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Nance College of Business Administration

An Integrated Look into the Pet Treat Market of London

Department of Marketing

Student Researchers: Julie Anielski, Cassie Cooper and Melanie Steele

Faculty Advisor: Thomas Whipple

CSU in England gave an opportunity to perform a market research analysis for a company in the Cleveland area that wanted to gain a perspective on the marketing possibilities to the London consumer market. The group's chosen company was Rusty's Paw All-Natural Pet Treats founded by owners Jayme Berta and Debbie Lucas. They wanted to develop a pet treat that is an alternative to store bought treats filled with preservatives. All of their pet treats are made with high quality, organic ingredients grown locally in the Cleveland area. The problem that Jayme and Debbie are facing is the lack of resources and knowledge to export the company's products to London. The research objective was to determine whether Rusty's Paw All Natural Pet Treats should export the company's product to London. This was determined by investigating the industry, distribution channels, and pet ownership. Aspects of consumer behavior and trends in the pet treats market in London were also investigated. To determine if there is a market demand in London, the research team studied the market demographics, preferences of pet treat brands, and the attractiveness of an all-natural treat to the British. The research also examined how pet treats are purchased and identified hindrances to anticipate including shipping costs, tariffs, and regulations.

Don Drumm Studios & Gallery

Department of Marketing

Student Researchers: Sanda Brezo, Johntay Brown, Colleen Hill, and Nan Noeum

Faculty Advisor: Thomas Whipple

Don Drumm broke new ground when he pioneered the use of cast aluminum as an artistic medium in the late 1950's. Experimentation is the heart of artistic expression and Mr. Drumm is no stranger to trying new things, working steadily as a creative machine in his gallery and studio. Don Drumm Studios & Gallery is a powerful force in the Akron, Ohio art community and has grown into an accomplished enterprise since its opening in 1971. The question that my group was concerned with was whether the artists handcrafted pewter and aluminum fine crafts would be able to successfully penetrate abroad the London market.

The purpose of this project was to research the opportunity of Don's artwork in the London market and recommend whether he should pursue selling his contemporary fine art crafts in London, England. We spent two weeks, May 10th through the 24th, in London conducting primary research by interviewing local art gallery owners and patrons. We also gathered secondary research from the British Library and via internet sources.

The compiled research was used to make recommendations to Don Drumm Studios & Gallery in regards to whether there is opportunity in penetrating the fine crafts market in London successfully.

Therefore, data gathered from secondary research and London interviews/surveys shows that there is a viable market for Don Drumm's pewter and aluminum fine art crafts. With that being said, the London art market has ample opportunity for many different genres and subcultures of artwork and crafts and the two weeks in London allotted for this project were not a sufficient amount of time to come to a definitive conclusion.

Nevertheless, it is in the best interest of Don Drumm Studios & Gallery to pursue a more extensive project in which market researchers pursue the best location within the London area to showcase Don's art in an existing studio. From there, Drumm can open his own Gallery in London based upon how well his art sells. In the mean time, Don's website should be emphasized as a means of selling abroad in the London market while further research is conducted as to how and where to sell it in London, England.

College of Education and Human Services

Using Science Probes to Describe Science Misconceptions Held by Pre-Service Elementary Education Majors

Department of Teacher Education

Student Researchers: Katherine Buettner and Donald Lyman

Faculty Advisor: Robert Ferguson

Pre-service elementary teacher who hold science misconceptions run the risk of perpetuating these poorly formed ideas in their future classrooms. In this study, we qualitatively collected and described several misconceptions about science held by pre-service preK-3 teachers. Sixteen pre-service teachers enrolled in Science Instruction in Preschool and the Primary Grades (ECE 417/517) at Cleveland State University participated in a blind study. Two undergraduate science majors sat in the science class acting as observers and teaching assistants. They watched, listened and probed for content knowledge of the participants. In order to elicit conversations about science, many of the students' activities involved science probes (digital, handheld data collection devices like a temperature probe). Analysis of the observations was completed via an inductive approach. Misconceptions regarding the physical sciences about electricity, magnetism, pH and heat emerged. Implications for the pre-service teachers to teach inquiry based science and for the future students of the pre-service teachers are discussed.

Members' Perception of YMCA Program and Facility Service Quality

Department of Health, Physical Education, Recreation and Dance

Student Researchers: Matthew Grassi and Bryan Henson

Faculty Advisor: Eddie T. C. Lam

Service quality has long been recognized as one of the major elements that affects member retention (McDonald & Howland, 1998). Program element can be used to assess service quality and customer satisfaction in the health-fitness setting; whereas physical facility has been used to evaluate customers' perceptions of service quality (Brady & Cronin, 2001). The purpose of this study was to examine service quality of the YMCAs using the Service Quality Assessment Scale (SQAS; Lam, Zhang, & Jensen, 2005). Participants (N=326) consisted of 26% male and 74% female members. Results of one-sample t-tests showed that mean perception scores for all items of the SQAS were significantly ($p < .001$) different from the median score. This indicated all members were satisfied with the service offered by the YMCAs. Post hoc analyses showed that members who visited the center between 6:00 p.m. and 11:00 p.m. were more disappointed than those who used the facility during other times (between 5 a.m. and 6 p.m.). In addition, members who used the facility once or twice a week were less satisfied than those who used the facility 3-6 times a week. It is suggested that the management should allocate more resources and personnel to this area.

Film Analysis as an Integrated Part of Sport Sociology Courses: Students' Perspective

Department of Health, Physical Education, Recreation and Dance

Student Researcher: Stany Matungulu

Faculty Advisor: Eddie T. C. Lam

Since the classroom is not a practice setting, course instructors have to rely on other teaching aids to illustrate theories and principles in the classroom (Downey, Jackson, Puig, & Furman, 2003). Some textbook packages even include interactive videos and computer simulations (Haney & Leibsohn, 2001). More recently, researches have shown that effective use of films as teaching aids can enhance students' learning. Nevertheless, little is known about the attitudes of students when films analysis was used in a class setting. The purpose of this study was to examine students' attitude towards film analysis as a teaching aid in sport sociology classes. First, the 11-item Film Analysis Attitude Scale (FAAS) was formulated. It was then administrated twice (before and after the film analysis assignment) to students (N = 122) who enrolled in sport sociology classes between the years 1998 and 2004. Results of the exploratory factor analysis identified three factors: Preference (5 items), Enhancement (3 items), and Interaction (2 items). One item was removed because of double loading (> .37). Cronbach's alpha for the three factors were .76, .77, and .76, respectively. Paired sample t-tests indicated that students had a significant ($p < .001$) more positive attitude towards film analysis after the assignment.

Decision Factors that Influence Spectators Attending Arena Football Games

Department of Health, Physical Education, Recreation and Dance

Student Researcher: Amanda Sapara

Faculty Advisor: Eddie T. C. Lam

Game attractiveness and marketing promotion as well as economic variables have been found to be positively related to game consumption (Baade & Tiehen, 1990; Noll, 1991). The purpose of this study was to identify variables that might have an influence on spectators' decision to attend arena football games. The measuring instrument, Decision Factor, was administered to spectators during an arena football game in 2008. Item responses were based on a 7-point Likert scale. A total of 363 questionnaires were useable for data analysis. One-sample t-tests showed that 10 variables were significant ($p < .05$) from the median score. *Football Fan* had the highest mean score, indicating spectators attended the game simply because they were football fans. The next two variables with the highest mean scores were *Entertainment Value* and *Affordable Ticket.* The average ticket price of the National Football League in 2007 was $67, compared to only $24 for the Arena Football League. This attracted fans to the games. Though the team provided such entertainment as fireworks and pre-games shows, what the fans enjoyed most was the performance of the dancing team and cheerleaders. For this reason, they should be well presented during the games or included in game promotion materials.

