVFV is known to induce abortion in domestic animals but has not previously been recognized as a cause of abortion in humans. This study was conducted to determine the etiological agents that cause abortion among febrile pregnant women in Port Sudan in the Red Sea State of Sudan.

A total of 132 pregnant women suffering from unknown fever during Jun 2011- Nov. 2012, were examined. Twenty three (17%) of those had a miscarriage presumably caused by the infection. The clinical history, physical examination, clinical and laboratory findings, and laboratory investigations were recorded. Serum samples were tested for viral hemorrhagic fever with quantitative RT-QPCR for dengue (DENV), Alkhurma (ALKV), Rift Valley fever, and chikungunya (CHIKV) viruses. Samples were tested for DENV IgM, IgG and RVFV, and IgG and IgM. Out of the 23 patients with miscarriage, viral pathogens were found in 17 (≈74 %) attributed to be RVFV. Six cases had an abortion at first trimester and two women (8%) had a preterm delivery.

In conclusion, RVF was detected in a majority of the febrile pregnant women that had an abortion or preterm delivery and probably was the causing agent. This is the first report showing that RVFV may associate with abortions among humans. This finding raises the explorable possibility that pregnant women are at a higher risk for complications during RVF outbreaks in endemic regions.

Poster # 68

Microfluidic Cell Separation for Clinical Diagnostics and Regenerative Medicine

Shashi Murthy, Northeastern University, United States

Microfluidic channels with immobilized proteins and antibodies have been utilized for a wide range of applications, from clinical diagnostics to tissue engineering. This poster will describe the team's work in the isolation of stem and progenitor cells for diagnostics and therapeutics from complex samples such as blood and digested tissue. A key element in this approach is the design of alginate hydrogel-based surface coatings that can be applied onto the surfaces of microfluidic channels. These hydrogels are functionalized with antibodies, enabling specific capture of target cells, but more importantly they also have the ability to release captured cells without loss of viability or function. The significance of this approach lies in the ability to isolate low abundance stem/progenitor cells without the need for labeling with fluorescent or magnetic tags, which significantly reduces the time required for their isolation relative to state-of-the art techniques and minimizes undesirable stimulation of these sensitive cells. Specific examples to be covered in the presentation will include isolation of endothelial progenitor cells for cardiovascular diagnostics and vascular tissue engineering, intestinal stem cells for intestinal organoid unit regeneration, and skin stem cells for tissue repair. The successful ongoing commercialization of this hydrogel technology will also be described briefly.

Poster # 69

Role of oprD Gene in Biofilm Formation and Imipenem Resistance in Pseudomoanas aeruginosa

Hadeel Musafer, Al-Mustansiriya, Iraq

Pseudomonas aeruginosa, a ubiquitous environmental organism, is a difficult-to-treat opportunistic pathogen due to its broad-spectrum antibiotic resistance and its ability to form biofilms. In this study, the team investigates the link between resistance to a clinically important antibiotic, imipenem, and biofilm formation. First, the team observed that the laboratory strain P. aeruginosa PAO1 carrying a mutation in the oprD gene, which confers resistance to imipenem, showed a modest reduction in biofilm formation.We also observed an inverse relationship between imipenem resistance and biofilm formation for imipenem-resistant strains selected in vitro, as well as for clinical isolates. Two clinical isolates of P. aeruginosa from the sputum of cystic fibrosis patients that formed robust biofilms were identified, but were sensitive to imipenem (MIC≤2 μg/ml). To test the hypothesis that there is a general link between imipenem resistance and biofilm formation, a transposon mutagenesis was perfomed on these two clinical strains to identify mutants defective in biofilm formation, and then tested these mutants for imipenem resistance. Analysis of the transposon mutants revealed a role for previously described biofilm factors in these clinical isolates of P. aeruginosa, including mutations in the pilY1, pilX, pilW, algC, and pslI genes, but none of the biofilmdeficient mutants became imipenem resistant (MIC≥8 μg/ml), arguing against a general link between biofilm formation and resistance to imipenem. Thus, assessing biofilm formation capabilities of environmental isolates is unlikely to serve as a good predictor of imipenem resistance. The team also discusses our findings in light of the limited literature addressing planktonic antibiotic resistance factors that impact biofilm formation.

