March 30 – 31, 2012
University of Maryland
Plant Sciences Building

GEMSTONE

BE A PART OF THE SOLUTION

Thirteenth Annual

Team Thesis Conference

Honors Undergraduate Multidisciplinary Research 2012

Gemstone Staff

Faculty Director	**Dr. James Wallace**
Associate Director	**Dr. Rebecca Thomas**
Assistant Director for Operations	**Mrs. Vickie Hill**
Assistant Director for Student Services	**Ms. Leah Kreimer**
Graduate Assistant for Team Development	**Mrs. Heather Creek**
Graduate Assistant for Student Development	**Ms. Courtney Singleton**
Graduate Assistant for Advising and Assessment	**Ms. Sydney Shippey**

Please join us….

You are cordially invited to attend

The Thirteenth Annual

Gemstone Citation Ceremony

Friday, May 18, 2012

University of Maryland Memorial Chapel

College Park, Maryland

From 4:30 p.m. to 6:00 p.m.

Reception immediately following Ceremony
6:00 pm to 7:00 pm
Memorial Chapel West Patio

Team Thesis Conference Schedule at a Glance

Friday, March 30, 2012, Plant Sciences Building

3:00 pm - 4:00 pm	Room 1130	BALANCE
	Room 1140	FRESH
4:15 pm - 5:15 pm	Room 1130	BLAZE
	Room 1140	ANTIDOTE
5:30 pm - 6:30 pm	Room 1130	BioFUELS
	Room 1140	AMIRA

Saturday, March 31, 2012, Plant Sciences Building

9:00 am - 10:00 am	Room 1130	FLIP
	Room 1140	FACE
10:15 am - 11:15 am	Room 1130	Green Justice
	Room 1140	LEGS
11:30 am - 12:30 pm	Room 1140	LEAF

FRIDAY, March 30, 2012
3:00-4:00 pm
Room 1130

BALANCE: Bettering Aged Living through Alternative Neural Corrective Exercises

Research Team

Marla S. Benedek, Marketing
Emily V. Fingland, Accounting
Jared Lindenberg, Accounting
Yu Lun, Physiology and Neurobiology
Adina Schwartz, Physiology and Neurobiology
Mengge Shan, Cell Biology and Genetics
Tiancheng Wang, Biochemistry
Kobena Y. Waters, Physiology and Neurobiology

Faculty Mentor

Dr. Jae Kum Shim, Associate Professor, Kinesiology, School of Public Health, University of Maryland

Librarian

Ms. Svetla Baykoucheva, University Libraries, University of Maryland

Discussants

Dr. Arick Auyang, Post-Doctoral Fellow
Dr. Adam Hsieh, Associate Professor
Dr. Sungjae Hwang, Post-Doctoral Research Associate
Dr. Alison Linberg, Research Physical Therapist
Dr. Richard Payne, Professor

Research Description

The prevalence of falls in the elderly population and the high susceptibility of the elderly to resulting injuries constitute a major health, wellness, and financial problem in the United States. Studies have shown that through resistance training, the elderly can improve their muscular strength and their balance. In this study, we compared the effects of two different types of resistance training, whole-leg and individual-joint, on the muscle strength and balance capabilities of both college-aged and elderly participants. Using a matched-pair, random assignment design, we collected and analyzed data from participants using a motion analysis system, force plate, and leg press machine. We tested participants at regular intervals over the course of their six-week training programs. We hope that our results and conclusions will help pave the way for future research so that the elderly can experience a lower rate of falls and a better quality of life.