Development of the Spectator Motivation Inventory (SMI) for Professional Sports

Department of Health, Physical Education, Recreation and Dance

Student Researcher: Brendan Downs

Faculty Advisor: Eddie T. C. Lam

Most research studies examined the determinants of spectator attendance were concentrated on professional or minor league games (e.g., Becker & Suls, 1983; Wakefield, 1995; Zhang, Pease, Smith, Lee, Lam, & Jambor, 1997), little research has been done on minor league football (i.e., Arena Football League). The purpose of this study was to develop the Spectator Motivation Inventory (SMI) to examine factors that might have influenced fans' decision to attend arena football home games. Development of the SMI was carried out in two steps: (a) formulation of the preliminary scale and test of content validity, and (b) test administration and an exploratory factor analysis. The 30-item SMI was administered to spectators during an arena football home game in a large metropolitan area in the Midwest region of the United States. Participants (N = 391) were male (64%) and female (36%) spectators. Results of the exploratory factor analysis indicated that the SMI included two factors and 28 items: Decision (16 items) and Promotion (12 items). The alpha reliability coefficients of the Decision and Promotion factors were .932 and .929, respectively. It was concluded that the SMI was a reliable scale in measuring spectators' decisions in attending arena football games.

Promotional Strategies and Their Relationship with Future Game Attendance

Department of Health, Physical Education, Recreation and Dance

Student Researcher: Shaina Carter-Fernandez

Faculty Advisor: Eddie T. C. Lam

As the sport industry has continued to thrive, marketing research has grown as a necessity in measuring progress and determining factors that may help to increase revenue streams. Relative to increasing market production, one of the most sought after correlation in sport marketing is the relationship between game attendance and the marketing techniques that generate a crowd response. Numerous recent studies have been conducted to explore the utilization of the marketing mix in fan appeal, retention and expanding fan base (e.g., Bauer, 2008; Donihue, 2007; Meehan, 2007). The purpose of this study was to examine the promotional strategies used by an arena football team and their relationship with future game attendance. Based on the team management, 12 promotional strategies were identified. The measuring instrument was administrated to spectators during an arena football home game in May 2008. Participants were asked to rate the importance of the variables in increasing home game attendance. Results indicated that *Direct Mail* and *E-mail Offer* had the lowest ranking. On the other hand, variables with the highest ranking were *Giveaways*, *Television Adverting*, and *Good Public Relations.* These variables, together with *Mini-Pack Ticket Plans*, showed a significant ($p < .05$) relationship with future home game attendance.

A Comparison of Energy Expenditure in College Students Using a New Generation Active Computer Game vs. Traditional Physical Activity

Department of Health, Physical Education, Recreation, and Dance

Student Researchers: Jennifer Wieand, Kristen Perusek, Amanda Sapara, Shaina Carter-Fernandez, Zach Smith, Brad Blevins

Faculty Advisors: Kathleen Little, Ph.D., Mary Motley, M.A., Sheila Patterson, Ph.D., Kenneth Sparks, Ph.D.

New video computer games, such as the Nintendo Wii sports games, allow users to physically interact while playing the sport. **Purpose:** The comparison between energy expenditure, heart rate, steps, and perceived exertion during heavy bag boxing vs. the Nintendo Wii boxing game was investigated. **Methods:** Fifteen males and 14 females, ages 18 to 40 years, randomly selected the heavy bag or Wii on their first test session. Participants completed 30 minutes at each session with a minimum of two days rest between sessions. The COSMED K4 portable oxygen analyzer measured heart rate, oxygen consumption, and energy expenditure. A pedometer measured total steps taken, and participants rated their perceived exertion on the Borg Rating of Perceived Exertion Scale. **Results:** Significant differences were found for average heart rate (bag=156 bpm, Wii=138 bpm) and perceived exertion (bag=13.8, Wii=11.4). However, energy expenditure (bag=8.0 kcal/min, Wii=7.1 kcal/min) and total steps (bag=3283 steps, Wii=3190 steps) did not differ significantly. The only significant gender difference was energy expenditure due to the larger body mass of the males. **Conclusion:** The results suggest that interactive video computer games, such as the Nintendo Wii, have the potential to provide similar energy expenditure as actual physical activity/sports participation.

Facilitating Pretend Play Skills in Young Children:

Does Teaching Approach Matter?

Department of Teacher Education

Student Researchers: Rosemary Shields, Zach Kantouros, Manshi Patel and Marjorie Hamers

Faculty Advisor: Connie S. Wong

Not only do children enjoy playing, they can learn and practice a range of skills and behaviors while playing. But when children engage in symbolic play, such as pretending that a bowl is a hat, they are engaging in the type of play that best promotes their social, cognitive, and language development. However, what teaching approaches best promote creativity and imagination in play?

In this ongoing research project, ten toddlers from the Cleveland State University Child Development Center were randomly assigned to a play intervention using either a structured teacher-led direct instruction approach or a naturalistic child-led approach. Each child was assessed on measures of play and attention and on visual, motor, receptive language, and expressive language skills and receiving eight 15-minute individual play sessions with trained undergraduate student researchers. Preliminary results indicate that children seem to master the target skill quicker with a structured approach but have more opportunity to demonstrate higher levels of symbolic play in the naturalistic approach.

Undergraduate research assistants also had the opportunity to analyze early childhood curricula for symbolic play and joint attention skills and examine imitation and language skills in young children with autism and other developmental disabilities.

Fenn College of Engineering

Biodiesel from Microalgae

Department of Chemical and Biomedical Engineering

Student Researcher: Colin Welter

Faculty Advisor: Joanne Belovich

Introduction: With the projected "peak oil" of fossil fuel at our doorstep, there has been an increasing trend towards deriving these oil feedstocks from renewable bio-sources. While common food crops such as soybean, sunflower, and canola have an extensive history of cultivation, several other alternatives have been receiving renewed interest, most notably microalgae.

Abstract: *Scenedesmus dimorphus*, an oliagenous microalgae, was grown autotrophically in the lab under controlled conditions to establish baseline characteristics of cell growth and maintenance. This cell line was then scaled-up by volume as part of an upstream population that was then subsequently utilized downstream for a novel gravity settling device designed by a member of our research lab. *S. dimorphus* was isolated from a culture provided by the UTEX Culture Collection. The culture was initially propagated on agar slants and then inoculated into 20 mL static volumes of a modified Basal Bold media and characterized for medium-term maintenance. The cultures were also propagated in 50 mL volumes at 30±1 degree C, 100 ft-c light (2x21W T5 –3000K and CRI of 85), and sparged with 0.1 LPM air at STP. At these parameters, a comparison between a standard modified Basal Bold media and a proteose-peptone enriched media were made. It was determined that the protein enrichment gave the culture an initial 5-8 day boost that allowed the culture to achieve stationary phase ≈40% sooner at equivalent cell densities of $3x10^7$ cells/mL. *S. dimorphus* was further scaled-up to 1.5 L working volumes. Growth parameters were changed to optimize cell growth: light at 1000 ft-c, sparging at 0.3 LPM with 3% CO_2 in air at STP, and culture temperature maintained at 33±1 degree C in a shaker bath. Overall culture density at early stationary phase did not significantly change during scale-up under these new conditions. Growth curve analysis showed that the modified Basal-Bold media in 1.5 L volumes supported a 32% increase in growth rate vs. protein enrichment under identical conditions.

