Program Book

1st CUHK International Symposium on Stem Cell Biology and Regenerative Medicine

6 Dec 2011 (Tue)
The Auditorium, 1/F Main Clinical Block and Trauma Centre
Prince of Wales Hospital, Shatin, Hong Kong

Organizers:

Stem Cell and Regeneration Theme, School of Biomedical Sciences, The Chinese University of Hong Kong
Centre for Stem Cell and Regeneration, The Chinese University of Hong Kong
Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong
The Hong Kong Jockey Club Sports Medicine and Health Sciences Centre
Key Laboratory for Regenerative Medicine (Ji Nan University-The Chinese University of Hong Kong), Ministry of Education, China

Conference Venue:
The Auditorium, 1/F Main Clinical Block and Trauma Centre
Prince of Wales Hospital, Shatin, Hong Kong

Content

Welcome Message

Message from

Professor Tai-Fai FOK
Dean
Faculty of Medicine
The Chinese University of Hong Kong

Dear colleagues and friends,

Welcome to the 1st CUHK International Symposium on Stem Cell Biology and Regenerative Medicine.

Regenerative medicine is an emerging discipline using cells, genes, other biological factors, and tissue engineering to repair or regenerate cells, tissues, and organs. It has enormous potentials to develop new paradigms for medicine focusing on tissue repair and regeneration obviating the need for organ replacement. This specialty will transform clinical practice, reducing dependence on invasive procedures and providing the potential to treat currently intractable diseases. As such it is of great societal and economic importance.

Stem cell research and the development of regeneration medicine, just like many other branches of medicine, require the concerted effort of basic scientists and clinicians in different areas. I am very delighted to note that this conference has brought together a truly multidisciplinary faculty of experts and speakers. I am sure all our participants, which are equally multidisciplinary, will benefit from their wealth of knowledge and experiences.

I would like to take this opportunity to thank all the speakers, and wish you all a very successful conference.

Yours sincerely

Prof. Tai-Fai FOK
Dean
Faculty of Medicine
The Chinese University of Hong Kong

Message from **Organizing Committees**

Dear colleagues and friends:

The 1st CUHK International Symposium on Stem Cell Biology and Regenerative Medicine will be opened in Prince of Wales Hospital, The Chinese University of Hong Kong on 6 December 2011.

First, we would like to thank sincerely for all the guest speakers to join us on this occasion and show your support. Your presence has made this symposium a truly international one. Research on stem cell biology and regenerative medicine in Hong Kong develop very fast, more and more staff are interested or involved in the research fields of stem cell biology, biomaterials, tissue engineering under the broader term of regenerative medicine. We hope that the symposium will provide a platform for us to share and learn new research ideas, findings and techniques from each other.

The symposium is divided into 4 main parts: biology of tissue regeneration; topics of regenerative medicine; technological advancements and translational medicine related topics. Experts from USA, Taiwan, Singapore, China as well as from CUHK will share their latest discoveries, research ideas and techniques on various fronts of regenerative medicine research. This symposium is an ideal opportunity for researchers, students, clinicians and people who are interested in regenerative medicine to learn and to share.

On behalf of the symposium organizers, we warmly welcome you to join us in Hong Kong and enjoy the symposium as well as the stay in Hong Kong!

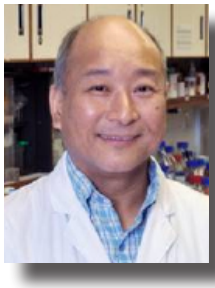
Chairmen of the Organizing Committee
The 1st CUHK International Symposium on Stem Cell Biology and Regenerative Medicine,
Prince of Wales Hospital, Hong Kong, 6 December 2011.

Prof. Wai-Yee Chan
Director
Chair Professor
CUHK-SBS

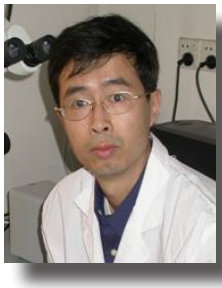
Prof. Kai-Ming Chan
Chair Professor
CUHK-ORT

Prof. Leung-Kim Hung
Chairman
CUHK-ORT

Prof. Gang Li
Professor
CUHK-ORT
CUHK-SBS-SCR



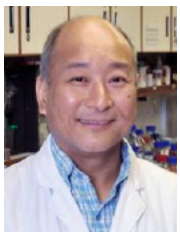
Prof. Kenneth Lee
Chief, SCR-SBS
Co-Director,
Jian-CUHK Key Lab for
Regenerative Medicine,
Ministry of Education, PR China



Prof. Dong-Qing Cai
Co-Director,
Jian-CUHK Key Lab for
Regenerative Medicine,
Ministry of Education, PR China

Organizers

Stem Cells and Regeneration (SCR) Theme
School of Biomedical Sciences
The Chinese University of Hong Kong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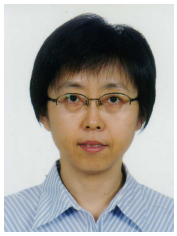
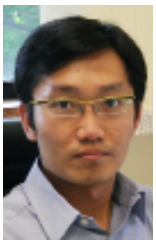

馮波


李剛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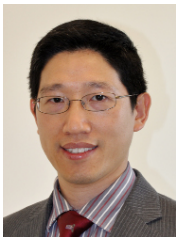
萬超


陳啓明


秦嶺


呂寶儀


曾淑瑩


袁平

Members of SCR:

Position	Name	Contact No.
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Members	Prof FENG Bo 馮波	39431455
	Prof LI Gang 李剛 (Deputy Chief)	37636153
	Prof MAK King Lun Kingston麥經綸	39434497
	Prof WAN Chao萬超	39434494
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	Prof TSANG Suk Ying Faye 曾淑瑩	39431020
	Prof WANG Huating 王華婷	37636047
	Prof XU Gang 徐剛	26370721
	Prof YUAN Ping袁平	37636039

Mission and Vision of SCR:

To co-ordinate and facilitate research, education, and clinical application of stem cells and regeneration technologies in the Faculty of Medicine, the Chinese University of Hong Kong and to implement a new, multidisciplinary, and sustainable program in translational research in regenerative biology, which will form the basis for incorporating clinical service with cutting edge technology into these disciplines.
More specifically we view as our missions:

- To provide a platform for interaction among investigators working on different aspects of stem cell biology and regenerative medicine in the Faculty of Medicine, CUHK.
- To enhance and facilitate collaboration between investigators.
- To serve as the representative body of all clinical and basic investigators in stem cell and regenerative biology at the Chinese University of Hong Kong when dealing with outside institutions.
- To provide a platform for collaborations with scientists in North America, Europe, Asia, Taiwan, Hong Kong and China mainland.
- To enhance international profiles of CUHK.

Research Focus of SCR:

The host reaction to tissue injury involves a complex interplay of local and systemic, cellular and hormonal responses. Mesenchymal stem cells (MSCs) present in many adult tissues can generate new cells either continuously or in response to injury/inflammation/cancer. The main research focus of this group is to understand the role of stem cells in diseases and development and to use MSCs for clinical translational research. The main research interests include:

- Study the fundamental biological/mechanical factors that control/regulate MSCs proliferation, differentiation and fate.
- MSCs as a source for tissue engineering and regeneration such as bone-tendon healing, tendon repair, fracture healing, cardiac tissue repair, etc.
- The role of MSCs in cancer development and the use of MSCs as carriers for anti-cancer gene therapy.
- Reprogram the somatic cells into induced pluripotent stem cell (iPS) and the use of iPS as models for studying diseases and developmental process.
- To use GMP stem cell facility to carry out cell therapy clinical trials.

Core technology and research platforms of SCR:

The following are some existing technologies that we have in the theme:

1. MSCs, iPS and embryonic cell culture techniques and standard characterization of various stem cells by flowcytometry, immunohistochemistry and morphology.
2. Multi-differentiation potential assays for stem cells, such as osteogenesis, chondrogenesis, adipogenesis, neurogenesis, angiogenesis and differentiation into cadivascualr muscles, b-cells of islets.
3. In Vivo imaging techniques to trace stem cell migration in vivo.
4. Chemotaxis analysis techniques and imaging techniques including microCT, VivaCT and ultrasound imaging.
5. Transgenic animal models of GFP rat, Luciferase mice, and BMP-4 promoter driver Luc-mouse.
6. Animal models of stem cell transplant, animal models of muscle, tendon, bone and cartilage, spinal card injury and repair and assessments.
7. Bioreactor platform for stem cell culture.
8. GMP standard clinical grade clean room for human stem cell culture and clinical cell therapy applications.

For the research interests of each members, please check at the following website:
http://www.sbs.cuhk.edu.hk/Research_Scr.asp

Organizers

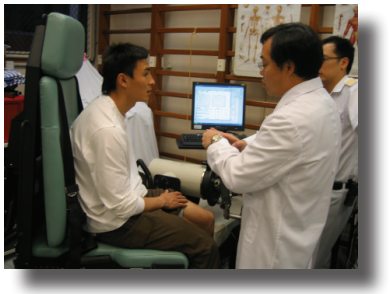
Department of Orthopaedics and Traumatology
The Chinese University of Hong Kong

The department was established in 1982 under the foundation Chairmanship of Professor PC Leung. The first batch of medical students started to have their clinical orthopaedic teaching in 1983.Through the years, the department has grown and developed under the clear Mission and Vision "to provide the highest quality service in patient care, research, education and teaching for medical students and postgraduate training".

The department has grown from a single professor team to more than 40 clinical colleagues and 60 supporting clerical, technical and research staff now. It would be appropriate to divide the development of the department into three different phases, namely the establishment, the expansion and the consolidation phases. The initial establishment phase stretched from 1982 to 1990 and could be regarded as the infancy and childhood phase. This was followed by a rapid expansion phases from 1991 to 1996 by "hundred flowers blooming" phase which was quite similar to the pre - adolescent and adolescent phase. The past few years, from 1997-2001 featured the early consolidation and sustained growth of the department with the analogy of early and young adulthood phase.

