李龙龙

博士研究生 | BioMEMS / 生物传感器 / 工程化心脏组织监测

全南国立大学 机械工程系

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面向学术合作、博士后申请和成果归档的完整版本。

个人简介

- 博士研究生，研究方向聚焦于 BioMEMS、多模态生物传感器、工程化心脏组织监测和药物心脏毒性评价。具备 MEMS 器件设计、微纳加工、细胞与组织培养、传感系统搭建和多模态生物信号分析经验。研究工作围绕应变传感器、微电极阵列和 3D 生物电子平台展开，目标是实现心肌组织机械收缩与电活动的同步、长期和定量检测。

教育经历

- 2022-Present | 全南国立大学，机械工程博士，韩国 光州
- 2018-2022 | 温州大学，机械工程本科，中国 温州

科研经历

- 科研经历 1 | 面向工程化心脏组织设计并开发基于 BioMEMS 的多模态传感平台。
- 科研经历 2 | 集成应变传感器与微电极阵列，实现心肌组织机械收缩与电活动的同步监测。
- 科研经历 3 | 建立 3D 工程化心脏组织培养与药物刺激流程，用于药物心脏毒性筛选和疾病模型研究。
- 科研经历 4 | 开发 MATLAB / Python 信号分析流程，用于提取收缩幅值、搏动频率、场电位特征和机电耦合参数。
- 科研经历 5 | 搭建包含低噪声信号采集、显微成像、传感器标定和硬件集成在内的实验测量系统。

技术技能

- 微纳制造 | 光刻、金属沉积、SU-8 / PI 工艺、MEMS 传感器制备、器件封装、传感器表征。
- 生物传感 | 应变传感器、微电极阵列、机电同步监测、低噪声信号采集、传感器标定。
- 细胞与组织工程 | NRVM / hiPSC-CMs 培养、工程化心脏组织构建、胶原 / dECM 生物墨水、药物刺激实验、免疫染色。
- 数据分析 | MATLAB、Python、心脏信号处理、特征提取、可视化、统计分析。
- 系统集成 | DAQ 系统、放大电路、显微成像、自动化测量平台、实验原型机开发。

项目经历

- 2026.03-Present | 仿生心脏缺氧模型与机电评估平台 | MNTL | 开发结合多模态机电读出的体外心脏缺氧模型。 | 集成机械收缩检测与电活动记录，用于工程化心脏组织功能评估。 | 用于疾病相关微环境下心脏组织响应的定量分析。
- 2024.03-2026.03 | 基于 3D 心脏组织的高通量药物毒理筛选平台 | MNTL | 设计并优化面向药物心脏毒性评价的 3D 心脏组织传感平台。 | 整合基于应变的机械读出与电生理读出。 | 支持药物诱导功能响应的长期监测和多参数分析。
- 2022.09-2024.03 | 石墨烯导电微环境对心肌细胞电生理通讯与成熟的调控机制 | MNTL | 研究导电微环境对心肌细胞成熟和细胞间通讯的影响。 | 开发基于 graphene / SU-8 的平台用于提升组织功能表现。 | 支撑期刊论文与国际会议成果输出。

论文发表

- Air-Breakdown Triboelectric Nanogenerator Inspired by Transistor Architecture for Low-Force Human-Machine Interfaces. Karthikeyan Munirathinam, Longlong Li, Arunkumar Shanmugasundaram, Jongsung Park, Dong-Weon Lee. Nano-Micro Letters, 18(1), 251, 2026. Link: 10.1007/s40820-026-02103-0
- Tilted-angle acoustofluidic separation of live and dead neonatal rat ventricular myocytes using hypotonic cell swelling. Mushtaq Ali, Qu Zhuji, Nomin-Erdene Oyunbaatar, Li Longlong, Dong-Weon Lee, Jinsoo Park. Sensors and Actuators B: Chemical, 2026. Link: https://www.sciencedirect.com/science/article/pii/S0925400526006970
- Harnessing native blueprints for designing bioinks to bioprint functional cardiac tissue. Mst Zobaida Akter, Fatima Tufail, Ashfaq Ahmad, Yoon Wha Oh, Jung Min Kim, Seoyeon Kim, Md Mehedee Hasan, Longlong Li, Dong-Weon Lee, Yong Sook Kim, Su-jin Lee,