Conclusions: *S. dimorphus* showed good overall growth characteristics under varying protocols. Ultimate cell density in either media

never exceeded much over $5.0x10^7$ cells/mL. In eight trials in 1.5 L volumes, under identical conditions, the growth rate of the cells in the modified Basal-Bold media exceeded the growth rate in enriched media. Further studies need to be performed in order to further optimize the media and growth parameters to achieve higher cell densities. *S. dimorphus* shows good early promise as a microalgae candidate for biodiesel production due to its growth rate in basic media and high sedimentation velocity.

Image-Based Construction of Computational Models of Cardiovascular Disease

Department of Chemical and Biomedical Engineering
and
Imaging Institute, The Cleveland Clinic

Student Researchers: Cathleen O'Grady, Sahitya Pidaparthi, and Navneeth Lakkadi

Cleveland Clinic Research Collaborator: Randolph Setser

Faculty Advisor: George Chatzimavroudis

The future of health care is in personalized medicine. One of the most appealing fields of cardiovascular research has lately been to develop patient-specific computer models of the cardiovascular system, which would help the clinician design a successful treatment strategy, specific for each patient. To determine the potential of image-based model construction, experimental models of a stenosed artery and of the left ventricle of the heart, which were developed at Cleveland State University, were scanned in an MRI scanner at the Cleveland Clinic. The models were mounted on a flow loop to simulate the physiologic blood flow environment. A set of sequential images were acquired to provide information about the anatomy of the models. The images were transferred to Cleveland State University for processing with specialized software packages. The real wall of the models was first identified in the images and its spatial coordinates per imaging slice were determined. Based on this data, the computational wall of each model was reconstructed for each image. Processing this information for all images collectively resulted in the complete computational reconstruction of the real experimental models. Comparison between the results in the experimental and the computational models showed agreement, suggesting that image-based CFD has great clinical potential.

Project Title: Field Implementation of Pervious Concrete Pavement Technology

Department of Civil and Environmental Engineering

Student Researchers: Tom Hyatt and Dan Fabriziana

Faculty Advisor: Norbert Delatte

Pervious concrete pavement technology has important potential green building, sustainable development, and storm water mitigation benefits. It allows water to flow directly through the pavement into soil or a holding system, rather than running off across the surface.

Portland Cement Pervious Concrete (PCPC) has an excellent performance history in the Southeastern U.S., but until recently has seen little use in environments with significant freeze thaw cycles. Therefore, assessment of actual field performance is important. Previous CSU research documented field observations, and nondestructive testing results of PCPC sites located in the states of Ohio, Kentucky, Indiana, Colorado, and Pennsylvania. PCPC is most often used as a pavement for parking lots. CSU has installed two pervious concrete pavement demonstration sites on campus, Parking Lot D in summer 2005 and Administration Building in summer 2007.

Field performance depends on the quality of the mixture as well as proper control of construction and curing. In addition to field observations and nondestructive testing, laboratory testing may be performed on cores removed from test sites. Cores were extracted from four different test sites in Northeast Ohio and tested extensively in the laboratory. Drainage of the two existing CSU sites was also tested.

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Thermal Characterization of Thin Film Deposition Processes

Department of Chemical and Biomedical Engineering

Student Researcher: Andrew J.R. Snell

Faculty Advisor: Jorge E. Gatica

Corrosion resistance and energy efficiency have long been driving forces to substitute low-carbon steels by more advanced materials. In the automotive and aerospace industries, structural materials commonly require a complex sequence for processing. Indeed, most structural materials require machining and the application of surface layers before ulterior processing. Some coatings might be required to be resistant to corrosion or act as chemically resistant coatings. One step that has proven to be an engineering challenge is surface pre-treatment process. With newfound environmentally friendly processes, chromates-based technology traditionally used as surface pre-treatment processes, have become a target for elimination by the United States Environmental Protection Agency (EPA).

My research project at CSU was aimed to characterize solutions of aryl phosphates and inter-metallic acetates, a proven efficient metal-working fluid, as precursors for conversion and protective coatings. With a new state-of-the-art Differential Scanning Calorimeter, I first compared a set of previous CSU coating characterization experiments to those performed using the new unit. The DSC cell enabled us to characterize deposition reactions, to correlate thermal properties, and to estimate kinetic parameters. Kinetic analysis of these experimental data yields a phenomenological model of the coating process, which can later be used for design and scale-up of the coating process. With the assistance of a sophisticated finite-element modeling environment, COMSOL^{TM} Multiphysics, we anticipate elucidating the complex interaction between transport phenomena and chemical kinetics occurring in deposition environments. We envision comparing these predictions for small and medium-scale deposition experiments.

Optimization of Biosynthesis and Purification of Antifreeze Proteins

Department of Chemical and Biomedical Engineering

Student Researchers: Haider H. Malik and Jonathan M. Allen

Faculty Advisor: Nolan B. Holland

Antifreeze proteins (AFPs) are ice-binding proteins found in various organisms (fish, plants, insects, bacteria) exposed to environments below 0˚C, aiding their survival by preventing ice crystal growth. AFPs depress the solution freezing point in a non-colligative manner, resulting in greater freezing point depression at lower solute concentrations. We expressed and purified two fish AFPs, an α-helical alanine-rich Type I AFP and a globular Type III AFP. The genes encoding the AFPs were in pET20b expression plasmids transformed into BL21*(DE3) *E. coli* cells. Optimal conditions for expression of the AFPs were determined using a design of experiment (DOE) based on the Taguchi method, which allowed us to analyze the effects of seven different chosen parameters at two levels each. The experimental plan consisted of eight experiments. Protein samples from the runs were quantified using polyacrylamide gel electrophoresis (PAGE) on the whole cell extract. To purify the AFPs, we exploited their unique property of being incorporated in growing ice crystals, while other solutes are excluded. We built a cold finger to grow multi-crystalline ice from cell extract solutions. The ice fraction contained purer fractions of AFP than the remaining solution. We analyzed the yield and purity of the protein using PAGE.