On the clinical services, the department has developed along the major fields of subspecialties in orthopaedics, from Hand and Microsurgery, Sports Medicine, Traumatology, Paediatric Orthopaedics to Orthopaedic Oncology, Spinal injury, Orthopaedic Rehabilitation, Joint Reconstruction Surgery to the latest addition of Foot and Ankle surgery 3 years ago. Many of these subspecialties enjoy significant local, regional and international professional and academic recognition and achievements.

Commitment to quality teaching of medical students is one of the main keystones of the department. The department has been involving in the teaching of musculoskeletal system and orthopaedics in Med 3 and Med 5 students and with the introduction of the new curriculum in 2001, teaching has been extended further into year 1 and 2. With the setting up of a formal teaching committee and departmental teaching coordinator, the curriculum in musculoskeletal system is regularly reviewed and updated. Regular teaching quality assessment, meeting with students and annual curriculum review with honorary teachers has helped not only to update but continuous improvement of the quality of teaching as reflected by the evaluation results and recognition by the faculty and university.



Significant growth has been achieved in the research area. From purely clinical reviews and research, the department has steadily expanded in the years to cover different areas of basic and applied basic research that spread from soft tissue, bone and cartilage to biomaterials, osteoporosis and traditional Chinese medicine. The research committee and the musculoskeletal research laboratory structure now have clear responsibility and function to plan, advice and implement defined policies related to research. Three main focused research programs and functionalisation have been established to incorporate all teaching and research staff of the department. The research output and research grants have increased significantly over the years both in quantity and quality. Up to now, 50 Mphil, 23 PhD and 2 MD have graduated from the department. Active collaborations with other departments, universities and research institutions locally, regionally and with other countries have opened up many new and important areas of research.

The department has put great emphasis on the development of information technology and audiovisual supporting services to all staff from administration to training, teaching, research to clinical services. The whole department is now connected by a sophisticated system of high-speed Intranet. Active research and application of IT in enhancement of web-based interactive teaching is well supported.One of the most important highlights of the department is the establishment of the Orthopaedic Learning Centre from generous donations around 2 million US$ in total. Since it's opening in April 1999, over 5,000 local, regional and international participants have attended different courses and workshops conducted in the centre. The centre has also been recognised as advanced training centre by various societies and also a favorite center for visit by any outside guest to the Faculty of Medicine.

Throughout the years, colleagues of the department have and will continue to be actively committed to the university, the professional and specialty development, and play important roles in public services, voluntary services and services to the community.

With the support, spirit and dedication of colleagues at all levels, we can proudly look forward into the future, continue to strive, seek and develop "to provide the highest quality service in patient care, research, education and teaching for medical students and postgraduate training".

The Hong Kong Jockey Club
Sports Medicine and Health Sciences Centre
香港賽馬會運動醫學及健康科學中心

The Hong Kong Jockey Club Sports Medicine and Health Sciences Centre

About us

With The Hong Kong Jockey Club Charities Trust's generosity and support, The Hong Kong Polytechnic University (PolyU) and The Chinese University of Hong Kong (CUHK) jointly established The Hong Kong Jockey Club Sports Medicine and Health Sciences Centre with the aim of improving Hong Kong's quality and quantity of sports-related elite and public clinical services, "sports for health" promotional programmes, academic research and professional education. Each University already has impressive credentials in the elds of sports medicine, sports science, sports rehabilitation, and sports health. The Centre takes these tasks to a new level by maximizing the cost-eective usage of resources and enhancing the cooperation between the two Universities.

Background

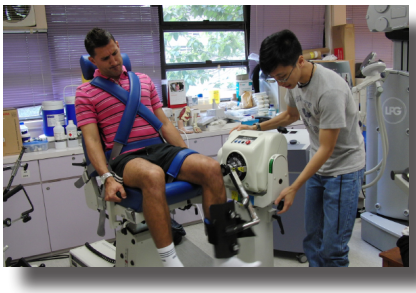
Physical inactivity is associated with a myriad of chronic diseases including cardiovascular disease, colon cancer, breast cancer and diabetes. At least 60% of the global population fails to achieve the minimum recommendation of 30 minutes moderate intensity physical activity daily. As physical activity continues to be promoted as part of a healthy lifestyle, sports-related medical & health issues and injures are also becoming increasingly important public health concerns. Prevention effort aimed at reducing sports injuries by targeting high-risk activities, places and modes of occurrence need to go beyond the focus on athlete and also to consider the general public. This also applies to the provision of clinical services that should address the needs of both groups.

Mission

To recreate a healthy society by promoting exercise in the general pubic and to provide integrated sports medicine and health science services through evidence-based practice, training of sports medicine and health sciences professionals, supported by clinical, basic and applied scientific research related to improving the safety and efficiency of sport performance.

Vision

To become the leading hub in the Asia-Pacific region for promoting exercise for health and advancing sports medicine and health sciences-related education research and technology.



Our Units

The Centre comprises of 14 Units, each focuses on a specific area in sports medicine, sport science, sports rehabilitation, or sports health. They work independently and synergistically to provide integrated clinical services, professional training programmes, academic research and community services.

Organizers

Key Laboratory for Regenerative Medicine
(Ji Nan University-The Chinese University of Hong Kong)
Ministry of Education, China

The Key Laboratory for Regenerative Medicine, Ministry of Education (Ji Nan University-The Chinese University of Hong Kong), was established by Ji Nan University, Guang Zhou, and the Chinese University of Hong Kong, Hong Kong, on the basis of the previously established Joint CUHK-JNU Lab for Regenerative Medicine in April 17th 2007. To further strengthen the expertise and resources of both universities, the Lab then applied for as a Key Lab of Regenerative Medicine, in the Ministry of Education, which was approved in Dec. 2007 to start building the Lab. Moreover, the Key Lab was approved in 2008 as an International Collaborative Base for Science and Technology, by the Department of Science and Technology, Guang Dong Province. In 2009, the key lab was further approved as International Collaborative Base for Science and Technology, by the Department of Science and Technology, P.R.China. Currently, the Key Lab has 31 permanent staffs with an average age of 45 years old. There are 20 high ranking members (Professor), 1 member with title in the “New Century National Hundred, Thousand and Ten Thousand Talent Project”, 1 member of Oversea Outstanding-Youth. Almost all of the principal investigators have been trained oversea. The expertise of the staffs includes almost all areas of regenerative medicine, which are medical regeneration, developmental biology, regenerative biology, cell and molecular biology, tissue engineering, physiology, and immunology etc. The total lab space is about 3600 m2 , which includes laboratories for molecular biology, cell biology, stem cells, biological imaging, morphology, functional analysis, and up-to 1000-grade cell culture rooms. The labs are furnished with state-of-the–art equipment. The equipment and apparatus procured are worth about 50 million RMB. Post-graduate students from both laboratories move freely and conduct research at both sites. Our mission is to improve the lives of our community by conducting research to find cures for degenerative diseases, such as ischemic heart diseases, skeletomuscular degeneration, eye disease and tissue degeneration caused by cancer/aging. Stem cell- and small molecule- based therapies are currently being developed by principle investigators in the Key Lab to treat the various forms of degenerative diseases mentioned.

Exhibitors & Sponsors List

香港中文大學 生物醫學學院 CUSBS

Department of Orthopaedics and Traumatology CUHK

The Hong Kong Jockey Club Sports Medicine and Health Sciences Centre 香港賽馬會運動醫學及健康科學中心

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Section 1— Biology of Tissue Regeneration

Different Means and Forms of Tissue Engineering

Prof. Li Gang, M.D., Ph.D
School of Biomedical Sciences,
Department of Orthopaedics and Traumatology,
The Chinese University of Hong Kong

Replacing diseased cells with healthy cells, a process called cell therapy, is a promising use of stem cells in the treatment of disease. Currently, researchers are investigating the use of adult, fetal and embryonic stem cells as a resource for various, specialized cell types, such as nerve cells, muscle cells, blood cells and skin cells that can be used to treat various diseases. Mesenchymal stem cells (MSCs) combined with biomaterials to replace or regenerate damaged or degenerative tissues are termed as tissue engineering.

There are various forms and means of tissue engineering approaches, such as classical cell-biomaterial-growth factor approaches; functional tissue engineering approaches by mobilizing endogenous MSCs using surgical techniques, intelligent biomaterials, and genetically modified MSCs. Issues of how to select MSCs source; how to deliver MSCs (local vs. systemic) and functional tissue engineering applications will be discussed. Stem cells applications that extended to gene therapy and targeted gene delivery for treating specific diseases such as cancer and immune diseases will also be discussed.

Cellular Response and Biomedical Application of Nano-scaled Inorganic Biomaterials--Interfacing Biology with Nanomaterials

Prof. Chang-Sheng Liu, Ph.D.
Engineering Research Center for Biomedical Materials of Ministry of Education,
School of Materials Science and Engineering,
East China University of Science and Technology, Shanghai

Advanced nanotechnologies have opened new opportunities offering numerous promising possibilities to significantly improve regenerative therapy, leading to an affordable higher quality of life for everyone. In spite of what has been achieved so far, a comprehensive understanding of how cells interact with nanostructures at the molecular level remains poorly understood. Here we show some interesting cellular response of nanobiomaterials with well-defined nanostructure and compositions. The well-ordered mesoporous silica nanoparticles display size-dependent effect of cell uptake and intramembrane delivery, which could provide synergic bone-induction via site-selective delivery of multiple cytokine and drug into or out cell. The anti-tumor activity, apoptosis and apoptotic signaling activation protein levels of the hydroxyapatite nanoparticles strongly depend on nanoparticle size as well. Apart from the size effect, the refined mesoscopic nanostructure and composition doping can provide new avenues to regulate the cell responsive activities. Furthermore, these nanostructured biomaterials are not limited to basic research, but rather have promising applications in tissue regeneration, such as bone repairing and hemostasis in emergency treatment.

