Stepping Stone Symposia

SSSTC

Sino Swiss Science and Technology Cooperation

Conference on

Medical Technology

September 27–28, 2012

ETH Zurich, Main Building, Semper Aula

www.steppingstone.ethz.ch

Sponsors: Contact Group for Research Matters

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Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Programme overview

(find the detailed programme on page 10)

Wednesday, 26 September 2012

17:30	**Welcome reception** Dozentenfoyer/faculty club, ETH Main Building, J-floor

Thursday, 27 September 2012

9:15	*Registration*
10:00	**Opening address** Nicholas SPENCER (President, Research Commission, ETH Zurich) Longchao ZHOU (Director, European Division, Chinese Ministry of Science and Technology) Mauro MORUZZI (Director, International Cooperation, State Secretariat for Education and Research)
10:20	**Introduction to the symposium** Marcus TEXTOR (ETH Zurich) Ralph MÜLLER (ETH Zurich)
10:30	**Session I: Tissue engineering I** *Session chairs: Simon Philipp HOERSTRUP (University/University Hospital of Zurich) and Yanan DU (Tsinghua University)*
12:10	*Lunch*
13:10	**Session II: Tissue engineering II** *Session chairs: Yilin CAO (Shanghai Jiao Tong University) and Marcy ZENOBI-WONG (ETH Zurich)*
15:30	*Coffee break*
16:00	**Session III: Imaging and sensing** *Session chairs: Gabor SZEKELY (ETH Zurich) and Jue WANG (Xi'an Jiao Tong University)*
from 19:00	*Dinner for invited guests at the restaurant "Grünes Glas"*

Friday, 28 September 2012

8:30	**Session IV: Innovation I** *Session chairs: Gangmin NING (Zhejiang University) and Philippe RENAUD (EPF Lausanne)*
10:30	*Coffee break*
11:00	**Session V: Innovation II** *Session chairs: Urs MATTES (Mathys China & Hong Kong/Medtech Switzerland) and Le XIE (Shanghai Jiao Tong University)*
13:00	*Lunch*
14:00	**Session VI: Market and regulation** *Session chair: Patrick Dümmler (Medtech Switzerland)*
15:20	*Coffee break*
15:50	**Podium discussion: How to create Sino Swiss synergy in medtech research and innovation** *Facilitators: Marcus TEXTOR (ETH Zurich) and Ralph MÜLLER (ETH Zurich)*
16:50	Concluding remarks
	Networking: "Apéro riche"

Welcome to the Stepping Stone Symposium on Medical Technology – An initiative of the Sino Swiss Science and Technology Cooperation (SSSTC)

Dear symposium participants,

It is our honour and pleasure to welcome you to the first Stepping Stone Symposium on Medical Technology.

In the past eight and a half years, the Sino Swiss Science and Technology Cooperation (SSSTC) has been devoted to promoting scientific contacts between China and Switzerland. Aside from various joint symposia and workshops in the pilot phase (2004-2007), nearly 200 research/exchange projects have been awarded in the current phase (2008-2012). Although Sino Swiss research and education collaboration is not an invention of the SSSTC, given the majority of the current projects are between new partners, the programme has surely significantly promoted and expanded scientific contacts between the two countries.

For the coming SSSTC phase (2013-2016), the SSSTC will also address the issue of Sino Swiss innovation cooperation. Not to downgrade the importance of education and research cooperation, these remain the centerpiece of the SSSTC, but it is necessary that we recognise innovation as an outlet and the realisation of fundamental research. In this symposium, we bring together researchers and clinicians from renowned Chinese and Swiss universities and hospitals so as to ensure scientific excellence. We also invited practitioners of innovation as speakers in order to keep societal needs in the perspective. We wish all participants an exciting and mentally stimulating conference.

Representing ETH Zurich (Leading House, SSSTC) and the University of Zurich (Associated Leading House, SSSTC), we thank the Swiss State Secretariat for Education and Research, the Chinese Ministry of Science and Technology, the Commission for Technology and Innovation, the Contact Group for Research Matters, and Medtech Switzerland for their moral, intellectual, and financial support. Last but not least, we thank the scientific board members and various session chairs for shaping the programme and the speakers for their scientific contributions: without your support, this symposium would not have been possible.

We look forward to welcome you again next time in China.

Sincerely yours,

Marcus Textor,

Ralph Müller,

Maio Chen

Organising Committee

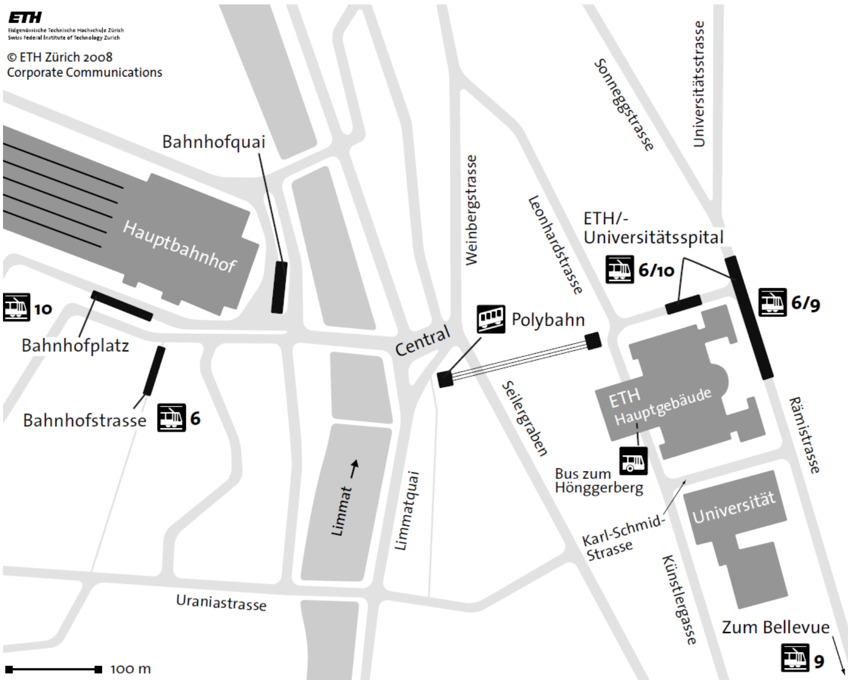
Information

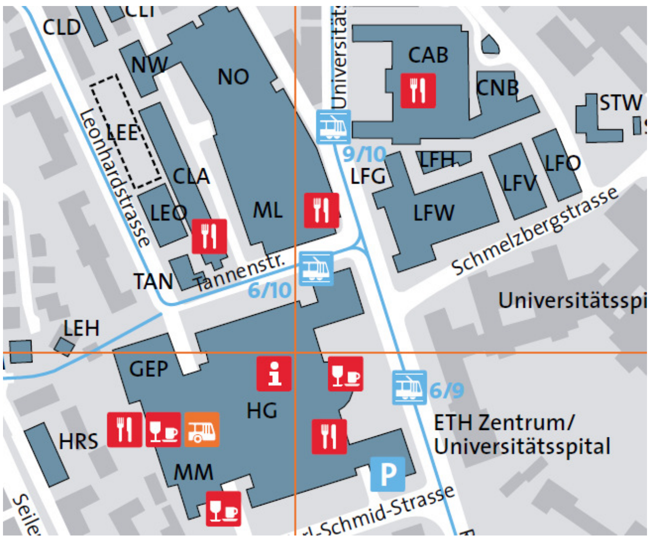
Directions

The symposium will take place in the **Main Building of ETH Zurich (ETH Hauptgebäude, building HG)** in the heart of the city of Zurich.

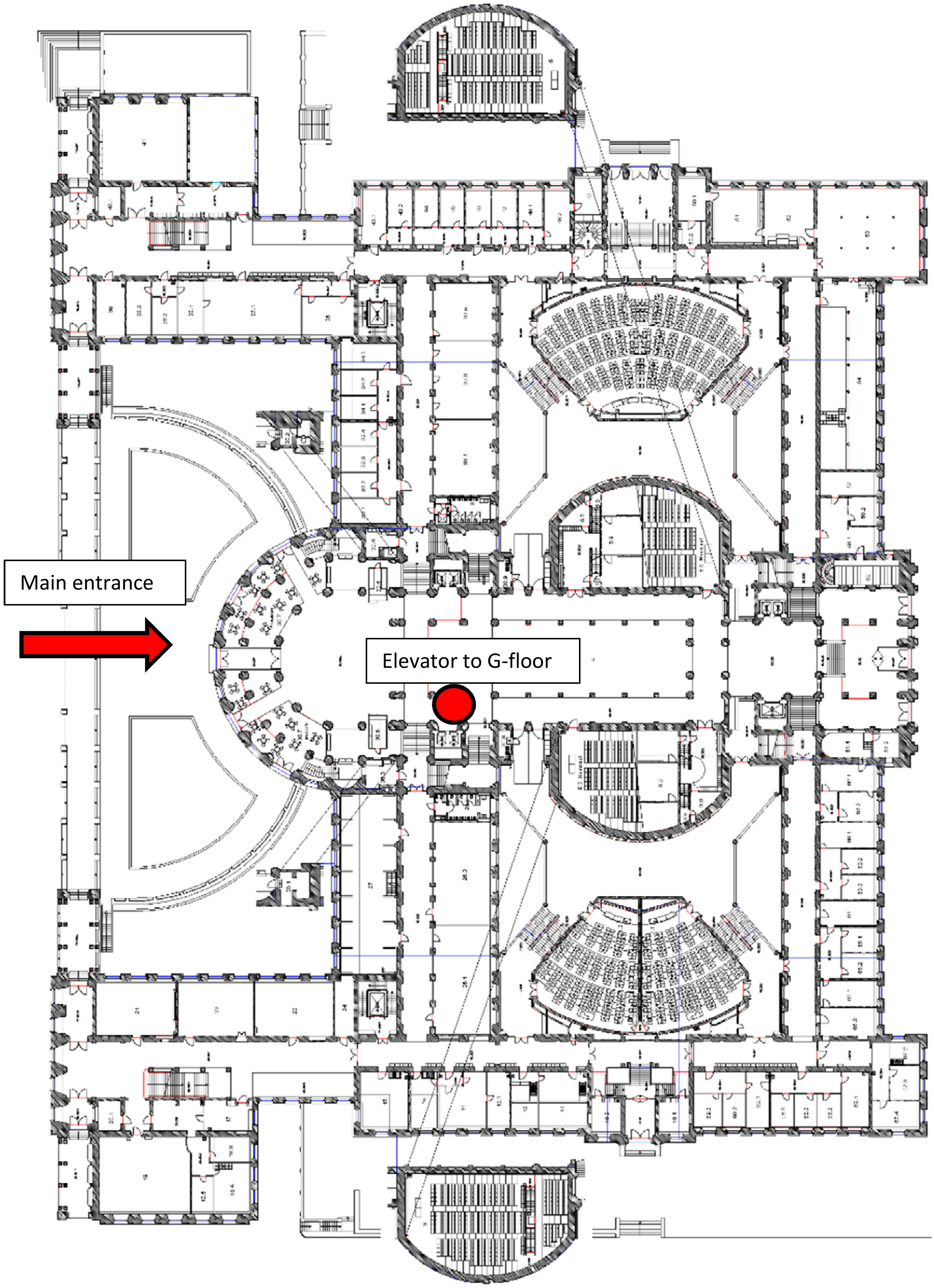
How to reach the conference location **from Zurich Airport**:
Take the tram number 10 to tram stop "ETH/Universitätsspital". The tram operates daily from 6 a.m to 11 p.m. with trams departing every 7 to 15 minutes. Journey time: 30 minutes.