Turning Chemistry Upside Down

Identification of Real Compounds from Molecular Models

Department of Chemical and Biomedical Engineering

Student Researcher: John Tatarko

Faculty Advisor: Rolf Lustig

Prediction and correlation of thermo-physical properties of fluids is of the utmost importance in the design of chemical, power and refrigeration processes. The chemical industry currently produces approximately 1000 compounds for actual use. Of these, the complete thermodynamics of perhaps a dozen are known. To date actual laboratory experiments were necessary to determine properties as a function of temperature and pressure. The compilation of data over the entire fluid range requires decades of man-hours and huge financial investment in experimental equipment. The evolution of high-speed, inexpensive computing tools has made it possible to perform virtual laboratory experiments at greatly reduced cost via molecular simulation. The underlying principle is statistical mechanics, a rigorous and fundamental theory in physics. The objective of the research project is the application of statistical mechanics to applied process engineering. We have chosen to study hexagonal models because a large number of chemical compounds fall into this class. These hexagons have 6 sites at the corners each of which interacts with all the sites of other hexagons. Specifying such interaction defines a molecular model. In our case, these site-site interactions are of the so-called Lennard-Jones type. It is the size of the hexagon which varies from substance to substance. In this work we have identified 50 real substances which qualify. The research conducted this summer is a prerequisite for an ongoing large-scale simulation project. The thermodynamics of hexagons of widely varying sizes will be determined via molecular simulation. The overall strategy is demonstrated with an example.

Zeolite Membrane Permeation: Modeling and Validation

Department of Chemical and Biomedical Engineering

Student Researcher: John Beard

Faculty Advisor: D.B. Shah

Zeolites are crystalline aluminosilicate absorbents that have a distinctly defined pore structure. In comparison to other absorbents in its class (i.e. silica, alumina, or activated carbon), zeolites have pores that are of uniform size and thus show no pore size distribution. As a result of this unique feature, they can be used to separate chemical species based on size, shape, and configuration. In this work, we have attempted to investigate the conditions under which a hydrocarbon separation based on molecular size, shape, and adsorptive and diffusive properties can be accomplished.

In the analysis of zeolite diffusion and permeation, a mathematical transport model is required in order to simulate and fully understand the overall separation process. In this study, multiple components are used in a set feed stream and are allowed to diffuse and permeate across a zeolite membrane. A model based on the Maxwell-Stefan equations developed by Krishna [1] was used to simulate the permeation behavior of mixtures. Two separate scenarios associated with weak and strong interactions were investigated. The simulated results obtained from the solution of the model equations matched well with those derived from more rigorous calculations. The present work shows that a simplified transport model can allow one to simulate the diffusive and adsorptive properties of a hydrocarbon mixture across a zeolite membrane.

References

1. R. Krishna, R. Baur, *Analytic solution of the Maxwell-Stefan equations for multicomponent permeation across a zeolite membrane*, Chemical Engineering Journal, 97 (2004) 37-45.

Improving Work Zone Safety Using Sensor Networks

Department of Electrical and Computer Engineering

Student Researchers: Mehrdad Ramezanali, Ishu Pradhan, Nilesh Patel, Joe Gotschall, Lawrence Edem, and Manohar Bathula (graduate student)

Faculty Advisor: Nigamanth Sridhar

Safety hazards encountered near construction work zones on highways are numerous, both in number and in kind. There is a need to monitor and improve vehicle and driver safety on highways, especially in construction work zones. In the past, traffic monitoring systems built using high-cost equipment such as inductive measuring plates, video cameras etc. have been proposed. These solutions are too cost-prohibitive to be used ``in the large.'' Moreover, extracting data from such systems for use in analysis and feedback to the design process for safe work zones is too computationally intensive.

Wireless sensor networks provide an opportunity space that can be used to address this problem. In this poster we present results from some initial prototypes that we have built to study the problem of traffic flow through a work zone, and to use such traffic flow data to inform the design of safer work zones (both for drivers and for workers). We have implemented a testbed to observe traffic parameters such as traffic density in a region, flow in that region, and average speed of vehicles moving through the region. Using this data, traffic flow is regulated near the construction work zones.

College of Liberal Arts and Social Sciences

Vernacular Landscapes and Economic Decline:

Urban Place in the 20th Century

Department of History

Student Researchers: Kristen Dute, Kieth Peppers, Angela Robinson

Faculty Advisors: Mark Tebeau & Mark Souther

Three researchers studied University Circle as a lens for viewing the changing contours of American cities. They examined the gradual acceptance of historic preservation, evolving sensibilities toward park space, and community-institutional relations against the backdrop of massive development in one of the nation's largest "eds and meds" and cultural districts.

Kristen Dute traces how pockets of historic residences in the Circle survived massive development spurred by the 1957 University Circle master plan, finding a pattern of grassroots activism coupled with university use of mansions responsible for buying time until a more favorable view of preservation emerged.

Kieth Peppers argues that University Circle from its inception saw buildings devour open space, a trend that accelerated after 1957. In contrast to New York's Central Park, which he uses as a point of comparison, University Circle never enjoyed the same commitment to preserving green space. Thus, the Circle's parklands got whittled away as planning favored institutions' expansion.

Angela Robinson suggests that the umbrella organization overseeing development planning after 1957 never adequately understood or embraced the master plan's recommendation to reach out to surrounding neighborhoods. Drawing on oral histories, she argues that University Circle remains somewhat removed from the communities around it.

FR:AMES (Film Research: Advanced Methods for Empirical Study)-- The Kuleshov Experiments Revisited

School of Communication

Student Researchers: Dan Griffith, Sian Wright, Rachel Campbell and Angelia Sciulli

Faculty Advisors: Evan Lieberman and Kimberly Neuendorf

The experiments conducted by Lev Kuleshov and his students at the VGIK in the Soviet Union during the 1920s form an important basis for our understanding of the workings of the cinematic language. The "Kuleshov Effect" posits that meaning in the moving image is not conveyed by the contents of an individual shot but rather by the juxtaposition of that shot with another by means of the edit. Long accepted as fact in the field of film studies there has until now never been an adequate empirical testing of Kuleshov's ideas under controlled clinical conditions. By producing a film that replicates as closely as possible the elements of Kuleshov's reported experiments, and developing a survey instrument to determine actual viewer response to these images and juxtapositions, the FRAMES group has undertaken a large scale examination of the real operations of signification in the moving image. Using the Media Lab software package, test subjects will be shown a variety of image combinations drawn from the stimulus film and will either view the film in its entirety or only in smaller sections to analyze the mechanisms by which image content and juxtaposition work to convey meaning to an audience.

FR:AMES (Film Research: Advanced Methods for Empirical Study)-- Audience Responses to Widescreen vs. Pan & Scan

School of Communication

Student Researchers: Dan Griffith, Sian Wright, Rachel Campbell and Angelia Sciulli

Faculty Advisors: Evan Lieberman and Kimberly Neuendorf

Two experiments tested differences in audience responses to images presented in authentic film widescreen aspect ratios vs. the 4x3 pan and scan TV/video format. Study 1 examined eight static images; Study 2 used four different moving image (film) clips. Both utilized the Media Lab experimental data collection system. A total of 111 subjects participated. Study 1 (static images) found an overall preference for widescreen, with it being perceived generally as more exciting, complex, colorful, pleasant, positive, and chaotic ($p<.05$). No differences were found with regard to presence, the sensation of immersion in a mediated presentation. Study 2 (moving images) also found a preference for and more positive evaluations of widescreen, and also found widescreen to be associated with a greater sensation of presence. However, one particular film/stimulus obtained a reversal of these findings, indicating an important content/form interaction that calls for further investigation. Across both studies, preference for widescreen aspect ratios in the home was significantly predicted (total R-sq = .44) by background factors that included being a film fan, habitual group television viewing, experience with the arts of poetry and videography, being nearsighted, and having HD in the home.

