10

STEM CELLS AND TISSUE REGENERATION

Adult Stem Cell Biology and Applications

Principal Investigator

Professor Gang Li

Team Members

Wayne Lee | Wang Yan | Feng Lu | Wang Bin | Weiping Lin | Linlong Li | Yujia Wang | Yucong Li | Qi Pan | Haixing Wang | Xiaoting Zhang | Yuan Li | Zhengmeng Yang | Shanshan Bai | Min Wang | Xuan Lu | Jessica Lo | Yongkang Yang | Lingchi Kong | Tszlam Yiu

Research Progress Summary

In 2020, the research team led by Professor Gang Li has 20 members (1 assistant professor, 4 postdoctoral fellows, 2 research associates, 2 research assistants, 1 visiting fellow, 9 PhD students and 1 MPhil student) with the following research projects carried out: (1) development of applications and products of secretomes derived from fetal and adult human mesenchymal stem cells; (2) biological roles of microRNAs and non-coding RNAs in bone and cartilage regeneration; (3) novel therapeuticstrategies for diabetic foot ulcers treatment; (4) industry and Hong Kong Government contract research works on pre-clinical studies of biological compounds and biophysical stimulations; (5)engaging in international collaborations and educational programs. These projects progress as planned, producing more than 20 peer-reviewed publications, and research grant of over HK$7 million were secured by the team in 2020. Prof. Li has been invited to give keynote speeches and lectures at over 10 national and international conferences and meetings (virtual form) in 2020, and served as visiting professors at many prestigious universities such as Monash University, Australia; University of Malaya, Malaysia; Guangdong Medical University, China, etc. Prof. Li also serves as the council member or member-at-large of 4 prestigious national research societies, and the editorial board member for 4 international journals. Prof. Li has been elected as a fellow by the international peers (the only one from China in 2020) of the American Orthopaedic Research (ORS) Society, for his long term contribution in service for ORS and outstanding achievements in orthopaedic research field internationally.

Research and Scholarship

Research Awards and Recognitions

Member's Name	Details	
	Award	Organisation
Wayne Lee	2020 American Society for Bone and Mineral Research Rising Star Award	The American Society for Bone and Mineral Research

Fellowships

Member's Name	Details	
	Fellowships	Organisation
Gang Li	Distinguished Tang Aoqing Guest Professorship	Jilin University, China
	Adjunct Professor, Australian Regenerative Medicine Institute (ARMI)	Monash University, Australia
	Visiting Professor and Assessor of Teaching Program, Department of Orthopaedic Surgery and Traumatology	University of Malaya, Malaysia
	Visiting Professor	Guang Dong Medical College, Dongguan, China
		Shenzhen Baoan People's Hospital, Shenzhen, China
		China Medical University, Shenyang, China
		South Eastern University Medical School, Nanjing, China

Fellowships

Member's Name	Details	
	Fellowships	Organisation
Gang Li	General Secretary, Division of Limb Deformity Correction and Reconstruction	Chinese Association of Orthopaedic Surgeons
	Chairman	China Branch, International Limb Lengthening and Reconstruction Societies (ILLRS)
		Association from Study and Application of the Methods of Ilizarov (ASAMI)
	骨橫搬糖足學組副主任委員	中國骨科醫師協會
	Council Member of Academic Division	Hong Kong Association of Scientists
	Vice Chairman, Branch of Regenerative Biomaterials	Chinese Association of Materials
	Member-at-Large (Global position)	Tissue Engineering and Regenerative Medicine International Society (TERMIS) Asia Pacific (AP)
	Council and Funding Member	Hong Kong Society of Cell Biology
	Fellow	International Combined Orthopaedic Research Societies
		American Orthopaedic Research Society

