



European Society of Biomechanics Newsletter

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ESB focus groups are getting started!

Georges Van der Perre, Leuven, Belgium

President of the ESB

A first focus group (or special interest group) was kicked off by Marie-Christine Hobatho with the recent workshop on "Ultrasound and Bone" (Journées d'Etude "Os-Ultrasons", Compiègne, January 24-25). Three others are ready for kick off: Dental Biomechanics, Tissue Engineering and Mechanobiology, and Implant Fixation. Others will follow soon.

The "Focus Group" initiative was launched at the 2000 General Assembly in Dublin. The aim is to initiate and support ongoing in-depth discussion among researchers working in the different relevant areas of biomechanics, focusing at finding answers to essential questions. Focus groups are expected to identify and specify clinical problems as well as research questions, and to formulate clear answers. They will draft and continuously update an inventory of essential questions and problems, answers and solutions, and questions remaining to be solved.

Focus groups will communicate through regular workshops (once or twice a year) as well as a discussion group on the ESB-website. Fully documented state of the art reports will be published regularly through e.g. the pages allocated to the ESB in Journal of Biomechanics.

Focus groups will get support from the ESB in different ways: hosting a homepage and discussion group on the ESB website, finding sponsoring and financial support (e.g. through concerted actions within the EU research programmes) for the organisation of workshops, activity

reports in the newsletter, review papers in Journal of Biomechanics, special workshops in the framework of the ESB-Conference, establishing cooperation with other scientific societies.

To get the initiative off the ground, council members have taken direct responsibility for the launch of the first four focus groups:

- Ultrasound and bone: Marie-Christine Hobatho
 - Dental Biomechanics: Michel Dalstra (with Pietrabissa, Natali, Bourauel and others),
 - Tissue Engineering and Mechanobiology: Patrick Prendergast and Keita Ito,
 - Implant fixation: Georges Van der Perre and Hanu Aaro.
- Please contact immediately one of these people, if you are interested in participating in one of those three groups.

Your own proposal to start another focus group will be warmly welcomed by the council. Obvious potential topics are: fracture healing and fixation, osteoporosis, musculoskeletal loading, joint kinematics, biofluid mechanics, rehabilitation engineering, sports biomechanics, occupational and safety biomechanics, impact biomechanics, spine biomechanics...

If you like to contribute to the focus group initiative in one way or the other, please contact us! Furthermore we are open to all your suggestions and criticism.

Wroclaw bids you welcome!

Michel Dalstra, Aarhus, Denmark

Newsletter editor

The Polish city of Wroclaw will be the setting for the next bi-annual conference of our society. The organizing chairman, professor Romuald Bedzinski, and his colleagues have taken it upon themselves to host this meeting and they are very much looking forward to meeting you there at the beginning of September 2002.

The 12th Conference of the ESB in Dublin in August 2000 has been one of the most successful meetings ever in the history of our society, so Wroclaw has now quite a standard to live up to. Furthermore, the 13th Conference will be placed slap-bang in the middle of the IV World Congress of Biomechanics in Calgary, Canada and the 12th Annual Meeting of the European Orthopaedic Research Society in Lausanne, Switzerland in August and October, respectively, so the competition from those will undoubtedly be fierce. However, Wroclaw has many things going for it.



Wroclaw's gothic Town Hall.

With 640,000 inhabitants it is the fourth largest city in Poland and it is an old town with a colourful history.

Situated on the meandering banks of the Odra and four lesser rivers, the origins of the city date back to the 6th century when it was established by the Slavic Slezanie tribe. As Wratislava it became soon a strong political and economic centre of medieval Poland. In 1333 the city and the surrounding principality were taken over by the Czech monarchy and remained under Czech rule for almost 200 years. Wratislava then changed its name to Breslau as it became then the capital of lower Silesia under the Austrian Habsburgs from 1526 until 1741, after which it came under Prussian and later German rule until 1945. After the destructions of World War II in which 70 percent of the city was devastated, the city is now beautifully restored with its market square, Town Hall and Ostrów Tumski Island in the Odra River, featuring some of the most beautiful of Wroclaw's more than 80 churches.