College of Science

Activation of Mitogen Activated Protein Kinase Mapk and IKB/NF-KB Pathways by Analogs of Cyclovirobuxine D

Department of Chemistry

Student Researchers: Ameer Lotfi-fard and Imaan Benmerzouga

Faculty Advisor: Aimin Zhou

Many diseases have been treated with drugs made from natural molecules that display a diversity of biochemical functions. Cyclovirobuxine D an active compound extracted from Buxus microphylla is being used to treat angina and myocardial infarction in the clinic in China. The pharmaceutical application for Cyclovirobuxine D includes: reducing cardiac muscle quantity of cost oxygen, and reduces the scope of myocardial infarction. Moreover, a recent study indicated that Cyclovirobuxine D significantly increased cardiomyocytes viability injured by oxidation or hypoxia. However, the molecular and biochemical mechanism of the compound action is largely unknown. Understanding the molecular mechanism by which Cyclovirobuxine D functions is of great interest to us.

We are investigating the effect of ZW-3, ZW-Z, LHF-A and LHF-Z analogs of Cyclovirobuxine D, on cell signaling. Interestingly, we have found that ZW-3 is able to activate both the mitogen activated protein kinase (MAPK) and IkB/NF-kB pathways in A10 cells, a rat embryonic thoracic aoratic medical layer myoblast cell line, and Raw cells, a mouse macrophage cell line. ZW-3 treatment induced the phosphorylation of extracellular signal-regulated kinase (ERK), the c-Jun NH2-terminal kinases (JNK) and degradation of IkB-alpha. In addition, the mechanism by which ZW-Z, LHF-A and LHF-Z function is similar to the action of ZW-3, with different treatment time interval responses.

The MAPK and IkB/NFkB pathways have been demonstrated to be involved in cellular proliferation. Thus our results suggest that the beneficial effect of Cyclovirobuxine D on patients with heart diseases may be through promoting the recovery of damaged cardiovascular cells.

Polymeric Nanoparticles as Drug Delivery Agents: Exploring Loading Capacity

Department of Chemistry
Department of Physics

Student Researcher: Adesola Saba

Faculty Advisor: Mekki Bayachou and Kiril A. Streletzky

Hydroxypropylcellulose (HPC), a non-carcinogenic macromolecule and FDA-approved food additive, forms microgel nanoparticles that can serve as a drug delivery system. Microgel particles form by self-association of amphiphilic molecules and can serve as reservoirs for controlled drug delivery and release.

The proposed project focuses on a pilot study that investigates drug loading of microgel HPC particles as well as the dynamics of temperature-induced drug release. The study uses dynamic light scattering (the Streletzky Lab) as well as Fourier Transform Infrared and Atomic Force Microscopy (AFM) coupled to electrochemical methods for imaging and detection purposes, respectively (The Bayachou Labs).

Acetaminophen (Tylenol®) was used as a model redox-active drug to follow the release/uptake capacity of HPC microgel particles. Dynamic light scattering study on synthesized HPC particles used in this study confirmed their nominal diameters. AFM characterization in solution showed a distribution of sizes with presence of small, non-crosslinked, polymer strands. We used flow-injection amperometry to evaluate the loading capacity of HPC microgel particles. Preliminary results show moderate acetaminophen uptake levels that vary with the nominal size of the particles. Temperature-controlled release of acetaminophen from loaded HPC particles was also followed by amperometry. The results will be discussed in the context of the ability of HPC particles to serve as temperature-driven drug release vehicles.

Effects of Increased Cholesterol Levels on the Molecular Activity of Membrane-Bound Proteins

Department of Chemistry

Student Researchers: Noufissa Zanati, Mchaelellen Mathews, John Moran, and Alan T. Riga

Faculty Advisor: Mekki Bayachou

Cholesterol is a major risk factor for cardiovascular disease which has been the number one killer in the United States since 1919. This disease comes with an estimated cost of over $448 billion.

The long-term goal of this investigation is to study the effects of increased cholesterol levels on the activity of the membrane-bound nitric oxide synthase (NOS) enzyme that is critical in the functioning of the cardiovascular system.

We used thermal and electrochemical methods to assess the effect of increased cholesterol levels on the molecular dynamics of this enzyme. Differential Scanning Calorimetry showed melting and recrytallization of components in phosphatidylcholine cholesterol./protein films. On the other hand, the fluidity of phospholipid films as a function of cholesterol content was evaluated using electrochemical techniques. Cyclic voltammetry was used to measure changes in the transport properties of a redox probe through the thin film, which gave an indication of changes in the PC/cholesterol film rigidity. Enhanced electrochemical current activity was observed in a transition temperature range close to the range where crystallization and melting is detected by the thermal methods. The results will be discussed in the context of the dynamic hypothesized modulation of NOS function with increased levels of cholesterol.

Dissecting the Interaction Between TBTRF and TB1710

Department of Biological, Geological and Environmental Sciences

Student Researcher: Clara Antoury

Faculty Advisor: Bibo Li, Ph. D.

Telomeres, the nucleoprotein complexes at the ends of linear chromosomes, are essential for protection of chromosome ends from illegitimate nucleolytic activities, DNA repairs, and recombination events. Telomere biology has been implicated in tumorigenesis and cellular aging, and the telomere protein complex is critical for these functions.

Trypanosoma brucei is a protozoan parasite that causes sleeping sickness in humans. In human bloodstream, T. brucei regularly switches the Variant Surface Glycoprotein (VSG) gene expressed to evade host's immune attack. VSG genes are expressed exclusively from VSG expression sites (ESs) located at subtelomeric loci. Interestingly, only one of ~ 19 nearly identical ESs is fully active at any time, resulting in monoallelic expression of VSG.

We have recently found that the telomere complex plays an essential role in VSG monoallelic expression. To further elucidate the telomere functions in VSG control, we did a yeast 2-hybrid screen using tbTRF – an essential telomere binding factor – as bait and identified an unannotated protein tb1710. We confirmed that full-length tbTRF interacts with full-length tb1710 and are investigating which domains of these proteins are essential for the interaction. The various domains of tbTRF and tb1710 are subcloned and tested in yeast 2-hybrid analysis.

A Role for Cell Cycle Checkpoints in the Apoptosis Associated with Skeletal Myoblast Differentiation

Department of Biological, Geological & Environmental Sciences

Student Researchers: Greg Kliment and Kevin Feeback

Faculty Advisor: Crystal M. Weyman

Programmed cell death (apoptosis) is induced at the same time as differentiation in skeletal myoblasts. These two processes are initiated by culture in differentiation media (DM) and result in mutually exclusive endpoints. However, the simultaneous regulation of these processes is not understood. We hypothesized that myoblasts undergoing apoptosis rather than differentiation are those that are past the G1/S cell cycle checkpoint. Apoptosis might be a consequence of the cleavage of cyclin E, a protein that is only synthesized past the G1/S checkpoint, or in response to the intra-S-phase checkpoint activated by unreplicated DNA. To test this hypothesis, we assessed the expression and cleavage of cyclin E. In accordance with our hypothesis, we found cyclin E expression predominantly in apoptotic myoblasts. However, the cyclin E was not cleaved. Next, we assessed the phosphorylation of Chk1, a marker indicative of activation of the intra-S-phase checkpoint. We determined that myoblasts cultured in DM have a higher level of phosph-Chk1 when compared to myoblasts cultured in GM. However, myoblasts cultured in DM are a mixed population of those undergoing differentiation and those undergoing apoptosis. Thus, future experiments will be to compare the level of phospho-Chk1 in differentiated myoblasts compared to apoptotic myoblasts.