Poster # 70

Nanotechnology for Future Energy Systems

Ammar Nayfeh, Masdar Institute, United Arab Emirates

The marriage between nanotechnology and future energy systems is inevitable. In this work, the team investigates the use of nanoparticles for both low power memory and future photovoltaic devices. The team demonstrates a charge trapping memory with 2-nm Silicon Nanoparticles (Si NPs). A zinc-oxide (ZnO) active layer is deposited by Atomic Layer Deposition (ALD), preceded by Al2O3 which acts as the gate, blocking, and tunneling oxide. A spin coating technique is used to deposit Si NPs across the sample between Al2O3 steps. The Si nanoparticle memory exhibits a threshold voltage (Vt) shift of 2.9 V at a negative programming voltage of -10 V indicating that holes are emitted from the channel to the charge trapping layer. The negligible measured Vt shift without the nanoparticles and the good retention of charges with Si NPs confirm that the Si NPs act as deep energy states within the bandgap of the Al2O3 layer. In addition to the nano memory, we study the effect of gold (Au) nanoparticles on the performance of a-Si:H solar cells. The solar cell stack is grown on a p+type Si wafer and consists of 20 nm heavily doped p-type a-Si, 500 nm undoped a-Si, 20 nm heavily doped n-type a-Si, and finally, 80 nm Indium Tin Oxide (ITO) on the top. Au nanoparticles of 10, 20, 50, 80, 100, 200 and 400 nm are spin coated on top of the ITO before metallization. The plasmonic effect of the Au nanoparticles allows for additional scattering at the surface thus reducing the overall reflectivity. The larger the nanoparticle size, the more scattering is obtained and the median reflectivity drops from about 23% to 18%. The results show an increase in the short-circuit current density (Jsc) and efficiency with increasing nanoparticle size. The Jsc increases from 9.34 mA/cm2 to 10.1 mA/cm2. In addition, the efficiency increases from 4.28% to 5.01%. Finally, in addition to Au and Si, the team also studied InN NPs and Graphene nano-platelets for similar applicationsThese results highlight a promising use of nanotechnology for enhancement of future energy systems.

Poster # 71

Enhancement of Phytochemicals Bioactivity via Nanotechnology

Fadwa Odeh, the University of Jordan, Jordan

Thymoquinone (2-isopropyl-5-methyl-1,4-benzoquinone) is a herbal-derived drug with potential chemopreventive and chemotherapeutic activity. However, thymoquinone suffers from high hydrophobicity causing poor solubility which limits its bioavailability and high lipophilicity causing poor formulation characteristics. In the context of this research, thymoquinone (TQ) activity was enhanced via its incorporation into nano-structures such as cyclodextrin and liposomes.Liposomes are versatile drug carriers that can be used to solve problems of drug solubility, instability, and bio-distribution. In this study, the team was able to prepare thymoquinone-loaded liposomes (TQ-LP) and thymoquinone loaded in liposomes modified with Triton X-100 (XLP) with diameters of about 100 nm and entrapment efficiency of more than 90% for TQ-LP and of 49.6% for XLP. The TQ-LP liposomes were effective in suppressing the proliferation of breast cancer cell lines MCF-7 and T47D, and at the same time, exerting very low toxicity on normal periodontal ligament fibroblast. Altogether, this report describes the first successful encapsulation of thymoquinone into liposome which maintains stability, improves bioavailability and maintains its anticancer activity. TQ was complexed with β-cyclodextrin (CD) to form nanosized aggregates. Various TQ:CD ratios were tested and it was found that the ratio of (1:0.25) TQ:CD formed distinguishable nanoparticles with minimum toxicity towards normal cells. These nanoparticles had an average size of 445±100 nm with a charge 21.8 mV using Zeta-sizer. Particle size measurement using scanning electron microscopy (SEM) showed an average size of 400 nm and also revealed the presence of smaller structures, with an average size of 50 nm. The in vitro antiproliferative activity on MCF7 cells was determined using an MTT assay and an IC50 of 4.70 ±0.60 μM for TQ-CD nanoparticles in comparison to 24.09 ±2.35 μM of free TQ solution after 72 hours of incubation. Simultaneously, TQ-CD nanoparticles showed lesser toxicity when was compared to the TQ solution using human periodontal fibroblasts as a model for normal cells. It could be concluded from the results that TQ loaded cyclodextrin nanoparticles might serve as a potential nanocarrier to improve TQ solubility as well as its antiproliferative activity with little toxicity to normal tissues.