Merchant houses on Wroclaw's market square.

It is actually the first time that a bi-annual conference of our society is being organized in an Eastern European country, so this will give a good opportunity to exchange biomechanical ideas between East and West and thus strike a bridge between them. For many of our members in Western Europe, it will be the first occasion to be properly introduced to the biomechanical tradition in Eastern Europe. The organisers of the conference are the Wroclaw University of Technology, which will also supply the accomodation for the meeting, the Polish Society of Biomechanics and the Polish Society of

Mechanical Engineers and Technicians. Co-organisers are furthermore the Polish Orthopaedic and Traumatology Society and the Scientific Committees of Rehabilitation and Social Adaptation, Mechanics, and Biocybernetics and Biomedical Engineering of the Polish Academy of Sciences.

More information about the 13th Conference of the ESB can be found on its homepage:

<http://www.esb2002.pwr.wroc.pl/>

Hope to see you all in Wroclaw!



Ostrów Tumski (Church Island) in the Odra River.

Biomechanics in ... Denmark

Henrik Sørensen & Michel Dalstra, Aarhus, Denmark

You might remember from previous ESB newsletters that we ran a series on biomechanical education and research in different countries. In this issue it is Denmark's turn.



Denmark and its university cities.

Denmark with its 5 million inhabitants has three general universities (Copenhagen, Aarhus and Southern Denmark), two technical universities (Lyngby and Aalborg) and one university centre (Roskilde) and it is predominantly at these academic institutions that biomechanics is being taught and biomechanical research performed.

At the University of Copenhagen biomechanical research and teaching is conducted at the Institute of Exercise and Sport Sciences, Faculty of Sciences and at the Institute of Medical Anatomy, Faculty of Health Sciences.

Most of the teaching is done at the Institute of Exercise and Sport Sciences, where biomechanics constitutes a minor part of the curriculum. Due to various traditional reasons muscle physiology is the major research and teaching area at the institute, while biomechanics enjoys far less recognition.

The Institute of Exercise and Sport Sciences offers bachelor, master and Ph.D. degrees. The bachelor degree is a three years program where a single biomechanics course is offered at the third semester. The course consists of two lessons per week for 15 weeks, given either by an assistant professor as auditorium lectures for the entire class (approximately 100 students) or by a teaching assistant as class room lectures for groups of approximately 20 students. Topics covered are simple kinematics, kinetics and movement analysis. The course also includes three laboratory exercises, one about force

plate use, one about EMG, and one about anthropometric measurements. The students perform these exercises in groups of six, and each group writes a report which is marked by the lab. TA. The entire course is judged on a final written three hours test. The bachelor program is open to all students regardless of the amount of natural science (mathematics and physics) they studied in high school. This means that several students who emphasized arts and humanities during high school have very limited skills in mathematics and physics. Hence, the teaching is aimed somewhere in between a qualitative and a quantitative approach, but still provides an interesting and challenging situation for the TA's, who are required to teach for instance basic algebra simultaneously with quantitative aspects of biomechanics.

The master program is scheduled to two years, but most students spend more time due to thesis work. Aside from the thesis the program consists of a big general human physiology course, a biochemistry course and eight smaller special courses. Each of these eight special courses are taught by an assistant professor four lessons per week for eight weeks and judged on a final written three hours test. The study material consists mainly of original research literature. The students are free to choose among these eight special courses, but must take at least three. Seven of the courses deal with various aspects of physiology while one is a biomechanics course. To enter the master program students are required to have skills in mathematics, physics and chemistry on medium high school level, which allows the level and progression rate of the master program biomechanics course to be considerably higher than at the bachelor course. The teaching approach is almost entirely quantitative. Topics covered are medium advanced kinematics and kinetics, inverse dynamics, muscle mechanics, electrophysiology and motor control.