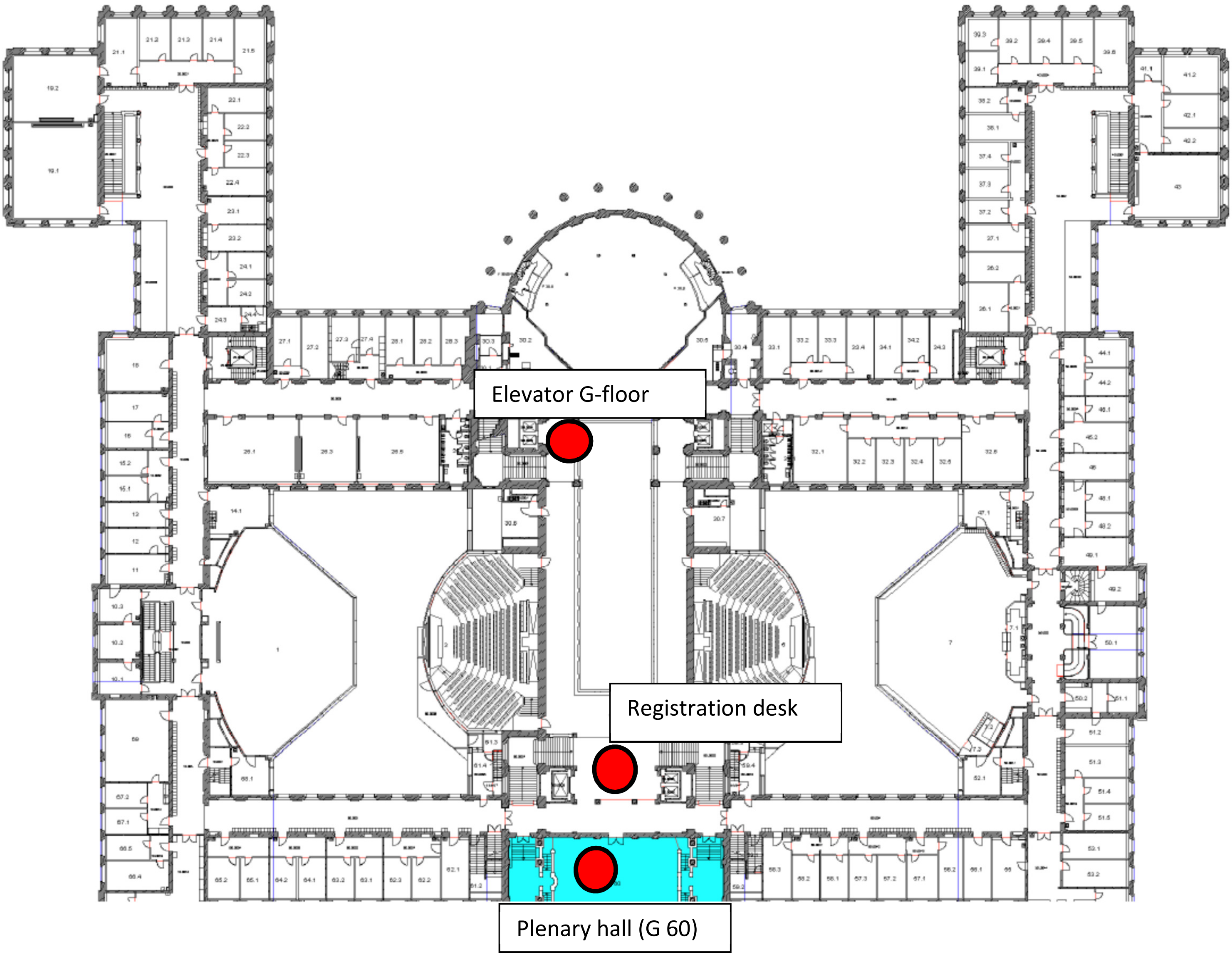
How to reach the conference location **from Zurich main train station**:
Take the tram number 10 (direction Flughafen or Bahnhof Oerlikon) from the tram stop "Bahnhofplatz/HB" to tram stop "ETH/Universitätsspital" or tram number 3 (direction Klusplatz) to tram stop "Central" (first stop), from "Central" by Polybahn (departing every 3 minutes) to the Polyterrasse. Journey time: about 8 minutes.





ETH Main Building – Site map




Elevator G-floor
Registration desk
Plenary hall (G 60)

Registration desk

The registration desk is located in the ETH Main Building (HG) on the **G-floor** in front of the conference room G 60 (Semper Aula). See also the site map above for further details.

It will open at 09:00 h on Thursday, September 27, 2012. After the first session it will be open and occupied every morning 30 min before the conference starts as well as before and after each session. Walk-in registration will be possible during the conference at the beginning of each session.

Instructions to speakers

To ensure that your presentation is loaded timely onto the presentation computer, please follow the instructions below and submit your presentation slides on September 26 to Maio Chen, or at the registration table on September 27/28.

- Save your presentation file on a USB memory stick as a PDF or Power Point (.ppt or.pptx) file. The USB memory stick should be inserted into an envelope ready to hand-in at the time of your registration. The envelope should be labeled with:
  - Your first name and last name
  - Date of the presentation
  - Time of the presentation

- The presentation on the USB memory stick must be named: NAME_DD_time.ppt where DD is the day of your oral presentation.
- You can collect your USB memory stick from the registration desk after your presentation.

Emergency contact numbers

Should you encounter any emergencies, please do not hesitate to dial the following numbers:

Lucia Arpagaus	0041 79 760 4990
Maio Chen-Su:	0041 78 611 4769
Ralph Müller:	0041 79 593 9385
Marcus Textor:	0041 79 407 6917

For general information, please contact:
Maio Chen: 0041 44 632 8101, maio.chen-su@sl.ethz.ch, or
Lucia Arpagaus: 0041 44 632 3194, lucia.arpagaus@sl.ethz.ch.
(email would be more reliable)

During the symposium, you can contact the conference staff at the registration desk.

Internet

We offer wireless access throughout the ETH campus for all participants. Please connect to the network "public" and enter the following connection details:

Log-in:	steppingstone
Password:	medtech

Programme

Wednesday, September 26, 2012

17:30–18:30	**Welcome reception** Dozentenfoyer/faculty club, ETH Main Building, J-floor

Thursday, September 27, 2012

09:15–10:00	***Registration***	
10:00–10:20	**Opening address** **Nicholas SPENCER** (President, Research Commission, ETH Zurich) **Longchao ZHOU** (Director, European Division, Chinese Ministry of Science and Technology) **Mauro MORUZZI** (Director, International Cooperation, State Secretariat for Education and Research)	
10:20–10:30	**Introduction to the symposium** **Marcus TEXTOR** (ETH Zurich) **Ralph MÜLLER** (ETH Zurich)	
Session I	**Tissue engineering I** Session chairs: **Simon Philipp HOERSTRUP** (University/University Hospital of Zurich) and **Yanan DU** (Tsinghua University)	
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11:10–11:30	**Ernst REICHMANN,** (University/Children’s Hospital Zurich) *“Generating pre-vascularized dermo-epidermal skin grafts for clinical application”*	page 39
11:30–11:50	**Hong Wei OUYANG** (Zhejiang University) *“Stem cells for soft tissues regeneration”*	page 37
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13:30–13:50	**Maximilian EMMERT** (University/University Hospital Zurich) *“The use of stem cells and transcatheter implantation techniques for the development of translational heart valve tissue engineering concepts”*	page 18
13:50–14:10	**Lianfu DENG** (Shanghai Jiao Tong University) *“OIC-A006, a novel small molecular compound, to promote the bone regeneration”*	page 15
14:10–14:30	**Dominique PIOLETTI** (EPF Lausanne) *“Biomechanical stimulus for tissue engineering and drug delivery applications in musculo-skeletal tissues”*	page 38

14:30–14:50	**Jian JI** (Zhejiang University) *"Layer-by-layer assemble as a robust technique to mimic basement membrane for in situ endothelialization of cardiovascular stent"*	page 30
14:50–15:10	**Jess SNEDEKER** (ETH Zurich/University of Zurich) *"Mechanics driving tendon, stem, and cancer cell biology"*	page 44
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16:20–16:40	**Rong Fu WANG** (Peking University) *"Situation and progress of tumor angiogenesis targeted imaging and therapy via radionuclide tracing techniques"*	page 49
16:40–17:00	**Beat WERNER** (University/Children's Hospital Zurich) *"Transcranial magnetic resonance guided high intensity focused ultrasound for functional neurosurgery"*	page 50
17:00–17:20	**Guoyan ZHENG** (University of Bern) *"Medical image computing for orthopaedic applications"*	page 55
17:20–17:40	**Gangmin NING** (Zhejiang University) *"Design of wireless vital physiological sign monitor for individual use"*	page 36
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Friday, September 28, 2012

Session IV	**Innovation I** Session chairs: **Gangmin NING** (Zhejiang University) and **Philippe RENAUD** (EPF Lausanne)	
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9:50–10:10	**Stephen FERGUSON** (ETH Zurich) *"Medical technology for our aching (ageing) backs"*	page 21
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12:20–12:40	**Qing WANG** (University Hospital Lausanne) *"Development of telemetric ventricular and vascular pressure monitoring device for animal and human with hypertension, cardiovascular diseases, and others"*	page 47
12:40–13:00	**Philippe RENAUD** (EPF Lausanne) *"Application examples of flexible MEMS technology: Eye pressure monitoring and neural probes"*	page 41
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14:20–14:40	**Urs MATTES** (Mathys China & Hong Kong/Medtech Switzerland) *"Bringing products into the Chinese market"*	page 35
14:40–15:00	**Liang YAN** (Shanghai State Food and Drug Administration, Shanghai Pudong Medical Device Trade Association) *"Product regulation in China"*	page 53
15:00–15:20	**Nathan KAISER** (Eiger Law, Shanghai) *"Intellectual property: Practice in China"*	page 31
15:20–15:50	***Coffee break***	
15:50–16:50	**Podium discussion: How to create Sino Swiss synergy in medtech research and innovation** Facilitators: **Marcus TEXTOR** (ETH Zurich) and **Ralph MÜLLER** (ETH Zurich)	
16:50	**Concluding remarks**	
	Networking: "Apéro riche"	

Speakers

Yilin CAO
Shanghai JiaoTong University
yilincao@yahoo.com

Research interests
Tissue engineering; plastic surgery

Educational history
1991 Ph.D. Dept. of Plastic and Reconstructive Surgery affiliated Shanghai Second Medical University
1988 M.S. Dept. of Plastic and Reconstructive Surgery affiliated Shanghai Second Medical University
1975 M.D. Dept. of Plastic and Reconstructive Surgery affiliated Shanghai Second Medical University

Previous positions
2011–2012 Adjunct Professor, The Wake Forest Institute for Regenerative Medicine
2006–present Dean, The Plastic Surgery Hospital Of Chinese Academy Of Medical Science
2003–present Director, National Tissue Engineering Center of China
1999–present Vice Dean, Shanghai 9th People's Hospital, Shanghai JiaoTong University School of Medicine

Yilin Cao, M.D., Ph.D.

