

血管神經化組織工程骨構建及其成骨相關機制研究

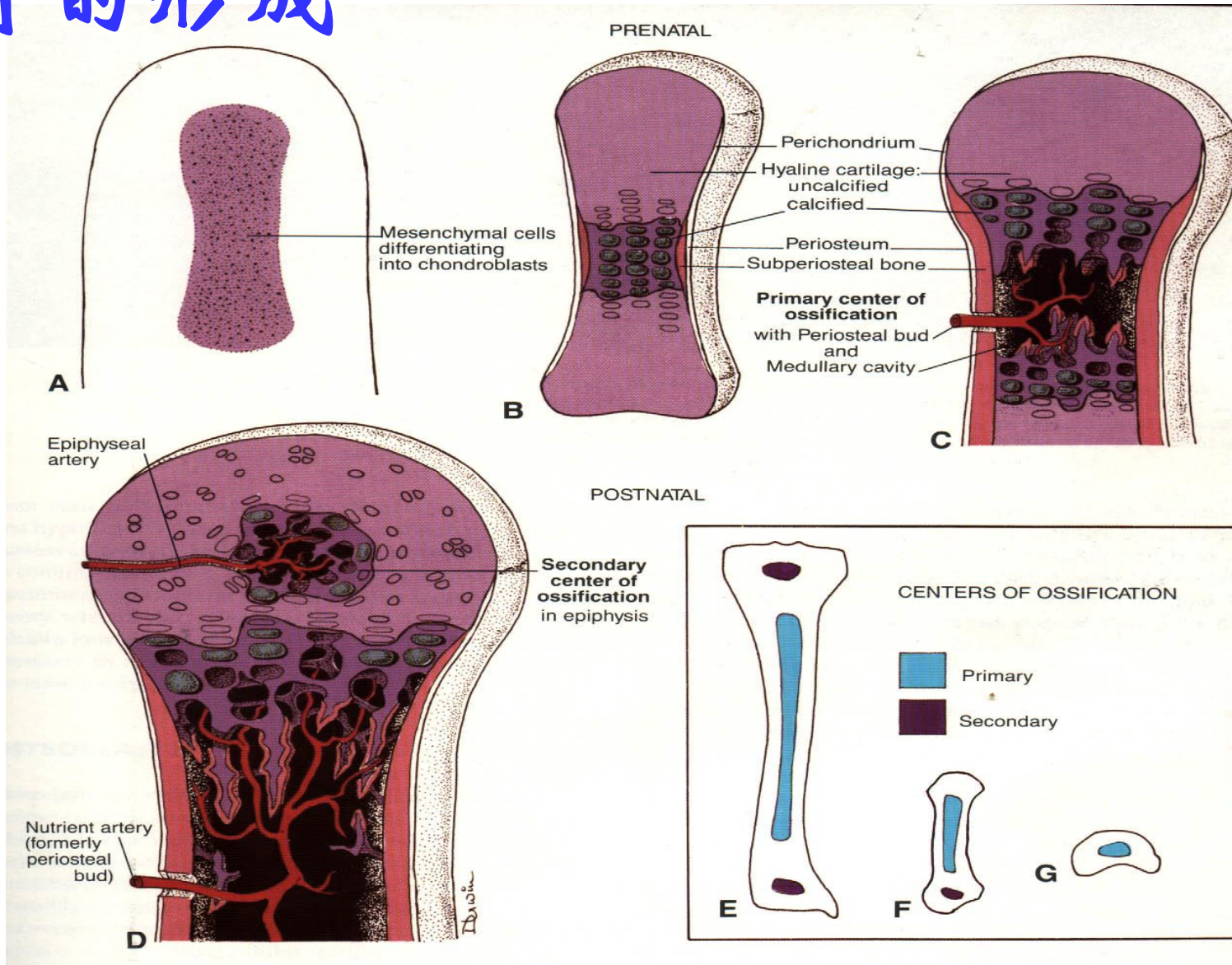
香港中文大學醫學院
矯形外科及創傷學系
李剛 教授



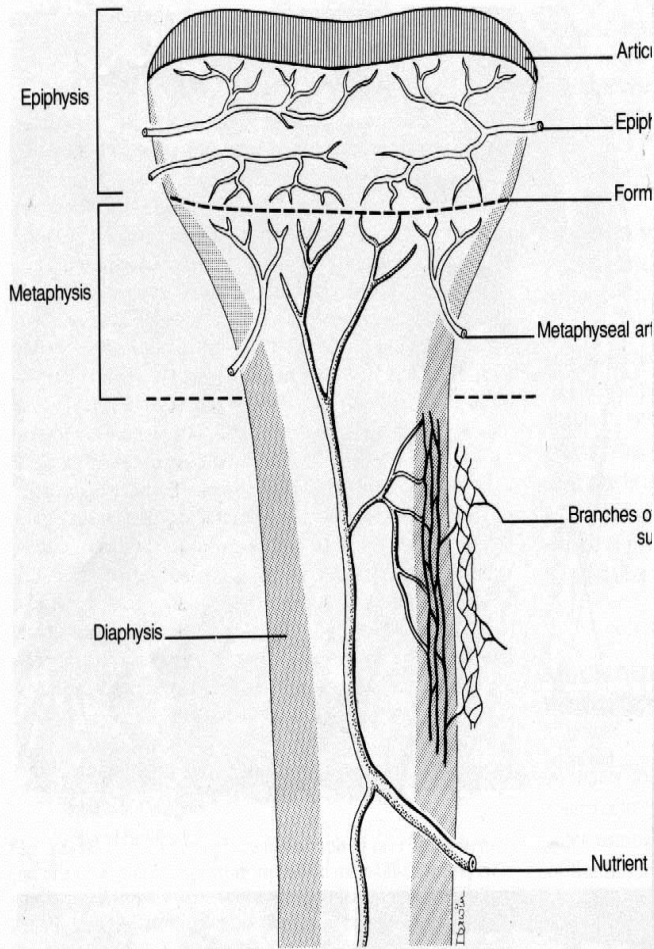
骨的功能

- **Mechanical**
 - Support for muscles and joints
- **Metabolic**
 - Mineral reservoir for calcium and phosphate homeostasis
- **Haematopoiesis**
 - Support blood formation