Most biomechanics research at the University of Copenhagen is conducted at the Institute of Medical Anatomy, Faculty of Health Sciences. Many years ago, Dr. Finn Bojsen-Møller, a macroscopic anatomist, founded the Laboratory for Functional Anatomy at the Institute of Medical Anatomy. During the early years most studies in this lab were on material properties of bone and ligaments, but gradually students from the Institute of Exercise and Sport Sciences, interested in the biomechanical aspects of human movement, started to drift in. The Laboratory of Functional Anatomy expanded, both equipment, people and name-wise. Today it is equipped with force plates, 3D-video analysis, and a 16-channel EMG system. Presently it employs two associate professors, four Ph.D.-students and three master students. After the laboratory for several years had attracted sport students interested in biomechanics as well as neuro-physiologists from other institutes at the Faculty

of Health Sciences interested in motor control, even its name expanded to its present Laboratory for Functional Anatomy, Biomechanics and Motor Control. Areas of research are movement analysis via inverse and forward dynamics, mostly of sport specific movements, material properties of bone and ligaments and reflex control of movements. Aside from research the laboratory's staff teaches various biomechanics-related courses for orthopaedic surgeons, sport's medicine doctors, chiropractors, physiotherapists and medical students.

In Aarhus, Denmark's second-largest city, biomechanics is an important part of the education and research programs at its university and University Hospital.

Since the 70's, there has been a Biomechanics Laboratory at the Department of Orthopaedic Surgery. Although it changed its name to Orthopaedic Research Laboratory a few years ago, the main lines of research are entirely biomechanical in nature and consist of bone mechanics (both conventional mechanical testing and structural analysis with micro-tomography and histomorphometry), joint stability and kinematics and mechanics of implants. The staff consists of a number of senior researchers, some laboratory assistants and around ten Ph.D.-students. A second biomechanical nucleus is located at Skejby Hospital, one of the parts of the University Hospital. At its cardiovascular department, a group of engineers and medical doctors are working on fluid dynamics and models for blood flow. Furthermore is Skejby Hospital home to the Institute of Experimental Clinical Research, which besides supplying the facilities for animal experiments, features the Scanning Acoustic Microscopy Laboratory, where the mechano-acoustic properties of bone, teeth and soft tissue are studied.

Biomechanics is also an important topic at the Orthodontic Department of the Royal Dental College, the university's dental school. Moving teeth with the help of orthodontic appliances, like braces, is entirely based on biomechanical principles. For both undergraduate and post-graduate students, biomechanics is therefore an integral part of the orthodontic teaching program. Furthermore, several biomechanically-based Ph.D. and M.Sc. research projects are being performed. These include both animal experiments on tissue reactions to orthodontically applied loads and finite element analyses of tooth/bone configurations.

A few years ago a new three-year bachelor study of sport sciences was started and the Institute of Sport Science was formed under the Science Faculty. It has an in-take of around 60 students per year. Biomechanics also has a place in the curriculum here. Basic biomechanics is taught in the first year for all students, while in the third year students can voluntarily choose an advanced course, which concentrates on kinematics and tissue mechanics.

The experimental facilities at the institute consist for the moment of a force platform and a number of high-speed video cameras, but there are plans for the establishment of a fully equipped gait and movement-analysis laboratory. For this there is also collaboration with the aforementioned Orthopaedic Research Laboratory.

Also from the last few years is the so-called candidate study of health sciences. This is a three-year program meant for physiotherapists, nurses and para-medical personnel, who would like to have a more scientific background. In the final year, the students have to choose between the internal medicine line or the rehabilitation line, and within the latter biomechanics forms one of the three pillars around which the study is built up. Focus here is predominantly put on the clinical aspects of orthopaedic biomechanics.

Finally, the latest development concerning biomechanics education is the collaboration between the Faculty of Health Sciences and Aarhus Technical Highschool. Another three-year candidate study is offered here on biomedical technology. Besides the biomechanical teaching, students of this course are encouraged to perform biomechanically orientated research projects at the various aforementioned institutes and laboratories.