New Potential High Energy Materials. High-Level Calculations on the Properties of Aminonitromethanes

Department of Chemistry

Student Researcher: Kelly Y. Mathews

Faculty Advisor: David W. Ball

In this study, we explore the possibility that methane substituted with one or two amino and nitro groups might act as high energy materials. G2 and G3 calculations were performed to determine optimized geometries, vibrational frequencies and spectra, enthalpies of formation, and enthalpies of combustion or decomposition of aminonitromethane and diaminodinitromethane.

Organic Chlorate and Perchlorate Derivatives as High Energy Materials: High-Level Computations on Methyl Chlorate and Methyl Perchlorate

Department of Chemistry

Student Researcher: Sara L. Brunswick

Faculty Advisor: David W. Ball

Although chlorate and perchloratre are well known as oxidizers, the study of organic chlorate and perchlorate compounds as potential high energy materials has not been explored. Here, we present molecular properties, including enthalpies of formation and decomposition, of methyl chlorate and methyl perchlorate. Both isomers of methyl chloragte – the Cl-bonded and the O-bonded – were examined.

Crystallization of the Catalytic Subunit of M. Jannaschii Aspartate Transcarbamoylase with the Anticancer Drug PALA.

Department of Physics

Student Researchers: Jonathan Allen and Khadidja A. Benmerzouga

Faculty Advisor: Jacqueline Vitali

ATCase is the enzyme that catalyzes the committed step in pyrimidine biosynthesis, the reaction between carbamoyl phosphate and aspartate to form carbamoyl aspartate and inorganic phosphate and is an important site of regulation in many organisms. The catalytic and regulatory chains of this enzyme from the barophilic and thermophilic archaeon *Methanococcus jannaschii* have been expressed in *E. coli*. During the past summer we purified the catalytic subunit and tried to crystallize it in the presence of the anticancer drug PALA which is an analog of both its substrates. Obtaining suitable crystals is an essential first step for carrying out X-ray diffraction to determine the structures of these complexes. Our results of these crystallizations will be presented. This work gives insight into the mechanism of catalysis by this important enzyme and helps design drugs against cancer.

Functional Analysis of Constructed Wetlands in West Creek Reservation

Department of Biological, Geological and Environment Science

Student Researchers: Mallory Karpy, Brian Blagg, Ynes Arocho and Michelle Canatsey

Faculty Advisor: Julie Wolin

Two wetlands were created in 2002 on reclaimed land at the Cleveland Metro Parks West Creek Reservation in Parma, Ohio. The wetlands were created for the purpose of improving water quality in West Creek as well as restoration and rehabilitation of the upper West Creek watershed. To determine if this wetland complex was performing as planned in reducing nutrient loadings, we sampled water nutrient content at eleven sites in the wetlands, including inflow and outflow, during June and July of 2008. Temperature, pH, percent dissolved oxygen, conductivity and oxidation reduction potential were measured at each site. Water samples were collected at the sites, chilled and taken back to the laboratory for analysis of phosphorus, nitrate-nitrite nitrogen, and ammonia using an AQ2+ discreet analyzer. The results of our analyses show that each wetland was functioning properly, and removing nutrients from the inflow to the outflow. Additionally, nutrient concentrations were reduced from the upper to the lower wetland. The West Creek reservation project is a work in progress, research was started in June of 2008 and is continuing through next year with analyses of nutrient retention in soil and plant material.

New Dynamic Light Scattering Spectroscopy System

Department of Physics

Student Researcher: Max Orseno

Faculty Advisor: Kiril A. Streletzky

Over a part of the summer I worked on a new Dynamic Light Scattering Setup for the Light Scattering Spectroscopy Lab. Here is a brief description of the many aspects of this project that I have completed successfully. My first task was to get the laser operational. I developed and installed a water cooling system for the laser. I designed and machined laser bases for the argon laser as well as a helium-neon laser. Another new addition is a system of mirrors that allow for a quick change from one laser to the other. The argon laser itself has been tuned for optimal output. This system has been aligned a few times and experiments have been run on it. The data, after collected and analyzed, has been compared with the existing Dynamic Light Scattering setup. The new results are decent but not as accurate as the results from the existing system due to minor alignment issues. While experimenting, I discovered that the alignment process is very sensitive; but a very crucial step. Further alignment will be needed to perfect this new experimental setup.

Determining the Specific Refractive Index Increment of HPC for Use in Static Light Scattering Experiments

Department of Physics

Student Researcher: Krista G. Freeman

Faculty Advisor: Kiril A. Streletzky

Light passing through different transparent solutions refracts differently due to the difference in index of refraction, a ratio of the speed of light within solution to the speed of light in a vacuum. The refraction process is the basis of light scattering experiments where light refraction depends on time due to spontaneous concentration fluctuations in solution caused by molecular Brownian motion. The specific refractive index increment (dn/dc), the change in index of refraction with concentration, is essential for static light scattering (SLS) experiments on polymer solutions. With a reliable value for dn/dc, SLS yields basic polymer properties such as radius of gyration, molecular weight, and second virial coefficient. This study focuses on determining dn/dc values of hydroxypropylcellulose (HPC) polymer solution and HPC microgels. Precise calibration and experimentation with the Brice-Phoenix differential refractometer (BP) were necessary to attain an accurate value for dn/dc. Using the BP, HPC solutions were analyzed at a range of concentrations, molecular weights, wavelengths, temperatures, and filtration protocols. Through the course of the study it was determined that dn/dc is independent of molecular weight and temperature in good solvents, inversely proportional to wavelength, and sensitive to polymer solution's filtration protocol.

Effects of Branch Diameter on Torque Generation During *Arboreal Locomotion*

Department of Health Sciences

Student Researcher: Rebecca Riffle

Faculty Advisor: Andrew Lammers

Maintaining equilibrium is a challenge to small, quadrupedal mammals when moving on horizontal tree branches that are narrower than the animal's body. Generating torque (a twisting moment around the long axis of the branch) is one important way that an animal can maintain balance and stability. We examined how substrate diameter affected torque generated by gray short-tailed opossums (*Monodelphis domestica*) during arboreal locomotion. The opossums ran on branch trackways that were 1 cm and 2 cm in diameter, which is about one-quarter and one-half the diameter of the animals' bodies, respectively. The trackways had an instrumented portion which measured the torque generated. We filmed *M. domestica* using high speed video to estimate the center of pressure of the right fore- and hindlimb as each contacted the instrumented part of the trackway. Torque was significantly greater on the wider branch as compared with the narrower branch because of muscular effort (as opposed to limb position). It is possible that the animals exerted less torque on the narrower branch because mediolateral body movement might have been diminished; work is underway to determine if this factor played an important role.