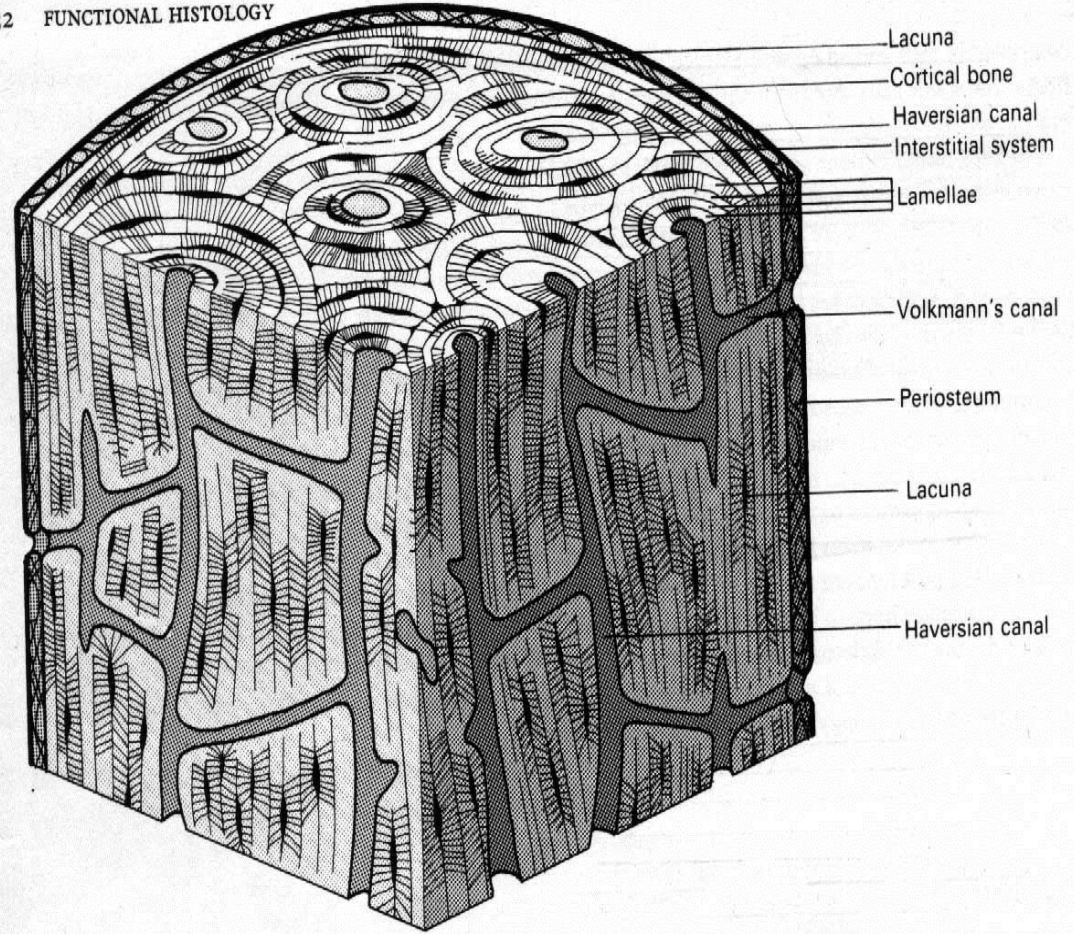
骨的形成



骨的结构

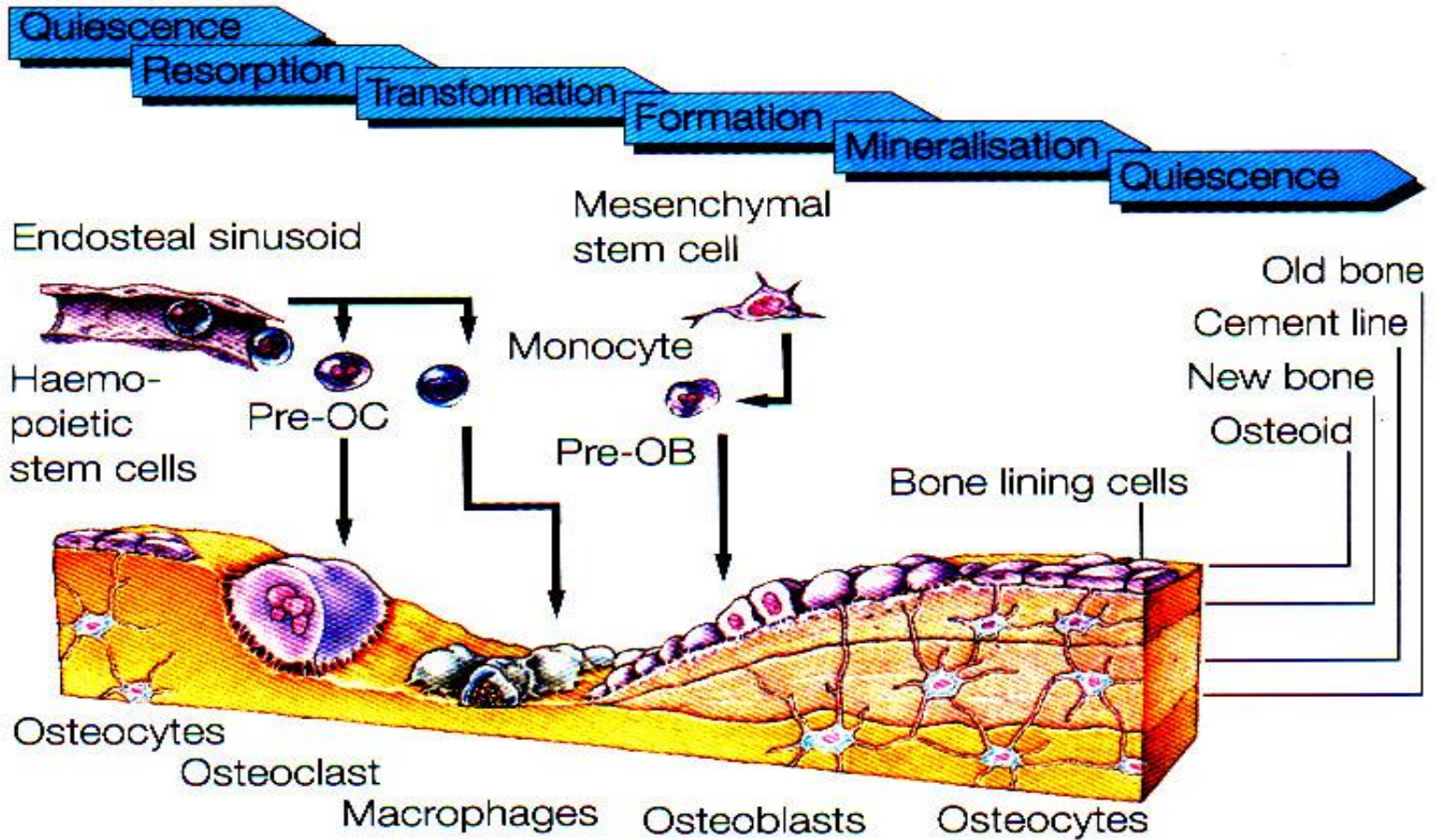