FRIDAY, March 30, 2012
3:00-4:00 pm
Room 1140

FRESH: Fixing Refrigeration Efficiency to Sustain Health

Research Team

Matt Conway, Chemical Engineering
Kelly Daniluk, Mechanical Engineering
Jason Felder, Mechanical Engineering
Andrew Foo, Mechanical Engineering
Amina Goheer, Government and Politics
Veena Katikineni, General Biology
Anthony Mazzella, Operations Management
Young Park, Finance
George Peabody V, Chemical Engineering
Amanda Pereira, Spanish
Divya Raghavachari, Physiology and Neurobiology
Sahil Shah, Neuroscience
Ravi Vaswani, Physiology and Neurobiology

Faculty Mentor

Dr. Shah Sameer*,* Department of Bioengineering, University of California, San Diego

Librarians

Mr. Bob Kackley, University Libraries, University of Maryland
Ms. Lily Griner, University Libraries, University of Maryland

Discussants

Dr. Kimberly Brown, CEO, Amethyst Technologies, LLC
Dr. Trent Carrier, Executive Director, Biologics Consulting Group, Inc.
Dr. Anwar Huq, Professor, Maryland Pathogen Research Institute
Dr. Yunho Hwang, Associate Director and Research Professor
Mr. Ben Woodard, Director, Bioprocess Scale-Up Facility Research Description

Research Description

In order to prevent the occurrence of vaccine-preventable deaths across the developing world, our team endeavored to improve upon existing passive refrigeration technologies used in the cold chain, the vaccine delivery system. We aimed to stabilize the temperature and preserve the potency of vaccines through the integration of phase change material (PCM) into our design strategy. In order to do this, we surveyed existing cold chain problems and developed a clear set of design criteria for our prototype. We then selected and characterized an appropriate PCM that would resist temperature fluctuations outside the range of 2-8°C. We proceeded to examine various PCM geometries and synthesized all the findings in our thermally-optimized cold box prototype. Our product was created with the field in mind and as such, we also developed a marketing plan for our cold box so that it can be integrated seamlessly into the existing cold chain.

FRIDAY, March 30, 2012
4:15-5:15 pm
Room 1130

BLAZE: Bettering the Lives of Animals in Zoo Environments

Research Team

Logan C. Anbinder, Physics
Amelia C. Cordell, Psychology
Gretchen E. Downey, Environmental Science and Policy
Kelly C. Freudenberger, Animal Science
Shabaab Q. Kamal, Psychology
Thao A. Khuc, Public and Community Health
Joshua G. Lacey, Government and Politics
Caitlin M. Moore, General Biology
Emmarie G. H. Myers, Bioengineering
Andrea E. Schmidt, Mathematics

Faculty Mentor

Dr. Kaci Thompson, Director, CMNS Entrepreneur Program, College of Computer, Math, and Natural Sciences, University of Maryland

Librarian

Mr. Timothy Hackman, University Libraries, University of Maryland

Discussants

Dr. Sarah Anne Balcom, DVM Professor, Reproduction

Dr. Cindy P. Driscoll, DVM State Wildlife Veterinarian, Head of Fish and Wildlife Health Program for MD DNR

Ms. Cheryl Lacovara, Private Zoo Owner

Dr. Mary Ann Ottinger, Professor, Reproduction and Physiology

Research Description

Captivity induces large amounts of stress in animals, leading to health issues and preventing research from reflecting the natural state of the animal. While zoos often employ environmental enrichment techniques such as toys, scents and novel feeding methods to stem the negative effects of stress, little research has compared the effectiveness of different types of enrichment. We aimed to fill that gap, looking at national enrichment practices and comparing the effects of different types of enrichment on the stress hormone cortisol. Our research consisted of three phases: first, administering a survey to determine enrichment practices in zoos nationwide; second, analyzing cortisol levels of felids on a pre-determined enrichment schedule; and third, manipulating enrichment schedules to deduce the effects of various types of enrichment on cortisol levels.

