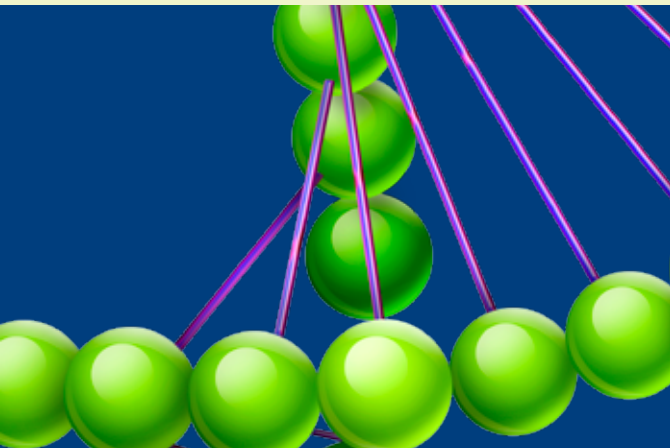


Center for BIOMEDICAL ENGINEERING RESEARCH



NEWSLETTER

Vol. 4 | 2013



In this issue...

- 2 | 2012 Symposium
- 3 | Research Highlights
- 6 | Announcements
- 7 | Awards & Recognition

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MESSAGE FROM THE DIRECTOR

JILL HIGGINSON

Thank you for your interest in the *Center for Biomedical Engineering Research (CBER)*.

In this newsletter, we provide a quick overview of ongoing research projects related to the understanding and treatment of stroke, osteoarthritis, osteoporosis, cerebral palsy and other conditions and disease processes. We also recognize the academic achievements of CBER faculty and students. See the timeline for key events and stories featured on [UDaily!](#)

To enhance the CBER mission of providing *engineering science and clinical technology to reduce the impact of disease*, we are developing (1) research experiences for undergraduates, (2) industry partnerships and (3) outreach initiatives. Stay tuned for more information!



I invite you to explore our website www.cber.udel.edu, review the online proceedings from our most recent research symposium **May 3, 2013**, visit our labs or contact our faculty about research opportunities. To discuss academic options or collaborative research ideas, [contact me](#) or any of our affiliated faculty members.

Best wishes for another successful and productive year!

www.cber.udel.edu

Biomechanics symposium features noted orthopaedic researcher

Darryl D'Lima was the keynote speaker at the Center for Biomedical Engineering Research (CBER) ninth annual research symposium. The April 23rd symposium brought together faculty and students from various biomedical and bioengineering disciplines.

D'Lima is the director of the Orthopaedic Research Laboratories at the Shiley Center for Orthopaedic Research and Education (SCORE) at Scripps Clinic in San Diego, California. His expertise lies in the measurement of tibial and tibiofemoral forces in the knee and its effect on both leisure and daily living activities. His research team developed an electronic knee implant known as a tibial tray that uses a microprocessor to read forces exerted on or by the knee through an array of activities and translate them into data.

The data compiled enabled the researchers to gauge which activities were safer for patients to engage in post-surgery. For example, the research showed that golfing places more force on the knee than expected and could lead to potential complications, while kneeling required less knee impact than once believed.

"Measuring these forces in vivo can improve preexisting in vitro methods, prosthetics, biomaterials and activities following knee replacement," explained D'Lima.

Doctoral students **Brian Knarr** and **Federico Pozzi** were among the first to arrive for D'Lima's keynote address.

