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2014 UNDERGRADUATE RESEARCH POSTER SESSION

Abstracts

STUDENT CENTER ATRIUM
THURSDAY, SEPTEMBER 4, 2014
10 AM - 2PM

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An Autonomous Robotic Indoor Environment Surveillance System

Monte Ahuja College of Business

Student Researchers: Andrew Gunnerson and Bogdan Olar

Faculty Advisor: Haodong Wang

Abstract

We developed an autonomous mobile robot platform capable of following a path and gather environmental data, including temperature, humidity, light intensity, etc. The robot is capable of detecting the path using its camera and correct most navigational errors, while the sensors support a limited set of instructions regarding which sensor data to collect and how often. Our experiment consisted of having the robot follow a looped path we set up in BU004 Lab. The robot was able to complete the loop and gather sensor data for light intensity, humidity and temperature at a frequency of once per second, and also positional data provided by the robot at around the same frequency.

Cigarillo and Little Cigar (CLC) Portrayals on Instagram

College of Liberal Arts and Social Sciences

Student Researchers: Sarah Mosley, Katrina Tomc, Danielle Tracy, and Kaala Walker

Faculty Advisor: Cheryl Bracken

Abstract

Among US public health concerns, smoking remains a significant target for intervention. However, teen and young adult users appear to be adopting different preferences and patterns of smoking than prior generations. Little cigar and cigarillo (LCC) use is rapidly expanding among this age group. Depictions of LCC product use are highly prevalent on social media, a preferred and ubiquitous channel of communication among young people. The purpose of the study is to identify and examine primary themes and message attributes of posted LCC behaviors and messages on social media – and specifically on Instagram. A quantitative content analysis was conducted to describe the profiles of Instagram users posting LCC – related images and the content of the posted images. The coded sample included more than 2000 images which were randomly selected to represent each of the four brands. Undergraduate coders were included in the creation of the coding scheme. The results identified the majority of Instagram users who posted LCC –related pictures as being young, white, males. The posted images feature LCC packages, partially smoked cigarillos, and blunts which are often posed for the photograph. The findings of this study will assist us in future prevention message creation.

Dark Awakening: Transmedia and Narrative Transportation

College of Liberal Arts and Social Sciences

Student Researcher: Rafeeq Roberts

Faculty Advisor: Kimberly Neuendorf

Abstract

Media convergence has led content creators to produce narratives that stretch across platforms, known as Transmedia. A Transmedia narrative titled Dark Awakening was created using three different platforms: A short film, an interactive short story, and a text based role playing game. All of these share overlapping themes, characters, and settings. Each narrative platform was designed to be taken and understood on its own, or viewed in conjunction with the others. A study of audience response to the Transmedia experience of Dark Awakening has been planned. The conditions for the study include the order in which the media are consumed, and previous exposure to the media types will serve as a moderator. The participants will be randomly assigned either one, two, or all three of the narrative media types and then asked about their reactions to the created narrative world. We expect that exposure to a narrative unfolding across multiple platforms will result in greater narrative transportation, which in turn will lead to increased understanding, cognitive engagement, emotional reaction, and enjoyment within the viewer. We anticipate that a greater degree of attention will be required than traditionally has been found, and that identification/empathy with characters will moderate impacts.

Lick the Blade: The Implications of Performance and Narrative Music Videos

College of Liberal Arts and Social Sciences

Student Researchers: Tara Burns, Joni Lewanski, Alex Farmer, Kelly McCafferty with Jeffery Allen, Matthew Egizii, Rebecca Fowler, Stephen Morgan, Rafeeq Roberts, and Jordan Tobin

Faculty Advisor: Kimberly Neuendorf

Abstract

Since MTV's introduction in 1981, music videos have shaped popular culture in various ways. Transitioning from television/cable to online platforms, thousands of music videos are viewed daily by millions through streaming sites such as YouTube and Vimeo. As a collaborative group, we wrote and produced a music video in collaboration with the metal band *Lick the Blade*, focusing on their original piece, "Blood Soaked Majesty." Footage was produced for both a performance video, showing only the band performing their piece, and a narrative video, featuring a story line that parallels the lyrics. An audience will be able to view a performance video, a narrative piece, or a "concept" video that links images from the narrative piece with the performance video, without providing a true story line. The produced footage allows us to edit various versions of the music video in order to study different outcomes of music video exposure, with three goals: (1) Compare spectators' involvement and interpretations for performance vs. narrative video versions; (2) investigate outcomes of different levels of violent content and victim gender; (3) examine the impact on reception of non-synchronous sound editing. Results from these studies could lend insight to producers of music videos.

Incarcerated Mothers: What Role Does Communication Play in Successful Family and Community Reintegration?

College of Liberal Arts and Social Sciences

Student Researcher: Rebecca Fowler

Faculty Advisors: Jill Rudd and Kimberly Neuendorf

Abstract

The Incarcerated Mothers Project (TIFF--Transitioning Incarcerated Females & Families) is a four-tiered investigation into the subject of incarcerated mothers and how communication affects parental dynamics. The first tier of research included an earlier pilot study of 53 incarcerated mother. The second tier involved an experiment assessing the impact of exposure to a documentary narrative about the impact of a mother's incarceration on her family; results showed significant knowledge gain and empathetic responses among general receivers. This summer, additional footage was added to the documentary, with instrumentation ready for a Fall 2014 data collection. Also this summer, progress was made on the third tier, which involved speaking with various experts and professionals in the field of incarceration and reintegration. These interviews established that both family and community support are vital preventatives toward preventing recidivism. The fourth tier of the project includes developing additional interview questions to continue the pilot study both with the established group of research subjects and extending that research pool for a more expansive data set. Data collected will be used to develop programs in communication, including family communication education modules video education modules for incarcerated and reintegrating populations.

Oral History, Mobile Curation, and African American Memory in Cleveland's Fairfax and Glenville Neighborhoods

College of Liberal Arts and Social Sciences

Student Researchers: Benne Christian, Willette Crawford, and Julie Gabb

Faculty Advisors: J. Mark Souther and Regennia N. Williams

Abstract

Fairfax and Glenville are historic neighborhoods with signal importance in the African American community. Too often these neighborhoods are subjected to a simplistic declension narrative that pins their heyday in the 1920s-50s and traces their decline to the convulsive riots of the late 1960s and the subsequent loss of population to the suburbs as middle-class African Americans mirrored "white flight." Our team conducted over 40 interviews, created story clips, and curated several new sites for the *Cleveland Historical* website and mobile application. Our research, rooted in oral history, exposed an important post-1968 counternarrative of resilience. Our oral histories demonstrate a continuing thread of black/white/Jewish collaborative approaches to community issues, particularly in Glenville, as well as the continuing relevance of the "old neighborhoods" for work, play, and worship long after middle-class suburban flight. They also reveal a selective memory that privileges personal connections to the neighborhood through kinship, friendship, faith, and social activism, yielding a "sense of place" that is not always tied to prevailing assumptions about the neighborhoods.