ANTIDOTE: Analyzing New Treatments for Infectious Disease with Obtained Therapeutic Extracts

Research Team

Noha M. Eshera, Physiology and Neurobiology
Song Fu, Cell Biology and Genetics
Angela M. Hou, Physiology and Neurobiology
Liv H. Johannessen, Chemistry
Rahel G. Kifle, Psychology
Nathan R. King, Chemistry
Eunsol Lee, Physiology and Neurobiology
Ke Ma, Physiology and Neurobiology
Gowri R. Nadmichettu, Cell Biology and Genetics
Alex S. Peters, Chemical Engineering
Gregory J. Polley, Geology
Steven R. Ramiro, Materials Science and Engineering
Crystal H. Wang, General Biology
Mengda Zhang, General Biology

Faculty Mentor

Dr. Andrea Ottesen, Research Associate, Plant Science and Landscape Architecture, University of Maryland

Librarian

Mr. Bob Kackley, University Libraries, University of Maryland
Ms. Lily Griner, University Libraries, University of Maryland

Discussants

Dr. George A. Bean, Professor Emeritus, Nutrition and Food Science
Dr. Jeffrey J. DeStefano, Professor and Director of MOCB Graduate Concentration Area
Dr. Najib M. El-Sayed, Associate Professor
Dr. Shyam Kottilil, Senior Investigator, Laboratory of Immunoregulation
Dr. Michael Montague-Smith, Lecturer and Director of Undergraduate Studies

Research Description

Our team investigated the therapeutic potential of extracts obtained from the medicinal plant, Phyllanthus niruri, as an alternative treatment for HCV. We used molecular barcoding to address the issue of taxonomic confusion among plants of the Phyllanthus genus and conducted chemical extractions of dried plant material to target active compounds. Next, we tested extraction products on HCV-infected cell lines to determine their effects on cell toxicity and viral load. Our results demonstrate a significant increase in cell viability in cells treated with Phyllanthus extracts. We were able to show that our extracts were not toxic to the cells but did result in an overall decrease in the viral load in vitro. While the mechanism of action resulting in this decrease is not clear from the in-vitro assay alone, our results indicate that P. niruri may provide a promising alternative treatment for HCV.

BioFUELS: Furthering the Utilization of Energy from Land and Soil

Research Team

Vishney Ambalavanar, Marketing
Michael Kang, Chemical Engineering
Felicia Kulp, Biochemistry
Theodore Michaels, Finance
Alexander Muroyama, Mechanical Engineering
Saad Rehman, Civil Engineering
Olufemi Sokoya, Bioengineering
Aalap Trivedi, Government and Politics
Kaiyi Xie, Bioengineering

Faculty Mentor

Dr. Gary Felton, Associate Professor, Environmental Science and Technology, University of Maryland

Librarian

Ms. Nevenka Zdravkovska, University Libraries, University of Maryland

Discussants

Dr. Frank Coale, Professor, Environmental Science and Technology
Dr. Steven Hutcheson, Founder, Zymetis, Inc. and Professor of Microbiology
Dr. Alan Kaufman, Professor, Geology
Dr. Stephanie Lansing, Associate Professor, Environmental Science and Technology
Dr. John Lea-Cox, Associate Professor, Nursery Research and Extension Specialist

Research Description

Our study examined the effects of land quality and water-absorbent polymer on the growth of Miscanthus x giganteus. Our goal was to help utilize previously uncultivable land efficiently and meet U.S. energy goals. Currently, most U.S. biofuel is produced from corn, which requires arable land for growth and therefore significantly disrupts the production of food crops. We predicted that M. x giganteus would be able to thrive on marginal land, unlike corn, with the aid of a water-absorbing polymer. After growing M. x giganteus on both arable and marginal land, with and without the application of a polymer, we found that our crop grew better on the arable land. We also found that the presence of the water-absorbing polymer in the soil did not affect the growth of M. x giganteus. Finally, an economic cost-benefit analysis showed us that growing M. x giganteus would not be a profitable business venture.