Conversion of Somatic Cells Into Pluripotent Stem Cells

Prof. Feng Bo, Ph.D.
School of Biomedical Science,
The Chinese University of Hong Kong

Pluripotent stem cells possess the unique properties to undergo unlimited self-renewal and can give rise to all cell types in adult organisms. This has made these cells a renewable source for cell therapy. Reprogramming of somatic cells into induced pluripotent stem cells (iPSCs) by transduction with defined transcription factors has further opened up the possibility of deriving patient-specific pluripotent cells from adult somatic cells, hence has tremendous potential for autologous regenerative medicine.

In order to uncover the mechanism for how reprogramming could reinstate pluripotency, we initiated a study to screen for new reprogramming factors. Through the screening, we identified orphan nuclear receptor Esrrb that could replace Klf4 and reprogram mouse embryonic fibroblast (MEFs) in conjunction with Oct4, Sox2 and c-Myc. The Esrrb reprogrammed cells share similar expression and epigenetic signatures with embryonic stem cells (ESCs), and also possess a similar capacity for multi-lineage differentiation. This finding indicates that it is possible to reprogram mouse fibroblasts independently of Klf transcription factors and links nuclear receptors to somatic cell reprogramming. Consistent with this notion, we identified another nuclear receptor Nr5a2 which could replace Oct4 in reprogramming. Given the fact that Oct4 functions as a master regulator of the unique transcriptional program in ESCs, the finding that Nr5a2 can replace Oct4 is of great interest to mechanistic investigations.

We are currently carrying on studies in this direction, hoping to further unravel the mechanism that controls pluripotency and to promote the generation of clinical-grade iPSCs.

MicroRNA-204/211 and Hu RNA Binding Proteins Regulate Runx2 Protein Translation and Mesenchymal Progenitor Cell Differentiation

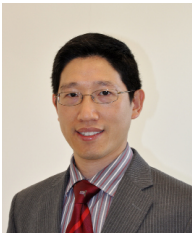
Prof. Di Chen, Ph.D.
Department of Biochemistry, Rush University Medical Center

Differentiation of mesenchymal stem cells (MSCs) into a particular lineage is tightly regulated and malfunction of this regulation could lead to pathological consequences. Patients with osteoporosis have reduced osteoblast differentiation and increased adipocyte accumulation, but the mechanisms involved remain to be defined. In this study, we aimed to investigate if microRNA and RNA binding proteins affect the fate of MSC differentiation through regulation of Runx2, a key transcription factor controlling the commitment and differentiation of mesenchymal stem cells into osteoblast lineage. We found that microRNA miR-204 and its homolog miR-211 and RNA binding proteins HuB/HuC/HuD were expressed in MSCs (primary bone marrow stromal cells and C3H10T1/2 and ST2 progenitor cells) and regulated Runx2 protein levels. Putative binding sites for miR-204/211 and Hu RNA binding proteins were identified in the 3'-UTR of Runx2 mRNA by sequence analysis. Mutations of an individual binding site (M1 and M4) for miR-204/211 up-regulated the Runx2 3'-UTR reporter activity and abolished miR-204-mediated down-regulation of the reporter activity, suggesting that miR-204/211 bound to specific sites of Runx2 3'-UTR. Over-expression of miR-204 decreased Runx2 protein levels in MSCs. Significant reduction of ALP activity and the expression of osteoblast marker genes and the inhibition of mineralized bone nodule formation were observed in miR-204-over-expressing ST2 cells; while enhancement of adipocyte formation demonstrated by increased Oil red O staining and the enhanced

Abstracts (cont')

adipocyte-specific gene expression was also found in cells over-expressing miR-204. In contrast, miR-204 inhibition, via transfection of antagomir oligos or retroviral over-expression of a miR-204/211 complementary fragment 'sponge', significantly increased Runx2 protein levels. miR-204 inhibition promoted osteoblast differentiation and suppressed adipocyte differentiation in ST2 cells. In addition, we also found that over-expression of RNA binding proteins, HuB/HuC/HuD, significantly up-regulated Runx2 protein levels and osteoblast differentiation. To further investigate the role of miR-204/211 in mesenchymal stem cell differentiation and bone formation in vivo, we have generated miR-204/211-sponge conditional transgenic (cTg) mice and bred these mice with Prx1Cre transgenic mice. Specific expression of miR-204/211-sponge in limb mesenchymal cells is achieved by Cre-recombination driven by Prx1Cre. The differentiation of MSCs into osteoblasts has been examined. Runx2 protein levels were up-regulated, ALP and Alizerin red staining was increased in bone marrow cells isolated from these transgenic mice. Micro-CT, histology and histomorphometry analyses revealed that bone mass was significantly increased in two independent lines of the transgenic mice. Bone formation rates were increased and osteoclast numbers and bone resorption surfaces were not changes in these mice. To further confirm the findings from these conditional transgenic mice, we have generated miR-204-flox and miR-211-flox mice. To obtain definitive evidence of the role of miR-204/miR-211 in regulation of mesenchymal stem cell differentiation and bone formation, we are now breeding miR-204-flox/miR-211-fox mice with Prx1Cre transgenic mice. Analysis of these conditional knockout mice is in progress.

Therapeutic Angiogenesis for Skeletal Tissue Regeneration



Prof. Chao Wan, Ph.D.
School of Biomedical Sciences, Faculty of Medicine,
The Chinese University of Hong Kong.

Therapeutic angiogenesis is an approach to stimulate the generation of new blood vessels in ischemic organs or tissues caused by trauma, surgery, degeneration or aging. Efforts have been made on direct delivery of angiogenic factors (e.g. VEGF, PDGF) or gene therapy for ischemic diseases (e.g. diabetic neuropathic lower extremity ulcers, myocardium infarction), while potential side effects or deficient efficacy in clinical settings remains under investigation. Oxygen is a fundamental requirement for cellular growth and viability. Reparative cells are readily located in the hypoxic region of the regenerating zone. The hypoxia inducible factor (HIF) pathway is a central mediator for sensing and responding to low oxygen tension. HIFs impinge on gene programs which influence angiogenesis and cellular metabolism. In addition, HIF can recruit inflammatory and mesenchymal stem cells (MSCs), influence cell proliferation and differentiation, and coordinate tissue response following injury. We recently showed that HIFs were required for normal function of MSCs and osteoblast lineage cells, the major cell components during skeletal development and regeneration. We manipulated the HIF pathway genetically and pharmacologically. Mice lacking pVHL in osteoblasts had markedly increased vascularity and produced more bone whereas mice lacking HIF-1α in osteoblasts had impaired angiogenesis and bone healing. The increased vascularity and bone regeneration in the pVHL mutants were VEGF signaling dependent. Small molecule inhibitors of HIF prolyl hydroxylation stabilized HIF/VEGF production and increased angiogenesis in vitro and in vivo. These results identify the HIF-1α pathway as a critical target of therapeutic angiogenesis for skeletal regeneration.

Section 2 — Topics of Regenerative Medicine

Tendon Development and Regeneration

Prof. Hong Wei Ouyang, Ph.D.
School of Basic Medicine,
Zhejiang University

Tendon is a quite specific fibrous tissue with limited regenerative capacity. A number of researches illustrate the molecular mechanism of tendon development. Also, current novel tendon tissue-engineering techniques combine the application of biodegradable biomaterials, seed cells; growth factors and gene transfer have been explored. This talk comprehensively reviews recent tendon development and regeneration researches as well as our previous studies. We construct new biomaterials that combine knitted silk and collagen sponge scaffold with “internal-space-preservation”. It improves structural and functional tendon repair by regulating matrix gene expression and collagen fibril assembly. Incorporation of SDF-1 alpha within a knitted silk-collagen sponge scaffold by increasing the recruitment of fibroblast-like cells and decreasing accumulation of inflammatory cells. Moreover, we further confirm the use of ESC as promising seed cells for tendon regeneration. Combination of biological and physical stimulus promote tendon regeneration with ESC.

Stem Cell Therapy for Tendon Regeneration

Prof. Pauline Po Yee Lui, Ph.D.
Department of Orthopaedics and Traumatology,
The Chinese University of Hong Kong

Tendons are traditionally considered to contain only tenocytes, for the maintenance, repair and remodeling of tendons. Stem cells, which are termed tendon-derived stem cells (TDSCs), have recently been identified in tendons. Our group is the first to report the isolation and characterization of TDSCs in rat tendons. The use of resident stem cells may promote engraftment and differentiation of transplanted cells in tendon and tendon–bone junction repair because the tendon milieu is an ideal and familiar environment to the transplanted cells. In this presentation, I will present the advantages and results of using TDSCs as a new cell source for musculoskeletal repair, particularly tendon repair. Issues pertaining to the use of TDSCs for tissue engineering including cell number, immunogenicity and tenogenic differentiation will also be discussed.