The History and Archaeology of Cleveland's Historic Central Market District

College of Liberal Arts and Social Sciences

Student Researchers: Katie Fry, Rachel Daley, and Kyle Riordan

Faculty Advisor: Phil Wanyerka

Abstract

In the early 1990's archaeologists and historians from Cleveland State University and the Cleveland Museum of Natural History explored and excavated an early frontier community located south and east of Public Square in the area known locally as the Central Market District. To most Clevelanders the Central Market District brings to mind the bustle of busy nightclubs or the aging facades of old Cleveland landmarks. Few people, if any, would associate this area with archaeology, let alone remember that from 1796 through the 1860's this area was home to one of Cleveland's earliest English and Welsh working-class communities. From the founding of the Central Market in 1856 through the mid-1950's, this district was a booming commercial area that included groceries, saloons, apothecaries, shoemakers, and other commercial businesses. By the start of the 20th century, this area was the main commercial hub for most of downtown Cleveland. However, by the late-1950's the businesses in this area began to wither and decline ultimately leading to the demise and abandonment of this once thriving commercial district. Things would dramatically change in the late 1980's when plans were announced that would revitalize this area with the construction of a new sports-entertainment complex known as Gateway. Today, the Gateway Complex is home to Progressive Field and to Quicken Loans Arena. Presented here on our poster are the results of our summer research which involved a historical examination and investigation of the residential, commercial, and entertainment eras of the Central Market District based on our analysis of more than 100,000 artifacts collected from this area. Our project demonstrates how archaeology can be used as a critical tool in understanding the history and archaeology of Cleveland's historic Central Market District.

The Art of Polyfoam Puppetry

College of Liberal Arts and Social Sciences

Student Researcher: Rafeeq Roberts

Faculty Advisors: Terry Pieritz and Russ Borski

Abstract

The construction of polyfoam puppets for theatrical productions is a highly specialized art form and requires a process that is often learned via mentorships and apprenticeships. Limited learning materials and resources presently exist or are publicly available on the techniques for producing these complex and genre specific puppets. This project investigated and visually documented the creative process and craftsmanship in the creation of polyfoam puppets. Working collaboratively with an undergraduate student of film and digital media, theatre Faculty Designers created an instructional video presentation of the step by step stages of polyfoam puppetry construction. The resulting video documents the creative process in sequential chapters to use as a resource for theatre professionals, artisans, educators, and as a virtual learning tool for students.

Connecting Historical Thinking and Technology in the Classroom

College of Liberal Arts and Social Sciences

Student Researcher: Victoria McDonough

Faculty Advisor: Shelley Rose

Abstract

The motivation behind the Social Studies @ CSU summer blog series is to encourage discussion among teachers about connecting historical thinking and technology with the content of their Social Studies courses. Many teachers are unaware of how to integrate critical thinking skills into their Social Studies courses, leaving students unable to use those skills to guide their own academic careers. Using the current model of Ohio Social Studies content standards and research completed by Sam Wineburg and Daisy Martin as a framework, the Social Studies @ CSU summer blog series provides technological and lesson planning resources and methods for integrating technology and historical thinking with Social Studies content. The results were seventeen blog postings that provide online resources and ideas that help teachers connect the content of the current Social Studies standards with modern technologies. Also featured are games and interviews with students and teachers that give practical advice and strategies about employing unconventional teaching methods to increase student engagement in Social Studies courses. In conclusion, the discussion about connecting historical thinking and technology in the classroom is ongoing, but research and current technologies are helping teachers integrate historical and critical thinking methods into their content more and more each day.

RNase L contributes to lipid metabolism

College of Sciences and Health Professions

Student Researchers: Morgan Ashcraft, Chunfang Liu, and Qiaoyun Zheng

Faculty Advisor: Aimin Zhou

Abstract

Macrophage-derived foam cell formation is a milestone of the atherosclerotic lesion initiation and progression, leading to cardiovascular diseases and stroke. Foam cells are formed from the disruption of a homeostatic mechanism that manipulates the uptake, intracellular metabolism and efflux of cholesterol within macrophages. Although studies have yielded much information about the homeostatic mechanism, the molecular basis of foam cell formation remains to be fully understood. We recently found that deficiency of RNase L attenuated macrophage functions including macrophage migration and its endocytic activity. Furthermore, RNase L markedly impacted the expression of certain pro- and anti-foam cell genes in macrophages. Most interestingly we have revealed that lack of RNase L significantly increased the formation of foam cells from bone marrow derived macrophages (BMMs). The increase of foam cell formation was associated with up-regulation of the expression of scavenger receptors such as CD36, SR-A, and PPAR-g. These studies provide new insights into foam cell formation and novel therapeutic strategies for atherosclerosis may be designed through activation/up-regulation of RNase L.

MIXED-CASE FORMAT AND LEXICAL DECISION PERFORMANCE: Initial Uppercase Is Special

College of Sciences and Health Professions

Student Researchers: Julia C. Harvey Azzolina, Lois M. Rotuno, and April D. Waltonen*

Faculty Advisor: Albert F. Smith

Abstract

Previous research has shown that there are phenomena that may require a route to word identification by means other than through letters. For example, in a lexical decision task, in which an experimental participant is asked to determine if a string of letters is a word or not, responses to items in a MIXed caSE format are slower than to items in PURE UPPERCASE or pure lowercase formats. In this experiment, we investigated the effect of different mixed-case formats on lexical decision performance, focusing on the type and location of the case transition. Twenty-four students participated in a lexical decision making experiment, consisting of twelve blocks of sixty-four six-letter items. Each block contained an equal number of words and pseudowords (nonwords that conform to rules of English orthography) presented in eight different case formats (e.g., travel, TRAVEL, Travel, tRAVEL, traveL, TRAVEl, traVEL and TRAvel). We found that mean response times to Initial Uppercase, PURE UPPERCASE and pure lowercase formats were all faster than the mean response times to all other MIXEd casE formats, suggesting that perception of initial uppercase items—a standard orthographic form in English—is different from that of other mixed-case formats.

*McNair Scholar

Motor output structure in targeted aiming: A mechanistic model

College of Sciences and Health Professions

Student Researchers: Dale Lewis, Roger Young, and Jeffrey Eder

Faculty Advisor: Andrew Slifkin

Abstract

Studies using a variety of experimental tasks have established that when humans repeatedly produce an action, fluctuations in action output are highest at the lowest frequencies and fluctuation magnitude (power) systematically declines as frequency increases. Such time series structure is termed *pink noise*. However, the appearance of pink noise seems to be limited to tasks where action is executed in the *absence* of task-related feedback. A few studies have demonstrated that when action was executed in the *presence* of task-related feedback, power was evenly distributed across all spectral frequencies—i.e., *white noise* was revealed. Here, participants produced cyclical aiming movements under visual feedback conditions and we sought to determine whether variations of both the movement amplitude requirement (A) and the target width (W)—in the form of the index of difficulty [ID = $\log2(2A/W)$]—would predict the structure of movement amplitude (MA) time series. There were five ID levels, and there was a small-, medium-, and large-scale version of each ID: The A and W values doubled with each increment in scale level. Given that increases in ID are known to induce increased reliance on the available visual feedback, we predicted an ID-induced shift in MA time series structure from pink to white noise, with no change in MA structure across scale levels.