Tissue engineering research: From bench to bedside

Tissue engineering; tissue engineered bone; blood vessel; tendon; skin and cartilage

Tissue engineering is the specialty that applies the techniques of biology and engineering to the generation of new tissues. During the past 15 years, tissue engineering research has advanced so rapidly that generation of human tissue for tissue repair has become a reality.

In our tissue engineering center, most works performed in recent years focused on the construction of different types of tissues in large animal models for tissue repair. These works include tissue engineered bone to repair sheep cranial bone defect, goat femoral bone defect and dog mendibular bone defect with successful results. Using isolated autologous chondrocytes, articular cartilage defect was successfully repaired with tissue-engineered hyaline cartilage in a porcine model using bone marrow stem cells. Following successful engineering of tendon tissue in a hen model using isolated tenocytes, we now are able to engineer tendon using isolated dermal fibroblasts in a porcine model. In recent year, we have successfully engineered blood vessel, tendon, skin and cartilage tissue in vitro. In addition, we have also applied engineered bone tissue for clinical bone defect repair with success. Our experience in tissue construction and clinical application indicates that tissue engineering has great potential for tissue repair and tissue regeneration and will become a new therapy approach in plastic and reconstructive surgery.

Lianfu DENG
Shanghai JiaoTong University
lfdeng@msn.com

Research interests
Bone and joint disease

Educational history

8/03–11/04	Visiting Scholar, Division of Molecular & Cellular Pathology, Department of Pathology, University of Alabama at Birmingham (UAB)
9/96–12/98	Postdoctoral Fellowship, Shanghai Key Laboratory of Medical Cell Biology, Shanghai, China
8/93– 6/96	PhD (Orthopedics), Shanghai Institute of Traumatology and Orthopedics, Shanghai Second Medical University, Shanghai, China
8/87–7/90	MPH (Clinical Anatomy & Surgery), Anhui Medical University, Anhui Province, China
8/79–7/82	BM (Medicine), Jining Medical College, Shandong Province, China

Previous positions

12/04–	Professor, Director of Shanghai Key Laboratory of Bone & Joint Diseases, Director of Shanghai Institute of Traumatology and Orthopedics, Ruijin Hospital, Shanghai Jiaotong University School of Medicin, Shanghai, 20025, China
2/99–7/03	Professor, Director of Shanghai Key Laboratory of Bone & Joint Diseases, Vice Diretor of Shanghai Institute of Traumatology and Orthopedics, Ruijin Hospital, Shanghai Second Medical University (SSMU), Shanghai, 20025, China
7/90–8/93	Associate Professor, Department of Clinical Anatomy & Surgery, Jining Medical College, Shandong Province, 237113, China
8/82–8/87	Assistant Professor, Department of Clinical Anatomy & Surgery, Jining Medical College, Shandong Province, 237113, China

Ming Cai, Xiaodong Liu, Huarong Shao, Jin Qi, Jinsheng Wang, Niandong Qian, Lianfu Deng

OIC-A006, a novel small molecular compound, to promote the bone regeneration

Small molecular compound; promote; bone regeneration

Bone morphogenesis proteins (BMPs) are one of the potent bone-forming factors. However, the safety, utility, and cost effectiveness of BMPs must be considered. Nowadays, there has been substantial interest in developing a chemical compound that safely promotes bone formation and facilitates fracture repair. Based on previous researches with high throughout screening assay, we have found one potent osteogenic inductive compound, OIC-A006 (Osteogenic inducible compound-active 006), which is classified in the amine family. In this study, we aimed to investigate the inducing effects of OIC-A006 on osteogenesis by bone marrow stem cells (BMSCs) in vitro and in vivo. We demonstrated that OIC-A006, at different concentrations, especially at optimal concentration of 6.25 μM, could stimulate BMSCs to express Alkaline phosphatase (ALP), Core-binding factor a1 (Cbfa1), Osteopontin (OPN) and Osteocalcin (OC), and to form calcified nodules in vitro. Under the bone tissue culture conditions, OIC-A006 also stimulated new bone formation of murine calvarial and metatarsal bone, indicating that OIC-A006 may exert positive effects on osteogenesis. Furthermore, to elucidate the in vivo osteogenic potential of OIC-A006, we Transplanted OIC-A006-Loaded true bone ceramic (OIC-A006/TBC) into rabbit critical-sized segmental radial defect. The results revealed OIC-A006/TBC accelerated bone repair significantly, compared with TBC alone. These showed that OIC-A006, has the potential to promote osteogenesis in vitro and in vivo. This new compound may provide a new alterative agent for growth factors to promote bone healing and bone regeneration.

Yanan DU
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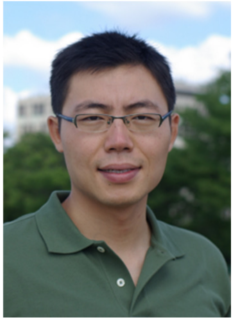

Research interests
Biomaterials; BioMEMS; cell engineering; tissue engineering

Educational history
Dr. Du received his B.Eng. degree in Chemical Engineering from Tsinghua University and Ph.D. in Bioengineering from National University of Singapore. Dr. Du completed his postdoctoral training at Harvard-MIT Division of Health Science and Technology, MIT and Brigham &Women's hospital, Harvard Medical School.

Previous positions
Yanan Du joined the Department of Biomedical Engineering, School of Medicine, at Tsinghua University, China in fall 2010, as Tenure-track Professor. Before joining Tsinghua, Dr. Du was a research fellow in Wyss Institute of Biologically Inspired Engineering, Harvard University, USA.

Yanan Du

Microengineered biomaterials with bio-mimetic heterogeneity for directing cell fates

Micro-engineered biomaterials; bio-mimetic, gradient, microfluidics, embryonic stem cell

Natural cellular microenvironment contains extracellular matrices with compositional and structural heterogeneity in high spatial precision which greatly influence the cellular behaviors. Microscale technologies are emerging as powerful tools for engineering biomimetic materials at the scale and precision comparable to the natural matrices. In this talk, I will present two examples that utilize microscale technologies to build bio-mimetic biomaterials with controlled heterogeneity to regulate cell fates: 1) biomaterials with tunable variances in chemical, mechanical and structural properties that effectively mimic the anisotropy of native extracellular matrice; 2) 3D hybrid hydrogels with controlled bioactivity to induce the polarized differentiation of embryonic cells; The bio-mimetic materials with microengineered heterogeneity presented here hold great promise for developing complex tissue substitutes and cell-based systems for bio-sensing and drug screening as well as physio/pathological model to reveal insight into natural phenomena.

Maximilian EMMERT
University/University Hospital Zurich
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Research interests
Cardiovascular regenerative medicine; cardiac stem cell therapy; cardiovascular tissue engineering

Educational history

03/2012	Habilitations-Thesis (Privatdozent Dr. med., Chirurgie), University of Zurich, Switzerland
11/2010	M.D.-Thesis (Dr. med.), Medical Faculty, University of Zurich, Switzerland
04/2008	German Medical Board, Hanover Medical School, Germany
2001–2007	Medical Training in Germany (Hamburg, Hannover), Switzerland (Zurich, USZ), UK (London, Royal Brompton Hospital), Australia (Sydney) and Singapore (National University Hospital)

Previous positions

Since 09/2009	Research Fellow, Special Program University Medicine (SPUM); 'Advanced cardiac cell therapies', Research Scholarship, Swiss National Science Foundation (SNF) (Prof. Hoerstrup)
Since 06/2008	Clinical Fellow, Specialty Training Cardiac Surgery, Clinic for Cardiac and Vascular Surgery University Hospital Zurich (Director: Prof. Falk)

Maximilian Emmert and Simon P. Hoerstrup

The use of stem cells and transcatheter implantation techniques for the development of translational heart valve tissue engineering concepts

Valvular heart disease, heart valve tissue engineering; stem cells; regenerative medicine; transcatheter

Valvular heart disease (VHD) represents a major cause of morbidity and mortality worldwide accounting for the death of numerous patients. Importantly, the incidence of VHD is continuously increasing with the higher percentage of aged people and approximately 30% of the treated patients are affected from prosthesis-related problems within 10 years postoperatively requiring dangerous re-operations. The therapy options for affected patients are currently undergoing rapid changes and minimally-invasive, transcatheter valve implantation techniques are rapidly evolving as alternative treatment option for the management of patients with VHD. However, despite this rapid technical progress, the currently available prostheses for transcatheter-approaches are still bio-prosthetic associated with the known disadvantages comprising progressive calcification and degeneration, which is a particular problem in the congenital setting.

The concept of regenerative medicine comprising cell-based therapies, bio engineering technologies and hybrid solutions has been suggested as a next generation approach to address cardiovascular diseases. In particular, heart valve tissue engineering (HVTE) has been demonstrated to be a promising concept to generate living, autologous heart valves with the ability to remodel and to grow which may be particularly beneficial for children. However, although this regenerative strategy has shown great potential in experimental studies, the translation into a clinical setting has been limited so far. A clinically relevant heart valve tissue engineering concept would ideally comprise both, minimally-invasive techniques for cell harvest and valve implantation.

In recent proof of concept studies we have demonstrated the principal feasibility of combining the concept of HVTE and transcatheter delivery techniques in different large animal models. Importantly, in a further pilot study, we introduced a novel and clinically highly relevant, translational concept of in-vivo implantation of autologous bone-marrow mononuclear cell (BMMC)-derived tissue-engineered heart-valves (TEHV). By using BMMCs without any phase of in-vitro culturing or expansion, we successfully generated and implanted autologous BMMC-derived TEHV in a one-step intervention of two hours comprising cell-harvest, in-vitro heart valve engineering and transcatheter delivery.

The major aim of this research is the systematic development of translational, cell-based heart valve tissue engineering concepts with a particular focus on minimally invasive, transcatheter-based implantation techniques.