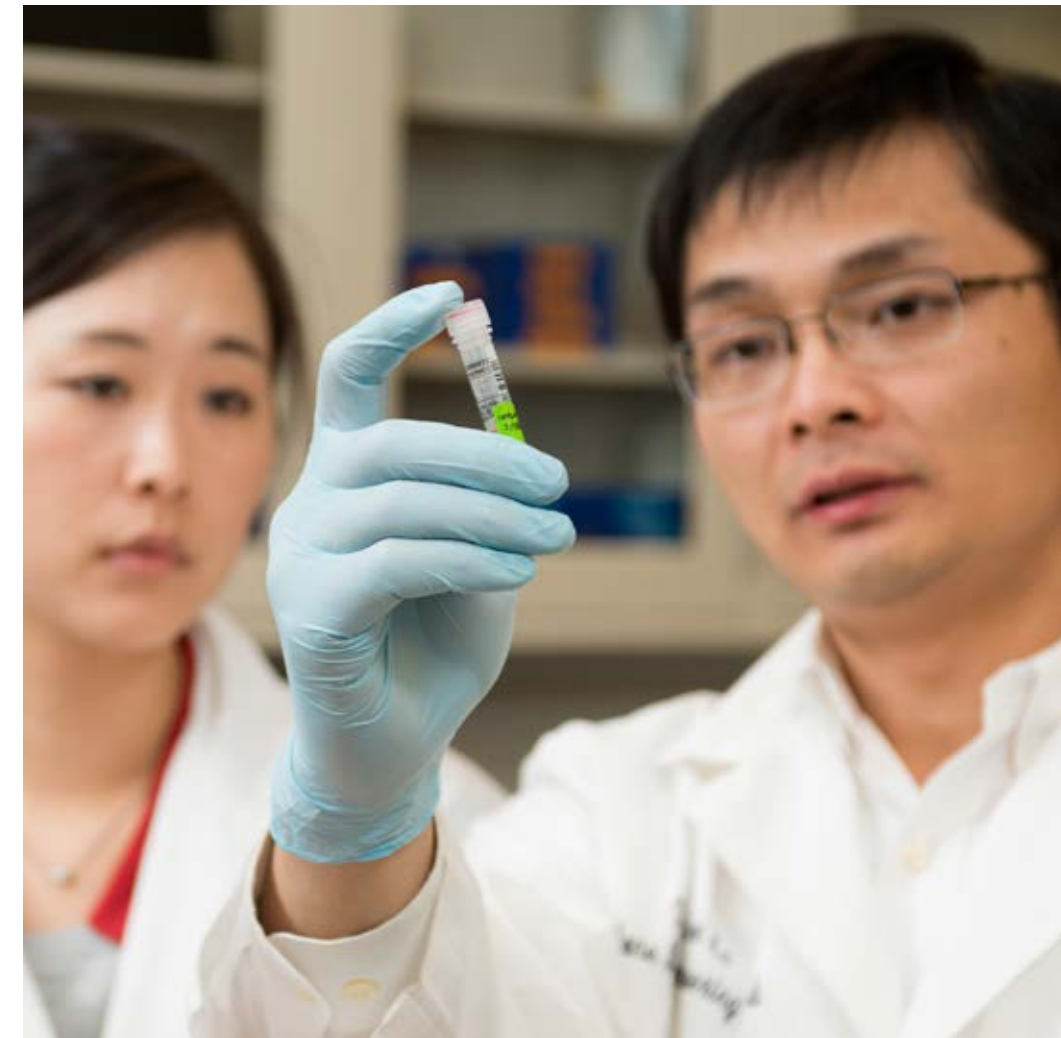
"D'Lima's work on measuring forces within the knee during various activities is particularly relevant to research on osteoarthritis and knee replacement performed here at UD, including my own. It was particularly enlightening to hear about the difficulties D'Lima faced getting his device approved by the medical community," remarked Knarr, a doctoral student in UD's Biomechanics and Movement Sciences (BIOMS) program.

"[CBER Day] is a great way to get involved and see the research happening at UD at different levels," said Pozzi, a first year doctoral student studying physical therapy, and member of the BIOMS program. "I found D'Lima's work specifically beneficial because, as a physical therapist, patients frequently ask me what activities they can safely perform following knee replacement."

The event also included 10 podium and 32 poster presentations by students and faculty. Knarr presented his work on the changes in knee contact force with experimental and simulated differences in body weight. Pozzi contributed a poster on loading patterns in "step up and over" tests and their effects on total knee arthroplasty (TKA).

"Attending the event was a great source of inspiration for future collaborations. The feedback I received on my poster has given me wonderful ideas on how to review, analyze and improve my research," added Pozzi.

The event concluded with an award session where four students: **Sumayeh Abujaber**, **Emily Gardinier**, **Woojin Han** and **Spencer Szczesny** were honored for their research.