What are the best skeletal indicators of handedness?

College of Sciences and Health Professions

Student Researcher: Margret B. White

Faculty Advisor: Anne Su

Abstract

Previous research indicates that there are asymmetries in limb bone structure and dimensions. It is hypothesized that these asymmetries are the result of hand preference, or repeated unilateral mechanical loading. The aim of this study was to first identify the best skeletal indicators of handedness by means of a comprehensive literature search. Based on the previous findings of other researchers, we examined non-pathological male individuals (N=19, aged 20-35) from the Hamann-Todd Skeletal Collection at the Cleveland Museum of Natural History for asymmetry of paired second metacarpals, by measuring the difference between right and left diameters at mid-shaft. We also tested relationships between metacarpal diameter and age and weight. Results indicate that there is asymmetry, with right metacarpals being significantly thicker in diameter than left metacarpals. We found no relationship between absolute thickness and either age or weight. But we unexpectedly found an inverse relationship between asymmetry and weight. Similar to previous researchers, our results indicate noteworthy asymmetries that may be interpreted as the functional adaptation of the upper-limb bones, hinting at side preference.

Asymmetrical variation in the trabecular bone within the human lumbar vertebrae of the Libben hunting population

College of Sciences and Health Professions

Student Researcher: Andrew S. Dickson

Faculty Advisor: Anne Su

Abstract

Trabecular bone, a porous network of struts found within mammalian bone, has been understood to show regional variations in response to weight bearing activities. In this study, the L4 vertebrae were examined from a population of prehistoric hunters and gatherers, with the hypothesis that the trabecular bone would show left-right asymmetry that may be an indicator of asymmetry in trunk and upper limb use such as during spear throwing. The L4 vertebra of 10 male individuals aged 18-35 were digitally imaged using micro-computed tomography (micro-CT). Trabecular bone properties were quantified in the left and right sides of each vertebral body, then asymmetry determined as the difference. Trabecular bone volume, thickness, and number showed about 10% or less asymmetry. However, anisotropy and elongation, properties that are indicative of the shape and orientation of trabecular struts, showed 35% or greater asymmetry. These results are consistent with other studies that suggest trabecular shape and orientation may be indicators of habitual postural or activity loads. Future studies will explore whether there is a relationship between this asymmetry in the L4 vertebrae and asymmetry in other skeletal indicators of upper limb use (handedness), which may be useful in understanding the evolution of human tool use.

Pharmacological and Pre-Clinical Testing of 5-NIdR as a New Therapeutic Agent Against Brain Cancer

College of Sciences and Health Professions

Student Researcher: Seol "Casey" Kim

Faculty Advisors: Anthony J. Berdis and Jung-Suk Choi*

Abstract

Approximately 4,000 children in the United States are diagnosed annually with a brain tumor. Brain cancers are the deadliest of all pediatric cancers as they have survival rates of less than 20%. Although surgery and radiation therapy are widely used to treat adult patients, chemotherapy is the primary therapeutic option for children. One important chemotherapeutic agent is temozolomide, an alkylating agent that causes cell death by damaging DNA. In this project, we tested the ability of a specific non-natural nucleoside developed in our lab, designated 5-NIdR, to increase the efficacy of temozolomide against brain cancer. Cell-based studies demonstrate that the combination of 5-NIdR and temozolomide kills more cells compared to treatment with either temozolomide or 5-NIdR used alone. Microscopy techniques demonstrate that the combination of 5-NIdR and temozolomide causes cell death via apoptosis rather than necrosis. Animal studies using xenograft (nude) mice were performed to evaluate the *in vivo* efficacy and safety of this drug combination against brain cancer. Preliminary results are provided which indicate that treatment with 5-NIdR does not inhibit the rate of tumor growth. In contrast, treatment with temozolomide reduces the rate of tumor growth but does not lead to the complete elimination of the tumor. Striking results are obtained using 5-NIdR and temozolomide together as this drug combination causes a significant reduction in tumor size. Finally, mice treated with the combination of 5-NIdR and temozolomide do not show overt signs of side effects such as weight loss, dehydration, or fatigue. Collectively, these studies provide pharmacological evidence for combining 5-NIdR and temozolomide as a new treatment strategy to effectively treat brain cancers.

**Post-doctoral Fellow*

Validating TbTIF2-interacting Candidates

College of Sciences and Health Professions

Student Researchers: Fan Wu, Jennifer Berkey, Joshua Hellsing, and Nisha Thaker

Faculty Advisor: Bibo Li

Abstract

Transmitted by the tsetse fly, *Trypanosoma brucei* is a protozoan parasite that causes sleeping sickness in human and nagana in cattle. While infecting the bloodstream and central nervous system, *T. brucei* evades the immune system by altering its major surface antigen, Variant Surface Glycoproteins (VSGs), which forms a thick coat on its cell membrane. The expression sites for VSGs are at the sub-telomeric regions of *T. brucei* chromosomes. Telomeres, DNA-protein complexes located at the end of chromosomes, provide chromosome stability by preventing degradation of the chromosome ends. The telomere complex also regulates the sub-telomeric VSG expression and switching in *T. brucei*. To eradicate *T. brucei*, further understanding of how the telomere complex regulates VSG expression and switching is needed. TbTIF2 (TRF-Interacting Factor 2), a telomere-specific protein, was discovered to be essential for cell viability and the suppression of VSG switching in *T. brucei*. To better understand the telomere complex and the mechanisms of TbTIF2 function, we have performed a yeast 2-hybrid screen and identified a number of proteins that may interact with TbTIF2. The goal of our current study is to validate the TbTIF2-interacting candidates. We have subcloned several promising TbTIF2-interacting factors. We are currently testing these candidates for their interaction with TbTIF2 using yeast 2-hybrid analysis.