Autologous Tendon Progenitor Cells Therapy for Treatment of Tendinopathy: From Preclinical to Clinical Trial

Prof. Minghao Zheng, MD, Ph.D., FRCP
Centre for Orthopaedic Resaerch, School of Surgery,
The university of Western Australia

Tendinopathy due to sport injury or over use is one of the most common clinical disorder in musculoskeletal clinics. The chronic degenerative condition frequently does not respond to treatment. In the current study, we propose that autologous tendon progenitor cell therapy (ATT) is effective in preventing tendon degeneration. We have conducted pre-clinical evaluation using a collagenase induced rabbit Achilles tendinopathy model. On the basis of the evaluation and characterisation of tendon cells, we have conducted a phase I trial in patient with refractory lateral epicondylitis.. For pre-clinical study, chronic tendinopathy in rabbit was created in the left Achilles tendon. The result showed that ATT improved tendon remodeling, histological outcomes, collagen content and tensile strength of tendinopathic Achilles tendons. Injected tenocytes were integrated into tendon tissue and could be tracked up to 8 weeks in vivo. As the pre-clincial study showed ATT may be a useful treatment of chronic Achilles tendinopathy, we next evaluated the safety and level of efficacy of ATT for treatment of refractory lateral epicondylitis in a pilot study. Cultivated autologous tenocyte from the patellar tendon were injected into the sites of intrasubstance tears and fibrillar discontinuity of the common extensor origin under ultrasound guidance. The interim results demonstrated sixteen patients who reached the 6 month period have shown up to 60% improvement in all scores when compared to pre-treatment. MRI results showed infill of tendon tear in the majority of patients but there was some variation in the quality of regenerated tendon. In conclusions, our study indicates that the feasibility of ATT for the treatment of tendinopathy.

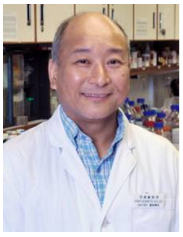
Developing an Off-the-Shelf Tissue Engineered Bone Graft for Clinical Application

Prof. Zhang Zhiyong, Ph.D.
4th Military Medical University

Large bone defect treatment still remains a major clinical challenge, requiring effective bone grafts for complete healing. Bone tissue engineering (BTE) strategy provides a promising approach to generate off-the-shelf tissue engineered bone grafts (TEBG), which may eventually address the ever-pressing clinical need for effective bone grafts. The clinical success of BTE strategy requires the synergetic efforts from multi-disciplinary research fields including three-dimensional (3D) scaffold fabrication, stem cell research, bioreactor development, scalable bioprocessing technology and animal model evaluation. In this talk, I would like to share with you how our multi-disciplinary team developed a clinically feasible off-the-shelf BTE strategy step by step. We firstly developed a polycaprolactone 3D BTE scaffold using fused deposition modelling technique, identified human fetal Mesenchymal Stem Cells (hfMSC) as a suitable off-the-shelf stem cell sources for BTE via a thorough comparative study, developed and optimized a unique bi-axial rotating (BXR) bioreactor for BTE application, and established a scalable microcarrier based stem cell expansion technique for clinical application of hfMSC. The proof-of-concept testing in proper animal model demonstrated the great bone defect healing efficacy of the off-the-shelf TEBG generated from the combinational use of PCL scaffolds, hfMSC and BXR bioreactor. Furthermore, we developed a microsurgery technique to prevascularize the TEBG, which showed a significantly higher new bone formation and capillary infiltration compared to non-prevascularized TEBG. Currently, we are on the stage of planning for the first-in-human clinical trial to evaluate the efficacy of off-the-shelf TEBG for large defect treatment.

Section 3 — Technological Advancements

Unlocking the Ability of Differentiated Cardiomyocytes to Proliferate



Prof. Kenneth Lee, Ph.D.
School of Biomedical Sciences,
Chinese University of Hong Kong

We have established that the cardiomycytes divided rapidly in 2 days-old postnatal mouse heart. However, when it reached 13 days-old, the majority of cardiomycytes had entered into terminal growth arrest and differentiation. We exploited this finding in order to identify proteins that were associated with cardiomyocyte growth and differentiation. The protein profiles of 2 days- and 13 days-old hearts were established by two-dimensional electrophoresis (2-DE) and compared. Seventeen protein spots were found to be differentially expressed at day 13. Eight of them were up-regulated while the remaining nine protein spots were down-regulated. We focused our attention on 2 of the proteins identified by MALDI-TOF MS, cyclin I and p53 because they are both believed to be involved in cell cycle regulation. Western blot analysis confirmed that both proteins were positively up-regulated in the 13 days-old postnatal heart. To determine directly whether these proteins were associated with cell proliferation, we examined their expression patterns in H9c2 cardiomyocytes maintained in vitro. We established that cyclin I expression was low during the growing phase of H9c2 culture and high during the growth arrest/ differentiation phases. In contrast, p53 expression was unchanged during both phases. The various growth phases were confirmed by the presence of cyclin A and growth arrest specific 1 (gas1) proteins. We investigated whether silencing cyclin I expression using cyclin I-siRNA could promote an increase in H9c2 cell proliferation. It was determined that silencing cyclin I could enhance a small, but significant, increase in H9c2 cell division. Similar results were also obtained for cardiomyocytes extracted from 13 days-old hearts. These results imply that the reason why cardiomyocytes in 13 days-old hearts increased cyclin I expression was probably associated with terminal growth arrest. However, the increase in p53 expression was probably associated with cardiomyocyte differentiation, rather than growth arrest.

Osteocyte Mechanobiology

Prof. X. Edward Guo, Ph.D.
Department of Biomedical Engineering,
Columbia University

Osteocytes form extensive and elaborate networks similar to neural network. Using microcontact-printing technique, the intracellular calcium waves in osteocytic network under either single cell nanoindentation or fluid shear were examined. It has been demonstrated that the purinergic and calmodulin kinase pathways are critical in calcium wave propagation in osteocytic network. Furthermore, unique calcium fingerprint has been quantified in individual osteocytes, which may have implications in mechanical memory by osteocytes and osteocytic network. The osteocyte deformation under dynamic fluid flow is less characterized. We have developed a novel Quasi-3D microscopy system for studying cytoskeletal mechanics of osteocytes under flow. Dynamics of cytoskeletons in osteocytes will be discussed.

Highly Efficient Generation of Integration-Free iPSCs with the CytoTune™ -iPS RNA Sendai Virus System

Dr. Timothy Wong, Ph.D.,
Market Development Manager, Primary & Stem Cell System, Asia Pacific,
Life Technologies Corporation

The generation of induced pluripotent stem cells (iPSC) from fibroblasts or other somatic cells enables the possibility of providing unprecedented access to patient-specific iPSC cells for drug screening, disease modeling, and cell therapy applications. However, a major obstacle to the use of iPSC for therapeutic applications is the potential of genomic modifications caused by insertion of DNA virus and resulting in multiple proviral integrations that pose the danger of insertional mutagenesis. A second area of concern is that reprogramming often requires the use of animal feeder layers to support the generation of iPSCs, which hinders clinical translation due to the presence of animal materials or pathogens. Finally, the current media used for reprogramming contain serum, which is unsuitable for the generation of clinical grade iPSCs. Here we report the generation of integration-free iPSCs by an RNA Sendai virus that does not integrate in the host genome. We demonstrate that iPSC generation can be performed in the absence of feeders and that iPSCs can be generated in completely xeno-free conditions. The iPSCs generated in this system are able to proliferate and maintain markers of pluripotency. Further these cells are able to give rise to embryoid bodies (EBs) that can differentiate to all the three lineages - ectoderm, endoderm and mesoderm. Generation of an integration-free iPSCs under xeno-free conditions should facilitate the safe clinical translation of iPSC-based therapies, and the ability to generate iPSCs in the absence of feeders will simplify the workflow and reduce cost significantly during reprogramming.

Recent Advance in the Role of FGF Signaling in Skeleton Development and Regeneration

Prof. Lin Chen, M.D., Ph.D.
Center of Bone Metabolism and Repair (CBMR), Trauma Center,
Institute of Surgery Research, Daping Hospital,
Third Military Medical University

Fibroblast growth factor (FGF) /Fibroblast growth receptor (FGFR) signaling is an important pathway involved in skeletal development. Missense mutations in FGFs and FGFRs were found in humans to cause multiple congenital skeleton diseases including chondrodysplasia, craniosynostosis, syndromes with dysregulated phosphate metabolism. Based the similarities between the molecular and cellular events underlying skeleton development and regeneration, FGF signaling has been naturally considered as an important pathway involved in bone healing, In fact, FGFs/FGFRs have also been found to play crucial roles in skeleton regeneration. Understanding the molecular mechanisms for the role of FGFs/FGFRs in the regulation of skeletal development, genetic skeleton diseases and fracture healing will ultimately lead to better treatment of skeleton diseases caused by mutations of FGFs/FGFRs and fracture. In this talk, we will summarize the major findings about the role of FGF signaling in skeletal development, FGF-related genetic skeleton diseases and skeleton regeneration, and discuss issues that remain to be resolved in exploring the mechanisms underlying bone regeneration and in applying FGF-related measures to promote the healing of injuried skeleton.

Mechanoresponsive microRNA Essential for Regulating Cartilage Growth

Prof. Qian Chen, Ph.D
Department of Orthopaedic Surgery, Brown Medical School
Rhode Island Hospital

Mechanical stress plays an essential role in tissue development and remodeling. In this study, we determined the role of microRNA in chondrocyte mechanotransduction. Using microarray, we identified miR-365 as a mechanoresponsive microRNA in parallel to mechanical induction of Indian hedgehog (Ihh) in primary chicken chondrocytes cultured in three-dimensional collagen scaffoldings under cyclic loading (1HZ, 5% elongation). Interestingly, expression of miR-365 is elevated in the prehypertrophic zone of the growth plate; coinciding with the Ihh expression region in vivo. MiR-365 significantly stimulates chondrocyte proliferation and differentiation. MiR-365 increases expression of Ihh and the hypertrophic marker type X collagen, whereas anti-miR-365 inhibits the expression of these genes. We identified histone deacetylase 4 (HDAC4), an inhibitor of chondrocyte hypertrophy, as a target of miR-365. MiR-365 inhibits both endogenous HDAC4 protein levels as well as the activity of a reporter gene bearing the 3'-untranslated region of HDAC4 mRNA. Conversely, inhibition of endogenous miR-365 relieves the repression of HDAC4. Mutation of the miR-365 binding site in HDAC4 mRNA abolishes miR-365-mediated repression of the reporter gene activity. Overexpression of HDAC4 reverses miR-365 stimulation of chondrocyte differentiation markers including Ihh, Col X, and Runx2. Moreover, inhibition of miR-365 abolishes mechanical stimulation of chondrocyte differentiation. Taken together, miR-365 is the first identified mechanically responsive microRNA that regulates chondrocyte differentiation via directly targeting HDAC4.