David FAN

ML Oprics, Nanjing

Educational history

2001–2005	China Europe International Business School, Business Administration, Master
1990–1994	Nanjing University of Aeronautics and Astronautics, International Trade, Bachelor

Previous positions

06/2004–now	Maolai (Nanjing) Instrument Ltd. General Manager
01/2003–05/2004	SCHOTT Shanghai Project Manager
01/2001–12/2002	Emerson China Investment Ltd. Intern
08/1994–12/2001	Jiangsu Foreign Trade Joint Stock Company Sales Manager

David Fan

The role of optics in modern medical device

The development of modern medical device is driving the development of optics, an enabling technology for a lot of hi-tech applications. The latest optics technology in some cases is also driving the development of medical device. As a key technology, optics plays a vital role in medical device. The current development of optics in the world and in China will be discussed and cases of how optics are used in medical devices will be shared.

Stephen FERGUSON
ETH Zurich
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Research interests
Musculoskeletal disorders, injuries and treatment; orthopaedic technologies and application

Educational history

1991	BASc in Mechanical Engineering, University of Toronto, Canada
1994	MSc in Mechanical Engineering, Queen's University, Canada
1998	Professional Engineering License (P.Eng.), Ontario, Canada
2000	PhD in Mechanical Engineering, Queen's University, Canada
2006	Habilitation (Venia docendi), Medical Faculty, University of Bern, Bern, Switzerland

Previous positions

2000–2011	Division Head, Biomechanics, University of Bern, Bern, Switzerland
2008–2011	Co-Director: ARTORG Spine Research Center, University of Bern, Bern, Switzerland
2011–present	Full Professor of Biomechanics, ETH Zurich, Zurich, Switzerland

Stephen Ferguson

Medical technology for our aching (ageing) backs

Spine; back pain; orthopaedics; fracture; disc degeneration

The spine is truly the backbone of our musculoskeletal system, providing both mobility and load-carrying capacity. Spinal pathologies, and back pain in general, are some of the most costly challenges facing our society. Intervertebral disc degeneration and vertebral fractures are the most common disorders requiring treatment. Age-related changes to the structural composition of the disc and bone tissue expose these to a higher risk of injury in response to acute loading. Current treatments do not specifically address the root cause of the problem and are not adequately adapted to an ageing patient population. In this talk, two examples will be given of how medical engineering principals can be applied to better understand the patho-mechanism of spinal degeneration and injury and to develop more effective treatments. For the prevention or treatment of osteoporotic fragility fractures, a combination of simulation methods and new biomaterials allow the minimally invasive repair and reinforcement of weakened or compromised bone. The problem of intervertebral disc degeneration and structural failure of the disc is approached by studying the mechanobiological response of the whole organ to normal mechanical loading and overloading. Combining knowledge of the mechanics and biology of the disc at multiple scales, new methods to repair damage to the disc and simultaneously suppress inflammatory response are explored.

Roger GASSERT
ETH Zurich
gassertr@ethz.ch

Research interests
Physical human-robot interaction; biomedical robotics; assistive technology

Educational history
Roger Gassert received the M.Sc. degree in microengineering and the Ph.D. degree in neuroscience robotics from the Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland, in 2002 and 2006, respectively. His PhD involved a one-year stay at ATR Computational Neuroscience Labs, Kyoto, Japan.

Previous positions

2006–2007	Postdoctoral fellow at Imperial College London and Simon Fraser University
2007–2008	Head of the U Tokyo–EPFL joint robotics lab
since 12/2008	Assistant professor of rehabilitation engineering at ETH Zurich

Roger Gassert

Neurobotics: From neuroscience to robot-assisted assessment and therapy (and beyond)

Despite intensive therapy, sensorimotor recovery after neurological injury is often incomplete, limiting patients in activities of daily living. The efficacy of therapeutic interventions is limited by our understanding of the neural mechanisms underlying sensorimotor control, and how physical therapy can optimally engage neuroplasticity and promote recovery.

This talk will present how Neurobotics – a combination of robotic interfaces, haptic displays and non-invasive brain imaging – can be used as tools to assess and perturb movements in humans and animal models, in order to investigate the mechanisms underlying sensorimotor control and recovery after neurological damage. Complemented with brain-machine interfaces for targeted neuroplasticity, this approach has the potential to allow shaping brain networks in order to improve sensorimotor performance.

This technology further has the potential to become a critical tool in image-guided surgical interventions.

Ursula GRAF-HAUSNER

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Research interests

Tissue engineering; implant materials; organotypic 3D models for substance testing

Educational history

1976 Diploma in biology and chemistry, Heidelberg University Germany. 1981 PhD in biochemistry Zürich University. Following years research scientist for biotechnology in Sandoz AG, Basel. Sabbatical leave at Novartis Pharma AG: cell biology in 1997. Second sabbatical leave in Seattle, USA in 2004: dental regeneration with adult stem cells.

Previous positions

Since 1990	Professor of micro- and cell biology at Zurich University of Applied Sciences
Since 2001	Vice president in the biotechnet Switzerland, the national Network of Excellence of Switzerland
Since 2008	Coordinator of R&D in the Institute of Chemistry and Biological Chemistry of ZHAW

Markus Rimann, Stephanie Mathes, Ursula Graf-Hausner

Tissue engineering for drug development and substance testing – The competence centre TEDD combines national and international forces

Organotypic tissue models; bioprinting; substance testing; competence centre TEDD

Organ-like human tissue models are an important tool for drug development and evaluation of active substances. The TEDD national competence centre pools and transfers knowledge and technologies in order to promote the further development and application of in vitro cell and tissue culture.

The network partners cover the entire development and value chain: basic and applied research at universities, engineering and enabling technologies of industrial partners, medical know-how at hospitals and end-users from the pharmaceutical industry, biotechnology, medical technology and cosmetics.

Through concrete research projects and knowledge transfer within a network of partners from these various interest groups, a powerful and successful platform has been created. TEDD actively contributes to the development and application of alternative test methods for routine use in industry. Knowledge and technologies like 3D tissue models, cryopreservation, automation, bioprinting, assay development and imaging technologies are in the focus of our research projects. www.icbc.zhaw.ch/tedd

Several of our current research activities will be presented:

- Different technologies to form scaffold free and scaffold based 3D tissues and their potential were compared.
- Cryopreservation of 3D microtissues was established. After thawing they retained their biological relevance represented by similar IC50-values of known compounds when compared to non-frozen control microtissues.

- Scaffold based 3D tissues could be produced in a fully automated way using the Freedom EVO liquid handling system provided by Tecan. In comparison to manually produced 3D tissues they showed similar results proving that this 3D technology is high through put compatible.
- The innovative bioprinting technology is used to fabricate 3D skin models. The layer-by-layer technology allows the precise and fast production of a living dermis equivalent. Preliminary experiments to print a full thickness skin model with dermis and epidermis are successful.
- First experiments to establish a novel bioassay to predict skin sensitizers are promising. A 3D human epidermal model, which can detect in a dose dependent manner skin sensitizers based on the KeratinoSens assay is under development.

Simon Philipp HOERSTRUP

University/University Hospital Zurich

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Educational history

2008	Professor of Experimental Surgery (Tissue Engineering and Regenerative Medicine), Medical Faculty, University of Zurich, Switzerland
2005	Ph.D.-Thesis (Dr. rer. nat.), Technical University of Eindhoven, The Netherlands
2003	Professor of Biomedical Engineering (part-time), Faculty of Biomedical Engineering, Technical University of Eindhoven, The Netherlands
2001	Habilitations-Thesis (Privatdozent Dr. med., Chirurgie), Medical Faculty, University of Zurich, Switzerland
1996	M.D.-Thesis (Dr. med.), Medical Faculty, University of Cologne, Germany
1995	German Medical Board, University of Cologne, Germany United States Medical Licensing Examination (USMLE Step II)
1988 – 1995	Medical School in Germany (Cologne), Switzerland (Berne) and USA (Houston, Baylor College of Medicine, Boston, Harvard Medical School

Previous positions

2009 – present	Head, Swiss Center for Regenerative Medicine, University and University Hospital Zurich, Switzerland
2008 – present	Head, Regenerative Medicine Program (Tissue Engineering and Cell Transplantation), University Hospital and University of Zurich, Switzerland
2007 – present	Scientific Director (Wissenschaftlicher Abteilungsleiter), Department of Surgery, University Hospital and University of Zurich, Switzerland
2004 – present	Head, Cardiovascular Surgery Research (Leitender Arzt, Forschung der Klinik f. Herz- und Gefässchirurgie), Department of Surgery, University Hospital and University of Zurich, Switzerland
2003 – present	Professor (part-time), Department of Biomedical Engineering, Technical University of Eindhoven, The Netherlands

Simon Philipp Hoerstrup

From cells to functional cardiovascular implants

Cell-based therapy concepts comprising regeneration of damaged organs by e.g. transplanted stem cells and replacement of diseased/malformed structures by tissue engineered, living implants represent promising novel treatment modalities, ultimately aiming at “restitutio ad integrum” instead of repair. First successful clinical applications such as stem cell therapies of myocardial infarction and tissue engineering of autologous trachea have recently been demonstrated. Various cell sources including several categories of stem cells are being examined for cardiovascular applications. Our laboratory has been focusing on using marrow stromal derived stem cells (MSCs) as a versatile autologous cell source for tissue engineering of living cardiovascular structures such as arteries and heart valves. Beyond the “classical” in vitro tissue engineering approach, in vivo technologies using the cell attraction and remodelling potential of MSCs are currently investigated. For myocardial repair, the optimal cell delivery format using 3-D microtissue technology and the most suitable route for cell delivery (intracoronary vs. intramyocardial) after myocardial infarction are under investigation.

Quiting HUANG
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Research interests
Analog, digital and RF integrated circuits for communications, signal processing and microsystems; integrated circuits and systems for medical applications

Educational history
Qiuting Huang graduated from the Harbin Institute of Technology, Harbin, China in 1982. He received his Ph.D degree in applied sciences from the Katholieke Universiteit Leuven, Belgium, in 1987.

Previous positions
Lecturer at the University of East Anglia, Norwich, UK
Assistant and Associate and full Professor at the Institute for Integrated Systems of the ETH Zurich
Chang Jiang Seminar Professor by the Chinese Ministry of Education
Founder and CEO of ACP Advanced Circuit Pursuit AG

Qiuting Huang, Roger Ulrich, Philipp Schönle, Schekeb Fateh, Felix Schultes, Fiona Huang

A wireless ECG/EEG module with fully integrated multi channel sensor interface

Growth factor; extracellular matrix

A multi-channel data acquisition system is implemented on a single chip that includes chopper stabilized instrumentation amplifiers, an A/D converter, and digital control functions that enable it to be fitted seamlessly into a small wireless module supporting BT and cellular connections. PCs, tablets and smart phones can be linked to the portable module wirelessly to receive high quality ECG, EEG and potentially other biomedical signals.