Cholesterol conjugated HDAC inhibitor as novel anti-cancer agent

College of Sciences and Health Professions

Student Researchers: Paul Orefice and Jane Peterson

Faculty Advisor: Bin Su

Abstract

Histone deacetylase (HDAC) inhibitors are a class of promising new multifunctional anticancer agents. These agents are able to affect multiple epigenetic changes in aberrant cells. In addition to regulating the gene expression and transcription via chromatin remodeling, HDAC inhibitors can also modulate a variety of cellular functions including proliferation, differentiation, and apoptosis. Vorinostat (SuberAniloHydroxamic Acid, SAHA), the first HDAC inhibitor approved by FDA, inhibited the metastasis of various cancer cells. However, SAHA distributes in cancer tissue and normal tissue in a similar level. It will be ideal to selectively delivery SAHA into cancer cells. Rapidly growing cancer cells have a great need for cholesterol to generate new membranes. Increased low-density lipoprotein (LDL)-uptake by tumor cells has been found. LDL is the major cholesterol carrier in plasma and its uptake is mediated by the LDL-receptor (LDL-R), a glycoprotein overexpressed on the surface of cancer cells. Cholesterol can be used as a delivery agent to enhance anti-cancer drugs penetrating cancer cell membrane via LDL-R. Degradation of LDL particles by endosomal enzymes will result in the release of the conjugates to target cancer cells. Herein, we designed and synthesized SAHA cholesterol conjugate, and tested the anti-cancer activity of SAHA and its conjugate. The results suggest that cancer cells uptake more cholesterol SAHA conjugate when the culture medium does not contain LDL. Based on the information, we will design and generate artificial LDL containing SAHA cholesterol conjugate to enhance the drug delivery.

Activation of DNA damage checkpoint pathways during skeletal myoblast differentiation and apoptosis

College of Sciences and Health Professions

Student Researchers: Mofetoluwa Oluwasanmi* and Greg Kliment

Faculty Advisor: Crystal M. Weyman

Abstract

A subset of skeletal myoblasts undergo apoptosis rather than differentiation when cultured in differentiation media (DM: absence of growth factors). While the muscle regulatory transcription factor MyoD is known to control the process of differentiation, our lab has recently discovered that MyoD is also controlling the apoptotic process in response to culture in DM by direct up-regulation of the pro-apoptotic Bcl2 family member PUMA. We similarly discovered that MyoD plays a role in the increased expression of PUMA and apoptosis in response to the DNA damaging agent, etoposide. This led to the hypothesis that culture in DM may lead to stalled replication forks during DNA synthesis that are "recognized" as DNA damage. We are testing our hypothesis by determining if culture in DM results in the activation of pathways known to respond to DNA damage. We have determined that p38, p53, and c-abl are all up-regulated in response to culture in DM. Next, we will determine the significance of MyoD to the increased expression of these molecules.

*McNair Scholar

Monitoring micelle formation in mixtures of linear and foldon-capped polypeptides with Light Scattering Spectroscopy

College of Sciences and Health Professions and Washkewicz College of Engineering

Student Researchers: Janna Mino, John P. Gavin, and Michael G. Price

Faculty Advisors: Kiril A. Streletzky and Nolan B. Holland

Abstract

Elastin-like polypeptide (ELP) polymers are ideal for producing environmentally responsive micellar systems because they exhibit a transition from being water-soluble at low temperatures to phase-separated at high temperatures. For application development of drug delivery vehicles and bio-sensing nanoparticles, it is important to prepare spherical micelles of controlled diameter and shape. Since at a given salt concentration, the headgroup area for each foldon should be constant, the size of the micelles is expected to be proportional to the volume of the linear ELP available per foldon headgroup. Therefore, adding linear ELPs to a system of ELP-foldon should result in changes of the micelle volume. At higher salts the electrostatic repulsion between headgroups is shielded, reducing the effective size of foldon headgroups, increasing the packing factor of micelles which leads to formation of non-spherical micelles. The effects of addition of linear ELPs on size, shape, and molecular weight of micelles at different salt concentrations were studied by a combination of Depolarized Dynamic Light Scattering (DDLS) and Static Light Scattering (SLS) Spectroscopies. The initial results on 50 μM ELP-foldon samples (at 25 mM salt) show that the apparent hydrodynamic radius of mixed micelles increases more than 5-fold as the amount of linear ELP raised from 0 to 50 μM. The size increase is accompanied by significant increase in depolarized scattering indicating the growing geometrical anisotropy of the micelles with increase of added linear ELP. In addition, the increase of the amount of linear ELP in the mixed micelles significantly increased the relative molecular weight of the micelles.

Controlling micelle formation using mixtures of linear and foldon-capped polypeptides (ELP): Measurements with UV-vis spectroscopy

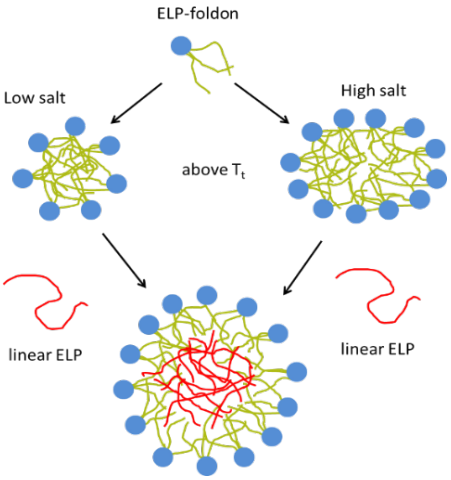
Washkewicz College of Engineering and College of Sciences and Health Professions

Student Researchers: John P. Gavin, Michael G. Price, and Janna Mino

Faculty Advisors: Nolan B. Holland and Kiril A. Streletzky

Abstract

Polymer surfactants developed in our lab have a protein headgroup (foldon) and three elastin-like polypeptide (ELP) tails. They can form micelles smaller than 30 nm, which may be useful in developing targeted drug delivery vehicles. Specifically, ELPs are capped with foldon, which is a 27 amino acid sequence that folds as a homo-trimer, resulting in a three-armed star polypeptide. This structure has been shown to form micelles above the transition temperature (T_t) of the ELP. The salt concentration affects the interaction between the headgroups affecting how the micelles assemble. At low salt concentrations the ELP-foldon will form spherical micelles; whereas, at higher salt concentrations the micelles are non-spherical, as is demonstrated by light scattering. When linear ELP is mixed with ELP foldon, it is expected that the ELP-foldon will stabilize small droplets of linear ELP in the form of a microemulsion. Different ratios of ELP-foldon to linear ELP were prepared and their transition behavior was characterized using turbidity measured with UV-vis spectroscopy. The turbidity increased at the T_t of the ELP, and then dropped substantially at the T_t of the ELP-foldon. Increased concentration of the linear ELP increased the measured turbidity level after both transitions, suggesting an increase in aggregate size. Light scattering was utilized to further characterize the size and shape of the aggregates formed.