Early Detection of Osteoarthritis

(supported by UDRF)

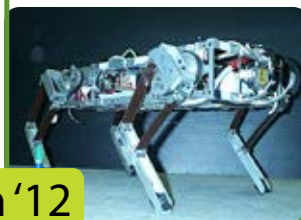
Lucas Lu (ME) aims to build a micro-indenter for the in vivo mechanical testing of cartilage tissue.

(supported by NASA)

Professor Lu is developing a mechanical technique to measure the biochemical components, i.e., proteoglycan content, in degenerated cartilage.

RUNNING ROBOTS

Ioannis Poulakakis investigates control strategies in four-legged running robots.



Jan '12

RESEARCH SUPERSTAR

Lynn Snyder-Mackler receives prestigious NIH MERIT Award for ACL research.



Mar

INBRE PROJECTS

8 pilot research projects led by Delaware investigators selected for scientific merit in cancer.



Apr

HOT RESEARCH

Dennis Prather, Michael Hochberg, Thomas Epps III & Xinqiao Jia published in peer-reviewed journals.



NATA HONOR

Charles Swanik named fellow of National Athletic Trainers Association.



INSPIRED BY INSECTS

For treatment of vocal fold disorders, UD researchers look to insect protein.



COBRE III (NIH)

The third renewal of the NIH COBRE study was initiated in August 2012. The scientific goal of the COBRE III proposal is to create the infrastructure and expertise base to address both mechanisms underlying the development and progression of osteoarthritis (OA) and its prevention and treatment.

The *Cytomechanics Core* supports UD's multidisciplinary focused study of OA, a major public health concern with large socioeconomic implications and patient quality of life issues related to pain and disability.

The *Patient-Specific Modeling Core* provides tools to address specific aims motion capture and simulation involving human subjects, then share knowledge with investigators, students and the biomechanics community through training and outreach activities.

The *Clinical Research Core* offers comprehensive support services for participant recruitment, regulatory submissions, study coordination, reporting of adverse events, data management and biostatistical analysis.

Visit www.udel.edu/dri/cobre.html for more information.

COBRE III pilot projects (NIH)

Lucas Lu (ME) is investigating whether FDA approved drugs can be used to prevent trauma-induced osteoarthritis (OA). Joint trauma is one of the most common injuries to young adults, athletes and military service members. According to Lu, FDA approved drugs originally designed for other diseases

may arrest the degeneration of cartilage post trauma. He hopes to identify therapeutic mechanisms and new treatment techniques for post-traumatic OA.

Catherine Kirn-Safran (Bio) is working to identify novel strategies to slow OA progression by using normal and genetically engineered cell lines and animal models of knee OA. Kirn-Safran will test the idea that functional inhibition of a specific calcium channel function is chondroprotective and slows load-induced OA progression in an in vivo mouse model of OA. Her long term objective is to gain insight into the molecular mechanisms involved in joint mechanosensitivity and OA and to help develop effective patient-based therapeutics aimed at lessening progression of OA in both injury-enhanced and age-related OA.

Modeling of post-stroke gait (NIH)

Jill Higginson (ME) together with Thomas Buchanan (ME), Stuart Binder-Macleod (PT) and Darcy Reisman (PT) are developing subject-specific walking simulations of individuals with post-stroke hemiparesis to understand muscle deficits and ultimately guide treatment. The work combines MRI imaging of individual leg muscles, twitch interpolation to identify muscle activation failure, strength testing, gait analysis and clinical exams with computer simulations to identify an individual's muscle impairments. Her team is also exploring the use of forward simulation to predict which stroke survivors will respond favorably to FastFES treadmill training.

Solute transport (NIH)

Liyun Wang (ME) is working to quantitatively measure diffusion and convection of molecules of different size and shape inside intact bones. She discovered that the differential velocities measured for large and small molecules could be used to study the sieving and structural functions of osteocytes pericellular matrix, the presumed mechanical sensors. For the first time, this thin fluffy cell structure was examined using confocal microscopy in intact bone, enabling the research team to document the changes of the pericellular matrix in aging and some disease conditions. Future work includes uncovering the secrets of bone loss in elderly and identifying which astronauts are more resistant to microgravity induced bone loss.