The integrated data acquisition system is designed to handle large DC drifts typically associated with dry electrodes, without the large AC coupling capacitors typically found in traditional instrumentation amplifiers that can only be realized with discrete components on a PCB. In addition to state-of-the-art low noise performance, the IC enables an efficient algorithm to be implemented that cancels any 50Hz interference without heavy filtering.

Wireless connectivity of medical sensors is of great benefit to clinical and other well-being applications but the management of separate wireless and data acquisition chips requires control functions to be realized in a separate microcontroller. Our data acquisition IC is a first step in the general trend of integration in wirelessly connected sensor interface modules. Further integration can be expected in our future devices.

Jeffrey HUBBELL
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Research interests
Biomaterials; tissue engineering; regenerative medicine; immunoengineering

Educational history
BS, Chemical Engineering, Kansas State University; PhD, Chemical Engineering, Rice University

Previous positions
Previous to joining EPFL, Prof. Hubbell was on the faculty at the ETH Zurich and University of Zurich, at the California Institute of Technology, and the University of Texas at Austin.

Jeffrey A. Hubbell

Engineering the regenerative microenvironment

Growth factor; extracellular matrix

In natural situations, angiogenic growth factors such as vascular endothelial growth factor (VEGF) are present in a matrix-bound form, yet therapeutic use of such growth factors has focused on application in soluble form. To explore matrix immobilization of angiogenic growth factors, we have explored two approaches, both in the context of fibrin as a surgically-relevant matrix: enzymatic conjugation of variant forms of the growth factors, and complexation with recombinant variants of fibronectin.

Angiogenic growth factors such as VEGF were engineered so as to contain a substrate domain for the coagulation transglutaminase factor XIIIa, modeled after the N terminus of alpha2 plasmin inhibitor. To provide a release mechanism, an enzymatic substrate was included in the growth factor variant between the transglutaminase substrate and the growth factor domain, taken as either a plasmin substrate domain or a matrix metalloproteinase domain. Thus, we have explored the activity of tripartite fusion proteins for inducing angiogenesis. We have most thoroughly studied the variant of VEGF-A, and we have demonstrated that the variant form of VEGF-A induces more angiogenesis than the wild type and induces a less hyperpermeable phenotype, both in the chick chorioallantoic membrane and in mouse skin.

To explore noncovalent immobilization upon matrices, we have engineered a fibrin-binding domain of fibronectin, containing the 12th-14th type III repeat (which was known to bind VEGF-A). In studies of the 12th-14th type III repeat, we determined that the growth factor binding activity of this domain was rather promiscuous, binding to VEGF-A, VEGF-C, PDGF-AA, PDGF-BB and PDGF-AB, for example, in addition to a wide number of other growth factors. Incorporation of this domain into fibrin, also through transglutaminase activity, provides a powerful and generalizable method to retain such growth factors into surgical matrices.

Patrick HUNZIKER

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Curriculum vitae

Patrick Hunziker has studied Medicine the University of Zurich, Switzerland. He received a doctoral decree based on thesis work in experimental immunology from the University of Zurich and did further research in experimental haematology at University Hospital in Zurich, Switzerland. He earned specialist degrees in Internal Medicine, Cardiology and Intensive Care Medicine. As a fellow the Massachusetts General Hospital, Harvard Medical School, worked on cardiac imaging in a joint project with the Massachusetts Institute of Technology, Cambridge. His professional activities in Europe, the U.S., Africa and China gave him a broad insight into the needs for the medicine of the future in a variety of settings. Hunziker became involved in medical applications of Nanoscience in the late nineties and has been the pioneer physician in Nanomedicine in Switzerland since then. With improved prevention, diagnosis and cure of cardiovascular disease as his main research topic, he worked in the nanoscience fields of atomic force microscopy, nanoptics, micro/nanofluidics, nanomechanical sensors and polymer nanocarriers for targeting. He is the founding president of the European Society of Nanomedicine, cofounder of the European Foundation for Clinical Nanomedicine and coinitiator of the European Conference for Clinical Nanomedicine and is clinically active as deputy head of the Clinic for Intensive Care Medicine at the University Hospital Basel, Switzerland. In November 2008 Patrick Hunziker became professor for Cardiology and Intensive Care Medicine at the University of Basel.

Patrick Hunziker

Intelligent nanomaterials as a new paradigm in medical practice

Jian JI
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Research interests
Surface modification for cardiovascular device; construction of bio-functional multilayer coating via layer-by-layer self-assembly; bio-inspired surface engineering of nano-carrier for nano-medicine

Educational history
Prof. Ji Jian received his Ph.D. degree in Polymer Science from Zhejiang University in 1997. He was a postdoctoral fellow at National Institute of Biomedical Engineering, Porto, (INEB) between 1998 and 2000 and a visit scientist at Institute of Applied Physical Chemistry, University of Heidelberg between 2003 and 2004.

Previous positions
Since 2008, he has been vice director of the Institute of Biomedical Macromolecule in Zhejiang University. In 2010, he received the Distinguished Young Scholars Award of the National Science Foundation of China.

Jian Ji

Layer-by-layer assemble as a robust technique to mimic basement membrane for in situ endothelialization of cardiovascular stent

Cardiovascular biomaterials; biomimic, surface treatment; layer-by-layer assembles

The in-stent restenosis (ISR) and the late stent thrombosis (LAST) represent the most common failures of stent implantation and are both mediated at the injured endothelium. The natural endothelium healing mechanism provides an approach to achieve in situ endothelialization of the implant by stimulating the neighboring endothelial cells (ECs) migration or capturing the circulating endothelial cells (CEC) directly from the blood circulation. The basement membrane is a thin layer of basal or reticular lamina that supports the endothelium and modulates the vessel repair. It is a multilayered hybrid self-assemble via different biomacromolecules, which is biodegradable and be able to control release of bioactive different growth factor to modulate the competition between endothelial cells and smooth muscle cells. And the micro-nanostructure and the stimuli-responsive mechanical properties of substrates also contribute a lot to achieve a highly specific guide of ECs in vivo.

Layer-by-layer self-assembly technique, with advantages of easy preparation, retainable biomacromolecules' activity, and adaptable to substrates with whatever size and shape, has increasingly been used to immobilize biomacromolecules onto the vascular prostheses and tissue engineering scaffolds to improve their hemocompatibility or cytocompatibility respectively. Our recently research demonstrated that the multilayered assemblies can be further explored as a versatile platforms for mimic the basement membrane structures and functionalities, which has been expend to fabricate a novel cardiovascular stent with excellent in situ Endothelialization and anti-restenosis.

Nathan KAISER
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Research interests
Corporate law; cross-border commercial and contract law; taxation, litigation and arbitration; intellectual property; foreign direct investment

Educational history
University of St. Gallen
University Robert Schumann, Strassburg
University of Lausanne

Previous positions
Founding Partner of Eiger Law since 2008
Of Counsel China for Bonnard Lawson 2008
Wenger & Vieli/Wenfei in Beijing, Shanghai and Taipei, 2000–2008

Nathan Kaiser

Protection of intellectual property rights in China. Special focus on medical devices and pharmaceutical products

Intellectual property rights; China; innovation; market; medical devices; pharmaceutical products

- Intellectual property: practice in China
- Brief primer on IP in China, with a focus of the relationship between foreign and local innovation
- Best practices of protecting innovation in the form of intellectual property
- Options of market presence in China

Kwok Sui LEUNG
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Research interests
Fracture healing; falls and fractures prevention; biophysical effect on musculoskeletal tissue

Educational history

1976	MBBS	HKU, Hong Kong
1980	FRCS	RCSEd Scotland
1991	M.D.	CUHK, Hong Kong
1991	DipBiomech	U Strathclyde Scotland
1994	FHKCOS,FHKAM (Orth.Surg)	HK
2002	FACS	USA

Previous positions

1983–1988	Lecturer Orthopaedics and Traumatology, CUHK
1988–1992	Senior Lecturer
1992–2004	Reader
2004	Chair Professor
Oct 1983 – Mar 1984	Clin Fellow, Ortho Surgery, Sunnybrook Med Centre, Toronto-Western Hospital, Canada

Kwok Sui LEUNG

Knowledge transfer in fragility fractures management – from laboratory to the community

Fragility fractures; prevention; biophysical stimulation; community elderly; translational research

Management of fragility fractures among elderly becomes a major challenge to orthopaedic professional to-day. The role of orthopaedic surgeon is not limited to surgical management. We also take part in the rehabilitation and prevention of the fractures. Since 2000, we started our community program on the prevention of falls and fractures in Hong Kong. Through series of organised and systemic community programs, we successfully raised much attention to this medico-social problem in the society. A multi-disciplinary clinical team was also formed to provide holistic care for these patients with a comprehensive management program. The building up of the collaborative relationship helps in our translational research programs and the applied community projects. The research and development on hip protectors, fall prevention shoes and vibrational platform and the related treatment programs are typical examples. High frequency low magnitude vibration(HFLMV) therapy is one of major projects we carried out since 7 years ago. Started with animal and laboratory studies, the prototype we developed was applied to human subjects. The effectiveness of this modality is further confirmed with specific clinical studies as well as large scale control study in the community. The results of these studies confirm this unique biophysical treatment on the very focused advances in the non-pharmacological modality to improve bone mass, enhance balance and co-ordination and improve muscle power among elderly. The equipment was subsequently licensed and now available in the market for general public use. These translational research become fruitful with the support from the University and a closed collaboration with industries and community end users. It is even more vital to have well planned Bench to Bedside and Beside to Bench research programs to provide scientific data for evidence based applications.

The advancement in treatment modalities, surgical, pharmacological as well as biophysical treatments were taken into the consideration in the planning of this comprehensive clinical management program: Surgically, orthopaedic surgeons are to provide the best treatment with minimally invasive technique to ensure least complication, quick rehabilitation and maximal recovery. Pharmacological treatment with anti-resorption therapy and anabolic calcium treatment would be the standard treatment to maintain and improve bone mass. Last not the least, biophysical stimulation on musculoskeletal tissues in enhancing balance ability, muscle power and maintenance of bone quality are essential in the prevention of fall and fractures, These will become the strategies for management of the ever increasing number of fragility fractures in our aging world.

Michael LEUNIG

Schulthess Clinic
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Research interests
Etiology and treatment of hip osteoarthritis incl. development of diagnostic and surgical instruments to improve outcomes

Educational history and previous positions
Medical School at LMU Munich, Germany, followed by Residency at the University Hospital in Munich. Thereafter, a 2 years Feodor Lynen Fellowship of Alexander von Humboldt Foundation at Harvard Medical School in Boston. Orthopaedic training (Inselspital Berne) and habilitation at the University of Berne followed by positions at Balgrist hospital (University of Zurich) and the current position at the Schulthess Clinic.

Michael Leunig

Minimally invasive hip surgery: Why and how

Osteoarthritis; hip; minimally invasive; total hip replacement

Minimally invasive surgery (MIS) has become widely used in many surgical areas. The rationale behind MIS is to minimize iatrogenic tissue injury while not sacrificing the surgical result. This presentation introduces the pros and cons of MIS total hip replacement including a demonstration of such surgery in patients.