Measuring Activity of Endothelial Nitric Oxide Synthase and Nanodisc Complex through Nitrate Production

College of Sciences and Health Professions

Student Researchers: Christopher Verdi and Ghaith Altawallbeh

Faculty Advisor: Mekki Bayachou

Abstract

Nitric oxide is an important bioregulator generated in various regions throughout the body by a family of isozymes referred to as Nitric Oxide Synthases (NOS). Within vascular endothelial cells, nitric oxide is generated from oxygen and arginine (amino acid) by endothelial nitric oxide synthases (eNOS). Within this environment nitric oxide plays a critical paracrine role, mainly anithrombotic and anti-atherosclerotic. This is accomplished by vessel dilation and prevention of platelet and leukocyte aggregation and adherence to the vessel wall. The activity of the eNOS enzyme has been studied within solution and is well understood. However, the impact that the lipid bilayer of endothelial cells has on the activity is not known. To better understand this interaction, we have formed "nanodiscs" to bind to the eNOS. Nanodiscs have two components that combine and self-assemble when added to solution, POPC (a lipid) and MSP1E3D1 (Membrane Scaffold Protein). The nanodiscs help provide a better microenvironment to study the enzyme and its activity. Through reaction with an indicator dye in the Griess reagent system, activity levels, as calculated by nitrate production, reduced dramatically. Over a 50% reduction was seen when calculating specific activity of the eNOS enzyme when bound to nanodiscs. A possible indication that a lipid bilayer restricts activity of the eNOS enzyme.

Selection of an evolved orthogonal N^{e}-Acetyllysine tRNAsynthetase that can incorporate the unnantural amino acid L-homocitrulline site-specifically into proteins

College of Sciences and Health Professions

Student Researchers: Jaclyn Alatrash and Camelia Baleanu Gogonea

Faculty Advisors: Stanly L. Hazen and Joseph DiDonato

Abstract

Oxidatively damaged apolipoprotein A1 (apoA1, the main protein constituent of high density lipoprotein (HDL) - the "good cholesterol") has been isolated from circulating plasma and atherosclerosis plaque with modification of lysine amino acid residues to homocittruline (carbamyllysine) in apoA1 identified as a modification found increased in smokers that correlates with elevated cardiovascular risk for myocardial infarction (MI), stoke or death (1). This dysfunctional HDL molecule has been shown to be proinflammatory in nature and can activate the expression of cellular adhesion molecules in endothelial cells via NF-κB transcription factor activation (2). Here we designed ApoA1 to include *specifically* carbamylated lysine at predefined sites to further investigate the role of oxidative damage in atherosclerosis, leading to dysfunctional HDL. Current chemical and enzymatic oxidation of proteins (e.g. apoA1) results in *incomplete* and *rarely* site-specific oxidation of amino acids. Thus, *genetic encoding* of oxidized amino acids through orthogonal tRNA/aminoacyl-tRNA synthetase (RS) pairs offers the most reliable method for producing *site specific* oxidized proteins (3). We used an orthogonal tRNA/RS pair from *Methanosarcina barkeri that has been evolved previously to incorporate the unnatural amino acid N^{ε}-acetyllysine instead of pyrolysine* (4) as a starting point to create a library of synthetase mutants that could utilize homocittruline (carbamyllysine) to specifically incorporate this uAA into proteins at defined sites. Using X-ray crystallographic information provided for the pyrolyisne tRNA synthetase (4) we replaced the pyrolysine with acetyllysine and observed which mutations were successful. Using this information and then replacing acetyllysine with carbamyllysine into the

catalytic pocket we identified likely key residues that were within 6.5 angstroms of carbamyl lysine as it would sit in the catalytic pocket that might enhance hydrogen bonding or salt bridge electrostatic interactions between carbamyllysine and the catalytic pocket backbone amino acids. From the *N^{ϵ}-acetyllysine* we identified A267(All), Leu270(All), Tyr 271(All), L274(All), F312(All) and C313(All). We used inverse PCR mutagenesis (4) to mutate each of these residues using two inverse PCR reactions and two mutagenic primers. A total of 6.4 $x10^7$ possible mutants could be made. After relegation of dilute isolated Bsa I restricted PCR plasmid DNA a library with a total of 1.5 x 10^8 was obtained. The library is in the process of being positively selected for incorporation of carbamyllysine into the kanamycin kinase gene at position 15 to suppress the encoded amber suppressor codon. Positive selected clones that grow on kanamycin sulfate (150μg/ml) in the presence of 1mM carbamyllysine will be negatively selected against incorporation of any non-carbamyllysine amino acid in the absence of carbamyllysine using suppression of uracil phophoribosyl transferase at two amber codon sites (5 and 125) to incorporate 5-fluorouracil into cellular DNA, resulting in cell death. Clones which grow after being negatively selected for will then be positively selected a final time on kanaymcin sulfate plates in the presence of 1mM carbamyllysine for a second round of positive selection. Individual clones from this round of selection will be isolated and tested the clone encoding the synthase which best incorporates carbamyllysine at the lowest uAA concentration. The selected carbamyllysine tRNA synthetase will then be used to express a series of human apoA1 alleles containing amber codons in place of various lysine residues and assayed for its ability to form nascent HDL particles and to activate NF-κB and vascular adhesion molecule expression on endothelial cells.

Anatomy-Based Transmission Factors for Technique Optimization in Portable Chest X-ray

College of Sciences and Health Professions

Student Researchers: Chris L. Liptak, W. Paul Segars, Ashraf G. Morgan, and Frank F. Dong

Faculty Advisor: Xiang Li

Abstract

Currently, portable x-ray examinations do not employ automatic exposure control (AEC). To aid in the design of a size-specific technique chart, acrylic slabs of various thicknesses are often used to estimate x-ray transmission factors for patients of various body thicknesses. This approach, while simple, does not account for patient anatomy, tissue heterogeneity, and the attenuation properties of the human body. To better account for these factors, in this work, we determined x-ray transmission factors using computational patient models that are anatomically realistic. A Monte Carlo program was developed to model a portable x-ray system. Detailed modeling was done of the x-ray spectrum, detector positioning, collimation, and source-to-detector distance. Simulations were performed using 18 computational patient models from the extended cardiac-torso (XCAT) family (9 males, 9 females; age range: 2-58 years; weight range: 12-117 kg). The ratio of air kerma at the detector with and without a patient model was calculated as the transmission factor. The transmission factor decreased exponentially with increasing patient thickness. For the range of patient thicknesses examined (12-28 cm), the transmission factor ranged from approximately 25% to 2.8% when the air kerma used in the calculation represented an average over the entire imaging field of view. The transmission factor ranged from approximately 25% to 5.2% when the air kerma used in the calculation represented the average signals from two discrete AEC cells. These exponential relationships can be used to optimize imaging techniques for patients of various body thicknesses to aid in the design of clinical technique charts.