Poster # 72

Plant-Microbe Diversity and Interaction Mmechanisms Enhancing Abiotic Stress Resistance in the Saudi Arabian Desert Landscape

Maged Saad, KAUST, Saudi Arabia

The Kingdom of Saudi Arabia (KSA) is located in one of the most arid and hottest regions of our planet and is chronically lacking the sufficient production of food. Harvest losses due to drought, salt, and heat stress amount to more than 60% of total productivity, making abiotic stress tolerance the major goal of crop improvement globally. The ability of a variety of plants to cope with stress conditions depends on their association with rhizosphere microbes and can potentially help increase food production in a sustainable way. However, so far, neither the microbial diversity nor the mechanisms of their beneficial interaction with plants are sufficiently understood to provide a general strategy for their use in agriculture. In this project, the biodiversity of plant root microbes and an environmental map of the Arab Peninsula will be generated at eight different representative locations. The map will be complemented by databases comprising a biochemical, genomic and transcriptomic analysis of the set of cultivatable microbes. Combining the microbes with the tool box of the genetic model plant, Arabidopsis thaliana, the mechanisms of enhancing the tolerance of plants to heat, salt, and drought stress will be analysed at the histological, physiological and molecular level. The large sets of molecular data of the microbial and plant responses will be provided open access to the scientific community. Using the latest bioinformatics methods, the data sets will be used for generating hypothetical plant-interaction models that will be challenged by reiterative, experimental validation.

Poster # 73

Role of Different Food Types in the Prevention of Type 2 Diabetes
Ahmmed Saadi, Dhofar University, Oman

The focus of this experimental work was to evaluate average glucose concentration in the blood for two groups of people between 15 to 40 (10 people) and 40 to 60 (5 people) years old using ten types of foods including tomatoes, coffee, grapefruit, cinnamon, fenugreek powder, cumin powder, fish, onion, cucumber, and turmeric powder. Cinnamon is one of the best food to reduce concentration of glucose by 43.448 % as compared to other types of food. Five experimental tests were done to find the active interaction between cinnamon and insulin which increased the performance of the medicine from 12.56% to 21.85% for the first hour and 28.82% to 37.03% for the following four hours.

Poster # 74

Electromagnetics for the Environment
Amr Safwat, Ain Shams University, Egypt

Electromagnetic engineering plays a significant role in improving environmental conditions. In this regard the team will present two applications: illumination of dense urban areas by light redirecting panels and metamaterial inspired compact antennas.

With the high population growth rate, especially in developing countries, and the scarcity of land resources, buildings are becoming very close to each other, depriving the lower floors and the alleys from sunlight and, consequently, causing health problems. Therefore, there is an urgent need for cost-effective and efficient light redirecting panels that guide sun rays into those dim places. The first application presents a novel sine wave based panel, which redirects light downward and enhances the illumination level in those dark places. Simulation results show that the proposed panel improves the luminescence values by more than 200% and 400 % in autumn and winter , operates over a wide range of solar altitudes, and redirects light efficiently.

In the second application, the recently introduced concepts of metamaterial have been exploited by inserting lumped components into antennas to generate either multi-band or wide band signals while maintaining a small size. This application describes a novel technique to reduce the antennas size and presents a systematic technique to design n-band antennas.

Poster # 75

Computational Mathematics for Global Problem Solving
Padmanabhan Seshaiyer, George Mason University, United States

Computational mathematics, which consists of modeling, analysis, and simulations, is quickly becoming the foundation in science and engineering to tackle some of the most urgent global problems in food security, environment, education, water, and global health. These real-world problems often involve complicated, dynamic interactions among multiple physical processes, thus presenting significant challenges in representing the physics involved and in handling the resulting behavior. If the desire to control and design the system is added to the picture, then the complexity increases even further. Hence, to capture the complete nature of the solution to the problem, a coupled multidisciplinary approach is essential. Performing research and teaching in computational mathematics, therefore, needs an in-depth understanding of the underlying mathematics and the fundamental principles that govern a physical phenomenon.

