李郁偉

WAYNE LEE

10 STEM CELLS AND TISSUE REGENERATION

Principal Investigator

Wayne Lee

Team members

Dorsa Dehghan-Baniani, Rachel Shiu, Tsz-lam Yiu, Ericsson Fung, Allen Hsiao, Belle Wang, Kenneth Yang, Jessica Lo, Rongliang Wang, Zhe Zhang

Research Progress Summary

Wayne Lee and his research team work on the role of osteocytes in musculoskeletal diseases by using advanced imaging and mechanical stimulation devices on 3D cell culture and transgenic animal models. They established primary osteocyte culture model derived from patients with adolescent idiopathic scoliosis (AIS), allowing them to identify abnormal expression of several miRNAs and lncRNAs which disrupt osteocytogenic differentiation. Based on these pre-clinical studies, they proposed a composite model consisted of clinical data and circulating biomarkers for the prediction of curve progression in AIS. The team has continued to search for factors associated with the onset and progression of AIS. They have deepened their studies to investigate the metabolomic and proteomic changes in AIS patients with high risk to curve progression. Osteocytes are the major mechanosensing cells in skeleton and transduce mechanical stimuli into biochemical signals through highly specialized dendritic processes and lacunocanalicular network (LCN). Recently, they have extended their osteocyte research platform to investigate the role of osteocytes in other musculoskeletal diseases such as osteoarthritis and osteoporosis. Their recent findings provide new insights into the development of potential treatments targeting osteocytes to prevent age-related bone loss and augment the benefits of exercise on senescent skeleton. Furthermore, with the generous support from Li Ka Shing (Canada) Foundation and the Matching Grant Scheme, the team and their clinical colleagues and industrial collaborator reported how a state-of-the-art multi-energy spectral photon-counting computed tomography (MARS) can imagine orthopedic implant failure not detected by standard current imaging techniques. This system has a potential clinical application in orthopedic patients.

Research and Scholarship

Research Awards and Recognitions

Member's Name	Details	
	Award	Organisation
Yujia Wang	Top Podium Presentation Award	The International Research Society of Spinal Deformities
Allen Hsiao	Young Investigator Poster Presentation Award First Place	Hong Kong Institute of Diabetes and Obesity

Reviewer of Journal / Conference

Member's Name	Details	
	Role	Journal / Conference
Wayne Lee	Editor and Reviewer	Journal of Orthopaedic Translation
	Reviewer	Biomaterials
		Scientific Reports
		Stem Cells International
		The Journal of Frailty & Aging
		BMC Musculoskeletal Disorders

Grants and Consultancy

Name	Project Title	Funding Source	Start Date (dd/mm/yyyy)	End Date (dd/mm/yyyy)	Amount (HK$)
Wayne Lee	Decellularized Scaffolds for Bone and Cartilage Regeneration	Innovation and Technology Commission – Innovation and Technology Fund	01/08/2021	31/01/2024	2,081,500
	Is Vitamin D Playing a Role in the Pathogenesis of AIS?	American Society for Bone and Mineral Research	01/10/2020	30/09/2023	468,000
	Bone Aging and Osteocyte Biology	The Chinese University of Hong Kong – Improvement on Competitiveness in Hiring New Faculties' Funding Scheme	01/08/2020	31/07/2023	1,106,667
	For the Acquisition and Maintenance of MARS Preclinical Spectral CT System to Facilitate the Research Projects	University Grants Committee – Research Matching Grant Scheme	01/01/2020	31/12/2025	1,849,650
	Research Study on Muscle Loss in Aged Mice	University Grants Committee – Research Matching Grant Scheme	01/10/2020	31/07/2023	60,000
	Novel Biological Action of Long Noncoding RNA LBX1-AS1 on Osteocytogenesis and Osteocyte Function in Adolescent Idiopathic Scoliosis	Research Grants Council – General Research Fund	01/01/2019	31/12/2021	861,601
	Exploration of Effects and Molecular Mechanism of Ginkgolide B in Treating Ageing-related Osteoporosis	Research Grants Council – General Research Fund	01/08/2020	31/07/2022	920,567
	Pathological Implication and Functional Characterization of a Novel Long Non-Coding RNA LBX1-AS1 in Adolescent Idiopathic Scoliosis	Health and Medical Research Fund – Research Fellowship Scheme	01/08/2019	31/07/2022	971,760
	Development of Staphylococcal Enterotoxins C2 (SEC2) as a Drug to Promote Osteoporotic Fracture Healing	The Chinese University of Hong Kong – Improvement on Competitiveness in Hiring New Faculties' Funding Scheme	01/04/2020	30/09/2022	2,268,318
	Aging, Skeletal Degeneration and Regeneration	Research Grants Council – Areas of Excellence Scheme	01/05/2021	30/04/2029	64,889,000