Fabrication and Characterization of Cell Membrane

College of Sciences and Health Professions

Student Researchers: Ali Naserallah and Valentinas Gruzdys

Faculty Advisor: Xue-Long Sun

Abstract

Cell membrane plays critical cellular functions in both physiological and pathological pathways and thus is important target for both basic and applied biomedical research. The domain structure features of cell membrane strongly affect the functions of membrane embedded biomolecules such as proteins and carbohydrates. However, understanding the structural aspects of membrane effects on the embedded biomolecule's function have not been able easily to do due to limited approaches available. We have engaged in fabrication of cell membrane mimetic systems for functional analysis of membrane proteins and cell surface carbohydrates [1,2]. Thrombomodulin (TM), an endothelial integral membrane protein, plays central roles in haemostatic balance by serving as a cofactor for thrombin-mediated protein C (PC) activation (*antithrombotic*) [3]. The structure of TM and its structural domains necessary for PC activation has been clarified and reactions occur on endothelial cell membrane surfaces [4]. Therefore, cell membrane may be involved in the protein C activation process. However, it is not conducted so far. In this research, we fabricate cell membrane mimetic systems containing TM and investigate the physiological significance of the lipid membrane on TM-enhanced PC activation mechanism. The proposed research will provide important information to understand the relative factors involved in PC activation and would offer opportunities to manipulate thrombotic disorders (*antithrombotic versus prothrombotic*) related to cardiovascular diseases. In addition, the cell membrane mimetic system can be used for examining binding interactions of other cell surface biomolecules such as carbohydrates and can be applied for drug screening applications as well.

Comparison of therapeutic exercise accuracy during completion of a home exercise program using the Exercise Tutor versus a written home exercise program

College of Sciences and Health Professions

Student Researchers: James Flis, Riana Stanko, and Megan Stang

Faculty Advisors: Ann Reinthal and Debbie Espy

Abstract

Exercise is powerful in rehabilitation and prevention of disability; however, patient adherence to home exercises is difficult, learning new movements requires a great deal of practice, and incorrectly performed exercises are ineffective or even dangerous. We have developed a system comprised of a Kinect device with wearable inertial sensors to capture, record, and process the exerciser's movement while concurrently providing targeted feedback to guide correct exercise completion. This pilot study allowed us to perform initial testing of this system, specifically, the effectiveness of this system in improving exercise accuracy, with and without the addition of inertial sensors to the Kinect camera feedback, as compared to a traditional written home exercise program. Twenty-four participants (18-48 years old, 14 female) completed one of three training types: a written exercise program, Kinect feedback only, or combined inertial sensor and Kinect feedback. All subjects completed a pre-test, three training sessions, and a post-test with the assigned feedback type, with movement accuracy as the outcome. These data are in analysis; therefore, previous data from the pilot for this project are presented here. Initial analysis indicates that kinect and inertial sensor feedback are better for different movement types, and are superior to a written program.

Comparison of Electronic and Mechanical Handgrip Devices in Lowering Blood Pressure

College of Education and Human Services

Student Researchers: Katie Webb, Brandon Musarra, Megan O'Keefe, Shana Strunk, and Courtney Perkins

Faculty Advisors: Kenneth Sparks, Emily Kullman, and Eddie T. C. Lam

Abstract

Hypertension causes billions of deaths per year (Millar et al., 2013). The Zona Plus™ is an expensive tool designed to lower blood pressure (BP) using isometric exercise. This exercise may be achieved using a less expensive Handgrip Dynamometer. **PURPOSE:** The purpose of this research is to determine if the Zona or Handgrip Dynamometer is more efficient at lowering BP and most cost effective for patients. **METHODS:** Twenty subjects used the Zona and twenty subjects used the dynamometer three times per week for six weeks. BP was taken once per week prior to the treatment. A maximum voluntary contraction (MVC) was recorded for each hand before every treatment. Participants were required to hold the handgrip at 30% of their MVC for four two-minute contractions. A paired samples T test was used to analyze changes in participants' BP. A one-way ANOVA was used to compare the BP changes between the Zona and the Handgrip. **RESULTS:** The results indicated no significant changes in participants' pre- and post- treatment after training when using the Zona for either stolic ($p=0.225$) or diastolic BP ($p=1.000$). There was also no significant difference in participants' post treatment systolic BP ($p=0.199$), however, the post treatment for diastolic increased significantly ($p=0.027$ BP between those that used the Zona Plus™ and Handgrip Dynamometer. **CONCLUSION:** Though the Dynamometer is more cost efficient, neither the Zona nor the Dynamometer resulted in lowered BP.

What Drives Asian Descendent Students' Motivation for Learning? Exploring the Key Ingredients to Nurture Achievement

College of Education and Human Services

Student Researchers: Melissa Beaune and Yiyin Wang

Faculty Advisors: Mmary Gove and Grace Huang

Abstract

This motivation project is part of a larger study of exploring the relationship between Asian parenting styles and children's academic achievement. In light of the consistent Asian students PISA (Programme for International Student Assessment) data results and the media phenomenon created by Amy Chua's *Battle Hymn of the Tiger Mother* in 2011 in U.S., our research team found that high motivation has been a reoccurring theme in children's academic achievement in the perceptions of Asian descendent parents. The purpose of this project is to examine the Asian descendent students' motivations for learning through the parents' experiences and perceptions. The research methods include individual interviews and a focus group interview. Eighteen parents, including thirteen mothers and five fathers participated in this study. All participants had at least one child within the ages of 2-20 years old. Based on our findings, four themes have emerged. We learned that these parents nurtured and sustained children's motivation for learning through the following four ingredients, including resources, communications, setting clear and high expectations, and the modeling of the parents. Implications for educators will be provided in this presentation.

Fun versus Practical: Physiological Responses and Preference of Exercise Equipment

College of Education and Human Services

Student Researchers: Shana Strunk, Courtney Perkins, Brandon Musarra, Megan O'Keefe, and Katie Webb

Faculty Advisors: Kenneth Sparks, Emily Kullman, and Eddie T. C. Lam

Abstract

The elliptical cross trainer has become a popular a mode of exercise, but can only be used indoors. The StreetStrider was designed as an outdoor elliptical-bike. **PURPOSE:** The purpose of this study is to determine whether the elliptical or the StreetStrider was more enjoyable, and to compare the physiological variables for energy expenditure, heart rate (HR), VO2, and Rate of Perceived Exertion (RPE). **METHODS:** Thirty participants (15 male, 15 female, mean age=22±2) from Cleveland State University exercised for 20 minutes at 75% of their age predicted maximal heart rate on the StreetStrider and elliptical. Energy expenditure was measured with a COSMED K4b metabolic system. Participants' RPE was recorded every five minutes using the Borg Scale for Rate of Perceived Exertion. Data was analyzed using SPSS version 18. A paired sample t-test compared physiological responses. A one-way ANOVA analyzed gender differences. A significance level of .05 was used to determine significance. **RESULTS:** No significant differences were shown in energy expenditure ($p=.930$), HR ($p=.098$), or in average RPE ($p=.529$) between the exercise trials. A preference survey concluded that most subjects found the StreetStrider more enjoyable than the elliptical. **CONCLUSION:** The StreetStrider is more enjoyable than the elliptical and as effective in energy expenditure, and could serve as a substitute for the elliptical.