Urs MATTES
Medtech Switzerland
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Research interests
Dissertation in field of vitamin B6, Biochemistry Department, University of Zurich

Educational history
Studied human medicine at University of Zurich
Postgraduate studies in experimental medicine, University of Zurich
MBA from University of South Australia, Adelaide, Australia

Previous positions
New Product Director Janssen-Cilag (a Johnson & Johnson company): Europe / West Asia / Middle East, Zug, Switzerland
GM Mathys Medical China / GM Synthes China, Shanghai
GM AO Asia Pacific, Hong Kong

Urs Mattes

Bringing products into the Chinese market

Chinese healthcare market; registration; tenders; corruption; education; human resources

The Chinese market is challenging for healthcare products. There are several hurdles such as product registration and tender applications to be taken prior to be able to sell a product. Even though the per capita expenditure in healthcare is still small as compared to western countries, opportunities are a growing middle class with more resources and a market in demand of imported healthcare products. While domestic companies supply low-end products, western companies focus on the high-end segment. The current battle is to gain access to the second and third tier cities with “medium-range” products. In order to develop such products, local R&D efforts are crucial involving a team of Chinese engineers familiar with market needs. A threat to the market is the rampant corruption in healthcare which requires foreign companies to engage distributors. Doctors are employed by the State and underpaid as compared to western colleagues.

Gangmin NING
Zhejiang University
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Research interests
Design and development of medical devices; biomedical signal processing; modelling and simulation in cardiovascular system; optimum therapy strategy for cardiovascular diseases

Educational history

1997–2001	Dr.-Ing., Biomedical Engineering, Technical University of Ilmenau, Germany
1987–1990	Master, Biomedical Engineering, ZhejiangUniversity, China
1982–1987	Bachelor, Biomedical Engineering, ZhejiangUniversity, China

Previous positions

2006–Present	Professor, Dept. of Biomedical Engineering, Zhejiang University, China
(12/08–02/09	Visiting Professor at Charité-Medicine Center, Berlin, Germany)
2001–2006	Associate Professor, Dept. of Biomedical Engineering, Zhejiang University, China
1997–2001	DAAD Scholarship Holder, Technical University of Ilmenau, Germany
1992–1997	Lecturer, Dept. of Biomedical Engineering, Zhejiang University, China
1990–1992	Teaching Assistant, Dept. of Biomedical Engineering, Zhejiang University, China

Gangmin Ning

Design of wireless vital physiological sign monitor for individual use

Physiological monitoring; wireless communication; individual use

The work aims to construct a reliable system for health status monitoring, specialized for people away from clinical professionals. The need of measurement of vital signals in health monitoring triggered the design of our system, which utilizes multifarious sensors and telecommunicate services to cover home and outdoor use.

The whole system consists of three parts, i.e. measurement devices, gateway for signal collection/transmission and server that integrates database, web interface and decision support system. The available vital signals are: electrocardiographic activity, weight, gross motor activity, and pulse wave velocity, which is a measure of arterial stiffness and has a strong relationship with cardiovascular events and all-cause mortality. Since the system is designed both for home and outside use, some specific considerations are taken. The equipments used for outside activities measurement should be portable and robust, while indoor use may ask for more comfortable facilities. Accordingly, the home-based measurement process is merged into daily activities, like TV watching or book reading etc.. When users are at home, they can use furniture based wireless measurement apparatus to acquire ECG, pulse wave and body weight. While outside, portable devices are available for monitoring ECG, exercising activity and so on.

Hong-Wei OUYANG
Zhejiang University
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Research interests
Stem cell biology; tissue engineering; translational regenerative medicine

Educational history

1994 M.D., Clinical Medicine, Hunan Medical University, China
2002 Ph.D, Tissue Engineering, National University of Singapore, Singapore

Previous positions

2011–present	Dean for School of Basic medical Science, Zhejiang University, China
2010–present	Adjunct Full Professor in School of Biomedical Sciences, The Chinese University of Hong Kong, China
2009–2011	Executive Dean for School of Basic medical Science, Zhejiang University, China
2005–2009	Deputy director for School of medicine, Zhejiang University, China
2004–2005	Clinical Scientist, Dept of orthopedic surgery, National University Hospital NUS, Singapore

Xiao-Hui Zou, Yang-Zi Jiang, Jia-Lin Chen, Xiao Chen, Hong-Wei Ouyang

Stem cells for soft tissues regeneration

Stem cell; cartilage; tendon; tissue engineering; soft tissue regeneration

Cartilage and tendon are frequent targets of sports injury with very limited regenerative capacity. Current therapeutics cannot be satisfied. We carried out a series of experiments on the design of functional silk scaffolds as well as the stepwise differentiation of embryonic or adult stem cells with the combination of biochemical and mechanical strategies. They improve structural and functional tendon and cartilage regeneration significantly in vitro and in vivo. Moreover, under the new regulations of the Ministry of Public Health in China, we established a standard approach for tissue engineered cartilage (TEC) transplantation. The first patch of 12 patients with articular cartilage injury was treated with TEC composed of autologous cartilage progenitor cells (CPC) and 3-D scaffolds. 11 of 12 patients achieved excellent or good outcomes after 2-year follow- up.

Dominique PIOLETTI
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Research interests
Biomechanics, tissue engineering, orthopedics, biomaterials

Educational history

1997	Ph.D. Physics Department, EPFL, Switzerland
1992	M.Sc. Physics Department, EPFL, Switzerland

Previous positions

2000–2005	Group Leader and Lecturer, Hôpital Orthopédique, CHUV
1997–1999	Post-Doctoral Research Fellow, UCSD, USA
1992–1997	Assistant and PhD Student, Biomedical Engineering Laboratory, EPFL and Hôpital Orthopédique de la Suisse Romande

Dominique Pioletti

Biomechanical stimulus for tissue engineering and drug delivery applications in musculo-skeletal tissues

Biomechanics; bone tissue engineering; smart drug delivery

Mechanical stimulus has been identified since a long time as a key player in the adaptation of the musculo-skeletal tissues to their particular function. The tissue differentiation has also been demonstrated to be influenced by its local loading environment. Mechanical loading is then an intrinsic variable to be considered when new development is proposed for treating different patho-physiological situations in the musculo-skeletal system. In this talk, I will describe this mechanical situation in the context of tissue engineering and drug delivery system. In particular, I will propose to make a clear distinction between: i) classical biomechanics tending to make a structural analysis of the mechanical situation under study (e.g. bone scaffold mechanical properties), and ii) mechano-transduction aspects tending to understand or use the mechanical stimulus for clinical application. I will give two examples how we take advantage of this mechanical stimulation. The first example will be the effect of controlled loading on bone formation inside polymeric scaffold and the second example will be the coupling between a loading and a delayed drug delivery system.

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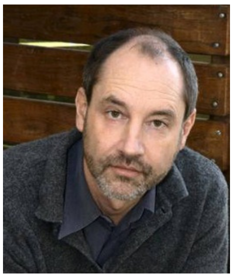

Research interests
Tissue engineering of human skin; cell biology; epithelial and mesenchymal stem cells

Educational history

PhD thesis	Ludwig-Institute for Cancer Research, Bern
Postdoc and staff scientist	Institute for Molecular Pathology, Vienna
Group Leader	Swiss Institute for Experimental Cancer Research (ISREC)
Head	Tissue Biology Research Unit, Department of Surgery, University-Children's Hospital (from 2001 until present)

Previous positions
Group leader at the ISREC, Lausanne

Ernst Reichmann

Generating pre-vascularized dermo-epidermal skin grafts for clinical application

Tissue engineering; novel skin grafts; pre-vascularization; melanocytes; matching of skin color

Large full thickness skin defects resulting from burns, congenital giant nevi, disfiguring scars, soft tissue trauma, tumour resection and disease leading to skin necrosis, represent a significant and common clinical problem worldwide. **This problem is far from being solved!** The main challenge encountered is that most autologous skin grafting techniques are based on transplanting split thickness skin (the today's gold standard). Split thickness skin contains all of the epidermis, but only remnants of the dermis. This lack of dermal tissue frequently leads to significant scarring, hence to unsatisfying functional and cosmetic results. Our concept to overcome this problem is derived from our long standing collaboration between scientists and clinicians. This resulted in the insight that improving the quality of the reconstituted dermis is of paramount importance to significantly ameliorate the clinical outcome. In addition, we are stringently aiming at a one-step surgical procedure (instead of the very common two step procedure that employs acellular templates such as Integra Artificial Skin®). A second focus of our research is based on the fact that insufficient vascularisation is one of the major reasons for engraftment failure. The diffusion limit of oxygen and nutrients allows application of transplants not thicker than 2-3 mm. Thus, a central goal of our research was (and still is) to generate pre-vascularized human skin grafts and to evaluate the effects of pre-vascularization on skin regeneration in vivo. After an intense and long research period, we are now able to generate networks of highly organotypic, branching, lumen-forming capillaries, on the experimental level, in the dermal component of bio-engineered skin substitutes. These methods have to be adapted to clinical protocols and clinical use. A third focus of our research is the melanocyte compartment, and matching the "color" of (healthy) skin with our bioengineered skin grafts. Presently we were able to isolate human epidermal melanocytes and to establish culture conditions that allowed to propagate these melanocytes in homogeneous cell cultures in vitro. Notably, we could show that these melanocytes survive in dermo-epidermal skin grafts for at least 8 weeks after transplantation onto immuno-incompetent rats.

Our overall goal is to combine the above-mentioned findings and to translate them into novel clinically applicable skin grafts that can be transplanted in a single step operation.

Philippe RENAUD
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Research interests
BioMEMS; microfluidics; medical devices; sensors

Educational history
1983 MS in Physics, University of Neuchâtel, Switzerland
1992 PhD in Physics, Institute of Physics, University of Lausanne, Switzerland

Previous positions
Post-doctoral fellow, Department of Physics, University of California, Berkeley CA, USA
Post-doctoral fellow, IBM Research Laboratory, Zurich, Switzerland
Scientific collaborator, CSEM, Neuchâtel, Switzerland

Philippe Renaud

Application examples of flexible MEMS technology: Eye pressure monitoring and neural probes

BioMEMS; polyimide; neurostimulation

Polyimide a biocompatible material that can be easily patterned and combined with metallic thin films or other polymer layers. We have developed a method that allows a smooth and solvent free detachment of polyimide-based microstructures form a silicon wafer. This allows the fabrication of flexible microstructures for biomedical applications.

In a first application example, we demonstrate the use this technology to realize ultrathin strain gages that have been embedded in contact lenses together with an RF passive telemetry chip for continuous monitoring of eye pressure. The device is powered by an external antenna, which is patched around the eye. The continuous eye pressure monitoring is used for assessing the glaucoma treatment.