Publications

A. Journal Papers

1. Yang KG, Lee WYW, Hung ALH, Hung VWY, Tang MF, Leung TF, Kong APS, Cheng JCY, Lam TP. Decreased cortical bone density and mechanical strength with associated elevated bone turnover markers at peri-pubertal peak height velocity: A cross-sectional and longitudinal cohort study of 396 girls with adolescent idiopathic scoliosis. *Osteoporosis International*. 2021;1:1-11. doi:10.1007/s00198-021-06200-1.

2. Yang G, Lee WYW, Hung ALH, Tang MF, Li X, Kong APS, Leung TF, Yung PSH, To KKW, Cheng JCY, Lam TP. Association of serum 25(OH)Vit-D levels with risk of pediatric fractures: A systematic review and meta-analysis. *Osteoporosis International*. 2021;32(7):1287-1300. doi:10.1007/s00198-020-05814-1. (Review)

3. Xu L, Feng Z, Dai Z, Lee WYW, Wu Z, Liu Z, Sun X, Tang N, Cheng JCY, Qiu Y, Zhu Z. A functional SNP in the promoter of LBX1 is associated with the development of adolescent idiopathic scoliosis through involvement in the myogenesis of paraspinal muscles. *Frontiers in Cell and Developmental Biology*. 2021;9:3256. doi:10.3389/fcell.2021.777890. (Review)

4. Wang Y, Chen H, Zhang J, Lam TP, Hung ALH, Cheng JCY, Lee WYW. Potential muscle-related biomarkers in predicting curve progression to the surgical threshold in adolescent idiopathic scoliosis — A pilot proteomic study comparing four non-progressive vs. four progressive patients vs. a control cohort. *Journal of Clinical Medicine*. 2021;10(21):4927. doi:10.3390/jcm10214927.

5. Lin W, Chen S, Wang Y, Wang M, Lee WYW, Jiang X, Li G. Dynamic regulation of mitochondrial-endoplasmic reticulum crosstalk during stem cell homeostasis and aging. *Cell Death & Disease*. 2021;12(9):1-8. doi:10.1038/s41419-021-03912-4. (Review)

6. Li Y, Yang Y, Wang M, Zhang X, Bai S, Lu X, Li Y, Waldorff EI, Zhang N, Lee WYW, Li G. High slew rate pulsed electromagnetic field enhances bone consolidation and shortens daily treatment duration in distraction osteogenesis. *Bone & Joint Research*. 2021;10(12):767-779. doi:10.1302/2046-3758.1012.BJR-2021-0274.R1. (Epub ahead of print)

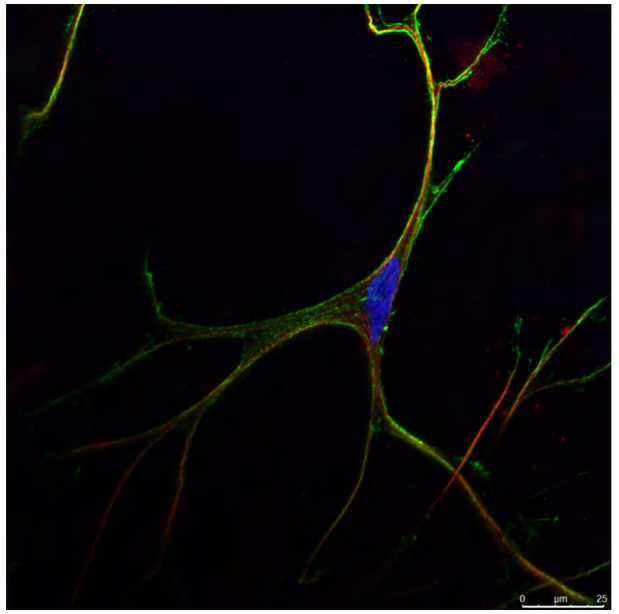
7. Li Q, Yang G, Xu H, Tang S, Lee WYW. Effects of resveratrol supplementation on bone quality: A systematic review and meta-analysis of randomized controlled trials. *BMC Complementary Medicine and Therapies*. 2021;21(1):1-15. doi:10.1186/s12906-021-03381-4.

