BMES Annual Meeting Trip Report – 10/03
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Council of Chairs Meeting

B.M.E. Education Summit

J. Linehan from the Whitaker Foundation reported on their plans for a second Educational Summit. He indicated that they plan to put more emphasis on industrial topics (design) this time. All programs will be invited to send representatives. The price of admission will be to enter information about programs in an updated version of their database. They plan to transfer data from the existing database into the new one. The format summit will include workshops and short presentations. They are still looking for program topics. They expect about 300 people to attend. Send Jack an e-mail to request the URL for the new database website (the old website is still operational).

ABET

P. Hale described the status of the recent approval of BMES as the lead society for ABET accreditation of Biomedical Engineering programs. This responsibility is expected to cost BMES about $50,000/yr but provides the society with the leading role in determining the criteria for biomedical engineering programs. He noted that many biomedical engineering students don't want their discipline considered a subset of traditional engineering disciplines. He is leading an effort by the Council of Chairs to also be the lead society for Bioengineering programs. He reported that progress is being made but the issue has not yet been resolved.

National BME Design Competition

P. Weilerstein from NCIIA and J. Goldberg from Marquette University described their efforts to set up a national BME design competition. The competition will stress innovation, design and entrepreneurship (in fact there is some type of Innovation, Design and Entrepreneurship Association (IDEA, get it?). Plans are not yet finalized but include a requirement of at least 1 biomedical engineering student (graduate or undergraduate) per team, intial proposals due in early October of 2004 (to include a problem statement, project objectives and market opportunity), selection of 1 team/program for entry into the competition, full applications due in June of 2005 (to include objective, design documentation, a prototype or proof of principle (concept), an IP summary (prior art & patentability), regulatory pathway, market analysis and a business plan with a commercialization strategy. Medical Device & Design (MD&D) magazine has been approach regarding their involvement in the competition. There was some discussion of their plans with the council voting to endorse the general concept of a design competition and asking for an update at their meeting at the AAMI meeting.

Dues and Long-term Goals

There was some discussion of substantially increasing the Council of Chairs membership dues to support more significant activities. However, there is no clear consensus on what these activities would involve (but there were several ideas). A committee was formed at the last Council of Chairs meeting to investigate and recommend long term goals for the organization. A motion was made and approved to ask that committee to continue their work and possibly (probably) propose a dues increase to support some clearly defined objectives at the next meeting.

BME International Distinguished Lecture

J. Abele, founder and chairman of Boston Scientific, spoke about the social implications of technological change. He mentioned two potentially interesting books in his talk including "The Innovators Dilemma" by Christensen and "The Future and Its Enemies" related to his presentation. He made the distinction between sustainable and disruptive technology, although his idea of sustainable technology is a little different then mine. He observed that technology is driving the democratization knowledge in general and health care in particular. He indicated that the power elite can no longer control access to information. He noted that while new technologies often appear to lower costs, they often have hidden or unanticipated costs by requiring large changes in infrastructure.

He anticipates several important advances. He expects biological imaging at the molecular level will allow rapid evaluation and modification of treatments. He is optimistic that minimally invasive hip replacements will soon reduce the cost and pain associated with hip replacement surgery. He has great expectations for electroactive polymers described as artificial muscle in a recent issue of Scientific American, but expressed concern about their possible misuse. He feels that common electronic patient records are technologically feasible, but have not yet been developed due to a lack of political will.

He has some specific concerns about the future of biomedical technology. These include the growing gap between discovery and assessment of new technology. He stressed the need for individuals and society to consider the implications of technological advances. He listed 6 simple ethical rules for the evaluation of medical and technological activities. He commented on the need for technical professionals to speak out on issues.

Plenary Keynote Lecture

J. Bransford spoke about learning science using the most sophisticated PowerPoint presentation I've ever seen. Topics he discussed included "issues of transition" and the need to actively seek feed back, for collaboration, for communication (at an individual level) and to listen as part of the learning process. He mentioned a book or report entitled "How People Learn." He explained the importance of meta-thinking (thinking about

thinking) in learning and doing. He stated that professors should both model behavior and help students understand the important aspects of this behavior. I noted the value of guidance during internships. He pointed out that while people learn **by** experience, they first must learn **to** experience.

He described the value of the concept of Quasi-Repetitive Activity Cycles (QRAC's) in most work. The concept leads to recognition of the value of adopting and adapting tools for problem solving (what he called "Working Smart" and "Smart Tools").

During the question and answer period the idea of disembodied learning (i.e., distance education) came up. He agreed that most research shows that embodied learning is what works best, but some distance learn techniques can be useful if applied correctly.