Academic Editorship

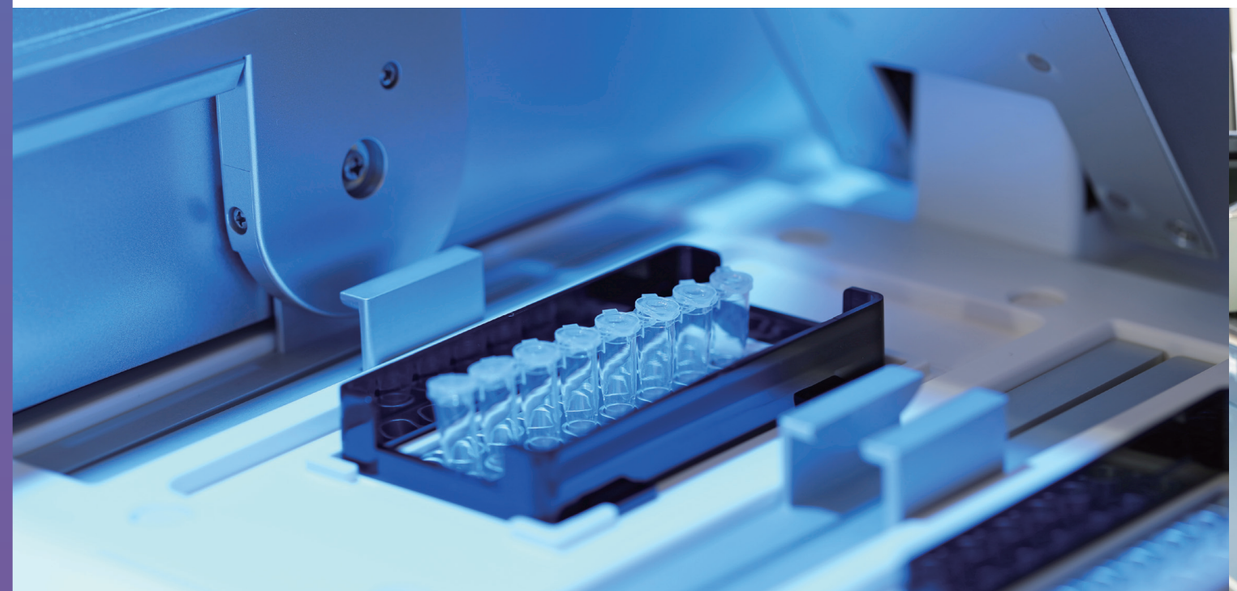
Member's Name	Details	
	Role	Journal
Gang Li	Executive Associate Editor	Journal of Orthopaedic Translation
	Member of Editorial Board	Calcified Tissue International
		Bone and Joint Research
		Bone
		Journal of Orthopaedic Research

Reviewer of Journal / Conference

Member's Name	Details	
	Role	Journal / Conference
Gang Li	Reviewer	Biomaterials
		Stem Cells
		Stem Cells Research and Therapy
		Cytotherapy, Journal of Physiology
		Journal of Chemical Engineering

Grants and Consultancy

Name	Project Title	Funding Source	Start Date (dd/mm/yyyy)	End Date (dd/mm/yyyy)	Amount (HK$)
Gang Li	Modulating Osteoarthritis Development via Balancing Endogenous Expression of Smad3 and Smad7	Research Grants Council – General Research Fund	01/01/2019	31/12/2021	953,029
	Effects of Danshen and Jixuecao Extracts on Glucocorticoid Induced Bone Loss and Growth Suppression	Food and Health Bureau – Health and Medical Research Fund	01/07/2019	30/06/2022	1,495,584
	Exploiting the True Joint Progenitor Cell for Articular Cartilage Repair	Research Grants Council – Collaborative Research Fund	01/06/2019	31/05/2022	7,370,000
	Biomaterials-mediated Bone Formation and Consolidation in Distraction Osteogenesis	Research Grants Council – General Research Fund	15/09/2017	14/09/2020	1,098,710
	PEMF Effects on Distraction Osteogenesis	Orthofix Company, USA	01/08/2020	31/12/2019	1,618,148
	Development of Staphylococcal Enterotoxins C2 (SEC2) as a Drug to Promote Osteoporotic Fracture Healing	Hong Kong Innovation Technology Commission	01/04/2020	31/01/2022	2,268,318
	Development of Staphylococcal Enterotoxins C2 (SEC2) as a Drug to Promote Osteoporotic Fracture Healing Postdoctoral Hin and Internship	Hong Kong Innovation Technology Commission	01/04/2020	30/09/2022	2,623,361
	Functional Bone Regeneration in Challenging Bone Disorders and Defects	Research Grants Council – Theme-based Research Scheme	01/11/2017	31/10/2022	333,333,333
	PGM-01 Research Matching Scheme for Stem Cells Studies	The Government of the Hong Kong Special Administrative Region	01/03/2020	01/03/2022	531,223