8. Li Q, Wang H, Zhang J, Kong AP shan, Li G, Lam T ping, Cheng JC yiu, Lee WYW. Deletion of SIRT3 inhibits osteoclastogenesis and alleviates aging or estrogen deficiency-induced bone loss in female mice. *Bone*. 2021;144:115827. doi:10.1016/j.bone.2020.115827.

9. Li Q, Cheng JC yiu, Jiang Q, Lee WYW. Role of sirtuins in bone biology: Potential implications for novel therapeutic strategies for osteoporosis. *Aging Cell.* 2021;20(2):e13301. doi:10.1111/acel.13301. (Review)

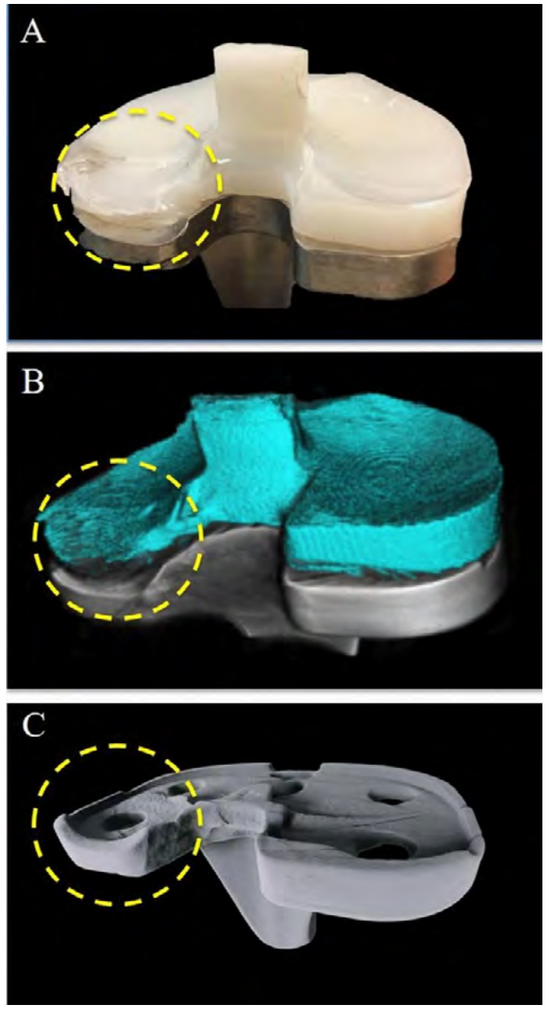
10. Lau LCM, Lee WYW, Butler APH, Chernoglazov AI, Chung KY, Ho KKW, Griffith J, Butler PH, Yung PSH. Multi-energy spectral photon-counting computed tomography (MARS) for detection of arthroplasty implant failure. *Scientific Reports.* 2021;11(1):1-6. doi:10.1038/s41598-020-80463-2.

11. Kong L, Wang Y, Wang H, Pan Q, Zuo R, Bai S, Zhang X, Lee WY, Kang Q, Li G. Conditioned media from endothelial progenitor cells cultured in simulated microgravity promote angiogenesis and bone fracture healing. *Stem Cell Research and Therapy*. 2021;12(1):1-14. doi:10.1186/s13287-020-02074-y.



Representative co-immunofluorescent staining demonstrates structural features of 3D culture of primary osteocytes derived from non-scoliosis adolescent requiring orthopedic surgery (cytoskeletal F-actin in green; dendrites E11 in red; and nucleus in blue). Scale bar, 25 µm.

Source: Zhang J, Chen H, Leung RKK, Choy KW, Lam TP, Ng BKW, Qiu Y, Feng JQ, Cheng JCY, Lee WYW. Aberrant miR-145-5p/b-catenin signal impairs osteocyte function in adolescent idiopathic scoliosis. FASEB Journal. 2018;32(12):6537-6549. doi:10.1096/fj.201800281.



(A) Photograph of an extracted arthroplasty implant, (B) MARS-CT image and (C) MARS-CT image with ultra-high molecular weight polyethylene digitally removed. The wear at the posteromedial aspect of the polyethylene implant and tibial metallic tray is clearly visible (dotted yellow circle).

Source: Lau LCM, Lee WYW, Butler APH, Chernoglazov AI, Chung KY, Ho KKW, Griffith J, Butler PH, Yung PSH. Multi-energy spectral photon-counting computed tomography (MARS) for detection of arthroplasty implant failure. Scientific Reports. 2021;11(1):1-6. doi:10.1038/s41598-020-80463-2.