132 FUNCTIONAL HISTOLOGY

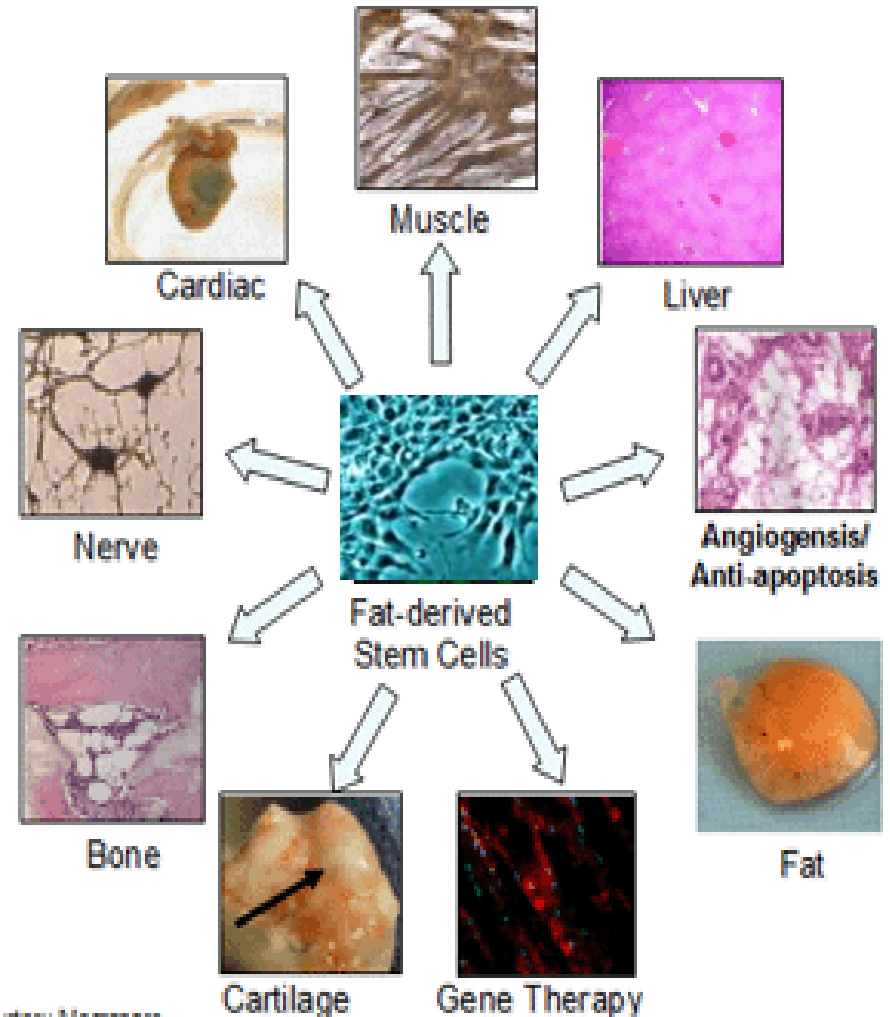
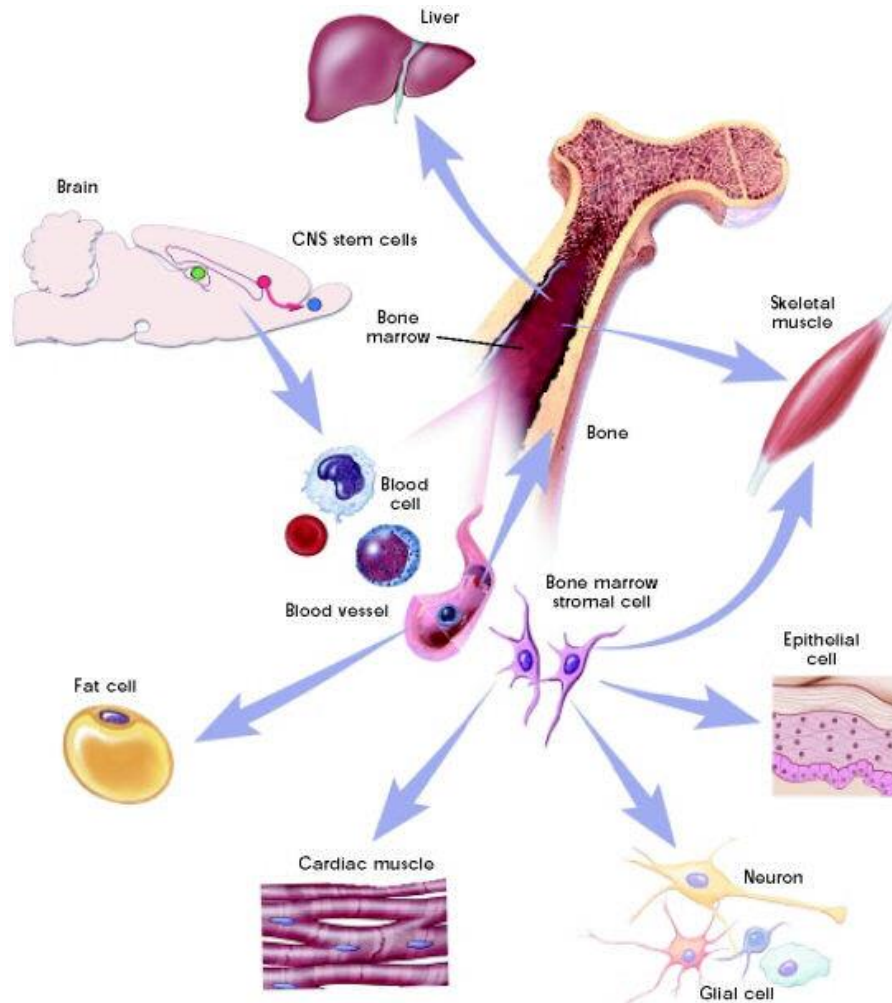