Motor learning post-stroke (Delaware INBRE)

Darcy Reisman (PT) is investigating differences in motor learning during walking between neurologically intact individuals and those with stroke, the effect of different practice conditions and the role of brain-derived neurotrophic factor in the motor learning processes.

Interventions to improve activity after stroke (NIH)

Darcy Reisman (PT) is developing interventions to improve the quality of life and overall health of individuals who have sustained a stroke. Specifically, Reisman plans to test whether adding a step activity monitoring program to fast treadmill training can improve walking activity to recommended levels in persons with chronic stroke.

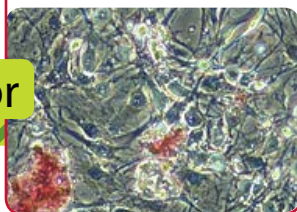


Biomedical research partnership (NIH)

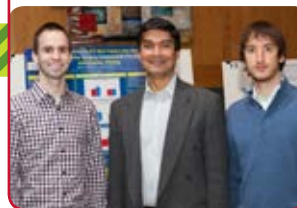
A collaboration between **John Scholz** (PT), Jill Higginson (ME), Stuart Binder-Macleod (PT), and Sunil Agrawal (ME) will determine whether stroke survivors can achieve sustained improvements in overground walking. Through intensive treadmill training with a robotic device that perturbs the swing phase trajectory of the impaired limb, the project seeks to determine whether changes in muscle synergies are related to improved walking ability.

Apr

FAT STOPPER
UD research identifies protein that regulates creation of fat cells.



CBER CELEBRATION
Biomechanics symposium features D'Lima, noted expert on orthopedic research.



CAPTIVATING CURIOUS
UD captivates crowds at USA Science & Engineering Festival.



May

EXPLORING POSSIBILITIES
Founder of LIMBS International speaks at Design and Rehabilitation Conference.



Aug

UD | NIH PARTNER
UD partners in \$2.5 million NIH grant to produce artificial salivary glands.



COBRE III AWARDED
NIH COBRE III award continues support of osteoarthritis research.



5

Announcements

CBER has initiated a **Summer Undergraduate Research Fellowship** to support eight students conducting full-time research under the supervision of a CBER faculty member. Students will be exposed to hands-on biomedical laboratory research and will participate in group activities pertaining to laboratory procedures, experimental design and graduate school application. Look for their poster presentations at the Undergraduate Research Symposium in August 2013!

Interdisciplinary Senior Design

Beginning in fall 2013, senior undergraduates in mechanical engineering and biomedical engineering will work on interdisciplinary teams for their Capstone Senior Design Project. This is an intense, semester-long program where teams are paired with industry and clinical partners to solve a real-world challenge. This may include new product design, process improvement or exploratory research. The Department of Mechanical Engineering has more than 20 years experience running this program, with industry sponsors such as WL Gore, Synthes, Alcore and Seimens, among others. We are currently seeking applications from industry and academic partners for our 2013 program. For more information, contact Prof. Jenni Buckley at jbuckley@udel.edu.

Graduate research assistants needed

The **Jia Research Group** has immediate openings for Ph.D. candidates in Materials Science and Engineering (MSEG) and Biomedical Engineering (BME). The Jia research program focuses on the design, synthesis and characterization of advanced biomaterials for the treatment of human diseases. Current research activities are supported by the National Science Foundation, National Institutes of Health and the DuPont Company. Depending on the nature of the thesis work, students can receive Ph.D. in MSEG or BME. Qualified candidates will be considered for the **University of Delaware Graduate Fellowship** and the **National Science Foundation IGERT Fellowship**. Students with basic training in organic chemistry, polymer science and engineering, chemical engineering, materials science and engineering, biomedical engineering and pharmacy are encouraged to apply. For consideration, send CV to Prof. Xinqiao Jia at xjia@udel.edu.

