Welcome to the first combined issue of the Bioengineering Center and Department of Biomedical Engineering Newsletter. 2004 has been a great year for both the Center and Department. On the teaching side, our Department now has 46 Ph.D. students and more than 120 M.S. students pursuing five separate tracks of study. Additionally, the faculty has approved the addition of two new tracks, biomedical imaging and forensic bioengineering, to provide our students with more flexibility in their study and research opportunities. Two student teams from BME were selected to compete in the 15-team semi-finals of the Enhanced Safety of Vehicle (ESV) International Collegiate Student Safety Technology Design Competition. There are five teams each from the US, Europe and Asia. We hope that our design prototypes will be selected for the final competition to be held in Washington, D.C. in the summer of 2005. Another team is now picking up steam to participate in the 2005 Biomedical Engineering Society design competition.

Our governmental research funding continues to grow. Research projects cover a wide range of topics including the prediction of brain deformation during brain surgery to improve the functional outcome of tumor patients, a study of neurophysiologic responses of animal facet joint capsule due to a rear end impact, and the evaluation of body armor. Privately supported projects are also growing. Three visiting scholars from Hyundai, Kia, and Toyota Central Research and Development Inc., are working at the Center on their respective projects. Our industrial sponsors include Ford, GM Motor sports, National Football League Charities, Nissan, Takata, Toyota, and TRW. Our students have presented papers on their research at many national and international conferences. Our recent MS graduate, Yednesh Parnaik, won first prize for his paper at the 2004 Stapp Car Crash Conference. There were a total of nine student authors presenting at Stapp this year from US and European universities.

We hope that you will find the articles in this newsletter interesting and we look forward to receiving your comments and suggestions.

Sincerely,

Albert I. King, Ph.D.
Distinguished Professor and Chair

King H. Yang, Ph.D
Professor and Director
Abdominal Impact and Injury Response of the Post Mortem Human Subject (PMHS) to High-Speed Seatbelt Loading

**Principal Investigator:** Warren Hardy

**Sponsor:** Toyota Motors Corporation

High-powered (rapid loading rate) pretensioners can be used to limit the excursion of an occupant within the passenger compartment, or they can be used in conjunction with load-limiting devices to reduce the load level experienced by an occupant without increasing excursion. This is an area for which there is little human response data.

The study objective is to obtain impact and injury response data of the abdomen to various pretensioner loading modes. Such data will contribute to the design of an effective surrogate abdomen and testing apparatus for use in the evaluation of injury potential during the development of pretensioners.

A high speed belt loading device will be constructed for this testing. A total of 11 repressurized PMHS will be tested in the umbilical region and the hypogastric region at speeds ranging from 3 m/s to 9 m/s. All belts and pretensioners for these tests will be provided by Toyota.

This study is part of a multi-year effort.

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**Neurophysiology of Whiplash Pain**

**Principal Investigator:** John M. Cavanaugh

**Sponsor:** Center for Disease Control

Whiplash associated disorders (WAD) to the neck are common and debilitating, and often without objective clinical findings. They occur during a motor vehicle impact when the head lags behind the accelerated torso, loading the neck. They can occur in frontal, side and rear impacts but most complaints occur after a rear-end collision by another vehicle.

This is the second phase of the whiplash study funded by the CDC aimed to determine:

1. the response of cervical facet nociceptors and mechanoreceptors to low-rate versus high-rate loading.

2. the response of paraspinal muscles to low-rate and high-rate facet capsule strain.

3. the morphology of the human cervical facet joint capsules (FJC),

4. the distribution of nerves and nerve endings in the FJC.

Congratulations to Dr. Chao Yang Chen for winning a New Investigator award in this research at the 50th Annual Meeting of the Orthopaedic Research Society in 2004.
Design and Integration of a Collapsible Clavicle and Magnetically Regulated Joint Capsule for the Development of a Highly Biofidelic Side Impact Dummy Shoulder

The dramatic influx of SUVs into the vehicle population is redefining the biomechanics of lateral and oblique impacts. The height differential between SUV front bumpers and passenger car doorframe elevates the contact point of side impact collisions to the occupant’s shoulder region. The impact often results in shoulder injury.

Current dummy designs are insufficient in predicting shoulder injuries in oblique impacts.

This research team proposes to develop a “collapsible clavicle” capable of simulating the affects of lateral and oblique forces before and after clavicle fracture.

**Design Team:** Brian McKay (team leader), Jingwen Hu, Sungwoo Lee, Sumer Petrous, Chirag Shah

Development of a Biofidelic Lumbar Spine

Fifty percent of all spinal injuries are the direct result of automotive crashes. In 1998, NHTSA classified the majority of these crashes (67%) as frontal or rear impacts in which the lumbar spine was subjected to a variety of loading conditions such as shear, bending, flexion, extension or a combination thereof. The introduction of knee airbags, the lower torso is restrained much earlier than the upper torso thereby causing a combined shear and flexion of the lumbar spine.

The proposed design utilizes the anatomical structure of the human lumbar spine to improve the biofidelity of existing unidirectional crash dummies so that it can be used for omni directional impacts.

**Design Team:** Tara Troxel (Overall Team Leader), Aditya Belwadi, Beniam Koffi, Chad Olson, Ankur Naik

**STAPP Student paper award:**

Congratulations! Yednesh Parnaik, a recent BME Master’s graduate, won first prize at the 48th Stapp Car Crash conference that took place November 1-3, 2004 in Nashville, TN for his paper entitled “The Influence of Surrogate Blood Vessels on the Impact Response of a Physical Model of the Brain.” The prize is given to student authors recommended by their advisors. There were 9 papers in this category this year.
New Courses for Winter 2005:

BME 5995 : DEVICE & DRUG APPROVAL AND THE FDA

Course Description: A seminar format course in which the class will examine the government regulations and industry procedures that lead to device approval. Topics will include the History of the FDA, drug evaluation and research, evaluation of biologics, definitions of medical devices, investigational device exemption, Institutional Review Boards, Informed Consent, clinical trial design and pre-marketing approval.