The Microenvironment Aging and Regeneration of Myocardial Infarction

Prof. Cai Dongqing, Ph.D.
Key Laboratory for Regenerative Medicine, Ministry of Education,
Ji Nan University

It is believed that aging incurs some of intracellular aging phenotypes which may be disadvantage for the regeneration of aged myocardium. Using in vivo phage display and cell biology techniques, we found that TNF-α receptor-1 expression was decreased in aged cardiac microendothelial cells. This age-related change incurs TNF-α-TNFR pathway to trigger more apoptosis in old heart and then play the disadvantage effect for regeneration of infarted myocardium. Furthermore, we found that BDNF receptor, TrkB1, expression was increased in aged cardiac microendothelial cells. This age-related change involves the BDNF-TrkB pathway which trigger the super-inflammation in aged infarcted heart which is disadvantage regeneration of infarcted myocardium. Our results suggest that with increasing age, some of the aging phenotypes exist in intracellular microenvironment and extracellular niche of myocardium which are disadvantage for the regeneration of aged infarcted heart. Aging changes in TNF-α-TNFR pathway and BDNF-TrkB pathway are the important reasons for the poor healing and regeneration seen in aged heart.

Section 4 — Translational Medicine Related Topics

Keynote Lecture
CUHK-CAE Special 2011 Academician Lecture

Wound Repair and Regeneration in China: Focus and Success

Prof. Fu Xiaobing
Academician of Chinese Academy of Engineering,
301 Hospital

The wound repair and regeneration is the focus in recent years and many works have been done in this field. We would like to give a brief review about the advance in wound repair and regeneration, including trauma, adult stem cells, tissue engineering and their translation application in China. Also, our personal opinion about their future will be given.

Cartilage Repair Using Stem Cells: From Bench to Bedside

Prof. Hui Hoi Po, James, Ph.D.
Department of Orthopedic Surgery,
National University of Singapore

Various attempts in cell-based therapy were available to treat cartilage injuries since 1994, but no method has been judged superior as articular cartilage injuries have a limited potential to heal. However, the ultimate goal of treatment is not only to restore normal knee function by regenerating hyaline cartilage in the defect and complete integration of the regenerated cartilage, but also to delay the primary end point of total joint replacement.

To date, 343 cases of Autologous Chrondrocyte and Bone Marrow Stem Cells (BMSCs) Implantation had been performed in the author's institution. At the last review, 87% of the patients had good and excellent results in terms of relief of symptoms and knee activities. Injectable intra-articular mesenchymal stem cells (BMSCs) suspended in hyaluronic acid as an alternative to the much more invasive methods had been commenced in clinical trial following good experimental results in porcine models. The cell-treated groups show improved cartilage healing both histologically and morphologically at 6 and 12 weeks compared to both controls. This injectable method can be performed as an out-patient procedure.

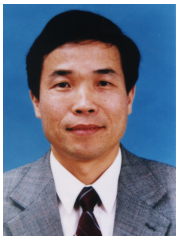
Recent literature had also argued on the different cell sources, growth factors and their reproducible efficacy. The challenge is that for clinicians and Basic Scientists to translate their superiority over traditional control methods. The success of these modalities would hopefully delay the need of patients to undergo artificial joint replacement.

Combined AAV Mediated Genetically- Engineered MSC and HSC Induce Vascularized Osteogenesis for Bone Regeneration

Prof. Yi-Ping Li, Ph.D.
Department of Pathology, University of Alabama at Birmingham

The potential of Bone marrow-derived mesenchymal stem cells (MSC) in regenerative medicine is increasingly gaining attention. The therapeutic approach coupling angiogenesis to osteogenesis using MSC as genetically-engineered stem cell source greatly advances health bone regeneration. We recently demonstrated that AAV mediated genetically-engineered MSC expressing BMP-2 significantly improved Bone density in a mouse model of osteoporosis. Additional studies in bone defect using AAV mediated genetically-engineered MSC expressing VEGF demonstrated significant vascular bone remodeling. Recently we have employed a new therapeutic approach that explores cross-talk between mesenchymal stem cells (MSCs) and hematopoietic stem cells (HSCs) that generate Bone and angiogenesis. We applied genetically-engineered MSC expressing BMP-2/VEGF and HSCs within biodegradable scaffolds to establish an adequate blood supply and thereby promote resident cells to undergo appropriate Tissue development and bone regeneration. We tested the ability of vascular networks preformed in vivo within biodegradable scaffolds. HSCs and genetically-engineered MSCs function synergistically to induce vascularized osteogenesis. The data showed that co- transplantation of genetically-engineered MSC and HSC lineages yielded vascularized Bone, more significantly than the transplantation of genetically-engineered MSC or HSC alone. This study revealed that the new therapeutic approach coupling the AAV mediated genetically-engineered VEGF/BMP-2 MSC and HSCs within biodegradable scaffolds has great potential for vascular bone regeneration clinic applications.

Surface Constructions of Nano-Micro Nest-like Structured Cap Biomaterials and Their Biocompatibility



Prof. Changjian Lin, Ph.D.
State Key Laboratory of Physical Chemistry of Solid Surfaces,
Xiamen University

In this work, we concentrated our attention to construct various nano-micro nest-like structured calcium phosphate (CaP) and their composite coatings, including octacalcium phosphate (OCP), hydroxyapatite (HAp), micropatterned titanium surface by using electrochemical techniques. The physico-chemical and biological properties of the as prepared nano-micro structured biomaterials were characterized by SEM, XRD, FT-IR, Raman, in vitro and in vivo evaluations respectively. It is suggested that under controlled prepared conditions, the primary CaP nanowires grow and self-assemble to construct an ordered micro-porous nest-like morphology, thus to form a nano-micro two-level structure. It is demonstrated that the CaP composite coatings exhibit a preferable biocompatibility, because they are similar to the natural bone in both chemical composition and micro structure on surface. Meanwhile the interaction between biomaterials and biospecies and insight into biocompatibility of the prepared nano-micro structured biomaterials were also elucidated from physicochemical and biological aspects.

Designing Matrix-based Microenvironment for Stem Cells

Prof. Peter X. Ma, Ph.D.
Department of Materials Science and Engineering,
University of Michigen

Trauma and disease can seriously damage various tissues and organs. Regeneration of biologically functional tissues would be advantageous over restoration using artificial implants and mechanical devices. Stem cells have high capacity of proliferation and high potential to differentiate into desired cell lineages for restoration. In the regenerative approach, matrix plays a key role to define the microenvironment to direct stem cell fate. Our lab develops biomimetic polymer scaffolds that recapitulate certain advantageous features of the natural extracellular-matrices (ECM) and impart engineering design to facilitate tissue regeneration. Novel phase separation techniques have been developed to create biodegradable ECM-mimicking nanofibrous scaffolds. Porous network design and computer assisted patient-specific scaffold fabrication are intended to facilitate the regenerative restoration of both structure and function. These novel scaffolds can deliver needed cells to the regeneration sites and have been shown to advantageously support various stem cells to regenerate bone, cartilage, and intervertebral disc tissues in predetermined shapes. To achieve minimally invasive repair of complexly shaped tissue defects, we developed star-shaped biodegradable polymers that can self-assemble into nanofibrous hollow microspheres as a novel injectable cell carrier. The nanofibrous hollow microspheres have been shown to efficiently accommodate cells and enhance cartilage regeneration over control cell carriers. To recapitulate biomolecule activities in development, we have also developed scaffolds that can release various biological molecules in a spatially and temporally controlled fashion to regulate cell functions for regeneration. These results demonstrate that designing matrix-based microenvironments to direct stem cell fate is a powerful approach in regenerative medicine.

Mechanotransduction in Bone Regeneration

Prof. Yi-Xian Qin, Ph.D.
Department of Biomedical Engineering,
State University of New York at Stony Brook

Aging and diseases induced bone loss is a critical skeleton complication occurred particularly in the weight-supporting skeleton, which leads to osteoporosis and fracture. Bone integrity is dependant on not only the mineral density, but also the quality of bone which includes the strength and structural parameters. Advents in mechanotransduction induced by dynamic fluid flow and ultrasound wave provides unique physical stimulations in bone; and can trigger remodeling and enhance the healing of fracture. The goals of this work were to 1) evaluate the novel mechanical signal to promote osteointegration, and 2) deliver ultrasound at the vertebrae in OVX rat to mitigate of bone loss.

Translational Research of Orthopaedic Implants: From SCI to FDA

Prof. Cheng-Kung Cheng, Ph.D.
Institute of Biomedical Engineering and
Orthopaedic Device Research Center,
National Yang-Ming University

The most critical research topics in orthopaedics always come from clinical problems and ideas proposed by clinical surgeons. For academic research, the ultimate goal is to publish papers in the SCI journals. However, journal articles are not realistic products for solving orthopaedic industrial problems. Translational research therefore becomes extremely important in transferring SCI papers to clinical products.

In practical concerns, new products must be examined both in effectiveness and safety, which is usually ignored in academic research and development. The safety must be ensured through indication definitions, size distribution, prototyping, risk analysis, biocompatibility, and clinical trials before the new product released.

In this presentation, I will present International Orthopaedic Research Center and Orthopaedic Device Research Center as examples, to demonstrate how translational research works in orthopaedics. In the meanwhile, I would like to exemplify that excellent journal articles can be published in translational research as well as in basic research.