Publications

A. Journal Papers

1. Hou Y, Lin W, Li Y, Sun Y, Liu Y, Chen C, Jiang X, Li G, Xu L. De-osteogenic-differentiated mesenchymal stem cells accelerate fracture healing by mir-92b. *Journal of Orthopaedic Translation*. 2021;27:25-32. doi:10.1016/j.jot.2020.10.009. (Epud ahead of print)

2. Wang B, Suen CW, Ma H, Wang Y, Kong L, Qin D, Lee YWW, Li G. The roles of H19 in regulating inflammation and aging. *Frontiers in Immunology*. 2020; 11:579687. doi:10.3389/fimmu.2020.579687. (Review)

3. Li G, Qin S. Ilizarov techniques in China for 30 years: From research to clinical translation. *Journal of Orthopaedic Translation*. 2020;25:1-2. doi:10.1016/j.jot.2020.11.006. (Editorial)

4. Zhu M, Zhang K, Feng L, Lin S, Pan Q, Bian L, Li G. Surface decoration of development-inspired synthetic N-cadherin motif via Ac-BP promotes osseointegration of metal implants. *Bioactive Materials*. 2021;6(5):1353-1364. doi:10.1016/j.bioactmat.2020.11.002. (Epud ahead of print)

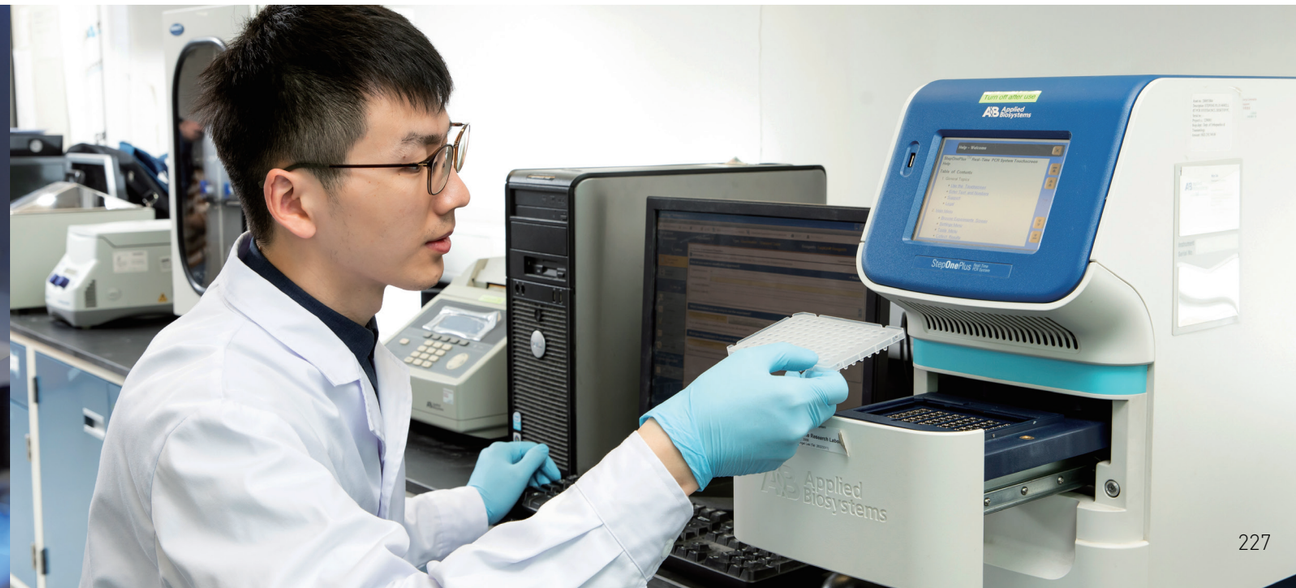
5. Li Y, Pan Q, Zhang N, Wang B, Yang Z, Ryaby JT, Waldorff EI, Lee WYW, Li G. A novel pulsed electromagnetic field promotes distraction osteogenesis via enhancing osteogenesis and angiogenesis in a rat model. *Journal of Orthopaedic Translation*. 2020;25:87-95. doi:10.1016/j.jot.2020.10.007.