骨的改建

Stages of bone remodelling



Bone marrow and Adipose tissue contain multi-potent MSCs













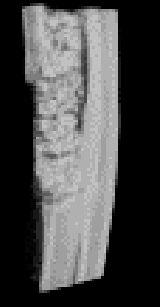




Courtesy Macropore

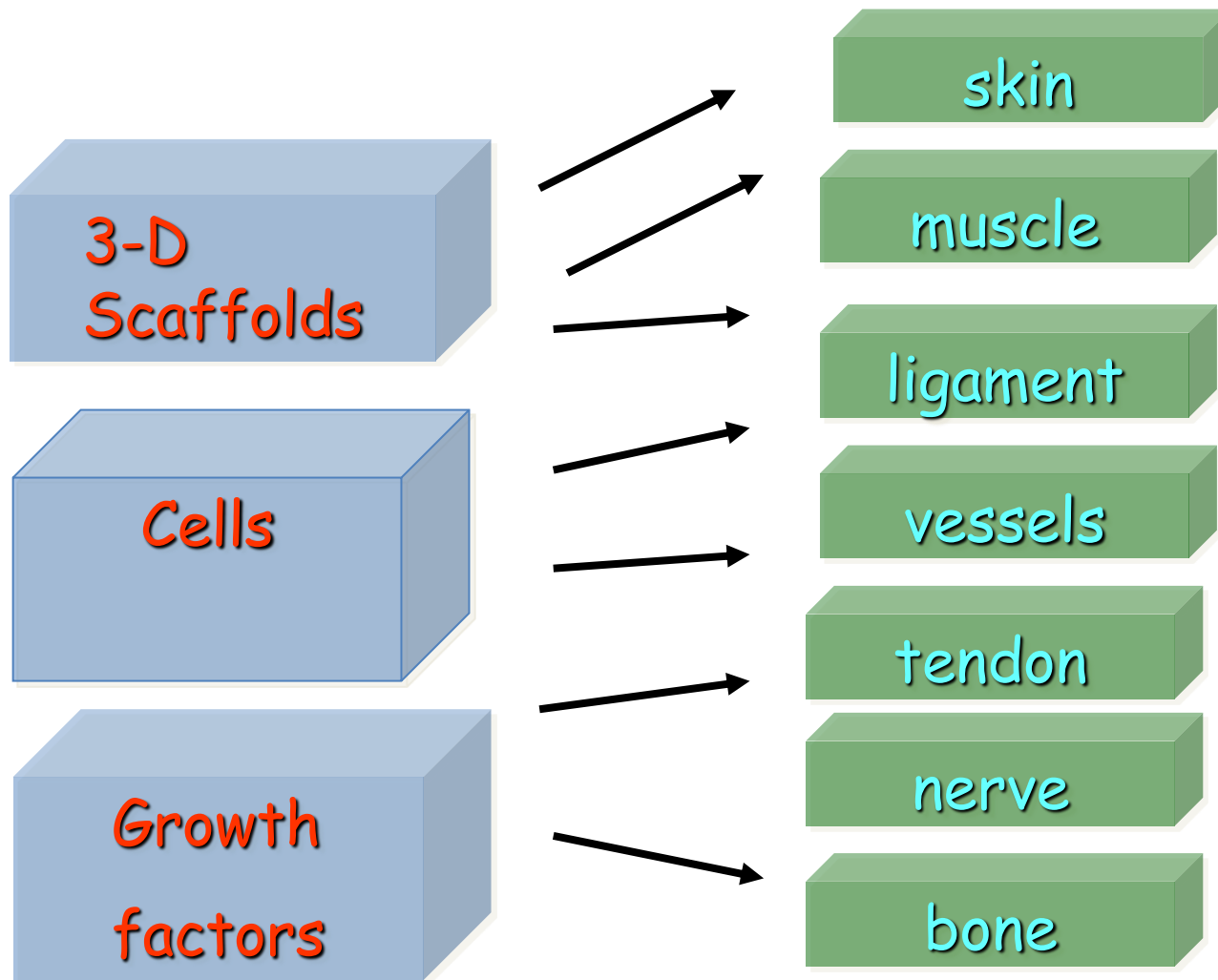
- Rabbit
- PBMSCs
- Repair cortical-sized bone defect

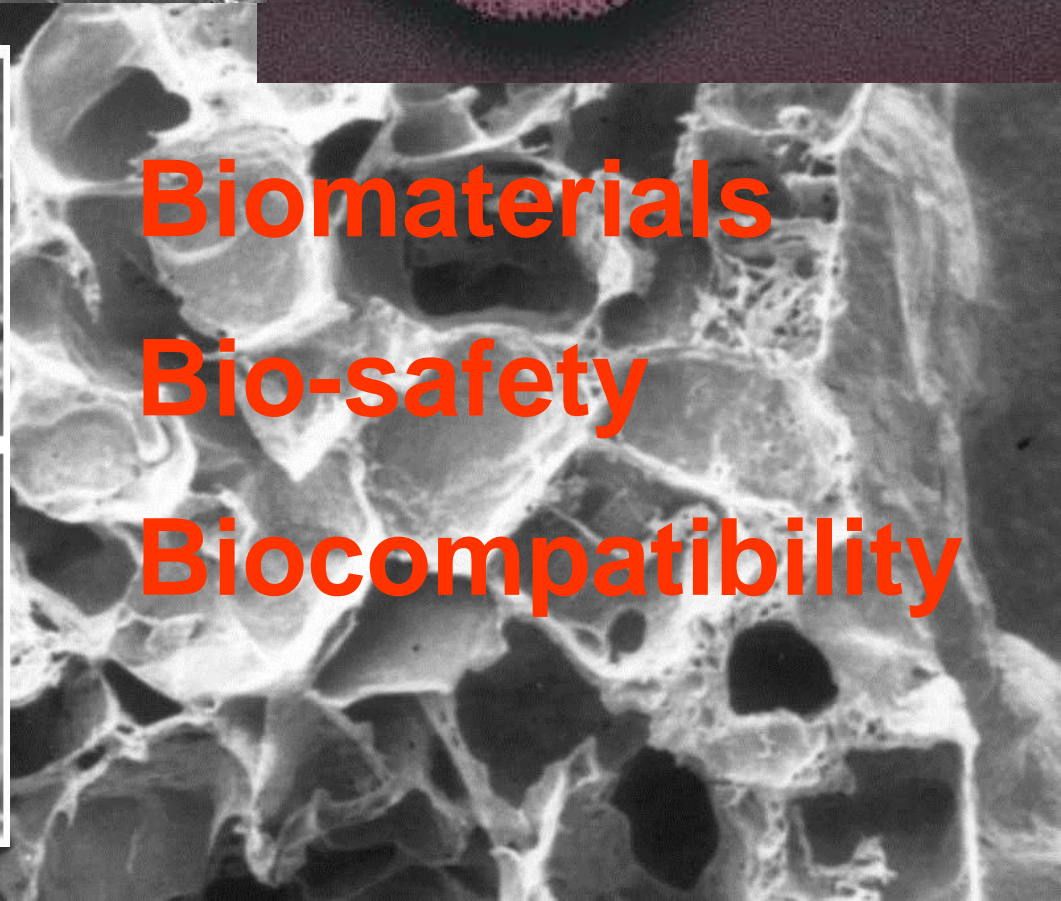