In this work, the team will describe examples of multidisciplinary, real-world, global problem solving that has evolved from partnerships with developing countries. In particular, the team will present a collaborative project between the Nelson Mandela African Institute of Science and Technology, Arusha, Tanzania and George Mason University in the United States, a Partnership for Enhanced and Engaged Research (PEER - Science) program funded by the National Science Foundation and USAID.. This collaborative partnership has helped to build STEM capacity in sub-Saharan Africa by engaging the students and faculty in novel solution methodologies that can help obtain efficient solutions that will not only benefit various scientific, medical and engineering fields, but also aid in the process of designing better products and processes. Some of the projects that the participants learn about and work on include fish harvesting and its economic impact; social process modeling & bio-conservation; optimization models for energy security; enhancing student learning in STEM; sensor networks to detect petroleum adulteration; mutualism models for rhizobia legume interaction; predicting tobacco concentrations using contaminant transport models coupled with disease dynamics and many others. This multi-disciplinary research focus is also integrated with an education plan where the primary goal is to teach students to apply these well-developed research concepts in engineering, computer science, and mathematics to fundamental applications arising in other areas of science and engineering. This is accomplished by incorporating research concepts developed into new or existing inter-disciplinary computational mathematical courses and also by mentoring students at the graduate, undergraduate, and high school level through workshops, seminars, and other enrichment activities.

Poster # 76

Manufacturing of New Nanostructured Polymers/Nanocomposites for New Industrial Applications

Amal Shendi, National Research Center, Egypt

We live in an age of new materials designed to cope with the increasing demands for efficient and functional materials that can be utilized innew and challenging applications across sectors. Nanostructured polymers and consequently, their nano-composites, address that demand as they act far more efficiently than traditional structural polymers in low loading contexts and, to some extent, save the environment from the hazards of traditional polymeric structures. Several polymeric materials were used including dendrimers, hyperbranched polymers amoung othersin various versatile applications such as dielectric materials, cement and construction materials, and drug delivery systems.

Poster # 77

Low Cost Integrated Optical and Electrochemical Sensors for Health and Environment

Sameer Sonkusale, Tufts University, United States

The poster will present design and fabrication of low cost, yet high performance sensors on paper substrates for health and the environment. Paper based sensors and microfluidic devices are paving the way for low cost medical diagnostics due to their simplicity, ease of fabrication, cost, and ease of use and disposal in resource limited settings. The team presents fabrication of dense nanowire electrodes on paper substrates for low impedance high surface area electrodes and utilize it for bio-potential recording and biological energy harvesting. Next, a low-cost, flexible and reliable method to effectively pattern paper for capturing optical dyes and implementing flow-based delivery of target samples for colorimetric chemical sensing is presented. Also shown is a simple approach for readout using ubiquitous consumer electronic devices (e.g. smartphones, flatbed scanner) without the need for specialized instrumentation. Using this approach, the team has developed a saliva

diagnostic toolkit on paper substrates for early screening of stomach cancer, which is quite prevalent in the Arab peninsula, by primarily screening for infection by Helicobacter Pylori bacteria which are responsible for stomach cancer. The team also presents preliminary results detection of other useful biomarkers (e.g. glucose, dopamine etc) for other medical conditions. The proposed devices showcase a clear path forward for high performance, low cost paper based sensors for the environment and health.

Poster # 78

Crystallisation of Human and Mouse Prion Proteins

Sameh Soror, Faculty of Pharmacy, Helwan University, Egypt

Prions are fatal neurodegenerative transmissible agents that cause many diseases (eg. Creutzfeldt-Jakob disease in humans, spongiform encephalopathy in bovines, also known as mad cow disease, and scrapie in sheep). The team obtained high resolution crystal structures from humans (1.5 Å) and mice (2.1 Å) PrP with a specific antibody (Nb_PrP_01). Camelidae antibodies are a class of immunoglobulin that lacks the light chains and is named a heavy-chain antibody which also referres to nanobodies (Nb). Nanobodies are composed of a single domain and posses all features of conventional antibodies. Since Prion proteins were discovered, the mouse PrPC has never been crystallized. The team's results illustrate the potential of nanobodies in improving the crystallization of difficult proteins. Nb_PrP_01 binds with high affinity to a conformational epitope of HuPrP, involving C-terminal (9 nM) and N-terminal parts (7 µM) of the protein. The long-term goal is to use nanobodies as innovative molecular tools to unravel the structures of the full length PrPC and shade on its oligomeric intermediates in the fibrillation process.