Translational medicine developments in CUHK-SIAT Shenzhen Campus

Prof. Qin Ling,
Department of Orthopaedics and Traumatology,
The Chinese University of Hong Kong

As a branch of the Chinese Academy of Science (CAS) in Southern China, the Shenzhen Institute of Advanced Technology (SIAT) was jointly established by Chinese Academy of Science and Shenzhen municipal government in Feb, 2006. Subsequently, sub-institutes had been set up, jointly by CAS, the Chinese University of Hong Kong (CUHK), and the Shenzhen Municipal Government. Institute of Biomedical and Health Engineering (IBHE) is one of them that was founded on Aug 15, 2007, with now 8 centers, including our Center, i.e. Translational Medicine Research & Development Center (TMC) opened on March 15, 2009 (www.siat.cas.cn). The overall mission of SIAT is: to enhance the innovative creation capability of modern equipment manufacturing and service industries in the region of Guangdong and Hong Kong; to promote the development of emerging industries with self-owned Intellectual Property.

The current director of TMC is Prof. Ling QIN from the Dept of Orthopaedics & Traumatology, CUHK. A number of CUHK hold the joint appointment to assist TMC's development towards Translational Medicine, currently mainly focuses in musculoskeletal and cardiovascular themes but also use her expertise and network for assisting other SIAT centers who are working in biomedical and related areas. TMC has now around 20 staff and is responsible for two important R&D platforms supported by Shenzhen municipal government, including 1) Preclinical Platform for Developing New Drugs and

Abstracts (cont')

Biological Therapies; 2) Personalized Orthopaedic Technologies and Manufactory Service Platform (Refer to Figure). As a young and dynamic center, TMC engages in multi-disciplinary R&D and is seeking for long-term local, regional and international cooperation with academic and R&D institutions.

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Abstract Submission From Students

Human umbilical cord lining epithelial cells with stem cell-like properties: an adjunct to skin regeneration

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Human umbilical cord (HUC) has been shown to be a readily available and ethically acceptable source of stem cells. Previously, we have isolated and propagated in culture human umbilical cord lining epithelial cells (CLECs). We propose that these cells have therapeutic potential in skin regeneration and in particular clinical burns care. In the present study, the in vitro propagation capability, phenotype and stem cell properties of CLECs were characterized by using immunocytochemistry (ICC), flow cytometry and RT-PCR assays. Their multipotentiality was assessed in vitro. The potential for epidermal regeneration was investigated in an organotypic culture model. Results showed that CLECs present a long telomere length and have an extended proliferative potential and passaging ability. They also display a series of stem cell-specific markers for epithelial as well as pluripotent stem cells, including CK19, p63, OCT-4, SSEA-4, TRA-1-60, SOX2 and Nanog. CLECs are found to possess low immunogenicity by expressing HLA-G, which is recognized as a major factor in pregnancy immune accommodation. They are capable of adipogenic, osteogenic and chondrogenic differentiation when exposed to the individual differentiation medium, suggesting their multipotency. In the organotypic culture model, CLECs generate a stratified epithelial structure, which is similar to that constructed using normal human keratinocytes. In conclusion, CLECs have stem cell-like properties in terms of the growth pattern, cell specific markers and multipotency of differentiation. They are capable of generating fully stratified epithelium in vitro. These findings suggest their potential clinical application in acute coverage in burns and other wounds.

Small molecules-Mediated Derivation of Multi-potent cells from NIH3T3 fibroblasts

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Center for Stem Cell and Tissue Engineering, School of Medicine, Zhejiang University, Hangzhou, China

Objective:
Diverse arrays of stem cells have been investigated for tissue regeneration. Nevertheless, there are still no appropriate seed cells meet the demand. Due to the complexity, long time period, and heterologous characteristic of deriving stem cells from tissues, reprogramming fully differentiated fibroblasts to multi-potent cells may provide an attractive source of stem cells for regenerative medicine. This study used small epigenetic molecules 5-Aza-dC and TSA to derive multi-potent cells from 3T3 fibroblasts, and assessed the efficiency of this reprogramming.

Methods:
In this study, NIH3T3 fibroblasts were treated with 5-Aza-dC (1uM, 3T3-A group) or TSA (300nM, 3T3-T group) or both (3T3-AT group), DMSO was used as control (3T3-D group). The multi-differentiation potential of reprogrammed 3T3 cells toward osteogenesis, adipogenesis, and chondrogenesis were tested by gene expression and histological staining.

Results: After 24 hours treatment, 3T3-T group and 3T3-AT group displayed obvious cell morphology transition from spindle shape to polygon shape. Osteo-related and adipo-related gene expression showed a significant up regulation in 3T3-A group and 3T3-T group. Especially, ALP gene and Fabp gene of experiment group showed about 100 times fold up regulation after 7 days osteo-induction or adipo-induction. The histological staining (ALP, oil red and Safranin-O) revealed consistent results with gene expression.

Conclusion: The small epigenetic molecules 5-Aza-dC and TSA showed great potency in directing fully differentiated 3T3 cells to multi-potent cells, thus may providing a new and effective way to obtain appropriate seed cells for regenerative medicine.

Changes of circulating MSCs during fracture healing process

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Background: Mesencymal stem cells(MSCs) was originally isolated and characterized from bone marrow. It possess multipotential capacity to differentiate into osteoblast, adipocyte and chondrocyte et al both in vitro and in vivo(1). The existence of MSCs were also found in many adult tissues including circulating blood. Li's group had reported that bone marrow cells were capable of systemic migrating to the fracture sites from the remote bone marrow cavity(2). Other groups have found circulating osteoblast-lineage cells revealed by double positive of osteocalcin and bone-specific alkaline phosphatase(3). Several studies indicated that circulating MSCs participated in fracture healing. MSC was thought to express CD105, CD73 and CD90, and lack expression of CD45, CD34, CD14. Cd45 and CD90 were selected to analyze circulating MSC from peripheral blood by flow cytometry method.

Methods: Internal fixation fractured rat model was established as previous reports. Peripheral blood was harvested 3 days before fracture surgery and 3,7,11,13,21,27 days post fracture. Blood was incubated in PE-Cy™5 Mouse Anti-Rat CD45(BD) PE Mouse Anti-Rat CD90 Mouse CD90.1 (BD) for 30min on ice. Erythrocyte was lysed by lysing buffer(BD). CD45-/CD90+ cells were analyzed by flow cytometer (BD LSR Fortessa™). Blood was also collected from none fractured rat and cultured in vitro.

Results and Discussion: The number of circulating MSC (CD45-/CD90+) increase significantly 3 days after fracture. It remained to increasing 11 days after fracture and became maximal at day 13. The number of circulating MSC (CD45-/CD90+) decreased rapidly two weeks after fracture. It returned to the level before fracture. Circulating MSC could be cultured successfully in vitro although the efficiency was low. It was proved to negatively express CD31, CD34, CD45 and positively express CD90, CD44. It can also be induce to osteogenesis and adipogenesis.

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Tendon-derived Stem Cells (TDSCs) Cell Sheet Produced by Connective Tissue Growth Factor (CTGF) and Ascorbic Acid for Tendon Tissue Engineering

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INTRODUCTION: This study aimed to produce TDSCs cell sheet in vitro by the effect of connective tissue growth factor (CTGF) and ascorbic acid which could form neo-tendon tissue in vivo, also we aimed to promote tendon regeneration by this TDSCs cell sheet in a rat acute patellar tendon injury model.

METHODS: GFP-TDSCs were isolated from the patellar tendon of GFP rats. The cells were treated with or without Ascorbic acid and CTGF in-vitro. At week 2, the cells were harvested for assessing the mRNA expression of tenogenic markers by qRT-PCR. The production of collagenous proteins at week 2 was also evaluated by Sirius Red staining and colorimetric assay. The cell sheet formed after treatment with CTCF and Ascorbic acid was rolled up, and fixed for histology. Then the cell sheet was rolled up and sutured on the back of nude mouse. At week 8, the transplanted tissue was harvested for gross observation, histological examination of cellularity and vascularity, polarization microscopy assessment of collagen fiber alignment, immunohistochemical staining of tendon-related ECM proteins. The cell sheet formed was rolled up and in vivo-loaded by suturing to the patellar bone and tibia in a rat patellar tendon window injury model. The injury model without the cell sheet served as control. At week 2, the patellar tendon was harvested, followed by routine histology.

RESULTS: TDSCs have higher mRNA expression of tenomodulin, scleraxis, tenascin C, Collagen Type I, Decorin, Biglycan, and Elastin after treated with CTGF and Ascorbic acid. The sirius red staining and colorimetric assay showed TDSCs had more production of collagenous proteins after treated by CTGF and Ascorbic acid for week 2. TDSCs-treated with CTGF and Ascorbic acid produced a highly elastic and cellular sheet which could not be easily digested by trypsin. The cell sheet formed was rolled up, and loaded on a U-shaped spring to form a tendon-like tissue. Histology showed that an immature tissue structure was formed as shown by a relatively loose extracellular matrix. The cellularity was high. The GFP-TDSCs were randomly oriented in the extracellular matrix. Polarization microscopy also confirmed that the collagen fibrils were thin and were parallel oriented. Immunohistochemical staining also showed this immature tendon-like tissue expressed tendon-related ECM proteins as same as intact patellar tendon, such as tenomodulin, type I & III collagen. After in vivo transplantation of the TDSCs sheet for 8 weeks, neo-tendon tissue formed. Histology showed that the cells were spindle oriented in the extracellular matrix. Polarization microscopy also confirmed that the collagen fibrils were thin and were parallel oriented. The neo-tendon also expressed tenomodulin, type I & III collagen. After the engineered cell sheet was in vivo transplanted for 2 weeks in the tendon window injury model, the cells in the sheet became more spindle in shape and better aligned longitudinally between the collagen fibers after transplantation. Higher levels of tendon extracellular matrix components were produced after in vivo transplantation. Polarization microscopy showed thicker and longitudinally-arranged collagen fiber in the neo-tendon tissue compared to that in the in vitro engineered cell sheet.