Investigating the Impact of the Deeper Learning Curriculum on High School Students' Understanding of Drug Discovery

College of Education and Human Services

Student Researchers: Gavin T. Custer, Thien Q. Dinh, and Yuriy Y. Krasnov

Faculty Advisor: Robert L. Ferguson

Abstract

In the summer of 2014, 23 local high school students participated in a pipeline program on the campus of Cleveland State University. The program, entitled "Careers in Health and Medical Professions" (CHAMPS), serves to prepare college-bound students for careers in the medical field. CHAMPS utilizes a simulated drug discovery curriculum based on "Deeper Learning" (Jensen & Nicholsen, 2008) to provide the high school students with authentic hands-on research experience. There are four main goals in this program: increase awareness of medical careers, introduce knowledge related to drug discovery, build on students' academic skills, and familiarize the students with 21st century skills. Three undergraduate student researchers were assigned to investigate these goals using a variety of methods, including surveys, individual and group interviews, and laboratory observations. General findings include participants were surprised at the source of drugs; their awareness of health and medical careers increased but their specific career did not change; and nearly all of the students possessed a proficient level of inter-personal skills, communication, and technology prowess.

Computer Vision and Route Planning for Humanoid Robots

Washkewicz College of Engineering

Student Researchers: Michael Iannicca and Dawei Du

Faculty Advisor: Dan Simon

Abstract

Our research focuses on vision-based route planning for the NAO humanoid robot. The robot is required to visually observe a scene and decide the shortest possible route for visiting the points of interest in that scene. A robust method for processing image information is used to determine the locations to be visited. We use a perspective projection algorithm to map points from a camera image to locations in three-dimensional space. A camera calibration algorithm finds the distance from the camera to the image plane. Linear regression is used to obtain the equations of camera calibration lines. Thresholds and binary masks are used to distinguish locations in the camera image. Connected component algorithms are used to label and group objects. We use brute force optimization to solve the path planning problem. A matrix containing distances between all pairs of objects is computed, and then a brute force search is used to find the shortest path between those objects. In case the number of objects is greater than about 10, brute force is not computationally feasible, and so artificial intelligence algorithms are used to find the shortest path.

Electronic Control Optimization of a Regenerative Leg Prosthesis

Washkewicz College of Engineering

Student Researcher: Taylor Barto

Faculty Advisor: Dan Simon

Abstract

Until recently, leg prostheses (artificial legs) operated similarly to a leg without muscles. With recent advances in electronic technology, motorized prostheses have become possible. However, these prostheses require large batteries and have a limited operation time. Our research focuses on using supercapacitors in prostheses to exploit the braking portion of human walking to regenerate energy, thus reducing the dependence on batteries. To use supercapacitors with the knee motor, electronic control circuitry is required. We are using a circuit that is similar to a standard motor controller to manage the flow of energy between the supercapacitor and the knee motor. This circuit can operate in two primary modes: one mode during motoring, and another mode during braking. Two additional, secondary modes arise depending on the direction the knee is rotating. Real-time switching between these four modes allows the prosthesis to correctly power the motor, and to maximize energy storage during braking. The prosthesis characteristics are optimized with artificial intelligence algorithms. Due to the large amount of computational effort required, the optimization algorithm is performed with parallel computing.

Modeling and Parameter Estimation of an Actuator for Prosthetic Joints

Washkewicz College of Engineering

Student Researchers: Bartholomew J. Brown and Katherine Florek

Faculty Advisor: Hanz Richter

Abstract

A mathematical model was developed for a linear actuator to be used in a powered leg prosthesis. The model consists of a differential equation relating motor voltage, external force and velocity. All model parameters were known from manufacturer's data, except inertia and friction. A numerical simulation was prepared to estimate these parameters from experimental data. Experiments were conducted and a numerical search was performed to arrive at parameter values that closely fit the data. The mathematical model will be used in subsequent control development work.

Is Steering Practice Task Dependent?

Washkewicz College of Engineering

Student Researchers: Dale Lewis and Seyed Amirhossein Hosseini

Faculty Advisor: Jacqueline Jenkins

Abstract

A driving simulation experiment was conducted to examine the performance improvement of participants while conducting a lane keeping task and two lane changing tasks on a straight road. Forty-four participants, sixteen females and twenty-eight males, drove one of three driving conditions. The data was analyzed to test whether 1) practice is better than no practice; 2) practicing a less challenging but similar steering task is good practice for a more challenging steering task; and 3) practicing a more challenging but similar steering task is good practice for a less challenging steering task. The results indicate that practicing the more challenging lane changing task had a significant impact on the performance of the subsequent, less challenging but similar task.

Reaction Engineering Routes to Waste Gasification for Sustainable Living Environments

Washkewicz College of Engineering

Student Researchers: Stephen A. Reeves, Mohammed S. Suleiman, and Joshua M. Cmar

Faculty Advisor: Jorge E. Gatica

Abstract

There is an increasing pressure to reduce waste generation and dependence upon fossil fuels in our society. The approach investigated in this project aims to address both concerns by formulating a low-temperature gasification process to process long-chain polymers typically found in municipal waste. Gasification routes which convert plastic and bio-waste into useful fuel syngas products has been extensively investigated. The novelty of the approach examined here consists on the use of a variety of catalysts, which can promote high conversion in gasification reactions at much lower temperature and pressure conditions. This route overcomes some of the financial and environmental shortcomings of typical gasification routes, such as incineration, currently in use as waste-management strategies. Utilizing a small batch reactor, the kinetics of several, predominantly polyethylene, waste simulants have been examined in the presence of both platinum and ruthenium-based catalysts. Using gas chromatography, the conversion of the carbon source was quantified and compared for the two different catalysts and different reaction conditions. Promising results were obtained, these results compare favorably with results found in the literature. A phenomenological model has been formulated to characterize the liquid phase gasification reactions and their interrelation with transport phenomena occurring in an heterogeneous reaction environment. Through the use of computational fluid dynamics (CFD), the effect of mixer speed on vortex shape has been modeled. These results are currently being incorporated into the model in the form of a detailed characterization of transport phenomena occurring during the gasification dynamics. Moreover, the refined model is anticipated to enable optimization of the reactor operation, and reducing or de-convoluting any transport limitation that may be affecting kinetic determinations.

Alternative Reaction Pathways to Metformin Hydrochloride

Washkewicz College of Engineering

Student Researchers: Mohammed S. Suleiman and Stephen A. Reeves

Faculty Advisor: Jorge E. Gatica

Abstract

Metformin Hydrochloride is an important pharmaceutical used for the treatment of type 2 diabetes. The current manufacturing of this product involves a well-known and proven process. The process includes the dissolution and reaction, followed by the precipitation of Metformin Hydrochloride. Although reliable and effective, the current process relies on the use of a solvent; which later needs to be eliminated from the precipitates. The purpose of this project is the investigation of an alternative reaction pathway which will avoid the use of solvents and simplify the final purification stage. The anticipated benefits include reduced costs for the processing and a final product which is closer to meet FDA and quality standards. These steps will eventually result in reducing the final market value of this important pharmaceutical. The investigation of different pathways was conducted using standard thermal characterization and surface analysis instrumentation. Namely, a differential scanning calorimeter (DSC) and a scanning electron microscope (SEM). The DSC was used for thermal characterization of the reactants and product standards; while the SEM was used to examine crystal morphology and elemental composition of reacting mixtures. Preliminary experiments were conducted using micro and laboratory scale solvent-less reacting environments. These experiments allowed identifying the presence of a single chemical reaction. The characterization results suggest that the alternative pathway can successfully synthesize Metformin Hydrochloride. Further characterization and testing protocols are currently being formulated.