Poster # 79

3D Bioprinting in Regenerative Medicine and Pharmaceutical Drug Screening

Binil Starly, North Carolina State University, United States

As the world's population ages, there will be a tremendous demand for the replacement of injured or diseased tissues and organs. Over the last two decades, significant development has occurred within the realm of tissue engineering and regenerative medicine products. Several products related to skin, cartilage and to a certain extent bone are available on the market today. While market commercialization trends are promising, significant challenges lie ahead for engineering the replacement of organs (both solid and hollow) and complex tissue. Clinical and economically viable commercial translation of lab-grown technologies for complex tissue/organ replacement can only be realized by the development of cost-effective manufacturing processes flow chains developed to begin from the hospital source to the final delivery of the end product.
The poster will showcase:- 1) Key enabling '3D-Bioprinting' technologies suitable for the custom fabrication of biomedical implants and devices used in in-vitro toxicity and drug testing protocols; 2) '3D printed' devices for the automated expansion of stem cells for cellular therapy; and 3) How the community can leverage computational modeling, non-invasive sensor development and data-analytics to help characterize, evaluate and ensure regenerative medicine based products meet design specifications and are amenable to cGMP operations. The 2006 US National Institutes of Health Report on Tissue Engineering has highlighted a tremendous need for promoting scale-up and translation of laboratory proven regenerative medicine therapies. We believe technologies such as 3D printing, smart manufacturing platforms and data analytics will play a key role to help translate laboratory-scale protocols to economically viable manufacturing processes.

Poster # 80

Comparison of Two Soil Water Evaporation Models

Ayman Suleiman, The University of Jordan, Jordan

Modeling soil water evaporation and soil moisture are valuable for many applications in diverse disciplines. Ritchie et al. (2009), R2009, and Snyder et al. (2000), S2000, presented different models to estimate soil water evaporation (ES) rates. The former also simulates the soil water dynamics at different soil depths. The objectives of this study were to evaluate the potential use of the S2000 model for soils with water content above θDUL in parts of the profile and to evaluate the R2009 ES model and compare its performance with that of S2000. The study was carried out at the University of Florida Indian River Research and Education Center in Fort Pierce, Florida in 2012 and 2013. Eight Time-Domain Transmissometry (TDT) probes were installed in a lysimeter filled with sand and the soil water content was measured hourly for six months. Three drying cycles (cases) were used for the evaluation of the models. R2009 underestimated the soil water content near the soil surface for Cases 1 and 2, while for Case 3, R2009 estimated the near surface soil water content accurately for the first four days and then it tended to underestimate it for remainder. S2000, with the proper parameterization, outperformed R2009 which overestimated ES. It was evident that getting the suitable parameterization for S2000 model was not always guaranteed. These finding may only apply for sandy soils similar to the one used in this study and so future studies should be done on different soils and diverse environment before a generalization can be made.

Poster # 81

Cardiac Segmentation using Motion Estimation with Physically Motivated Inter-Region Constraints

Ganesh Sundaramoorthi, KAUST, Saudi Arabia

The team proposes a method for tracking structures (e.g., ventricles and myocardium) in cardiac images (e.g., magnetic resonance) by propagating forward in time a previous estimate of the structures using a new physically motivated motion estimation scheme. This method estimates motion by regularizing only within structures so that differing motions among multiple structures are not mixed. It simultaneously satisfies the physical constraints at the interface between a fluid and a medium that the normal component of the fluid's motion must match the normal component of the medium's motion and the no-slip condition, which states that the tangential velocity approaches zero near the interface. This research shows that these conditions lead to partial differential equations with Robin boundary conditions at the interface, which then couple the motion between structures. The team shows that propagating a segmentation across frames using this new motion estimation scheme leads to more accurate segmentation than traditional motion estimation that does not use physical constraints. This method is suited to interactive segmentation, prominently used in commercial applications for cardiac analysis, where segmentation propagation is used to predict a segmentation in the next frame. The team shows that its method leads to more accurate predictions than a popular and recent interactive method used in cardiac segmentation.

Poster # 82

Cancer in Jordan: Causes, Research and Future Projections

Lubna Tahtamouni, The Hashemite University, Jordan

Cancer is the second leading cause of death in Jordan after cardiovascular disease. The rate of cancer is increasing faster than the rate population growth. However, the causes for this increase are poorly studied and largely remain unknown. Major suspects are genetics, poor-fiber diet, sedentary life style, and environmental carcinogens. In Jordan, breast cancer ranked the first among cancers in females, while colorectal cancer is the highest among males. Amman, the capital of Jordan, recoded the highest percentage of cancer patients.
The current work aims at summarizing the data regarding the incidence of cancer according to age, gender and governorate. In addition, for each governorate, cancer risk factors will be presented. Finally, the team will focus on breast cancer and present a summary of the data regarding its incidence according to age, gender, survival rates and geographical distribution. The team will also present its work on understanding the molecular pathways that regulate the migration of metastatic breast cancer cells. The results of this work may help in promoting cancer research in Jordan, basic and clinical, and help in proper planning for cancer care, thus increasing survival rates.