In a second application, we have developed implantable microelectrode arrays for electrical neurostimulation and recordings. The flexibility of the probes ensures minimal damage to the tissues after implantation. The polyimide microelectrode arrays can be used for small animal studies and for deep brain stimulation in humans. The same technology has also been applied to retinal implant.

Erik SCHKOMMODAU

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Research interests
Computer-assisted surgery; implant design

Educational history
Electrical Engineering studies at RWTH Aachen University
Semester abroad and research project at Trinity College Dublin, Ireland
Ph.D. in Biomedical Engineering at RWTH Aachen University

Previous positions
Research and development engineer at Medical Center Aachen in the field of surgical robotics and navigation
Founder Member of SurgiTAIX AG, Aachen, Germany
Director of Institute for Medical and Analytical Technologies at University of Applied Sciences Northwestern Switzerland

Erik Schkommodau, Matthias Jeker, Sandro Fabbri, Roland Gräfe, Jens Schultze, Christina Egger, Raniero Pittini, Doan Baykut

A feasibility of a hollow-rotor-axial-flow-pump as ventricular assist device

Blood pump; hollow rotor; left ventricular assist device

One million patients suffering from severe heart disease with life expectancy of less than 12 months enter end-stage heart failure each year. Heart transplantation (HTX) for these patients remains the only therapeutic option. However, HTX is limited by the availability of donor hearts for the right patient at the right time. A alternative for patients with no other perspectives of survival are ventricular assist devices (VAD). Current axial-flow blood pumps contain a conveying spiral with central rotating body. The high speed impact of blood to central body generates adverse effects like friction and shear stress. Hemolysis and thrombus formation are inevitable results, a major clinical complication source. The hollow rotor (Hotor) concept could have a high potential for enhanced hemo-compatibility and high efficiency due to his smaller distance between coils and rotor magnets and its significant lower mechanical stress at the center of the impeller.

To show suitability of this principle in a first step initial impeller designs were determined on the basis of traditional pump theories. Targeting parameters were inner diameter, number of blades, blade in- and outlet angle, size of the inner hole and the blade length. But the fluid conveying principle without a solid central body limits the applicability of traditional pump theories. Thus, different empirical 3D-Hotor test models were initially produced by 3D-printer (Objet Eden 250). The iterative design process included bench tests with water as test fluid.

In a second phase engine, passive magnetic/mechanical hybrid-bearing and a matching diffusor were calculated, manufactured and integrated on the basis of Computational Fluid Dynamics. The material of the rotor was changed to titanium and manufactured by Selective Laser Melting. Final tests were carried out with water and animal blood over 7 hours (ASTM F1841 – 97).

The tests have shown that the hollow rotor concept fulfills major requirements of a LVAD system. The measurements show a direct correlation between the design parameters and the pump efficiency. The obtained results show a good durability of the bearing and drive system with promising indicators for a low blood damage.

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Research interests
Tendon disease and healing; cell-matrix mechanics

Educational history
B.S. (Highest Honors) Mechanical Engineering, Lehigh University
M.S. Bioengineering, Pennsylvania State University
Ph.D. Mechanical Engineering, ETH Zurich

Previous positions
R&D engineer, WL Gore and Associates
Production engineer, General Motors

Jess Snedeker

Mechanics driving tendon, stem, and cancer cell biology

Multi-scale biomechanics; cell instructive biomaterials

In the past decade, basic research has established the primacy of mechanical forces in defining cellular niche, with astounding breadth and depth of implication to biological system homeostasis, disease, and therapeutic intervention. These implications are uniquely critical in the musculoskeletal system, where healthy tissues must bear substantial static and dynamic loads required for locomotion, and where therapeutic biomaterials are immediately challenged by extreme mechanical demands.

In this lecture, a few pressing orthopedic clinical problems will be introduced to provide context for our work: specifically tendon repair and osteosarcoma (a deadly bone cancer that primarily affects children). While these clinical issues are highly disparate, they share common grounds for research, specifically the cell-matrix interactions that likely lay behind the pathologies themselves, and the cell-biomaterial interactions that may be applied to healing. We will discuss our efforts to quantitatively investigate cell-matrix interactions in the guided differentiation of bone marrow stromal cells, which have potential as an autologous therapeutic cell source. We will also discuss osteosarcoma in the context of the so-called “epithelial-mesenchymal transition” in which cancer can be viewed as a disease of the extracellular matrix. In both cases, we will introduce numerical and experimental platforms being developed to better understand and predict cell behavior when confronted with engineered biomaterials for both basic research and potential therapeutic purposes.

Gabor SZEKELY
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Research interests
Medical image analysis, biomedical simulation and visualization; computer aided and image guided medical interventions

Educational history
Graduate degree in Chemical Engineering, Technical University of Budapest
Graduate degree in Applied Mathematics, Eötvös Lóránd University, Budapest
PhD in Analytical Chemistry, Technical University of Budapest
Venia Legendi, ETH Zurich

Previous positions

1985–1986	Head of the Computer Science Department, Institute of Isotopes of the Hungarian Academy of Sciences, Budapest
1986–1990	Software developer, Bruker Spectrospin AG, Fällanden, Switzerland
1991–2002	Senior Scientist, Computer Vision Laboratory, ETH Zurich

Gabor Székely

Computer simulation for supporting clinical diagnosis and surgical therapy

Biomedical simulation; virtual physiology; therapy planning; surgical training simulation

Due to the development of highly advanced visualization and simulation technologies during the past two decades and the breathtaking growth of available computational resources, powerful tools have been created for supporting clinicians in optimizing medical diagnosis and therapy through physiological simulation. This talk will discuss recent results in developing sophisticated tools for extracting hidden information from diagnostic imaging data, supporting personalized pre-operative planning and optimization of interventions as well as allowing training surgical skills without animal experiments or direct patient involvement. Example will be presented related to different clinical fields, like cardiovascular diagnosis, orthopaedics or gynaecology.

Jue WANG

Xi’an Jiaotong University

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Research interests

Neuro-functional informatics; rehabilitation engineering; biomechanics

Educational history

1977 Bachelor Degree in Radio Engineering, Xi’an Jiaotong University
1991 Master’s Degree in Biomedical Engineering, Xi’an Jiaotong University
2000 Ph.D. degree in Rehabilitation Science and Technology, University of Pittsburgh

Previous positions

1994–2001 Visiting associate professor, research associate, graduate student researcher, assistant professor in University of Pittsburgh

Jue Wang

Neuro functional informatics and rehabilitation engineering

Neuro-functional informatics; rehabilitation engineering

This seminar will discuss the inner link between the Neuro-Functional Informatics (NFI) and the Rehabilitation Engineering (RE). It probes the role of NFI research in promoting the RE and the requirements of RE on NFI research. The taking will analyze the inner link of NFI and RE by comparing their definition, study object and study scope. It introduces the model of Neural Function Information Transfer and Processing and Human Activity Assistive Technology Model. It forms a system that combines the research on Neuroscience, rehabilitation engineering with clinic rehabilitation treatment closely. As samples, the talking will introduce the researches on Neuro Functional Informatics and Rehabilitation Engineering in Xi’an Jiaotong University, Such as a neuro-information feedback (NFB) system is applied to treat the children with attention deficit hyperactivity disorder (ADHD), Deep Brain Stimulator and MEMS Brain Electrode for the Persons with Parkinson Disease (PD), and so on.

RE needs to be supported by NFI achievement and makes NFI research to be much significant and valuable on clinic rehabilitation. It is believed that the understand to the mechanism of Neuro-functional information generation, transfer and processing will open new ways and raise new methods for clinic rehabilitation intervention and evaluation. It promotes also that new generation products on rehabilitation engineering and assistive technology come into being.

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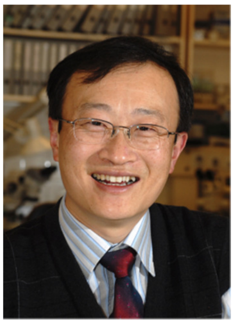

Research interests
Salt, hypertension, renal and cardiovascular remodeling; development of hemodynamic monitoring device

Educational history

1984	BSc in Medicine, Xianning Medical College, Hubei, China
1990	MSc in Medicine, Tongji Medical College (formerly named Tongji Medical University), Huazhong University of Science & Technology, Wuhan, China
2002	M.D., University of Lausanne, Lausanne, Switzerland

Previous positions

1996–2002	Medical Assistant, Division of Hypertension, CHUV, Lausanne, Switzerland
2002–2005	1st Assistant (Postdoc), Division of Hypertension, CHUV, Lausanne, Switzerland
2006–	Research Project Leader, Service of Nephrology, CHUV, Lausanne, Switzerland

Q. Wang, H. Van Lintel, E. Kilinc, C. Dehollain, and P. Renaud

Development of telemetric ventricular and vascular pressure monitoring device for animal and human with hypertension, cardiovascular diseases, and others

Telemetry; ventricular pressure; hypertension; cardiovascular disease; device

Today, hypertension affects approximately 25% of the adult population worldwide, and its prevalence is predicted to increase by 60% by 2025, when a total of 1.56 billion people may be affected. Hypertension is the most important risk factor leading to cardiovascular diseases (CVD) and causing 60% stroke and 50% myocardial infarction (or coronary heart disease). According to the World Health Organization report in 2008, deaths from cardiovascular diseases (CVD) will rise from 17.1 million in 2004 to 23.4 million in 2030. Small mammals such as mouse and rat are widely used for investigating the pathogenesis of Human hypertension, cardiovascular diseases, diabetes, etc and for developing new diagnosis and therapeutic strategies. Wireless biosensors are increasingly being used for improving vital signal monitory system, solving a wide variety of medical and research challenges, and improving research and medical quality. This requires innovative high-precision micro technology. We have designed an implantable telemetric pressure device for long-term accurately monitoring of left ventricular pressure and heart rate etc in a free moving small rodent animal (mouse and rat) and for improvement of conventional Human hemodynamic monitoring system in patient. The telemetric implant comprises a pressure sensor, a telemetry chip, and an implantable catheter. The prototypes have been proved in mice and can be adapted for connecting to human venous and arterial catheters. A remote powering supply and wireless communication between the implant and receiver has been proved in practice in air by using discrete electronic components, which will be tested in animals. Further step is to minimize the size of the device by producing a telemetric ASIC chip with an appropriate data transmission bandwidth and couple distance for accurate monitoring of high frequency vital signals such as mouse left ventricular pressure and electrocardiogram etc. The telemetric pressure device enables for (1) long-term accurately monitoring of arterial and venous blood pressure, ventricular pressure, and heart rate etc, (2) drug delivery and blood sampling, and (3) multi-sensing monitoring vital signals in animals and patients with hypertension, cardiovascular diseases, diabetes, and others.

Rong Fu WANG
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Research interests
Novel molecular imaging probes; multiple model molecular imaging

Educational history
Rong Fu Wang graduated from Fujian Medical College with a Bachelor of Science in Medicine in 1982. In 1990, he was sent to France as a visiting scholar by the National Education Committee. Rong Fu Wang graduated from Paris V in 1992 and Toulouse III in 1995, receiving doctoral degrees in both Nuclear Medicine (MD)and Pharmacology(PhD).