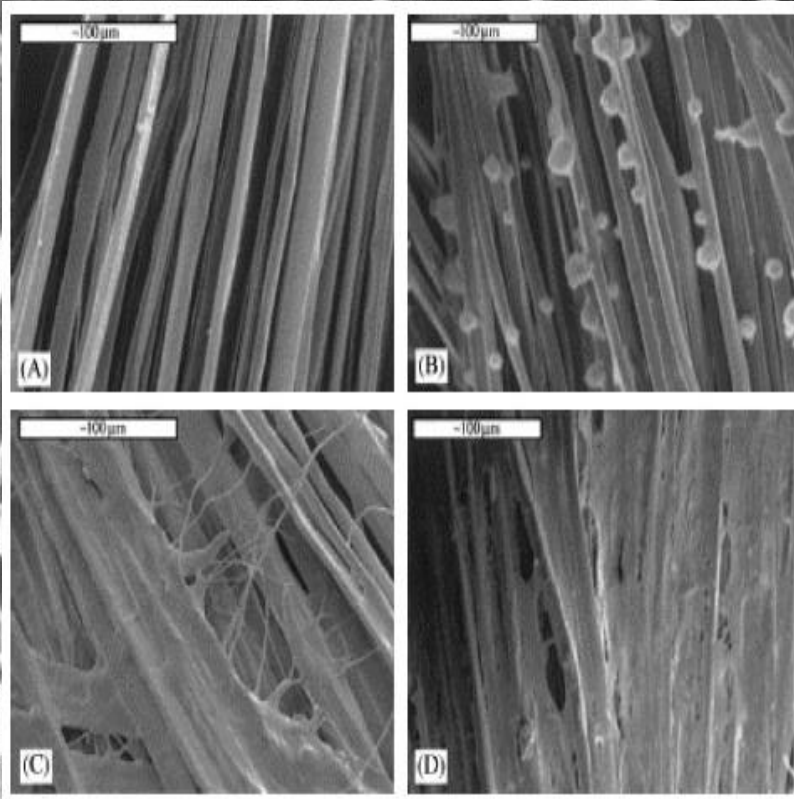
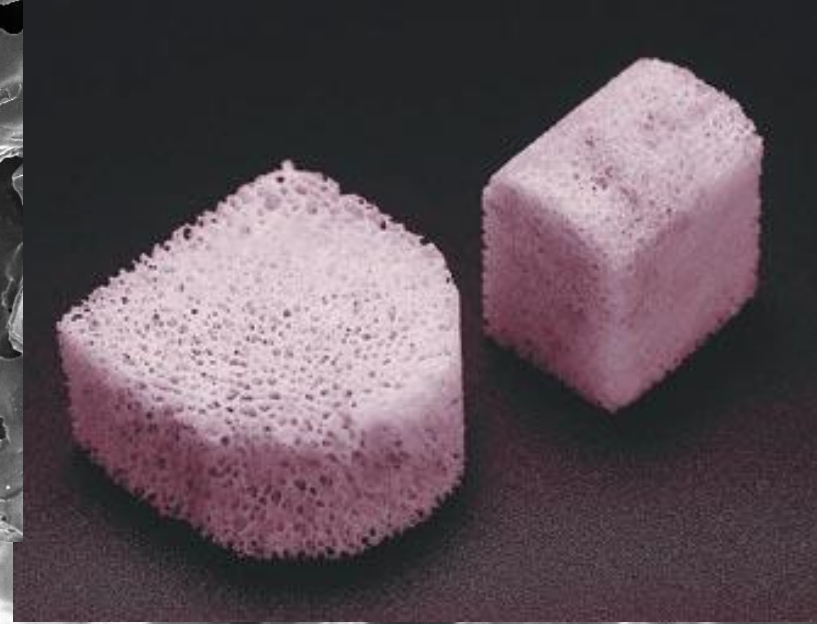
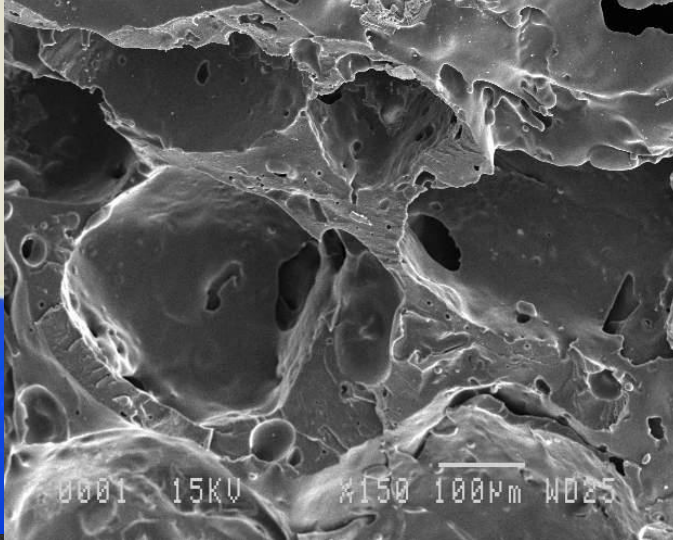
Wan C, He Q, Li G.
Allogenic peripheral blood derived mesenchymal stem Cells (MSCs) enhance bone regeneration in Rabbit ulna critical sized bone defect model.