Vestibular Processes

> This area is a relatively new application of biomedical engineering. The objective is to replace the sensory information provide by the vestibular system (linear and angular acceleration including orientation relative to gravity). I think this area should be investigated as a possible alternative application by the MEM's design team (01003).
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> C. Wall described his work on sensory substitute for balance prostheses. He noted that 6.2 million Americans have some form of chronic balance disorder. He described the vestibular system as 5 motion sensors that provide 6 degrees of freedom and noted that it general behaves as a lumped parameter system. He noted that neurons carrying singles from the vestibular system display tonic activity. This signal is frequency modulated with acceleration information and the difference between the left and right signals is used by the brain. His system involves a tactile feedback system that is placed on the back and belly. The accelerometer in his system is placed on the trunk (it has been found that placing the accelerometer on the head is not necessary). He used the term tactors for the FDA approved tactile vibration transducers used in his system. His system used a accelerometer and gyro system from Draper(?).
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> M. Dozza spoke about his use of an audio biofeedback system for balance information. His system involved a laptop computer with a DAQ. The sensor on his system was located on the trunk. The output from his system was amplitude and frequency modulated stereo audio that provide information on both AP and ML axis tilt. He found that gravity (slow), acceleration (fast) and velocity information is important to users of his system. I noted that his device that he demonstrated would make and interesting new musical instrument. His device is limited to rehab application due to cross talk problems with using audio feedback. He found that subjects learned to use his system quickly and experienced some residual benefit after using the device. This residual benefit was also observed in projects described latter in the session.

Y. Danilov described a electrotactile system for vestibular substitution. His head mounted system used a 12x12 electrode are applied to the tongue. I observed a short training time with his device and positive results for patients with vestibular deficits. His force plate data on postural correction gave me an idea to use postural correction data as a means of individual identification (each patient had an unique force plate "signature" with and without his device).

D. Merfeld described his vestibular implant animal research. His device stimulates the ampullary nerve based on acceleration data in order to mimic normal encoding. He studied the vestibular-ocular reflex but subjectively noticed improved postural stability.

Product Design & Development (in the Orthopedic Bioengineering track)

Progress continues in the area of cell matrices for tissue engineering.

A. Ratcliffe described a cell-matrix for cartilage repair. The matrix described for large defects was produced using 3D printing technology. It consisted of 32 layers and included 5 different polymers. Scale-up of bench scale technologies presents a significant challenge that might be addressed in part using robotics and high volume bioreactors. An ASTM standard for Tissue Engineered Medical Products (F4.04) was mentioned.

B. Hatcher described his work on producing and using hybrid organic (polyvinylpyrrolidone)-inorganic (77S bioactive glass) fibers for bone tissue engineering. He noted that current 5 year success rates are low (25% for autografts and 15% allographs) illustrating the need for improved material for filling large bony defects.

E. Hedberg described her work investigating biodegradable microparticles for the controlled release of hyaluronic acid (HA) oligomers. Her microparticles consisted of HA entrapped in a poly(DL-lactic-co-glycolic acid) (PLGA) with or without poly(ethylene glycol). She used a fractional factoral design to identify the most important parameters (PEG presence or absence, HA molecular weight, PLGA molecular weight and HA loading).

B. Bucklen described his work on optimizing scaffolds for cellular mechanotransduction. He used the finite element method (using Matlab) to modify 3D structures to provide more uniform parameter distributions. Parameters of interest included stress, strain and strain energy.

J. Fryman described his studies of wear in metal on metal hip joint prosthesis. Metal on metal implants are popular in Europe where it is believed that poly wear products produce excessive inflammation. Specifically, he used a novel apparatus to study the impact of ball size and clearance on wear. He tested cobalt-chrome implants using a walking gait load curve at 1 Hz for 6 million cycles (the

equivalent of about 6 years of use). He noted period of rapid wear during the fist million cycle followed by a period of slower wear for the next 5 million cycles.

Current Thrombosis Strategies

Several speakers challenged traditional models of thrombosis formation in this session. If they're correct, and they made pretty good cases, we'll have to change the name of the extrinsic pathway.

Y. Nemerson presented an analysis and data indicating that tissue factor (TF) in intravascular blood clots originates in the blood rather than the tissues. This is contrary to conventional models of coagulation processes, but he (and later speakers) made a very good case. He believes that TF may be picked up from the circulation by PMN's and transferred to platelets by pseudopod processes. His theory helps explain how deep vein thromboses (DVT's) can occur without apparent preexisting tissue damage.

M. Goel presented results from a series of experiments that supported the idea that TF and other factors in platelets play a significant role in *in vitro* coagulation. His experiments used materials like gel filtered platelets, platelet free plasma, Corn Trypsin Inhibitor (CTI).

Biosensors I *in vitro* Applications

Attended, but no report available.

American Society of Engineering Education – Biomedical Engineering Division (ASEE-BED)

Attended, but no report available.