Effects of Substrate Texture on Stability During Terrestrial Locomotion

Department of Health Sciences

Student Researcher: Christopher Davis

Faculty Advisor: Andrew Lammers

Stability is the ability to resist a force that would normally create a change in state. Maintaining stability during locomotion on a variety of surfaces is often essential for survival. We hypothesized that an animal moving on a relatively smooth, slippery surface would increase lateral forces to maintain stability. Six gray short-tailed opossum (*Monodelphis domestica*) were trained to travel across two flat trackways. The first track was coated with 60-grit sandpaper, and the second with smooth, painted paper. A force plate embedded into the surface of the trackways measured forces generated by the animals' limbs. Forces were integrated against time to calculate impulse, which is an overall measure of what a limb is doing in a particular direction. Preliminary analysis indicates that on the smooth surface, lateral impulses were somewhat higher than on the rough trackway. This result suggests that the animals may abduct their limbs and push laterally with opposing limbs to increase the size of the base of support. The opossums use a semi-sprawled limb posture, intermediate between animals like lizards (sprawling limb posture) and horses (erect limb posture). Most likely the stability strategy employed by the opossums represents an intermediate between these taxa.

Research Assistant Experience in the Language Research Laboratory

Department of Psychology

Student Researchers: Brian Stegmayer, Jen Hrusovsky, Rosemary Ziemnik, Teresa A. Markis, Alisa Maibauer, Anne D. Sito, Steven P. Beyer

Faculty Advisor: Conor T. M^{c}Lennan

There are many advantages to working as a Research Assistant (RA) in the Language Research Laboratory (LRL), including the opportunity to gain important research experience and learn about - and become involved in - a variety of research studies (see Hrusovsky et al., this session). Working as an RA in the LRL provides hands-on experience working with research participants, including CSU students, non-student residents of the Cleveland area, bilinguals, and older adults. Furthermore, working as an RA in the LRL is an excellent way to learn about various experimental research designs (e.g., a completely within-participants design) and subsequent statistical analysis plans (e.g., repeated measures ANOVA). Moreover, working as an RA in the LRL is also an excellent way to learn about experimental tasks (e.g., shadowing, lexical decision, and eye-tracking), an experimental control program (e.g., Superlab), and other software used in the LRL, such as digital waveform editing programs (e.g., Peak and Praat). Finally, there are several additional practical benefits to working as an RA in the LRL, including preparation for graduate school, and the opportunity to work closely with a faculty member (Dr. M^{c}Lennan) and graduate student RAs, which in turn are likely to open doors for future opportunities.

Examining the Role of Talker-Specific Details in the Perception of Spoken Words by Different Populations of Listeners and in Different Conditions

Department of Psychology

Student Researchers: Jen Hrusovsky, Brian Stegmayer, Rosemary Ziemnik, Teresa A. Markis, Alisa Maibauer, Anne D. Sito, and Steven P. Beyer

Faculty Advisor: Conor T. M^{c}Lennan

Work in the Language Research Laboratory is aimed at trying to gain a better understanding of how listeners perceive spoken words. Previous research demonstrates that listeners are faster to recognize words spoken by the same talker, relative to words spoken by a different talker (talker effects). Moreover, talker effects are more likely when processing is relatively slow (M^{c}Lennan & Luce, 2005). A series of studies are underway in which we are examining talker effects in different populations of listeners and in different conditions. In an experiment involving bilinguals, we predicted greater talker effects for participants hearing their second language than participants hearing their native language. Another experiment examined the time course of talker effects in older adults (60-80). Because processing is typically slowed in older adults, we hypothesized robust talker effects would be obtained in this population of listeners. Two additional experiments are designed to examine talker effects for familiar talkers (i.e., talkers whose pictures are flashed on the screen throughout the experiment), and for famous talkers (Hillary Clinton and Barack Obama). The results of these studies should lead to improved theories and models of spoken word recognition, and should have a variety of important practical applications.

The Role of Amino Acids 1549-1552 of Factor Va for Prothrombinase Complex Assembly and Function

CHEMISTRY DEPARTMENT

Student Researchers: John Vaughn, Jamila Hirbawi, Oruba Abdallah, and Jodi Hawkins

Faculty Advisor: Michael Kalafatis

Proteolytic conversion of prothrombin to thrombin is catalyzed by the prothrombinase complex composed of the enzyme, factor Xa (fXa), the cofactor, factor Va (fVa), assembled on a membrane surface in the presence of divalent metal ions. Site-directed mutagenesis was performed to generate FVa molecules with mutations at amino acids 1549-1552 of the light chain. These recombinant molecules along with wild type FV (fV^{WT}) were transiently expressed in COS7 cells and assessed for their capability to promote prothrombin activation. Two-stage clotting assays revealed that prothrombinase assembled with either FVa^{GN} or FVa^{RR} had clotting times that were similar to the wild-type, while prothrombinase assembled with FVa^{NR} had a prolonged clotting time when compared to FV^{WT}. Kinetic analyses demonstrated that K_d values for FVa^{RR}, FVa^{GN}, and FVa^{NR} showed similar values to wild-type. However, k_{cat} values for the prothrombinase complex formed with the various molecules, differed. The k_{cat} values for FVa^{RR} and FVa^{GN} did not have a significant difference to values obtained from prothrombinase assembled with FVa^{WT}. In contrast, prothrombinase containing FVa^{NR} had a k_{cat} value of about 33% of the wild-type. Data presented in this study provides an insight into a possible role of amino acids 1549-1552 of the FVa light chain.

High-Performance Thin Films

Department of Physics

Student Researcher: Sirirat Sangwian

Faculty Advisor: Paul Hambourger

Self-Cleaning Surfaces for Indoor Use

Interior wall coatings that decompose organic contaminants would reduce health hazards and maintenance costs.

Titanium dioxide decomposes organic substances when exposed to ultraviolet. It will not work indoors unless this can be made to happen under visible light. Previous workers did this by adding nitrogen to titanium dioxide while heating to high temperature. This makes it impossible to coat plastics and other low cost materials.

Using a new method, we have successfully coated polycarbonate plastic with nitrogen-doped titanium dioxide. Optical properties of these coatings suggest they will work in visible light. We are currently preparing an experiment to test this.

Transparency and Electrical Conduction in Zirconium Dioxide

Moon dust is extremely hard and abrasive. Static electricity will cause dust to stick to transparent surfaces, such as solar panels and spacesuit faceplates, and scratch them. Hard, transparent coatings that conduct electricity are needed to protect surfaces and bleed off static charges.

Zirconium dioxide forms very hard transparent protective coatings but is not conductive. By adding excess Zirconium, we made a transparent, conductive coating. However, the transparency may be inferior to that of other coatings previously developed at CSU.

Design Optimization of Passive Micromixers with Fractal Surface Patterning

Department of Physics

Student Researcher: Matthew Itomlenskis

Faculty Advisors: Petru S. Fodor and Miron Kaufman

We have explored computationally the feasibility of enhancing the mixing capability of microchannels by employing the Weierstrass fractal function to generate a pattern of V-shaped ridges on the channel bottom. Motivated by experimental limitations such as the finite resolution (~ 20 micrometers) associated with rapid prototyping through soft lithography techniques, we study the influence on the quality of mixing of having finite width ridges. The designs are optimized with respect to: the distances between the ridges and the position range of their tip along the width of the channels. We find that the entropic mixing indexes of the channels with fractal patterns are consistently higher than for their staggered herring bone (SHB) counterparts. Furthermore, since the optimization curves (mixing index vs. geometric parameters) are broader at the maximum for fractal microchannels than for their SHB counterparts, the microchannel designs using the Weierstrass fractal function are less sensitive to experimental uncertainties.This research can be relevant for drug delivery applications were microfluidic devices have to achieve efficient mixing of two or more fluid components.