Journal of Orthopaedic Research; 2006; 24(4):610-8.

Groups	Empty Control	Skelite Alone	PBMSC Skelite	BMMS C Skelite	PBMNC Skelite
Day 0					
Week 8					
Week 12					

Tissue Engineering Principles





Biomaterials
Bio-safety
Biocompatibility

Using Autologous BM-MSCs for the treatment of bone defect

Bone biopsy in culture

After 4 weeks, Bone cells in culture

Cultured bone cells were seeded on human bone carrier

Implantation of the engineered bone back to the patient

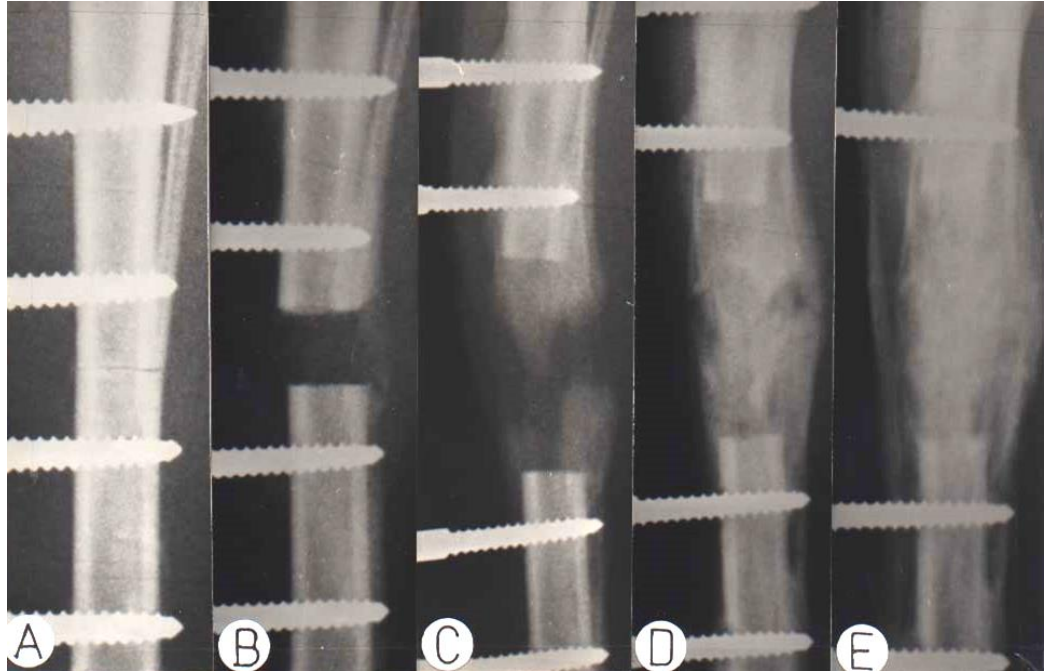


GMP Human Cell Culture Labs- CUHK PWH Campus



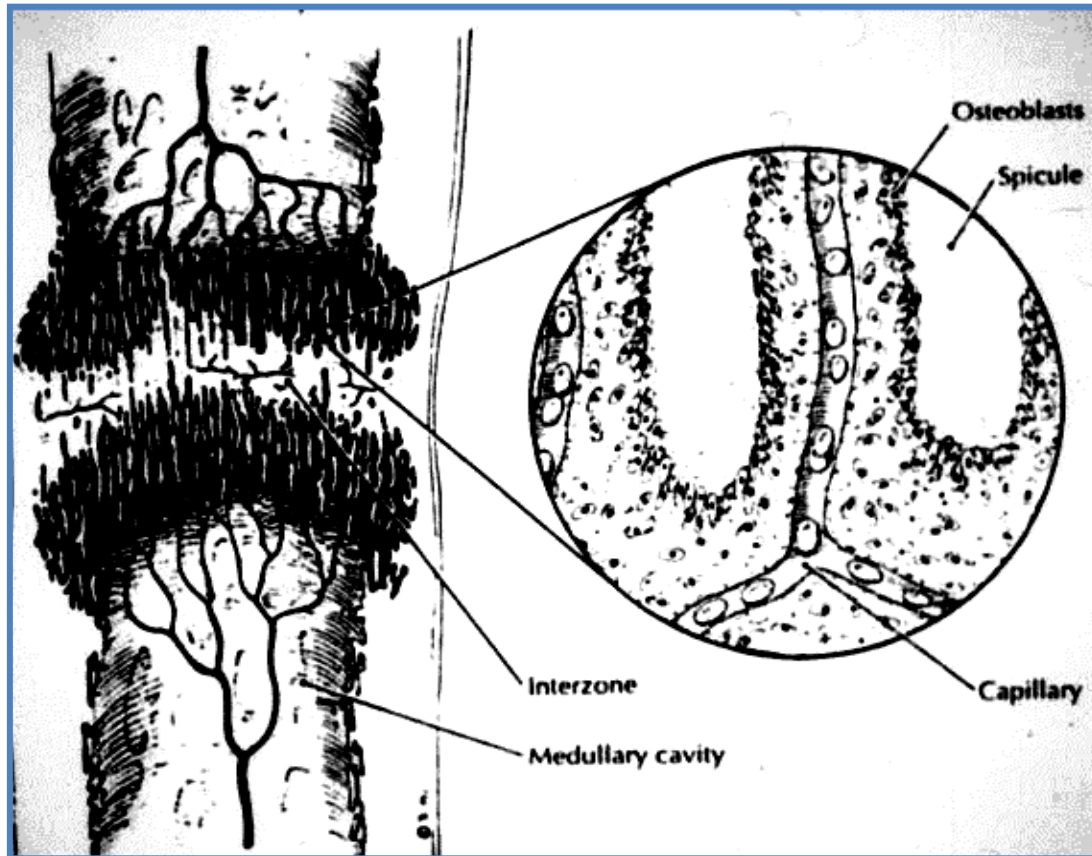
Investment in GMP Labs
Local regulations
Ethical permissions
Patients Consents

What is distraction osteogenesis (DO)



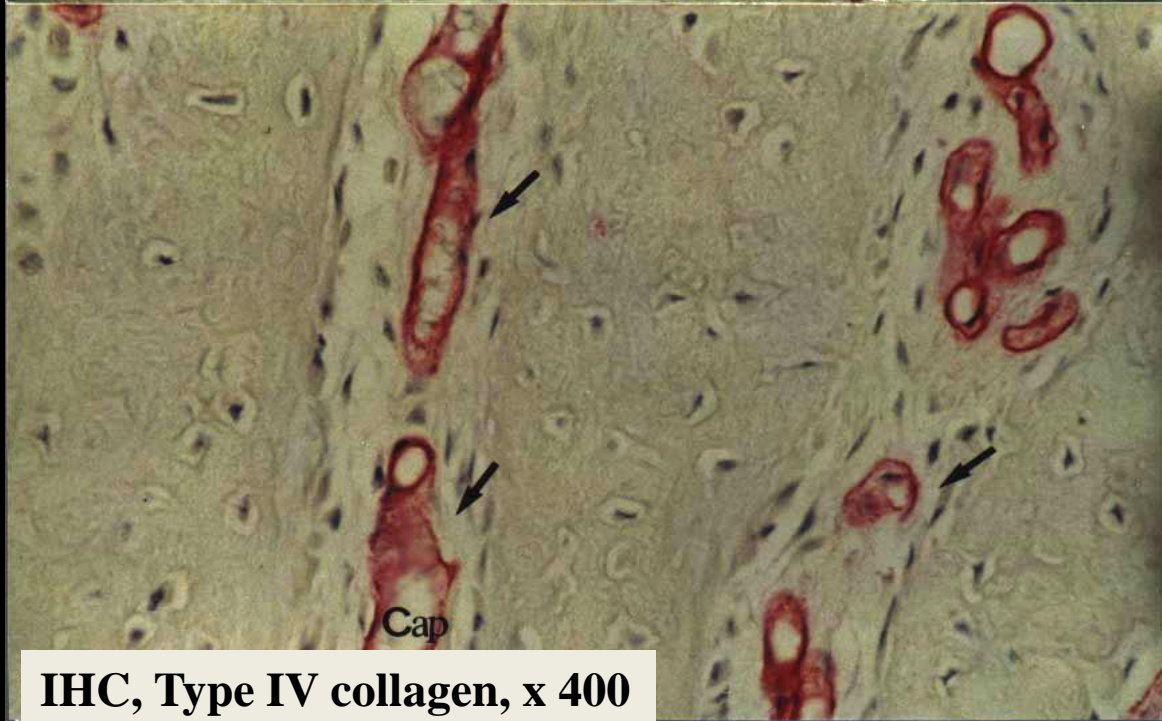
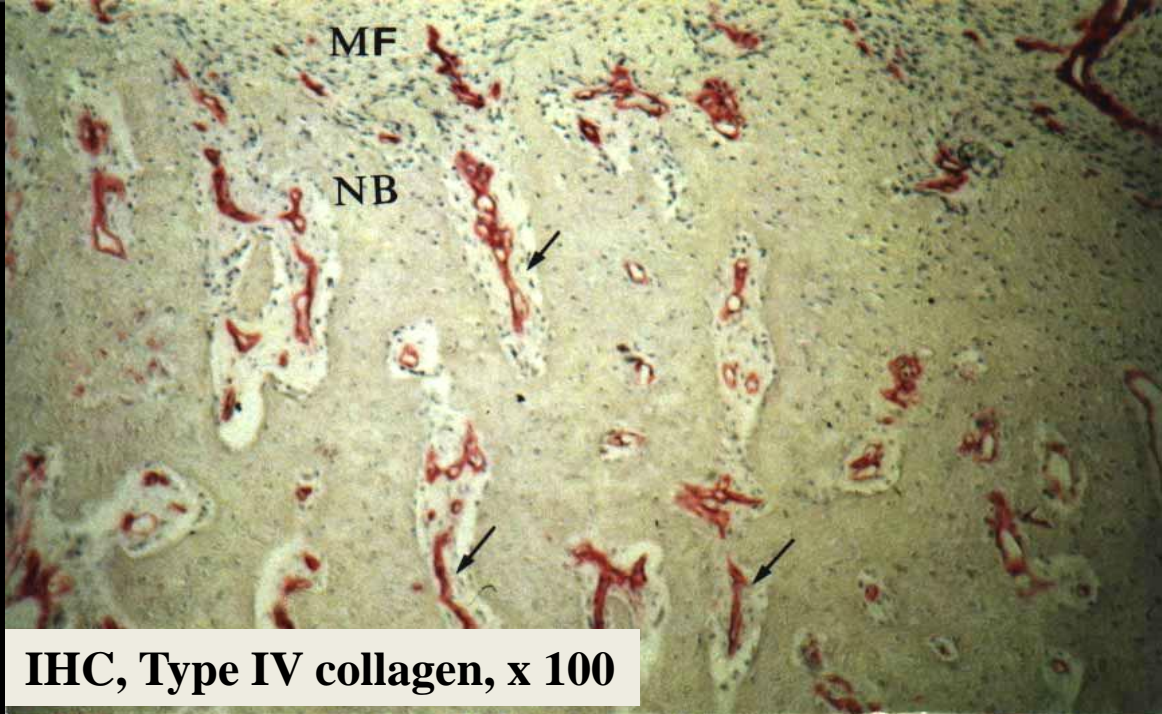
1. Osteotomy
2. External Fixation
3. Gradual Traction (lengthening)

Angiogenesis in Distraction Osteogenesis



Angiography showing new vessels in the regenerate.