With all these different groups working more or less independently of one another, there are now plans to bundle resources and come to a closer collaboration. This might even lead to the formation of a Center for Biomechanics at the University of Aarhus in the future.

The Odense campus of the University of Southern Denmark is home to the Institute of Sport Science and Clinical Research. Research activities here are focussed on 1) clinical biomechanics and 2) exercise physiology and biomechanics. Within the former low back pain, whiplash and cervicogenic headache form the current research interests, while in the latter there is a blend of muscle physiology and kinematics in relation to sports. The five-year study of sport science is very practically orientated and offers besides biomechanics, also courses in arts, psychology and sociology.

The university is furthermore the only one in the Nordic countries to offer a degree in chiropractic (clinical biomechanics). This means that at the Nordic Institute of Chiropractic and Clinical Biomechanics half of the students are Danish, while the other half are from the other Nordic countries. Courses in this study are both theoretically and practically orientated. For full recognition of a chiropractor degree, students have to complete a one-year training program after the basic 3-year study.

The last of the Danish universities at which biomechanics is practised is the Technical University of Aalborg. Here

the International Doctoral School of Technology and Science is located. Part of this is the Center for Sensory-Motor Interaction (SMI), which is recognised as a Marie Curie Training Site in biomedical science and engineering. Doctoral students are invited to stay at SMI as a Marie Curie fellow for a period. The research at SMI is interdisciplinary and focused on three inter-related areas within the field of neuroscience: 1) Basic motor control and biomechanics, which comprise theoretical and experimental investigations of central and segmental interaction between motor and sensory control mechanisms and biomechanical structures, 2) Sensory systems, which comprise basic human experimental pain research involving standardised techniques to activate, assess and modulate reactions from the human pain system under normal and pathophysiological conditions, and 3) Rehabilitation technology, which comprises the development of functional and reliable implantable devices for restoration of lost motor functions.

The Department of Medical Informatics and Image Analysis (MIBA) is second of Aalborg University's biomechanically orientated institutes. Since 1999 the study of Biomedical Engineering at MIBA consists of two specialisations Medicinsk Informatik (MI) and the International Master's in Biomedical Engineering. In the latter curriculum, courses given are physiology for engineers, neurophysiology, medical instrumentation, sensory mechanisms and psychophysics, rehabilitation technology, bioelectric modelling, medical imaging systems, applied biomedical signal processing, biomechanical systems and motor control, biostatistics, neural networks and fuzzy logic, adaptive systems, engineering responsibility, time-frequency analysis, multidimensional signal processing, scientific methods and communication. In Medical Informatics the project courses are based on the area Information Systems in the health care sector.

Finally, a rather curious collaborative initiative between a number of departments at Aalborg University is the so-called AnyBody project (<http://anybody.auc.dk/>), which is new and extremely efficient method for the simulation of multi-body biomechanics systems. The aims of the project are 1) to develop methods for the analysis of movement strategies and tendon, muscle and joint forces in humans performing specific manual tasks, 2) to investigate what numerical simulation can teach us about the function of the human body, and 3) to use the analysis for ergonomic optimization of tools, workplaces and man/machine interfaces.

The authors have tried to give a complete overview of the state of Danish biomechanics. As they themselves originate from the Universities of Copenhagen and Aarhus, these institutions have received more attention

than Odense and Aalborg, but that is because they simply know more about their home institutions and not because these universities would precede the others. The authors hope that, after reading this article, the reader will appreciate that, although Denmark may be a small

country, biomechanics is very well represented at its universities. With many of the aforementioned research activities, the involved scientists are in fact counted among the leading in the world.

IOC - Olympic Prize 2002

Professor Bengt Saltin M.D., Drs.h.c.