AMIRA: Analyzing Movement of Infants at Risk for Autism Spectrum Disorder

Research Team

Eileen L. Chai, Biochemistry
Jillian L. Chavis, Accounting
Kevin Daniel Chodnicki, Physiology and Neurobiology
Timothy L. Crisci, Physiology and Neurobiology
Nathan Robert Johnson Destler, Psychology
John Duncan Graham, Architecture
Kesshi Marin Jordan, Bioengineering
Richard N. Landa, Mechanical Engineering
Conrad William Merkle, Bioengineering
Soh H. Park, Chemistry
Christopher J. Paxton, Computer Science
Rachita Sood, Physiology and Neurobiology
James E. Tanner, Computer Science
Brendan Michael Wray, General Biology

Faculty Mentor

Dr. John Aloimonos, Professor, Computer Science, University of Maryland

Librarian

Mr. Glenn Moreton, University Libraries, University of Maryland

Discussants

Dr. Jane Clark, Professor and Director, Cognitive Motor Neuroscience Labs
Dr. Leonardo Claudino, Research Graduate Assistant
Dr. Andrew L. Egel, Professor, Special Education
Dr. John J. Jeka, Professor, Kinesiology
Dr. Rebecca Landa, Director, Center for Autism and Related Disorders
Dr. Klaus Libertus, Post-Doctoral Fellow

Research Description

Autism Spectrum Disorders (ASD) are a group of socially debilitating disorders that affect 1 in 110 children. Researchers have long understood that early diagnosis and intervention lead to the best possible outcome for children with ASD, compelling researchers to develop early diagnostic methods. Researchers believe that a better understanding of the effect of ASD on movement will aid in developing these early diagnostic techniques. To assist in understanding the effect of ASD on movement, our team performed a proof of concept study to determine if a passive motion capture system can be used to characterize motion indicators of ASD. To accomplish this goal, our team analyzed three distinct movements in infants, six to twelve months, at high and low risk for ASD. We determined that passive motion capture systems can characterize movement indicators of infants at high and low risk for ASD.

FLIP: File Lending in Proximity

Research Team

Bobak Azarbayejani, Computer Science
Andy H. Chang, Marketing
Bill Bradley Franklin, Computer Science
Hugo S. Hall, Mechanical Engineering
James H. Polivka, Economics
John Shao, Computer Engineering
Cindy Weng, Information Systems

Faculty Mentor

Dr. Jim Purtilo, Associate Professor, Computer Science, University of Maryland

Librarian

Mr. Jim Miller, University Libraries, University of Maryland

Discussants

Mr. Josh Caldwel, Software Engineer, Phase2Technology
Dr. Dennis Pitta, J. William Middendorf Distinguished Professor and Chair, Marketing & Entrepreneurship
Mr. Kevin Tom, Program Manager
Dr. Ralph Wachter, Program Manager
Mr. Scott King Walker, Software Development Manager

Research Description

This project FLIP (File Lending in Proximity) seeks to create a way to share files with respect to the people that usually matter the most to us, the people around us physically. The FLIP software works as a geo-centric wiki, with information closest to you presented most prominently, while things out of range are not displayed at all. To do this, the FLIP team has created software that allows users to determine their location via GPS and subsequently share information, including but not limited to data and files, based on their locations. In addition to creating a platform for location-based file sharing, the FLIP team has conducted field studies with accompanying surveys which have been used to gauge whether or not this sort of location-based sharing over the Internet is effective and desirable to its primary user base: the students of the University of Maryland.

FACE: Facial Analysis for Communicating Expression

Research Team

Douglas T. Astler, Aerospace Engineering
Harrison Wynne Chau, Aerospace Engineering
Kailin L. Hsu, Physiology and Neurobiology
Alvin S. Hua, Electrical Engineering
Andrew W. Kannan, Computer Science
Lydia A. Lei, Electrical Engineering
Melissa Rose Nathanson, Anthropology
Esmaeel Paryavi, Bioengineering
Michelle H. Rosen, Mechanical Engineering
Hayato Le Unno, Physiology and Neurobiology
Carol Wang, Electrical Engineering
Syeda Khadija F. Zaidi, Bioengineering
Xuemin Zhang, Physiology and Neurobiology

Faculty Mentor

Dr. Rama Chellappa, Professor, Institute for Advanced Computer Studies, University of Maryland