Poster # 83

Association of Some Dietary Factors and Physical Activity with Breast Cancer among Jordanian Females

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Globally, the most commonly diagnosed cancers are those of the lung, colorectal, and breast, with lung cancer being the leading cause of cancer death. According to the latest issued statistics (2010 National Cancer Registry Report), 6,820 Jordanians and non-Jordanians were diagnosed with cancer in 2010. Of these, 4,921 new cancer cases were registered among Jordanians. In 2010, the number of new cancer cases among Jordanians increased by 123 cases, compared to 4,798 cases in 2009. Breast cancer is the most common cancer overall as well as the most common malignancy afflicting women in Jordan. According to the latest statistics from the Jordan National Cancer Registry, 864 females and 9 males were diagnosed with breast cancer in 2010, accounting for 18.8% of the total new cancer cases. Breast cancer ranked first among cancer in females, accounting for 36.7% of all female cancers, and is the leading cause of cancer deaths among Jordanian women.
Prevention of such health problem means reducing the suffering and pain of patients with cancer and their families. To our knowledge, there are no published studies on dietary and lifestyle risk factors of breast cancer among Jordanians. Lack of such studies among the Jordanian population may be attributed to multiple reasons including relying on the results and recommendations of Western studies, absence of encouraging collaboration between different sectors in Jordan, and limited financial resources that support such studies. Therefore, conducting this study will be crucial to identifying the association of dietary and lifestyle factors as well as physical activity on breast cancer development based on culture and race differences from Western populations.

Poster # 84

Toward Theranostic Nanoparticles: An Innovative Approach with Potential Application in Cancer

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Chemotherapy seeks to minimize tumor progression and increase patient survival. However, the main problem is to find a balance between the drugs therapeutic effect on cancer cells and their deleterious effect on healthy cells. Due to their high hydrophobicity or rather their high

hydrophilicity, these molecules must be injected in high and frequent doses, to avoid a rapid elimination and overcome their lack of specificity. Unfortunately, the high chemotherapeutic doses have side effects that patients find difficult to tolerate. Additionally, the diagnosis and imaging of tumor evolution remain a challenge.

Nanoparticle-based theranostics could help concentrate drugs in tumors while reducing the drug dosage, and simultaneously provide a diagnostic means of imaging the pathological evolution of the tumor with various biomedical-imaging techniques. In essence, it is a treatment and monitoring system in one, and individualized for the patient.

In this aim, the team developed a theranostic platform consisting of Iron oxide (γ-Fe2O3) nanoparticles (NPs) coated with water soluble and biocompatible cucurbit[7]uril (CB[7]). The inner cavity of these CB[7] is hydrophobic, which will allow the encapsulation and the transportation of hydrophobic drugs. Density functional theory (DFT) calculations support a binding model in which the carbonyl oxygens of CB[7] coordinate directly to surface Fe3+ ions. The modified particles (CB[7]NPs) are stable under a wide pH range (2–12) and have a transverse relaxivity, R2, of 113 s−1mM−1.[1] The team investigated the ability of the CB[7]NPs to encapsulate molecules inside the cavity of CB[7]and chose Nile Red (NR), a hydrophobic dye, for proof-of-principle experiments. NR was loaded into the cavities of the surface-adsorbed CB[7]s and intracellular delivery of the dye to colon cancer cells was observed by confocal laser scanning microscopy (CLSM).
Powerful anticancer drugs (Paclitaxel, Doxorubicine and Cis-Platine) had been successfully encapsulated drastically improving their solubility. In vitro results demonstrate that encapsulation of drugs in the CB[7] cavities on the NP surfaces facilitates the cellular internalization of the drug, thereby enhancing its anti-cancer properties.