6. Pan Q, Li Y, Xu J, Kang Y, Li Y, Wang B, Yang YP, Lin S, Li G. The effects of tubular structure on biomaterial aided bone regeneration in distraction osteogenesis. *Journal of Orthopaedic Translation*. 2020;25:80-86. doi:10.1016/j.jot.2020.09.009.

7. Kong L, Li HA, Kang Q, Li G. An update to the advances in understanding distraction histogenesis: From biological mechanisms to novel clinical applications. *Journal of Orthopaedic Translation*. 2020;25:3-10. doi:10.1016/j.jot.2020.09.003. (Review)

8. Shi L, Wang C, Yan Y, Wang G, Zhang J, Feng L, Yang X, Li G. Function study of vasoactive intestinal peptide on chick embryonic bone development. *Neuropeptides*. 2020;83:102077. doi:10.1016/j.npep.2020.102077.

9. Feng L, Zhang J, Shi L, Yang Z, Wu T, Wang H, Lin W, Lu Y, Lo JHT, Zhu D, Li G. MicroRNA-378 suppressed osteogenesis of mscs and impaired bone formation via inactivating Wnt/β-catenin signaling. *Molecular Therapy - Nucleic Acids*. 2020;21:1017-1028. doi:10.1016/j.omtn.2020.07.018.



10. Li G, Ling SKK, Li HA, Zhang Y, Hu J. How to perform minimally invasive tibial cortex transverse transport surgery. *Journal of Orthopaedic Translation*. 2020;25:28-32. doi:10.1016/j.jot.2020.06.005.

11. Guo Q, Peng J, Wang A, Li G, Qin L. In memory of Prof. Lu Shibi, MD. *Journal of Orthopaedic Translation*. 2020;23:A1. doi:10.1016/j.jot.2020.06.007. (Editorial)

12. Lin W, Xu L, Li G. Molecular insights into lysyl oxidases in cartilage regeneration and rejuvenation. *Frontiers in Bioengineering and Biotechnology*. 2020;8:359. doi:10.3389/fbioe.2020.00359. (Review)

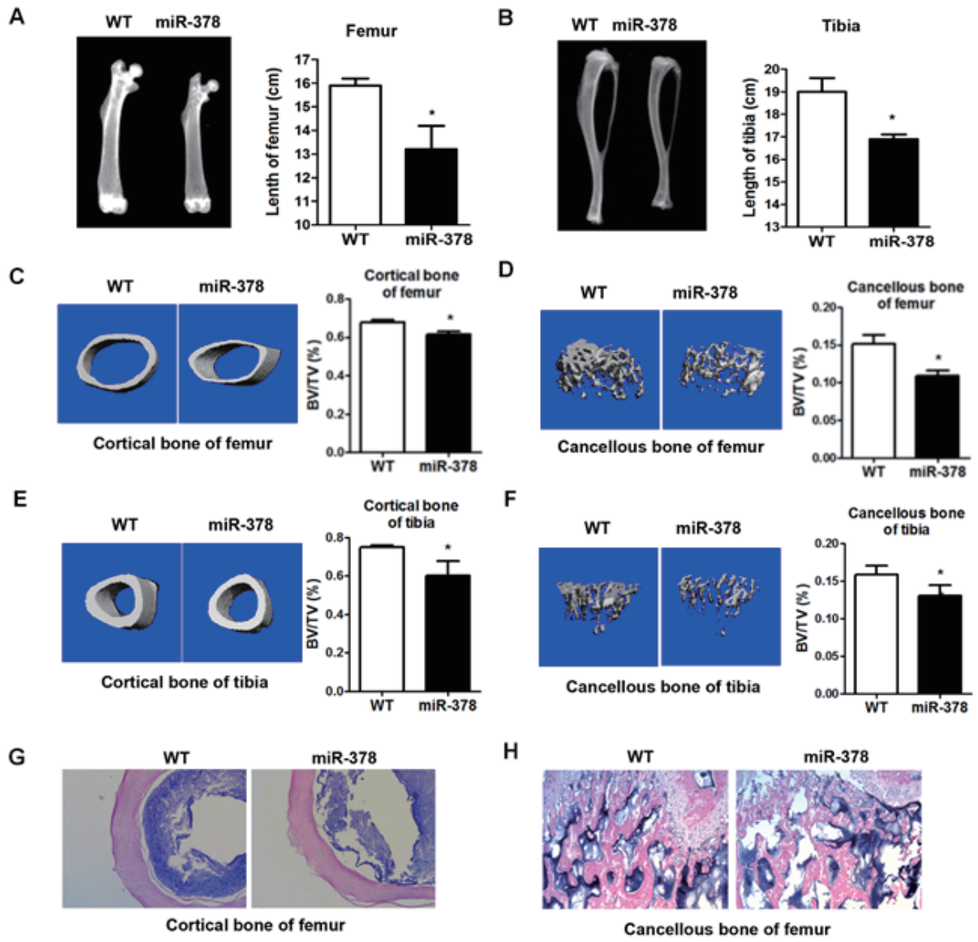
13. Wang H, Yang G, Xiao Y, Luo G, Li G, Li Z. Friend or foe? Essential roles of osteoclast in maintaining skeletal health. *BioMed Research International*. 2020;2020:4791786. doi:10.1155/2020/4791786. (Review)