Librarian

Mr. Jim Miller, University Libraries, University of Maryland

Discussants

Dr. Larry Davis, Professor & Chair
Dr. P. Jonathon Phillips, Program Manager
Dr. Ankur Srivastava, Associate Professor
Ms. Sima Teheri, Expression Expert
Dr. Yaser Yacoob, Associate Research Scientist

Research Description

When people communicate, they do so through intonation, gestures, and facial expressions in addition to words. The majority of communication between two people is comprised of these nonverbal cues, which are not readily accessible to the blind. Our team has developed an assistive device based on computer vision, which relays facial recognition and expression information to the user. Designed to store images of people the user frequently interacts with in a custom database and analyze faces for expressions, the device consists of a camera mounted on a white cane. The system is unique in the amount of control a user has over their surroundings, receiving real-time feedback and choosing when and how they want the device to function. In order to design a device suited best to the user's needs, we engaged both sighted and blind participants in surveys and interviews to understand the perceptions of vision technology. In fall of 2011, we completed the algorithm and physical designs of the device, in addition to subject tests with blind participants to gauge the effectiveness of our product. In October of 2011, we presented our work at the 13th International ACM SIGACCESS Conference on Computers and Accessibility in Dundee, Scotland.

Green Justice

Research Team

Jessica L. Albrecht, Psychology
Blair A. Broser, Finance
Brendan J. George, Finance
Caleb C. Hii, Civil Engineering
Vy L. Nguyen, Microbiology
Rachana Patel, Physiology and Neurobiology
Najeff Waseem, Psychology

Faculty Mentor

Dr. Alex Chen, Associate Professor, Urban Studies and Program Planning, University of Maryland

Librarian

Ms. Lara Otis, University Libraries, University of Maryland

Discussants

Mr. Lee Flick, Associate Director
Ms. Candace B Hollingsworth, Council Member, Ward 1
Mr. Matthew McKnight, President
Mr. Patrick Ryan, Director
Ms. Shani Warner, City Council Member, Ward 2
Mr. Eric Wingard, Council Member, Ward 1

Research Description

The average American generates about 4.6 pounds of solid trash a day, causing serious economic, environmental, and social costs to cities. Many cities, such as Hyattsville, struggle to implement an efficient waste reduction program. Gemstone Team Green Justice has worked in the city to assess the effectiveness of a pilot program in reducing waste, promoting recycling, and changing residents' attitudes towards waste management. Additionally, we aimed to better understand the relationship between income level and amount of waste generated. We have gathered data from the Department of Public Works, PG County Waste Management Group, surveys, focus groups, and individual interviews with various members of the community. We plan to present our data not only to Gemstone, but also to the City Council and the Hyattsville Environmental Committee, in order to complement their evaluation of the program.

LEGS: Ligament Elasticity post Graft Surgery

Research Team

Matthew G. Costales, Chemistry
Benjamin C. Garbus, Physiology and Neurobiology
Joseph D. Hartstein, Bioengineering
Kelley M. Heffner, Bioengineering
Rupal S. Jain, Physiology and Neurobiology
Kelly M. Klein, Microbiology
Alicia N. McDonnell, Physiology and Neurobiology
Payal V. Patel, General Biology
Victoria L. Stefanelli, Bioengineering
Jenny Wang, Physiology and Neurobiology
Joseph T. Weinberg, Physiology and Neurobiology
Tina Zhang, Bioengineering

Faculty Mentor

Dr. Adam Hsieh, Associate Professor, Mechanical Engineering, University of Maryland

Librarian

Mr. Bob Kackley, University Libraries, University of Maryland
Ms. Lily Griner, University Libraries, University of Maryland