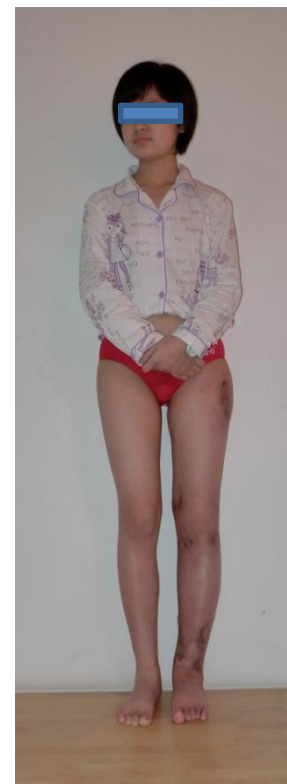
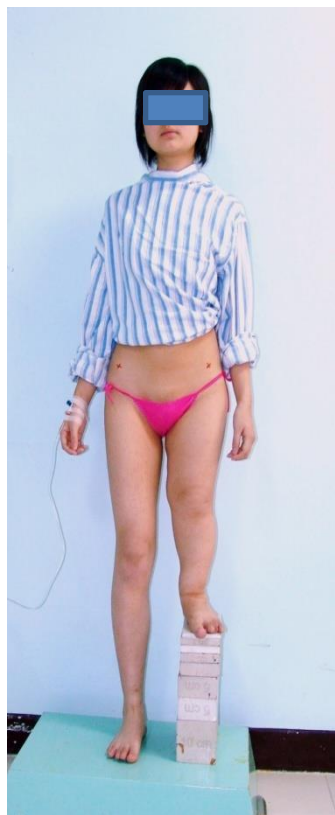
Angiogenesis study during DO



Clinical Outcome
Limb-reconstruction

肢體延長術矯治下肢特大幅度短縮畸形

患者：女、16歲，左股骨脛骨多發性內生性骨軟骨瘤，致下肢短縮30.5cm (A2)。同期進行股骨和脛骨延長，恢復正常肢體長度，經過順利。



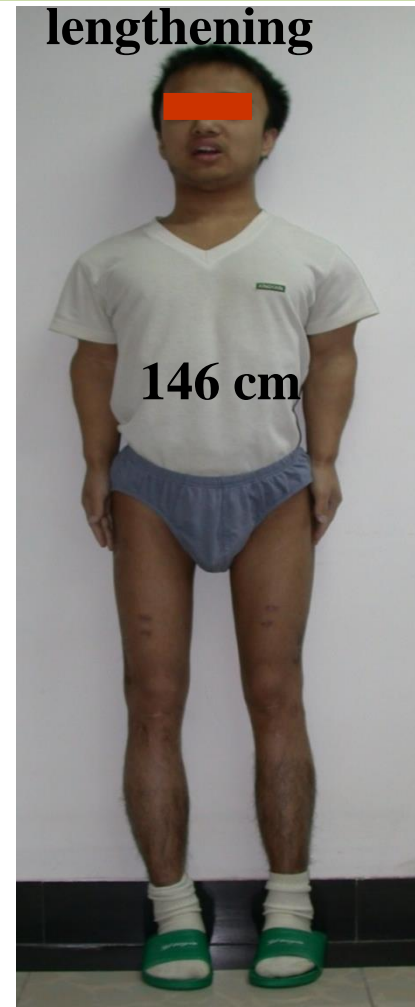
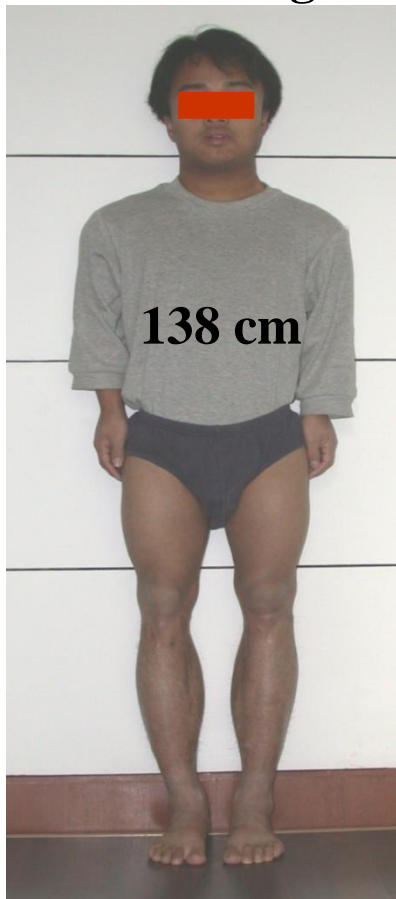
In collaboration with Dr. Xia He-Tao and Prof. Tang Pei-Fu (Beijing)