December 12th, the president of the International Olympic Committee, Dr. Jacques Rogge, announced that Professor Bengt Saltin, M.D., was selected as winner of the 2002 IOC Olympic Prize on Sport Sciences, the highest honor in the field of movement, exercise and sport sciences (MES). Endowed by Pfizer, the \$500,000 prize is officially presented to Dr. Saltin at the 2002 Olympic Winter Games in Salt Lake City - along with an Olympic medal. The announcement noted Dr. Saltin's outstanding contributions in exercise physiology, including his path-breaking research that proved the benefits of physical activity in health recovery. His research explores the valuable question of "to exercise or not" in prevention of and recovery from diseases.

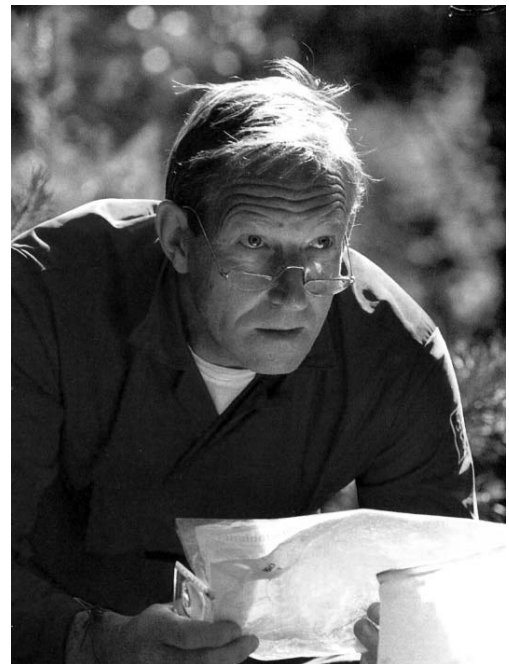
"Dr. Saltin's work epitomizes what this award is all about - helping people live active lives," said Prince Alexandre de Merode, Chairman, IOC Medical Commission. "The IOC Olympic Prize is a catalyst for scientific discoveries that will benefit athletes and recreational enthusiasts of all ages and abilities. Together, the IOC and Pfizer are committed to improving research and sharing scientific knowledge in this field."

The impact of Dr. Saltin's research can be felt throughout society - in the medical field and in the everyday lives of people, from the promotion of basic physical health to the enhancement of elite performance.

Through research studying the effects that inactivity has on the body, which was commissioned in part by NASA, Saltin confirmed that exercise, not bed rest, should be a part of recovery after experiencing illness/injury. This

marked a major shift in how patients were treated following injury or illness.

"Years ago, it was thought that rest and relaxation were the best ways to recuperate from an injury or illness, but my research proved that, in fact, it's the opposite," said Saltin. "People should work with their doctor to create an active recuperation plan following any injury or illness, cardiovascular or athletic."



Dr. Bengt Saltin

Dr. Saltin's findings also contributed to the concept that regular exercise is important for health and well-being. In addition, his study of elite athletes while exercising and training has led to a better understanding of the importance of oxygen flow to the muscles (as well as

availability of nutrients) in exercise and overall health. He has used these findings to study other areas such as anemia and the overall positive effects of exercise, focusing on the use of exercise to maintain and regain health.

“Pfizer is committed to furthering scientific research that underscores the importance of exercise and physical activity in cardiovascular and other disease treatment. This research is crucial to improving human movement, providing preventative care, and better managing disease states for people who seek to live a healthy lifestyle,” said Randall Kaye, MD, Director of Olympic Affairs for Pfizer, Inc.

In addition to the \$500,000 and an Olympic Medal, Dr. Saltin will receive a diploma of excellence for his contributions to science. The Olympic Winter Games in Salt Lake City will mark the fourth time this coveted prize has been awarded.

The IOC Medical Commission and Pfizer believe the IOC Olympic Prize heightens the recognition for research

of movement and mobility, and thus attracts brilliant scientific minds to study and further human performance.

To ensure that the IOC Olympic Prize reflects scientific work of the highest degree, a Selection Committee composed of worldwide renowned scientists and thought leaders evaluated peer nominations of candidates from multiple fields of science. Rigorous criteria guide the selection of a scientist whose contributions to movement, exercise, and sport sciences have a significant impact on science and/or society.