Awards & Recognition

- **Jackie Palmer** won the Professional Student Research Award from the Neurology Section of the American Physical Therapy Association for her research: **Palmer JA, Binder-Macleod SA, Wright T, Reisman D. Spatiotemporal gait asymmetry, walking efficiency and speed after stroke.** Combined Sections Meeting of the American Physical Therapy Association, January 2013.
- **Jim Glancey**, Mechanical Engineering, was promoted to Full Professor.
- **Bert Tanner**, Mechanical Engineering, was promoted to Associate Professor.
- **Xian Xu** (advisor: Xinqiao Jia) was selected for a TA Instruments Graduate Student Presentation Award for his talk at the Polymeric Biomaterial Symposium at the 244th American Chemical Society Annual Meeting in Philadelphia.
- **Xinqiao Jia** served as the thematic program chair of the 244th American Chemical Society National Meeting. The meeting's theme was "Materials for Health and Medicine."
- **Ying Mao**, Sunil Agrawal's graduate student, received the 2012 Best Student Paper Award at the IEEE International Conference on Robotics and Automation (ICRA).

- **Dawn Elliott** was named Fellow of the American Society of Mechanical Engineers and the American Institute for Medical and Biological Engineering.



- **Bin Wang**, a visiting student from Chongqing University in China, won the Webster Jee Young Investigator award at the 2013 ORS annual meeting (San Antonio) for his paper "Perlecan/Hspg2 Deficiency Alters Solute Diffusion and Convection in the Bone Lacunar-canalicular System." Wang studied solute transport in loaded bone under UD professor Liyun Wang. www.ichts.org/news/webster-jee-young-investigator-awards-2013-ors-ichts-membership-meeting.



SEEDING RESEARCH

University of Delaware Research Foundation awards 11 projects.



Jun

BIOMEDICAL COLLABORATIONS

Inaugural UD biomedical engineering symposium focuses on collaboration.



Jul

MR. SPORTS MEDICINE

Michael Axe receives 2012 Robert E. Leach "Mr. Sports Medicine Award".



Sept

NEW DOCTORAL PROGRAM

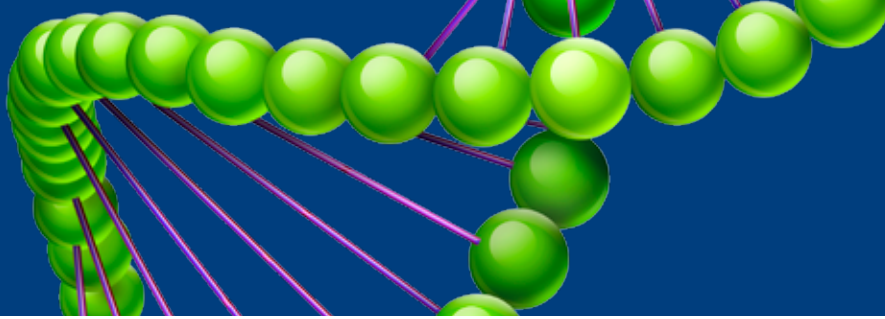
Biomedical engineering launches new doctoral program.



INTERNATIONAL CLASSROOM

Global exchange programs build cultural diversity in engineering.





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Mission Statement

The Center for Biomedical Engineering Research, CBER, is an interdisciplinary center whose mission is to provide engineering science and clinical technology to reduce the impact of disease on the everyday life of individuals. It was created to provide an appropriate forum and infrastructure to promote the interaction of biomedical researchers from the university and the medical community.

BEST PAPER

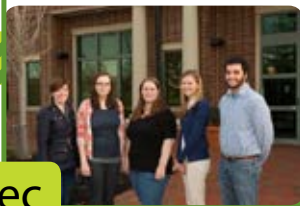
UD's Mao wins IEEE
2012 "Best Student
Paper" on robotics.



Nov

IGERT SCHOLARS

Delaware Biotechnology
Institute hosts reception
for IGERT Scholars.



Dec

PROMISING NANOTECHNOLOGY

Nanotechnology for drug
delivery shows promise
in treatment of pediatric
leukemia.



GRANT WRITING WORKSHOP

Center of Biomedical
Research Excellence
sponsors grant writing
workshop.



Jan '13