DISCUSSION: The tenogenic differentiation process of TDSCs by CTGF and ascorbic acid produced an elastic cell sheet in vitro which could form neo-tendon tissue in vivo. In vivo transplantation and loading in the window injury further promoted the maturation of the cell sheet to form a neo-tendon tissue. Further study will test biomechanical properties after in vivo transplantation in the rat patellar tendon window injury. TDSC-sheet produced by CTGF and ascorbic acid therefore may be used for tendon regeneration.

Allogenous TSPCs in silk scaffold for rotator cuff regeneration

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INTRODUCTION: Tendon stem/progenitor cells (TSPCs) were recently identified within tendon tissues. The aim of this study was to investigate TSPC-seeded knitted silk-collagen sponge scaffold for functional shoulder repair.

METHODS: The multi-differentiation potential, proliferation and immune properties of TSPC were investigated in vitro, while the efficacy of TSPC-seeded knitted silk-collagen sponge scaffolds in promoting rotator cuff regeneration was evaluated in vivo within a rabbit model.

RESULTS: TSPC, which exhibited universal stem cell characteristics (i.e. clonogenicity, high proliferative capacity and multi-differentiation potential), non-immunogenicity and immunosuppression, proliferated well on our scaffold in vitro. Implantation of allogenous TSPC-seeded scaffolds within a rabbit rotator cuff injury model did not elicit an immunological reaction, but instead increased fibroblastic cell ingrowth and reduced infiltration of lymphocytes within the implantation sites at 4 and 8 weeks post-surgery. After 12 weeks, the allogenous TSPC-treated group exhibited increased collagen deposition and had better structural and biomechanical properties compared to the control group.

CONCLUSION: This study thus demonstrated that the allogenous TSPC-seeded knitted silk-collagen sponge scaffold enhanced the efficacy of rotator cuff tendon regeneration by differentiating into tenocytes, and by secreting anti-inflammatory cytokines that prevent immunological rejection. Hence, allogenous TSPC-seeded knitted silk-collagen sponge scaffolds can be a clinically useful application for tendon tissue engineering.

Role of Cellular Retinol Binding Protein 1 (CRBP1) in Regulating osteogenesis and adipogenesis of Mesenchymal Stem Cells

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Mesenchymal stem cells (MSCs) are multipotent adult stem cells that can differentiate into osteoblasts, chondrocytes and adipocytes, providing a potential source for musculoskeletal tissue engineering. Retinoid signaling plays very important roles in skeletal development. CRBP1 (cellular retinol binding protein 1), a key component of retinoid signaling pathway, is known to take part in vitamin A metabolism and intracellular transporting of retinoids. However, the role of CRBP1 in MSCs remains still obscure. In this study, we investigated the cellular effects of CRBP1 on osteogenic and adipogenic differentiation of bone marrow derived MSCs in vitro and in vivo. Our results showed that CRBP1 overexpression promoted osteogenic differentiation of bone marrow derived MSCs, while inhibited their adipogenic differentiation. We also demonstrated that the possible underlying mechanism for CRBP1 promoting osteogenic differentiation of MSCs was by direct protein-protein interaction with RXRα, inhibiting RXRα-induced β-catenin degradation, maintaining β-catenin and pERK1/2 at higher levels. These findings reveal a potential role of CRBP1 in the regulation of β-catenin turnover which can greatly affect the process of osteogenesis and adipogenesis of MSCs.

Tendon-derived Matrix Stimulates Human Tendon Stem/Progenitor Cells Tenogenic Differentiation.

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Tendon stem/progenitor cells (TSPCs) may serve as an optimal seed cells to restore normal structure and function to injured tendons. Nevertheless, how to precisely regulate and control TSPC differentiation toward tenocytes by extracellular microenvironment for desired tissue development both in vitro and in vivo remains an intensively investigated subject in the field of stem cells and tissue engineering. The hypothesis of this study was that the tendon-derived matrix may be the ideal substrate for TSPCs commitment. The acellular dermal matrix and demineralized bone matrix, which were also composed mainly by collagen, were prepared to compare the inductive difference on TSPCs. We detected the cell morphology and proliferation of TSPCs on different tissue derived matrix. Biochemical and lineage-specific gene expression data were analyzed to evaluated the differentiation differences of TSPCs on native extracellular matrix. Furthermore, we constructed an engineered tendon with TSPCs and tendon-derived matrix, and assessed the efficacy of this engineered tendon for Achilles tendon reconstruction. The expression of tendon-specific genes, morphology, immunohistochemistry, collagen concentration and mechanical properties of the repaired tissue were evaluated. We found that tendon derived matrix promoted TSPC differentiate into tenocytes and the engineered tendon showed much better structural and mechanical properties of repaired tendon than ECM alone group. These findings demonstrate a practical strategy of utilizing TSPCs integrate with native tissue ECM for tendon regeneration and may assist in future treatment to tendon diseases.

Incorporation of exogenous Parathyroid hormone-related protein (PTHrP) within a bi-layer silk-collagen sponge scaffold for osteochondral repair and regeneration

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Introduction:
Mesenchymal stem cells (MSCs) are being recognized as promising cell source for cartilage tissue engineering. A serious challenging for further application ,however, is the unwanted hypertrophic phenotype during chondrogenesis and then formation of calcifying cartilage instead of normal hyaline cartilage. In the present study, we want to address whether PTHrP, which has an inhibitory effect on chondrocyte hypertrophy in growth plate cartilage, could inhibit articular cartilage calcification and promote cartilage repair and regeneration.

Methods:
Rabbit MSCs were differentiated in chondrogenic medium with or without recombinant human PTHrP. We evaluate the ALP activity, gene expression, histologic staining of each group. The rabbit model with full-thickness cartilage defects was established and then repaired by a bi-layer silk-collagen sponge scaffold with or without intra-articular injection of recombinant human PTHrP . Histologic analysis ,immunohistochemistry staining and mechanical test were used to assess the repair of defects by the complex.

Results:
The hypertrophic phenotype was inhibited in vitro when MSCs were cultured with recombinant human PTHrP .From in vivo study we can get better cartilage repair and little calcification with intra-articular injection of PTHrP.

Conclusion:
From our preliminary results, PTHrP has the capacity of inhibiting cartilage hypertrophy and can be used for cartilage tissue engineering.

The Efficacy of Human Eyelid Derived Adipose Stem Cells for Spinal Cord Injury Treatment Enhanced by Pre-adminastration of 17β-Estradiol

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Evidence showed that cell transplantion is a potential therapeutic strategy for replacing neurons lost after spinal cord injury (SCI), but many obstacles remain that could not be fully overcome by cell transplantation alone. Combining complementary strategies might be required to advance cell-based treatments to the clinical stage.17-β-estradiol (E2) has recently been reported the effect of cell protection against cytotoxicity in vitro and neuroprotection in central nervous system (CNS) insults. Here, we evaluated that whether the combination of stem cells and E2 can enhance the cells efficiency and cell survival in vivo, and investigated synergistic therapy effect for SCI. In this study, we isolated novel stem cells from the human eyelid fat named as human eyelid adipose-derived stem cells (hEASCs). These cells displayed characteristics of neural crest cells. T9-10 hemisection SCI was induced in male rats followed by sustained administration of E2 for 15 days. hEASCs were transplanted into the injury rat7 days after SCI. One week later, E2 treatment significantly increased the number of surviving transplanted hEASCs, reduced cell apoptosis by regulating caspase-3 and bcl-2, and increased expression of growth factors detected by real-time PCR. Six weeks later, the grafted hEASCs survived and integrated into the injured spinal cord. MAP2 and NF200 immunopositive cells colocalization with hEASCs were observed, while no GFAP was expressed in hEASCs. Pre-E2-hEASCs combination groups significantly exhibited improved histological outcomes, myelin regeneration and hind limbs motor function recovery as determined by the Basso Beattie Bresnahan (BBB) scores and grid walking. In conclusion, it has been shown that transplantation of hEASCs combined with estrogen gives a satisfactory outcome in SCI recovery, to some extent by reducing cell apoptosis and increasing expression of stem cell factors. These findings provide evidence that the combination of cell transplantation with cytoprotection drugs of transplanted cells could be a novel clinical chemo-cell cocktail strategy for the treatment of incurable neurodegenerative diseases.

The contribution of mesenchymal stem cells to the growth and development of tumor cells in vitro

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Mesenchymal stromal cells (MSCs), also called mesenchymal stem cells, are known to migrate to tissues as a result of inflammation or injury, where they contribute to regeneration of the damaged tissues. Recent results from both animal models and human tumors have suggested that MSCs also migrate to tumor tissues, where they incorporate into the tumor stroma (1). This tropism of MSCs for tumors is reportedly due to the presence of soluble factors secreted by tumor cells, similar to inflammatory responses (2). These findings have led to increased interest in understanding the effects of MSCs in the tumor microenvironment.

In this study, we showed that MSCs increase proliferation of tumor cells in vitro. We also further analyzed the potential mechanisms that underlie these effects. We isolated bone marrow-derived mesenchymal stem cell from Luciferase transgenic mice. Effects of MSCs on tumor cell proliferation in vitro were analyzed in a co-culture model with HepG2 cells. Both co-culture with MSCs and treatment with MSC-conditioned media led to enhanced growth of HepG2 cells, although the magnitude of growth stimulation in co-cultured cells was greater than that of cells treated with conditioned media. We also show that when MSCs exposed to tumor-conditioned medium over a prolonged period of time, the expression of markers associated with migration (CXCR4); neovascularization (α-SMA, and VEGF); tumor promoting growth factors (TGF-β and IL6) were increased. Our data suggest that MSCs may promote tumor growth through four levels in the tumor microenvironment: 1) matrix formation, 2) growth factor production, 3) vasculogenesis/angiogenesis and 4) expression of proteins associated with tumor aggression.