14. Shi L, Feng L, Zhu ML, Yang ZM, Wu TY, Xu J, Liu Y, Lin WP, Lo JHT, Zhang JF, Li G. Vasoactive intestinal peptide stimulates bone marrow-mesenchymal stem cells osteogenesis differentiation by activating wnt/β-catenin signaling pathway and promotes rat skull defect repair. *Stem Cells and Development*. 2020;29(10):655-666. doi:10.1089/scd.2019.0148.

15. Yang Y, Pan Q, Zou K, Wang H, Zhang X, Yang Z, Lee WYW, Wei B, Gu W, Yang YP, Lin S, Li G. Administration of allogeneic mesenchymal stem cells in lengthening phase accelerates early bone consolidation in rat distraction osteogenesis model. *Stem Cell Research & Therapy*. 2020;11(1):129. doi:10.1186/s13287-020-01635-5.

16. Wen G, Xu J, Wu T, Zhang S, Chai Y, Kang Q, Li G. Functionalized polycaprolactone/hydroxyapatite composite microspheres for promoting bone consolidation in a rat distraction osteogenesis model. *Journal of Orthopaedic Research*. 2020;38(5):961-971. doi:10.1002/jor.24542.

17. Liu Y, Xu L, Hu L, Chen D, Yu L, Li X, Chen H, Zhu J, Chen C, Luo Y, Wang B, Li G. Stearic acid methyl ester promotes migration of mesenchymal stem cells and accelerates cartilage defect repair. *Journal of Orthopaedic Translation*. 2020;22:81-91. doi:10.1016/j.jot.2019.09.008.



Abnormal bone tissues and impaired bone quality were observed in miR-378 TG mice.
A-B, bone phenotype of femurs (A) and tibia (B) of miR-378 TG mice and their wild-type (WT) mice were examined by digital radiography. C-F, representative microarchitecture 3D images of cortical (C, E) and trabecular bone (D, F) of femur as well as tibia. BV/TV of the cortical and trabecular bone all showed that the bone mass was significantly decreased in the miR-378 TG mice (age: 3 months; n=10; *P<0.05, versus WT group). G, H&E staining of transverse and coronal plane of femurs revealed thicker cortices, smoother edge of cortical bone and more paralleled alignment of osteocytes in the WT mice than those in the miR-378 TG group. Scale bar=400 μm. H, H&E staining of sagittal plane of metaphyseal region of femurs revealed more disrupted bone microarchitecture and homeostasis in cancellous bone of miR-378 TG mice femur. Scale bar=100 μm.

Source: Feng L, Zhang JF, Shi L, Yang ZM, Wu TY, Wang HX, Lin WP, Lu YF, Lo JHT, Zhu DH, Li G. MicroRNA-378 suppressed osteogenesis of MSCs and impaired bone formation via inactivating Wnt/b-catenin signaling. Molecular Therapy: Nucleic Acids. 2020;21:1017-1028. doi:10.1016/j.omtn.2020.07.018.