Examining Brij-35 Micelles

Department of Physics

Student Researchers: Karen Johnson and Mike Lekan

Faculty Advisor: Kiril A. Streletzky

We studied properties of Brij-35 surfactant micelles in solution using Dynamic Light Scattering (DLS) Spectroscopy and Optical Probe Diffusion method. Aqueous solutions of Brij-35 with concentrations ranging from 2 to 30g/L were analyzed, both with and without polystyrene latex probes of diameters 24, 50, 186, 282 and 792nm. Solutions were studied at four temperatures of 10, 25, 40 and 70^{o}C with DLS to obtain micelle and probe diffusion coefficients (D_m, D_p). Using both diffusion coefficients we deduced micelle radius (a_m), micelle water content (□, and number of surfactant molecules per micelle (N) using two different models. The hard sphere model of micelles/probe interaction was used to analyze the data after a_m was obtained from the intercept of $D_m(c)$. The second model treats micelles as core-shell particles with corona radius (a_c). The first method of this model uses only $D_m(c)$ to determine a_m and a_c using the linear least-squares fit of the data. The second method uses $D_m(c)$ and $D_p(c)$ data simultaneously to determine the best combination overall of N, □, a_m and a_c. Using this model we determined a_m to be 4 - 4.5nm and $a_c - a_m$ to be 1nm. Results for N and h are consistent.

Investigating the Diffusive Behavior of HPC with DLS and FPR

Department of Physics

Student Researcher: Ryan McDonough

Faculty Advisor: Kiril A. Streletzky

Chains of HPC (Hydroxy-propyl-cellulose) polymer were dissolved into aqueous solution in order to explore the diffusive qualities. Two fundamentally different methods: FPR (Fluorescence Photo-bleaching and Recovery) and DLS (Dynamic Light Scattering), were employed to study the structure and dynamics of HPC solutions. FPR requires polymer to be “tagged” by fluorescent molecules by a chemical reaction and subsequent processing. FPR captures diffusion by establishing a photo-bleached boundary and “sees” only tagged particles diffusing back into bleached area yielding a decay-like function. DLS auto-correlates scattered intensity from particles in order to determine a statistical decay function which give information about the self diffusion of particles at chemical equilibrium. Inverse Laplace transform (CONTIN) and stretch exponential line shape analysis (LSA) served to quantitatively decompose decay data into clusters of diffusion processes or modes. The modal distributions for FPR and DLS spectra on the same sample have shown consistent dissimilarities which may indicate comparative limitation or sensitivity to a particular range of diffusive speeds or processes. The tag and tagging process also seems to alter samples in a way that is quantifiable and consistent. It is paramount that the physical properties of diffusion processes are characterized in order to more fully understand stated differences.

Identification of Novel Genes Required for Chromosome Segregation by Two Genome-Wide Screens

Department of Biological, Geological, and Environmental Sciences

Student Researchers: Christine Jamison, Jude Odafe, Glenn Stokes (Visiting Scholar, University of Dayton), Dina Tagayeva, Ege University, Bioengineering Dept, Bornova/Izmir-Turkey

Faculty Advisor: G. Valentin Börner

Meiosis, the specialized cell division used to form haploid gametes from diploid precursors, is essential for generating viable, genetically diverse progeny in all sexually reproducing organisms, including humans. Accurate segregation of chromosomes depends on meiotic recombination, with defects in this process resulting in offspring that lack or have extra copies of chromosomes. Meiosis involves a precise order of events, each episode regulated by distinct genes. Many genes affecting meiosis are conserved from budding yeast to humans, making yeast an ideal model organism to study meiosis. Two genome-wide screens were established to identify genes with roles in meiotic chromosome segregation. In the first screen, candidate genes were identified based on their associated inability to complete the meiotic cell division. Appropriate mutants, generated by transposon-mutagenesis, were further analyzed for viability patterns characteristic for chromosome segregation defects and processed for sequence analysis. A second screen was established to identify genes that when overexpressed can restore normal chromosome segregation in a mutant that lacks the synaptonemal complex (SC). The SC is a structure essential for meiotic chromosome segregation. Together, the two screens will identify new genes with roles in yeast meiosis, and potentially, with analogous roles in the human germline.

Development of a Cell Based Assay to Study Therapeutic Potential of Regulatory MicroRNAs in Prostate Cancer

Department of Biological, Geological and Environmental Sciences

Student Researchers: Jinani E. Slaibi, Megan A. McGervey and Kavleen Sikand

Faculty Advisor: Girish Shukla

Prostate cancer (PCa) is the most common type of cancer found in American men, and the second leading cause of cancer related illness and deaths in the United States. Recent epidemiological study shows that 1 in every 6 men over the age of 45 is at risk of PCa. Androgen receptor (AR) plays a causative role in the development of hormonal-refractory PCa. Hormonal blockade therapy which inhibits the expression of AR eventually fails and disease progresses to fatal androgen-refractory stage from androgen-dependent stage. Therefore, novel molecular approach that can target and blockade the expression of AR is urgently required. We propose that microRNAs (miRNA) that function as negative gene regulators have potential as PCa therapeutics. Using bioinformatics methods we identified that human miRNA Hsa-miR-488* has the potential to inhibit AR expression. In this project we are developing an assay to validate AR as a target of miR-488* using luminescence reporter construct. Currently we are optimizing effect of miR-488* on the expression of AR in prostate cancer cells.

Polymeric Nanoparticles as Drug Delivery Agents: Exploring Loading Capacity

Department of Chemistry
Department of Physics

Student Researcher: Adesols Sabs

Faculty Advisor: Mekki Bayachou

Hydroxypropylcellulose (HPC), a non-carcinogenic macromolecule and FDA-approved food additive, forms microgel nanoparticles that can serve as a drug delivery system. Microgel particles form by self-association of amphiphilic molecules and can serve as reservoirs for controlled drug delivery and release.

The proposed project focuses on a pilot study that investigates drug loading of microgel HPC particles as well as the dynamics of temperature-induced drug release. The study uses dynamic light scattering (the Streletzky Lab) as well as Fourier Transform Infrared and Atomic Force Microscopy (AFM) coupled to electrochemical methods for imaging and detection purposes, respectively (The Bayachou Labs).

Acetaminophen (Tylenol®) was used as a model redox-active drug to follow the release/uptake capacity of HPC microgel particles. Dynamic light scattering study on synthesized HPC particles used in this study confirmed their nominal diameters. AFM characterization in solution showed a distribution of sizes with presence of small, non-crosslinked, polymer strands. We used flow-injection amperometry to evaluate the loading capacity of HPC microgel particles. Preliminary results show moderate acetaminophen uptake levels that vary with the nominal size of the particles. Temperature-controlled release of acetaminophen from loaded HPC particles was also followed by amperometry. The results will be discussed in the context of the ability of HPC particles to serve as temperature-driven drug release vehicles.

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Department of Chemistry

Student Researchers: Noufissa Zanati, Mchaelellen Mathews, John Moran and Alan T. Riga

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