BME 7995-2 : Mechanisms and Models of Cellular Regulation for Engineers

Course Description: Regulatory and control processes in cells are presented from a genetic and biochemical network perspective. This course provides an overview of the basic concepts of intracellular signaling pathways for individuals with engineering backgrounds. We will explore the mechanisms that govern the ability of mammalian cells to recognize, interpret and respond to stimuli in the environment. Environmental stimuli include both physical factors (biomaterial, mechanical force) and chemical factors (hormones, cytokines, extracellular matrix).

BME 7995-3 : MRI

Course Description: This is a conventional lecture series with blackboard material and power point presentations. The basics of magnetic resonance imaging will be presented.

Wayne State University Imaging Program

The use of Imaging, particularly non-destructive biological and medical imaging, increased dramatically in the 20\textsuperscript{th} century, with applications from imaging the human body to investigating the sources of oil and gas in the earth. There are numerous methods used for imaging humans: magnetic resonance, ultrasound, computed tomography, optical, electro-encephalography, and magneto-encephalography to name a few. Imaging methods are developed and used both in academia and industry.

The objective of this program is to prepare students with a bachelor’s degree in science or engineering for positions in research in the imaging industry/academia/product development or in the application of various imaging methods to problems in engineering and science. Our imaging program here consists of several core elements independent of the focus. Specifically, students should gain experience and obtain a strong background in: image/signal (data) processing, mathematical/numerical analysis, the physics of imaging, and, medical applications, and anatomy and physiology of the human body in its healthy and diseased states.

For more information on the Imaging Program visit the BME department website.

Imagine that! One of the more exciting aspects of MR imaging is the ability to follow changes in blood flow. As we think or see or perform physical motions that part of the brain that controls these functions changes its blood flow. By imaging the brain before and during these functions we can actually see the areas that are responsible for these actions lighting up. This area of MR is called functional MRI. It has become a major part of neuroscience in the last 10 years.
Wayne State University Forensic Bioengineering Program

In the field of forensic investigation, there exists a strong need for scientists with academic training in forensic biomechanics. Currently, there are only a limited number of forensic science graduate programs, and no formal program is available with an emphasis on forensic biomechanics. Many scientists in this field receive training through post-bachelor certificate programs, on-the-job experience, or self-teaching methods. A concentration in forensic biomechanics at the graduate level would provide students with a background in both engineering and forensics.

The proposed forensic bioengineering concentration will consist of the core biomedical engineering courses, specified elective courses in the biomedical engineering program, and specified courses in the mortuary science program. In addition, new courses in forensic biomechanics are planned as the program matures.

For more information on the Imaging Program visit the BME department website.

Forensic Factoids:

- Although DNA samples are processed in 12 minutes on the hit CBS program CSI, in reality it takes days or even weeks to process a DNA sample.
- A solid block of 20% gelatin is used to represent soft tissue properties in ballistics testing.
- The velocity of a non-lethal projectile ranges from 200-400ft/s.
- Advances have been made in making wound molds using dental impression material.

Welcome Back Week Engineering Barbecue:

The annual Engineering welcome back week barbecue was held on September 17, 2004 – turn out was good and fun was had by all!

BMES is always looking for new members!!

If you are interested in joining please contact:
Nick White at: whiten@wayne.edu
Tara Troxel at: ttroxel@wayne.edu
Wayne State University, Sponsored by the College of Engineering’s Transportation Research Group and Bioengineering Center in conjunction with The Office of Highway Safety Planning, Michigan Department of State Police hosted its first Traffic Safety Campaign this year. There were daily events and hourly prizes for students, staff and faculty who correctly answered a traffic safety questionnaire.

Activities available over the four day event included:

**Fatal Vision Goggles** - Experience the world as you do when you are impaired by alcohol. *Sponsored by the Wayne State Department of Public Safety*

**“Safety Innovations in Auto Racing”** – Special lecture by John Melvin, PhD.

**Child Safety Seat Check** - Certified technicians verify the fit and installation of your child’s safety seat


**Demonstrations of the Crash Lab** – Twice daily at the Bioengineering Center

### Safety Facts:
- Motor Vehicle accidents are the leading cause of death in people ages 2 years old to 33 years old.
- Despite their known effectiveness in preventing serious injuries in automobile accidents “only 75%” of Americans wear their seat belts regularly.

If you have any ideas for our next Newsletter issue, please send them along to Renée Dawson at: ag6485@wayne.edu

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**BME ALUMNI:**
To update your information please contact:

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Sukhinder Bilkhu
skb220@yahoo.com

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**Department Events/ Important Dates:**

**BMES Activities:**

Oct 22: Laser Tag @ 6:30

Dec 10: Rock ‘n Bowl @ 6:30

**Conference Dates:**

Feb 2004 - Personal Armor Safety Symposium, Den Haag, NL

Oct 2004 - 5th Conference on Engineering of Sport, UC Davis, CA

Nov 1-3: STAPP Car Crash Conference in Nashville, TN

Nov 5-11: ASME Conference, Orlando FLA.

Nov 15-17: NTAR Conference,

**Seminar Dates:**

Nov 30: Dr. Terry Tremell – “Spinal Injuries in Indy Car Racing”

**Special Events:**

Oct 11-13: “Drive Safely to Wayne” Campaign - Gullen Mall

Oct 4-7: International Student Week

Nov 24-25: Thanksgiving holiday – school closed

Dec 23: Last day of school before Christmas break

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Renée Dawson, editor