Reference

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2. Klopp AH, et al. (2007). Tumor irradiation increases the recruitment of circulating mesenchymal stem cells into the tumor microenvironment. Cancer Res. 67:11687–95.

The role of Smad7 in bone development and mMSCs characterization

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TGF-β (transforming growth factor β) is a pleiotropic cytokine regulating diverse cellular processes. It signals through membrane-bound receptors, downstream Smad proteins and/or other signaling mediators. Smad7 has been well established to be a key negative regulator of TGF-β signalling. It antagonizes TGF-β signalling through multiple mechanisms in the cytoplasm and in the nucleus. Smad7 can be transcriptionally induced by TGF-β and other growth factors and serves as an important cross-talk mediator of the TGF-β signalling pathway with other signalling pathways. Accordingly, it plays pivotal roles in embryonic development and adult homoeostasis, and altered expression of Smad7 is often associated with human diseases, such as cancer, tissue fibrosis and inflammatory diseases.

However, how Smad7 acts on bone development and MSCs characterization is not well understood. To investigate the role of the TGF-β/Smad7 signaling in the process of bone development, MSCs characterization and fracture healing, we performed a serious of in-vivo and in-vitro experiments using wild-type (WT) and Smad7-null (KO) mice. The surface expression of CD90, CD44, Sca I, CD34, CD45 was assessed by flow cytometry. The osteogenic, adipogenic and chondrogenic differentiation potentials of mBMSCs were assessed by standard assays after induction. The mRNA expression of the markers was measured by quantitative real-time reverse transcription-polymerase chain reaction. The parameters of the bone development were assessed by digital X-ray, micro-CT, mechanical test and other histology methods. And all the data analysis was done by SPSS software and Mann-Whiney U test, $p \leq 0.05$ was regarded as statistically significant. In the present study, the in-vitro experiments showed that mBMSCs of KO group has better adipogenic potential than WT group at day7, 14 and 21; but worse osteogenic potential than WT group at day 7 and 14, using both staining (n=3) and mRNA expression detection (n=6). The in-vivo study including micro-CT and mechanical test results showed that the KO group has insignificant increase of BMD (P=0.119), BV/TV (p=0.119), TbTh (p=0.435), TbSp (p=0.015), Maximum load (p=0.236), Energy between (p=0.083), significant increase of Slope/Stiffness (p=0.050) , and significantly decrease of TbN (p=0.015) in the group of 6-weeks old (n=12). And in the group of 12-weeks old (n=12), the KO group has significant decrease of BMD (P=0.039) and TbSp (p=0.039), insignificant decrease of BV/TV (p=0.123), TbTh (p=0.168), significant increase of Slope/Stiffness (p=0.013), insignificant increase of TbN (p=0.140), Maximum load (p=0.094), Energy between (p=0.100). The group of 24-weeks-old group is not available now, but the results indicated that the Smad7 may have different effect on mice in the early and mid stage of development.

The effects of systemic administration of allogeneic Mesenchymal stem cells in bone repair

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INTRODUCTION: Mesenchymal stem cells (MSCs) are immune-privileged cells source for tissue repair. Previous studies showed that there is systemic mobilization of osteoblastic precursors to the fracture site via circulation, we hence hypothesized that systemic administration of allogeneic MSCs may promote fracture healing.

METHODS: Bone marrow derived MSCs and skin fibroblasts were isolated from the GFP-SD rats, cultured and characterized. Closed transverse femoral fracture with internal fixation was established in 48 adult male SD rats, whom were randomly assigned into 4 groups receiving: PBS injection; MSCs systemic injection; Fibroblasts systemic injection and MSCs fracture site injection. 2x106 cells were injected at 5 days after fracture. All animals were terminated 5 weeks after fracture; examinations included weekly radiograph; Micro-CT of the fractured femurs; mechanical testing; histology and immunohistochemistry.

RESULTS: The callus size of MSC injection groups were significant larger among all the groups ($p<0.05$). 3D-reconstruction images showed that the fracture gaps united in the MSCs groups, where gaps were still seen in the fibroblast and PBS injection groups. E-modulus, max force and energy were significantly higher in the MSCs injection groups than these in the fibroblast and PBS groups, but no difference was found between the MSCs local and systemic injection groups. Immunohistochemistry demonstrated that GFP cells were distributed along the fracture gaps in the MSCs injection groups.

DISCUSSION: The findings provide critical insight for developing MSC-based therapies in patients with poorly healing fractures, and systemic injection of allogeneic MSCs may be a novel treatment method for patients with multiple fractures.

Program Rundown

	Time	Key Events	Speaker
	08:30-08:45	Opening Ceremony	Prof. Tai-Fai FOK Prof. Wai-Yee CHAN Prof. Kai-Ming CHAN
	08:45-09:00	Officiating Ceremony of CUHK-ORT-ICHTS Collaborating Laboratory	Prof. Edward GUO Prof. Leung-Kim HUNG Prof. Gang LI Prof. Ling QIN
	09:00-09:15	Group Photo	
Section 1: Biology of Tissue Regeneration Moderators: Prof. Kenneth LEE *(HK)* Prof. Qian CHEN *(USA)*	09:15-09:30	Issues of stem cells research and tissue engineering applications	Prof. Gang LI *The Chinese University of Hong Kong, HK*
	09:30-09:45	Biomaterials in tissue regeneration	Prof. Chang-Sheng LIU *East China University , Shanghai, China*
	09:45-10:00	Embryonic Stem Cells and iPS Cells: their implications in regenerative medicine	Prof. Bo FENG *The Chinese University of Hong Kong, HK*
	10:00-10:15	Lessons learnt from transgenic animal models on regenerative biology	Prof. Di CHEN *Rush University, USA*
	10:15-10:30	Hypoxia and tissue regeneration	Prof. Chao WAN *The Chinese University of Hong Kong, HK*
	10:30-10:45	Panel Discussion & Questions and Answer Session	
	10:45-11:00	Coffee Break	
Section 2: Topics of Regenerative Medicine Moderators: Prof. Ling QIN *(HK)* Prof. Edward GUO *(USA)*	11:00-11:15	Tendon development and regeneration	Prof. Hong-Wei OUYANG *Zhengjiang University, China*
	11:15-11:30	Cell therapy for tendon regeneration	Prof. Pauline LUI *The Chinese University of Hong Kong, HK*
	11:30-11:45	Cell therapy for tendinopathy management	Prof. Ming-Hao ZHENG *The University of Western Australia, Australia*
	11:45-12:00	Bioreactor expansion of MSCs	Prof. Zhi-Yong ZHANG *The Fourth Military Medical University, Xian, China*
	12:00-12:15	Panel Discussion & Questions and Answer Session	
	12:15-14:00	Lunch Break	
Section 3: Technological Advancement Moderators: Prof. Kai-Ming CHAN *(HK)* Prof. Yi-Xian QIN *(USA)*	14:00-14:15	Stem cells and drug discovery	Prof. Kenneth LEE *The Chinese University of Hong Kong, HK*
	14:15-14:30	Mechnobiology and tissue regeneration	Prof. Edward GUO *Columbia University, USA*
	14:30-14:45	Highly efficient generation of integration-free iPSCs with CytoTune™-iPS RNA sendai virus system	Dr. Timothy WONG *Life Technologies Corporation, Shanghai, China*
	14:45-15:00	The role of FGFs in development and regeneration	Prof. Lin CHEN *The Third Military Medical University, Chongqing, China*
	15:00-15:15	Mechanoresponsive microRNA essential for regulating cartilage growth	Prof. Qian CHEN *Brown University, USA*
	15:15-15:30	Cardiovascular muscle regeneration	Prof. Dong-Qing CAI *Jinan University, China*
	15:30-15:45	Panel Discussion & Questions and Answer Session	
	15:45-16:00	Coffee Break	
Section 4: Translational Medicine Related Topics Moderators: Prof. Gang LI *(HK)* Prof. Ting-Ting TANG *(China)*	16:00-16:30	Keynote Lecture CUHK-CAE Special 2011 Academician Lecture: Wound Repair and Regeneration in China: Focus and Success	Prof. Xiao-Bing FU *Academician of Chinese Academy of Engineering, 301 Hospital, Beijing, China*
	16:30-16:45	Application of stem cells in orthopaedics – from bench to bedside	Prof. Hoi-Po HUI *National University of Singapore, Singapore*
	16:45-17:00	Engineering bone marrow-derived MSCs for angiogenesis and osteogenesis of bone regeneration	Prof. Yi-Ping LI *University of Alabama at Birmingham, USA*
	17:00-17:15	Surface modification in medical implant applications	Prof. Chang-Jian LIN *Xiamen University, China*
	17:15-17:30	Designing matrix-based microenvironment for stem cells	Prof. Peter MA *University of Michigan, USA*
	17:30-17:45	Promotion of bone regeneration and healing with mechanobiological intervention	Prof. Yi-Xian QIN *State University of New York, Stony Brook, USA*
	17:45-18:00	Notes for designing and development of new medical products	Prof. Cheng-Kung CHENG *National Yang-Ming University, Taiwan*
	18:00-18:15	Translational medicine developments in CUHK-SIAT Shenzhen Campus	Prof. Ling QIN, CUHK *The Chinese University of Hong Kong, HK*
	18:15-18:30	Panel Discussion & Questions and Answer Session	
Section 5: Award Presentation	18:30-18:45	Award Presentation Ceremony	Prof. Kai-Ming CHAN Prof. Gang LI

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