Clinical Outcome
Limb-reconstruction

**After 2nd 8 cm
femoral
lengthening**

**After First
18 cm tibial lengthening**

Before Treatment



2014年度高等学校科学研究优秀成果奖(自然科学奖)一等奖

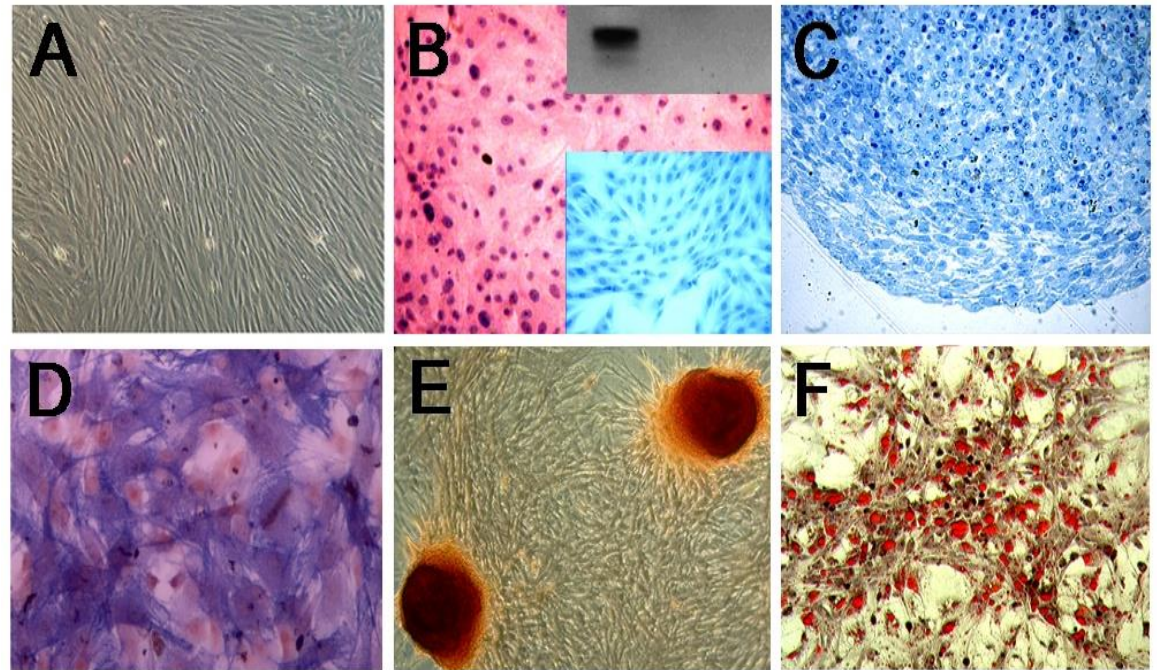
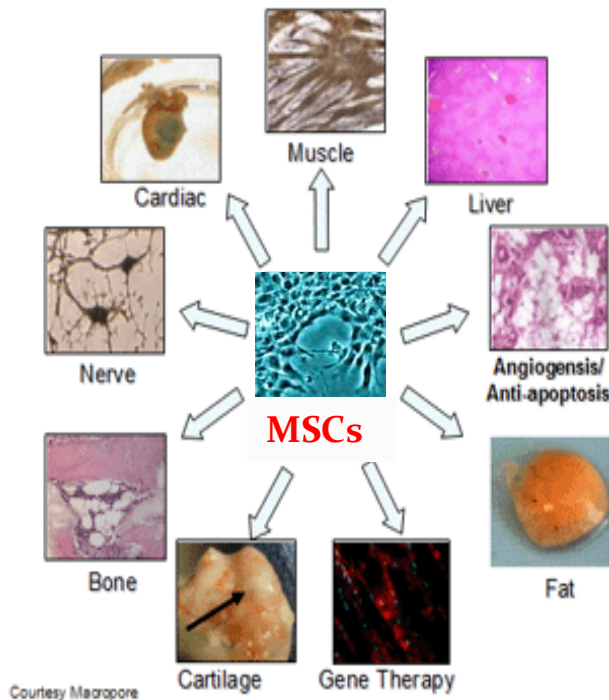
血管神经化组织工程骨构建及其成骨相关机制研究

裴国献, 张智勇, 李刚
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本课题最早建立了组织工程骨种子细胞的临床应用流程、标准及GMP洁净间；立足于临床转化严格制定了组织工程骨临床试验方案，为临床应用从理论、技术、方案及准入等层面上奠定了全面的基礎。

Mesenchymal Stem Cells (MSCs) Culture and Characterization



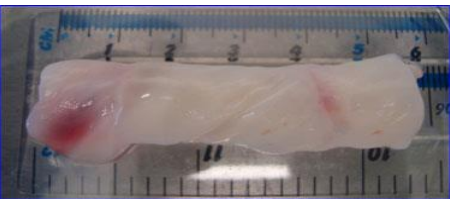
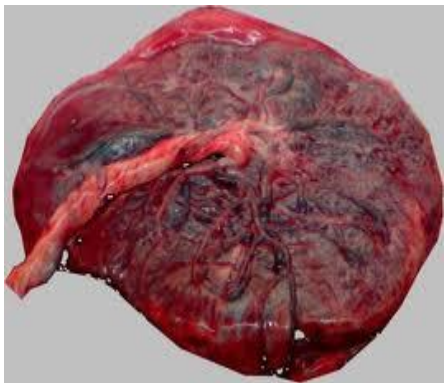
Selected publications:

Chen X, Xu H, Wan C, McCaigue M, Li G. Bioreactor expansion of human adult bone marrow-derived mesenchymal stem cells (MSCs). [Stem Cells](#); 2006; 24: 2052-2059.

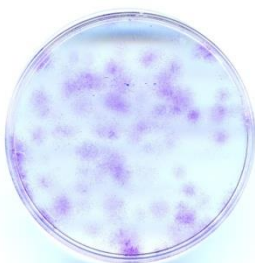
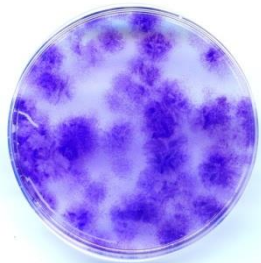
Wan C, He Q, McCaigue M, Marsh D, Li G. Human marrow mesenchymal stem Cells (MSCs) in the peplated non-adherent cell population serve as a complementary source of osteogenic cells. [Journal of Orthopaedic Research](#); 2006; 24 (1): 21-28.

**Stem Cells
Culture
Techniques**

1. Source of Stem Cells and Phenotype Stability
2. Rapid Cell Expansion
3. Delivery Routines and Stem Cell Fate In-Vivo
4. Stem Cells in Gene Therapy Approaches
5. Clinical Trials / Safety and Regulatory Issues



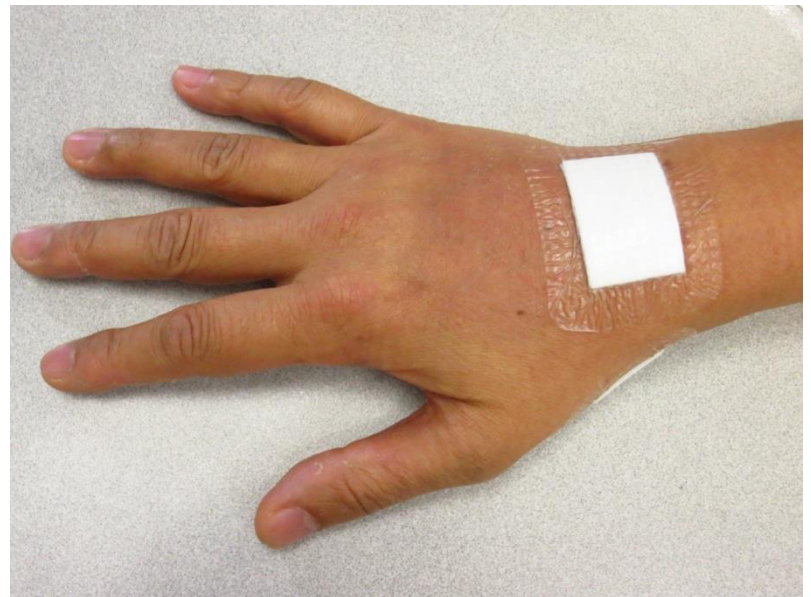
Surface Markers	P001	P002	P003
CD45	6%	1%	1%
CD34	2%	1%	1%
CD44	98%	/	99%
CD73	84%	95%	93%
CD90	90%	99%	99%
CD105	44%	/	59%
CD31	52%	/	17%
CD14	17%	/	3%



Fetal MSCs contains more progenitor cells -CFUs



**Hand/Wrist joint
Cartilage repair
Clinical trial**



CUHK LiKS-SBS Stem Cell and Regeneration Lab Members

香港中文大学医学院-生物医学学院干细胞与再生医学组-李刚团队



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