The stability, biocompatibility, and dual purpose functionality (drug delivery and magnetic resonance imaging) of the CB[7]NPs will consolidate diagnosis and targeted therapy into a single, centralized and personalized system of treatment. This developing technology has potential to pave the way for treating cancer in a relatively sensitive and selective manner.
References:

1. F. Benyettou, I. Milosevic, Y. Lalatonne, F. Warmont, R; Assah, J.-C. Olsen, M. Jouaid, L. Motte, C. Platas- Iglesias, A. Trabolsi. J. Mater. Chem. B, 2013, 1, 5076–5082.

Poster # 85

Approaches to Enhance Disinfection Efficiency for Small Drinking Water Systems
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The present research is aimed at better understanding the complex flow patterns that are found within water disinfection contact tanks using both computational fluid dynamics (CFD) and physical tracer studies. One of the primary goals of this research is to improve the contact time of a number of different tanks that may be used in small drinking systems. A number of different improvement techniques were investigated to increase the contact time ranging from random packing material of 1" to 3.75" spheres, inlet modifications and integral baffles. All of these proposed modifications were first investigated using CFD except for the random packing material due to the large computational cost. The packing material study comprised of 67 tracer studies that were conducted on systems exploring the three sizes of packing material, two tank sizes, and two flow rates. Results suggest that the utilization of random packing material in water contact tanks can significantly increase the baffle factor. Inlet modifications via the use of manifold diffusers and gaged packing material placed at the inlet show remarkable increases in the baffle factor compared to base cases with sharp inlets. The baffle tank study consisted of over 60 simulations in which the number of

baffles and baffle length were both varied. These simulations were then used to investigate the relationship between dead (i.e. stagnant) zones to the overall hydraulic efficiency. This research shows how a combination of one or more of the above approaches can be used to improve the contact efficiency (i.e. the baffle factor) of a number of different tanks that can be used in small drinking water systems in Colorado. Furthermore, this study highlights the increasing role and value of CFD in improving the design of water systems.

Poster # 86

Smart Materials for Oil/Water Separation

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Advanced materials with surfaces that have controllable oil wettability when submerged in aqueous media have great potential for various underwater applications. Here the team has developed smart surfaces on commonly used materials, including non-woven textiles and polyurethane sponges, which are able to switch between superoleophilicity and superoleophobicity in aqueous media. The smart surfaces are obtained by grafting a block copolymer, comprising blocks of pH-responsive poly(2-vinylpyridine) and oleophilic/hydrophobic polydimethylsiloxane (i.e., P2VP-b-PDMS) on these materials. The P2VP block can alter its wettability and its conformation via protonation and deprotonation in response to the pH of the aqueous media, which provides controllable and switchable access of oil by the PDMS block, resulting in the switchable surface oil wettability in the aqueous media. On the other hand, the high flexibility of the PDMS block facilitates the reversible switching of the surface oil wettability. As a proof of concept, the team also demonstrates that materials functionalized with our smart surfaces can be used for highly controllable oil/water separation processes and serves as highly regenerable sorbents for oil spill cleanup (the materials can capture and release oil on demand). As a further development of the block copolymer grafting strategy, remotely controllable liquid marbles that rupture upon ultraviolet illumination and can be remotely manipulated by an external magnetic field, are prepared by encapsulating water droplets with novel core-shell structured responsive magnetic particles, consisting of the responsive block copolymer (i.e., P2VP-b-PDMS) grafted mesoporous silica shell and magnetite core.

Poster # 87

Computational Modelling of Photonics for ICT Low-Carbon Applications

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The last decade has witnessed dramatic progress and interest in the micro- and nano-fabrication techniques of complex photonic devices. In almost all cases, an accurate quantitative theoretical modelling of these devices has to be based on advanced computational techniques that solve the corresponding, numerically very large linear, nonlinear, or coupled partial differential equations.
The team will present the results in the area of computational modelling with emphasis on photonics, nanodevices and sensors for the realisation of energy-efficient photonic devices towards future ICT infrastructure, and many other low-carbon applications. A "comprehensive numerical package" was developed based on the full vectorial finite element methods for the accurate numerical modelling of electromagnetic wave propagation in a wide range of photonic devices. A comprehensive, numerically efficient, versatile and accurate suite of frequency-domain and time-domain numerical models has been created. A vast wide range of passive, active, linear, and nonlinear, micro- and nanophotonic devices have been analysed, designed, and optimised to give the best performance for ICT low-carbon applications. Being robust, rigorous, and yet numerically efficient, this newly developed numerical model is considered to be pioneering in the area of Computational Modelling of Photonics.