Although the IOC Olympic Prize on Sports Sciences is the main focus of the Pfizer/IOC Medical Commission partnership, Pfizer also endows three other major IOC Medical Commission initiatives including: IOC Olympic World Congress on Sport Sciences, IOC Olympic Academy on Sports Sciences, and Pfizer/IOC Olympic Research on Sport Sciences. For further information about the IOC Olympic Programs visit www.olympic.org or www.pfizer.com.

BioNet Event

Biomechanics in the Decade of the Bone and Joint

Brussels, April 27th – 29th , 2002

The BioNet Event is part of the BioNet project (“Strategic Development of European Networks in Biomechanics”, coordinated by Prof. Gordon Clapworthy, e-mail gc@dmu.ac.uk). The Event wants to create a discussion forum for all parties, involved in biomechanics, whether they come from industry, medicine, research, academia, charities, etc. The objective is to identify and address biomechanical problems that are of the greatest contemporary importance. By including a session that is specifically designed to promote discussion on

“controversial” topics, the event wants to be different from “traditional” congresses. Apart from this "Get it off your chest" session, keynote lectures that bring the current state of the art, parallel sessions on specific topics and poster sessions are scheduled as well. At the end of the Event, Work Groups will be defined in order to tackle the specific problems identified.

More information on the BioNet event can be found at <http://www.mk.dmu.ac.uk/bionet>.

Dates to remember biomechanical congresses & meetings

Micro to Macromechanics of Hierarchical Living Materials and Technical Structures - Bad Honnef, Germany.....March 25th - 28th, 2002

BioNet Event "Biomechanics in the Decade of the Bone and Joint" - Brussels, Belgium.....April 27th - 29th, 2002

102nd Annual Session of the American Association of Orthodontists - Philadelphia, Pennsylvania, USA.....May 3rd - 7th, 2002

29th European Symposium on Calcified Tissues - Zagreb, Croatia.....May 25th - 29th, 2002

78th Congress of the European Orthodontic Society - Sorrento, Italy.....June 4th - 8th, 2002

Advanced School and Workshop on Mathematical and Computational Modeling of Biological Systems - Lisbon, Portugal.....June 17th - 21st, 2002

Advanced School and Workshop on Bone Mechanics - Mathematical and Mechanical Models for Analysis and Synthesis - Lisbon, Portugal.....June 24th - 28th, 2002

20th International Symposium on Biomechanics in Sports - Cáceres, Spain.....July 1st - 5th, 2002

4th World Congress of Biomechanics - Calgary, Canada.....August 4th - 9th, 2002

13th Conference of the European Society of Biomechanics - Wroclaw, Poland.....September 1st - 4th, 2002

4th International Conference of the Engineering of Sport - Kyoto, Japan.....September 3rd - 6th, 2002

Comparing Design in Nature with Science and Engineering - Udine, Italy.....September 10th - 12th, 2002

17th European Conference on Biomaterials - Barcelona, Spain.....September 11th - 14th, 2002

11th Meeting of the European Society for Movement Analysis in Adults and Children - Leuven, Belgium.....September 19th - 21st, 2002

24th Annual Meeting of the American Society for Bone and Mineral Research - San Antonio, Texas, USA.....September 20th - 24th, 2002

12th Annual Meeting of the European Orthopaedic Research Society - Lausanne, Switzerland.....October 11th - 13th, 2002

International Congress of Biomechanics - Biomechanics of Man 2002 - Cejkovice, Czech Republic.....November 13th - 15th, 2002

2nd European Medical and Biological Engineering Conference - Vienna, Austria.....December 4th - 8th, 2002

30th European Symposium on Calcified Tissues - Rome, Italy.....May 8th - 12th, 2003

15th Conference of the International Bone and Mineral Society - Osaka, Japan.....June 2nd - 7th, 2003

19th Congress of the International Society of Biomechanics - Dunedin, New Zealand.....July 6th - 12th, 2003