Discussants

Dr. Yu Chen, Assistant Professor, Director Biophotonic Imaging Laboratory
Dr. James C. Dreese, Assistant Professor of Orthopaedics, Team Physician
Dr. Stephen Fahey, Staff Physician
Dr. Robert C. Gillis, Resident, University of Maryland Medical Center
Mr. Andrew C. Merkle, Program Manager, Biomechanics & Injury Mitigation Systems
Dr. Jae Kun Shim, Associate Professor, Director of Neuromechanics Laboratory

Research Description

Despite the high incidence of anterior cruciate ligament (ACL) tears, many aspects of the reconstruction surgery, such as graft material, fall under the surgeon's discretion. Thus, our research aimed to relate the tensile strength of ACL grafts to their respective collagen organization. We then compared the efficacy of hamstring versus patellar tendon grafts. A surgeon reconstructed cadaveric knees with graft tissue, and the knees were then stressed to replicate continuous passive motion. To evaluate differences in graft tissue before and after mechanical testing, we used brightfield microscopy and optical coherence tomography (OCT). We hypothesized that greater collagen undulation would result in higher tensile strength, and thus better graft performance. Our research will help standardize an aspect of ACL reconstruction and improve patient satisfaction post-graft surgery.

LEAF: Light Energy in the Agriculture of the Future

Research Team

Thomas W. Brooks, Computer Science
Sean P. Collins, Government and Politics
Alexander J. Edgerton, Mechanical Engineering
Blaine B. Ford, General Biology
Preetha Gautam, Aerospace Engineering
Matthew S. Goldfinger, Psychology
Ian A. Hall, Mechanical Engineering
Billy Z. Huang, Mathematics
Michael J. Lanzo, Chemical Engineering
Melissa P. McGowan, Physiology and Neurobiology
Taylor Macks Myers, Fire Protection Engineering
Christopher M. Salata, Physics
Andy J. Zheng, Electrical Engineering

Faculty Mentor

Dr. Ray Adomaitis, Professor, Chemical and Biomolecular Engineering, University of Maryland

Librarian

Ms. Nedelina Tchangalova, University Libraries, University of Maryland

Discussants

Dr. Vivek Dwivedi, NASA Research Engineer
Dr. Sheryl Ehrman, Keystone Professor and Chair
Dr. Greg Jackson, Professor, Mechanical Engineering, Assistant Director of UMERC
Mr. Peter Lowenthal, Market Development Leader
Dr. Chunsheng Wang, Assistant Professor

Research Description

As the 'Green' movement sweeps the nation, more and more research is being put into renewable energy. In the field of solar technology, there has been a lot of progress in using large reflectors to concentrate the sun's energy. These systems generally involve complex mounting systems to track the sun as it moves, thus incurring a large initial cost. We have designed a concentrated photovoltaic system that is significantly cheaper than these complex industrial models but still more efficient than a standard flat panel. We have tested our prototype with a stationary linear parabolic reflector optimized to concentrate the sun's light on a small strip of photovoltaic solar cells. We hope that our system will have a greater power output than the control, a flat panel with the same number of photovoltaic cells, thus contributing data that will support the construction and further research of low concentrating photovoltaic systems.

Gemstone

The Gemstone Program at the University of Maryland is a unique multidisciplinary four-year research program for selected undergraduate honors students of all majors. Under guidance of faculty mentors and Gemstone staff, teams of students design, direct and conduct significant research exploring the interdependence of science and technology with society. Gemstone students are members of a living-learning community comprised of fellow students, faculty and staff who work together to enrich the undergraduate experience. This community challenges and supports the students in the development of their research, teamwork, communication and leadership skills. In the fourth year, each team of students presents its project in the form of a thesis to leaders in the field, and the students complete the program with a citation and a tangible sense of accomplishment.

Our Mission

We are committed to providing a challenging and rewarding team research experience. We are dedicated to the development of citizens, scholars, and leaders. Our efforts are focused on holistic student development, both inside and outside the classroom. We value qualities of mutual respect, intellectual excitement, collaboration, and diversity of thought. We strive to give our students the transferable skills valuable for wherever life will lead them.

GEMSTONE
UNIVERSITY OF MARYLAND