3D Cultures of Human Liver Cell Lines Encapsulated in PuraMatrix on a Microarray Chip Platform

Washkewicz College of Engineering

Student Researchers: Pratap Lama, Alexander D. Roth, Pranav Joshi, and Akshata Datar

Faculty Advisor: Moo-Yeal Lee

Abstract

A high-throughput cell printing technology has developed to simulate the liver tissue environment using a hydrogel-based chip platform that has potential to shift *in vivo* drug toxicity models towards *in vitro* tests. However, the hydrophobic nature of polystyrene chips is not promoting direct adhesion of hydrogels, which created a problem with spot attachment. The main goal of this research is to create a surface chemistry that helps to attach a peptide-based hydrogel, including PuraMatrix, to a polystyrene-based micropillar chip. Seven analogs of maleic anhydride co-polymers were used to coat the micropillar chip to create a functional surface. Then, six ionic solutions were tested for inducing gelation of PuraMatrix. Formation of bubbles and spot detachment on the chip platform was quantified. As a result, an optimum polymer, PMA-OD was selected for surface attachment based on its low bubble formation and high spot attachment. This polymer could easily coat the chip for better gel adhesion. In regards to the gelation of PuraMatrix, poly-L-lysine was the most favorable for spot attachment and cell viability on the chip platform. In future research, encapsulated human liver cells expressing drug metabolizing enzymes will be tested with different drugs to determine mechanisms of drug toxicity.

High-Content, 3D Cell Culture Assays on a Micropillar/Microwell Chip Platform

Washkewicz College of Engineering

Student Researchers: Pranav Joshi, Akshata Datar, Alexander D. Roth, and Pratap Lama

Faculty Advisor: Moo-Yeal Lee

Abstract

High content imaging (HCI) is a multi-parametric assay using multiple fluorescent dyes that are relevant to specific cell functions. The HCI assays provide an insight into the mechanisms of toxic drug responses, thus enhancing predictability of drug toxicity. However, current HCI assays are performed on 2D cell monolayer cultures which are physiologically irrelevant, creating a new opportunity for better predictable 3D HCI assays. The goal of this research is to develop HCI assays on 3D cellular microarrays that can be implemented for various toxicity screening, leading to classification of drug toxicity via investigating profiles of cell injury. As a model system, Hep3B human liver cells were dispensed onto a micropillar chip with a microarray spotter, which were exposed to various concentrations of model drugs. The chip containing the cells was then stained with multiple fluorescent dyes and scanned with a chip scanner to measure different end points. Conclusively, HCI assays performed on the 3D cellular microarrays showed a capability to identify several mechanisms of toxic drug responses. The mechanisms including DNA and mitochondrial impairment, calcium homeostasis, and glutathione conjugation were successfully demonstrated on the micropillar/microwell chip platform. Computational algorithms along with additional assays will be developed for enhanced predictability.

The use of elastin-like polypeptides as a drug carrier material: A compatibility study

Washkewicz College of Engineering

Student Researchers: Michael G. Price, John P. Gavin, Eric Helm, and James T. Cole

Faculty Advisor: Nolan B. Holland

Abstract

Stimuli responsive self-assembling nanoparticles of elastin-like polypeptides are promising platforms for targeted drug delivery and release. These particles spontaneously assemble from elastin-like polypeptide building blocks in solution. The nanoparticles stably self-assemble under specific temperature, salt, and pH conditions and can dissociate upon changing of these conditions. With appropriate design, the surface of the particles can be decorated with labels that cause them to accumulate in specific diseased tissues. In addition, the size of the particles is appropriate to minimize undesirable rapid clearance from the body. In this study, we are testing the ability of the elastin-like polypeptide core to store and release drugs and model drugs with differing chemical properties. Three chemotherapeutic compounds were loaded into the core of the nanoparticles and the release profile of the drug was determined under conditions that disrupt the particle. This release was compared to baseline release profile of the drug. This study is important in establishing the ability of ELP based nanoparticles to act as triggered drug release vehicles.

Live Cell Imaging of Bone Marrow Stromal Cells on Nano-pitted and Polished Titanium Surfaces: A Micro-Incubator in vitro Approach

Washkewicz College of Engineering

Student Researcher: Zakaria Benmerzouga

Faculty Advisors: Surendra Tewari and Joanne Belovich

Abstract

Current orthopedic implants are not conducive for optimal integration of the biomaterial with newly-formed tissue (osseointegration) inside a patient's body. In this study, medical-grade Ti-6Al-4V was used as a substrate due to its biocompatibility and ability to facilitate cellular adhesion and proliferation. Live cell imaging was conducted on bone marrow stromal cells, genetically modified to express the green fluorescent protein (GFP), from the 24-96 hours growth period, with the first 24 hours of growth being held inside a lab-scale incubator. Periodic images were recorded on nano-pitted anodized and polished Ti-6Al-4V substrates to study how substrate-stiffness influences adhesion and proliferation. Collected images were analyzed for mitosis, adhesion, and filopodia-stretchability using ImageJ, an image processing program. Images were enhanced in order to perform cell counts at 24, 48, 72, and 96 hours of growth. Continuous recordings were produced to account for the number of mitosis occurrences and cellular migration on each of the substrates. Based on the conducted experiments, it appears that polished Ti-6Al-4V has a higher cell adherence than "nano-pitted" anodized surface and an improved rate of proliferation which may be because the cells once adhered on the nano-pitted surface have less ability to detach in-order to undergo mitosis.

Analysis of Smartphone Traffic

Washkewicz College of Engineering

Student Researcher: Nick Ruffing

Faculty Advisor: Ye Zhu

Abstract

Smartphones have become the central communication and computing devices in our daily life because of their nearly ubiquitous Internet access through various communication capabilities such as WiFi, 3G, or even 4G networks, their user-friendly interfaces supporting touch and gesture based input, and their numerous applications and games. Operating system (OS) detection, the first step to launch security attacks on a target smartphone, enables an adversary to tailor attacks by exploiting the known vulnerabilities of the target system. We investigate OS identification against smartphones that use encrypted traffic. We evaluate the identification algorithms against collected smartphone traffic. The experiments results show that the algorithms can identify a smartphones OS accurately.