Previous positions
From 1982 to 1990, Rong Fu Wang engaged in clinical practice, teaching and scientific research in Fujian Medical University. From 1990 to 1995, he was sent to France as a visiting scholar. From 1995 to today, Rong Fu Wang worked in Peking University First Hospital.

Rong Fu Wang

Situation and progress of tumor angiogenesis targeted imaging and therapy via radionuclide tracing techniques

Tumor; angiogenesis imaging; peptides; RRL; SPECT; PET

Tumor angiogenesis imaging is a new tumor research field, and the key scientific problem is how to find a specific and targeted tumor angiogenesis imaging tracer. The realization that angiogenesis is an essential step for tumor growth and for the initiation of metastasis has led to the development of angiogenesis imaging methods on early diagnosis , optimal treatment for individual patients and predict subsequent clinical response. Radiolabeled peptides are of increasing interest in nuclear oncology. These small-molecule agents gain access to their target sites more easily than monoclonal antibodies. In our previous study we found that radionuclide labeled small peptide Arg-Arg-Leu(RRL) labeled with single photon and positron radionuclides could combined with tumor derived endothelial cells specifically and has high good imaging in tumor tissue by SPECT and PET imaging. On the other hand, RGD peptide is a group of small molecular polypeptide which contains Arg-Gly-Asp triple amino acids , a highly selective and affinitive receptor of integrin $\alpha v\beta 3$. Integrin $\alpha v\beta 3$ plays a critical role in tumor-induced angiogenesis and metastasis and has become a promising diagnostic indicator and therapeutic target for various solid tumors. Radiolabeled RGD peptides that are integrin specific can be used for noninvasive imaging of integrin expression level as well as for integrin-targeted radionuclide therapy[. Therefore we assess the impossibility of RRL and RGD as tumor angiogenesis imaging tracer and carrier of tumor targeted therapy in high invasive tumor, so that we try to find a new way to diagnosis and therapy tumor.

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Research interests
Medical applications of focused ultrasound

Beat Werner

Transcranial magnetic resonance guided high intensity focused ultrasound for functional neurosurgery

For over 50 years researchers have been seeking for a way to perform non-invasive thermal ablation for brain treatments. Recent technical advances allowed the clinical introduction of Magnetic Resonance guided High Intensity Focused Ultrasound for non-invasive surgery under closed loop image guidance and control throughout all steps of the intervention process. MR-imaging allows for precise intraprocedural localization of the ablation target, definition and verification of safety margins for the ultrasound treatment, real-time monitoring of thermal ablation dynamics, and intra- and post-treatment assessment of intervention results. Thanks to its non-invasiveness Focused Ultrasound minimizes the risk of bleeding and infection and avoids collateral damage to non-targeted tissue. In addition, it does not involve ionizing radiation. Transcranial application of MR guided Focused Ultrasound, therefore, promises to become an important new modality for neurosurgical interventions and is envisioned to enable novel treatment strategies against a variety of brain diseases.

Here, we will present a short introduction into this exciting technology and give an overview of the clinical studies conducted in the context of the ongoing Co-Me III research programme.

René WILLI
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Research interests
Medical Device

Educational history

11/2009	Breakthrough Program for Senior Executives, IMD (Lausanne)
11/2003	Strategic Marketing Executive Course (Medtronic Marketing Leader Program), The Wharton School (University of Pennsylvania)
10/1998–10/2000	Postgraduate Degree in Industrial Engineering and Management (BWI), ETH Zurich
1/1993–8/1996	PhD in Technical Sciences at the Laboratory of Technical Chemistry, ETH Zurich
11/1987–11/1992	Master in Chemical Engineering, ETH Zurich

Previous positions

6/2005–present	Senior Vice President, Head Business Unit Surgical, Institut Straumann AG
6/2004–5/2005	Marketing Manager Core Coronary, Europe and Emerging Markets, Medtronic
4/2003–6/2004	Product Manager Balloons and Guiding Catheters, EMEA, Medtronic
10/2000–4/2003	Management Consultant, McKinsey&Company
7/1998–7/2000	Senior Manager Sales & Engineering, Von Roll Inova AG
9/1996–6/1998	Process engineer and project leader, EMS-Inventa AG

René Willi

Innovation – Driving growth today and tomorrow

Le XIE

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Research interests

Minimally invasive surgical assistant robot; rehabilitation robot; virtual surgical training

Educational history

Dr. Xie Le received his B.E in mathematics from East China Normal University, China, in 1985, M.S. in computational mathematics and PhD in Aeronautics and Astronautics manufacturing from Nanjing University of Aeronautics and Astronautics, China in 1995 and 1999. From 1999 to 2001, he researched as post doctor in Shanghai Jiao Tong University, China.

Previous positions

Dr. Xie Le is a professor of Shanghai Jiao Tong University (SJTU), China, where he carried out interdisciplinary research in digital manufacturing and digital medicine. He has led on more than 10 research projects on virtual surgery, surgical robot and rehabilitation robot. His research interest focuses on medical robot, virtual reality and rehabilitation engineering.

Dr. Xie Le e is vice director of the rehabilitation engineering institute of SJTU, the Committee Member of Bio-manufacturing Engineering Institution of Chinese Mechanical Engineering Society, Vice secretary-general of technical innovation strategic branch alliance for Chinese rehabilitation assist instrument industry.

Le Xie

Medical robot and virtual surgery

Minimally invasive surgical robot; rehabilitation robot; virtual reality; virtual surgery; haptic

The minimally invasive surgical assistant robot is developed rapidly in the world recent years, the slave-master minimally invasive surgical assistant robot prototype system is developed, in which the force measuring in slave robot and haptic feedback in master robot are especially discussed.

The exoskeleton robotic could be used in rehabilitation engineering, the exoskeleton rehabilitation robot for upper limb and lower limb are developed, the key technology in which is discussed.

The cardio surgery and laparoscope surgery need long time to train. Combining with surgery the virtual reality technology is able to use in surgical training, which could reduce the doctor training time, fee and practice operation risk. The virtual cardio surgery and laparoscope surgery are researched, especially the haptic technology in virtual surgery is discussed.

Virtual reality could also be used in the rehabilitation training and evaluating, the virtual rehabilitation training is discussed.

Liang YAN

Shanghai State Food and Drug Administration, Shanghai Pudong Medical Device Trade Association

Curriculum vitae

Professor Yan Liang has been engaged in the government administrative work more than 35 years that focusing on the pharmaceutical and medical device industry management and administrative regulations area. He served as the director of Medical Device Registration, director of legal affairs and International affairs in SFDA Shanghai for 13 years. In China planned economy period, he was in charge of the director of Science and Technology department in Shanghai Pharmaceutical Administration Bureau. 2009 retired from the government service positions.

Currently he serves as the president of the Shanghai Pudong medical device trade association, the vice president of Medical Devices Industry Association vice president, Also served as a senior consultant of the Shanghai Food and Drug Administration and Institute of Food and Drug Safety. He promote the establishment of Sino-US joint medical devices MBA regulations education courses in 2010, and served as the RASP China Office director.

Professor Yan Liang in 1989 to raise and draft China's first medical device regulations, then continue to participate in the establishment and implementation of a national medical device regulatory system. In 2006, adopting UDI concept to organize a world's first pilot project of the implantable medical device traceability system in Shanghai 120 hospitals. In 2009, he led a medical device nomenclature translational research groups to completed the first Chinese version of GMDN (global medical device nomenclature system) in China. He had raised the most simplify the medical sales model to get the attention of global competent authorities. He was the member of GHTF AHWG UDI, involved in the drafting of a global UDI guidance documents, as well as the first chairman of AHWP STG for device naming and coding harmonization in Asia. Prof. YAN Liang received a Global Leadership award in 2011 from Regulatory Affairs Professional Society (RAPS), which was the first recognition by global medical RA professional society for a Chinese.

Liang Yan

Product regulation in China

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Research interests
Tissue engineering and regeneration for musculoskeletal and neural applications

Educational history
PhD: Mechanical Engineering, Stanford University
PostDoc Fellowship: Orthopaedic Research Laboratories, University of Michigan
Habilitation: Dept. of Clinical Research, University of Bern

Previous positions
Coordinator of the MSc Biomedical Engineering program, ETH Zurich
Group Leader, M.E. Müller Institute for Biomechanics

Marcy Zenobi-Wong

Engineering microenvironments for improved cartilage repair

Cartilage; tissue engineering; biomaterials; cell-based therapies

Current therapies for cartilage repair are hampered by variable outcomes and insufficient mechanical properties of the repair tissue. Even when the treatment is augmented by cells and/or living tissue, a number of challenges remain including cell retention/survival, adhesion of the repair tissue to the native matrix, and fibrosis. In our laboratory we use multiple approaches to improve the outcome of cartilage repair treatments. We study how factors in the microenvironment of cells (e.g. oxygen tension, scaffold/hydrogel stiffness, charge, adhesion sites) can control the state of differentiation and synthetic activity of the cells. We use functional mimics of the native 3D extracellular environment (methacrylated chondroitin sulfate, methacrylated hyaluronic acid, and sulfated alginate) combined with 3D printing techniques to pattern cell types and materials in spatially complex geometries. To address the cell retention problem, we use the layer-by-layer technique and Schiff base reactions to improve the adhesion of implanted cells to each other and to the defect site. This research lays the foundation for improving current clinical strategies for cartilage repair and regeneration.

Guoyan ZHENG
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Research interests
Information processing for medical interventions; medical image computing; augmented reality for medical applications; computer assisted surgery

Educational history

2010	Privat Dozent (PD), Medical Faculty, University of Bern, Bern, Switzerland
2002	Doctor of Philosophy, University of Bern, Bern, Switzerland
1995	Master of Science, Southern Medical University, GuangZhou, China
1992	Bachelor of Science, Southern Medical University, GuangZhou, China

Previous positions

2005–present	Head – Information Processing for Medical Interventions Group, Institute for Surgical Technology and Biomechanics, University of Bern
2003–2005	Postdoc research associate, Institute for Surgical Technology and Biomechanics, University of Bern

Guoyan Zheng and Lutz-Peter Nolte

Medical image computing for orthopaedic applications

Medical image computing; orthopaedics; statistical shape modeling; 2D/3D reconstruction

The role of medical image computing in computer assisted orthopaedic diagnosis and interventions is continuously increasing. Recent innovations in medical imaging technology are revolutionizing diagnosis, therapy planning and follow-up, and allow for multi-modal, multi-temporal, and multi-subject assessment. A consequence is that accurate and automated quantitative image computing has become indispensable to computer assisted orthopaedic diagnosis and interventions. In this talk, I will discuss the state-of-the-art medical image computing technologies for orthopaedics, with a focus on the construction and the application of a variety of statistical shape models of human skeleton in orthopaedics.

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