Hyung-Seok Kim, Youngkeun Ahn, Yeong-Jin Choi, Hee-Gyeong Yi. iScience, 28(3), 2025. Link: https://www.cell.com/iscience/fulltext/S2589-0042(25)00142-7

- Development of multifunctional PAA-alginate-carboxymethyl cellulose hydrogel-loaded fiber-reinforced biomimetic scaffolds for controlled release of curcumin. Kamrun Nahar Fatema, Longlong Li, Khurshid Ahmad, Jongyun Kim, Dong-Weon Lee. International Journal of Biological Macromolecules, 301, 140449, 2025. Link: 10.1016/j.ijbiomac.2025.140449

- Dual-sensitized hollow SnO2 nanospheres with rGO and Pd for highly sensitive detection of acetone in exhaled breath. Arunkumar Shanmugasundaram, Kun Woo Baek, Changung Paeng, Longlong Li, Goeun Cha, Jonghyeon Woo, Dong-Su Kim, Changyong Yim, Jongsung Park, Jung Sang Cho, Dong-Weon Lee. Applied Surface Science, 696, 162959, 2025. Link: https://www.sciencedirect.com/science/article/pii/S0169433225006737

- Hydrogel-Integrated Biomimetic Hydroxyapatite Scaffolds with Tunable Porosity for Enhanced Curcumin Delivery. Kamrun Nahar Fatema, Longlong Li, Khurshid Ahmad, Jongyun Kim, Dong-Weon Lee. Journal of Drug Delivery Science and Technology, 107572, 2025. Link: https://www.sciencedirect.com/science/article/pii/S177322472500975X

- Enhancing cardiomyocyte maturation through PEDOT:PSS-coated surfaces and mechanical stimulation with strain sensors. Jongyun Kim, Arunkumar Shanmugasundaram, Longlong Li, Zhuo Qu, Eung-Sam Kim, Bong-Kee Lee, Dong-Weon Lee. Journal of Micromechanics and Microengineering, 35(4), 045002, 2025. Link: 10.1088/1361-6439/adb8f9

- InGaN-GaN-MQW-ZnO based e-nose sensors for nitrogen dioxide detection using advanced machine learning approaches. Arunkumar Shanmugasundaram, Mandar A. Kulkarni, Changung Paeng, Jonghyeon Woo, Heonzoo Lee, Longlong Li, Huijin Lee, Changyong Yim, Yonggwan Won, Sang-Wan Ryu, Jongsung Park, Dong-Weon Lee. Sensors and Actuators B: Chemical, 138650, 2025. Link: https://www.sciencedirect.com/science/article/pii/S0925400525014261

- Graphene SU-8 platform for enhanced cardiomyocyte maturation and intercellular communication in cardiac drug screening. Longlong Li, Arunkumar Shanmugasundaram, Jongyun Kim, Nomin-Erdene Oyunbaatar, Pooja P. Kanade, Seong-Eung Cha, Daeyun Lim, Chil-Hyoung Lee, Young-Baek Kim, Bong-Kee Lee, Eung-Sam Kim, Dong-Weon Lee. ACS Nano, 18(49), 33293-33309, 2024. Link: 10.1021/acsnano.4c05365

学术会议 - 口头报告

- Multimodal Microelectrode-Microcantilever Array for Electromechanical Analysis of Cardiomyocyte Tissue in Drug Testing. Haolan Sun, Longlong Li, Eung-Sam Kim, Bong-Kee Lee, Dong-Weon Lee. IEEE MEMS 2026, Salzburg, Austria, 2026. Link: https://ieeexplore.ieee.org/abstract/document/11419567

- A Dual-Detection Approach for Cardiotoxicity Screening: Utilizing Nano Silicon Strain Sensor and Mea to Monitor Contractility and Field Potential in Cardiomyocytes. Haolan Sun, Longlong Li, Dong-Weon Lee. IEEE MEMS 2025, Kaohsiung, Taiwan, 2025. Link: https://ieeexplore.ieee.org/abstract/document/10917809

- Enhancing Cardiomyocyte Maturation via Mechanical Stimulation of 3D Printed Cardiac Tissue Using a Origami-based 3D Sensor and Magnetic Fields. Longlong Li, Haolan Sun, Jong-Yun Kim, Yun-Jin Jeong, Bong-Kee Lee, Eung-Sam Kim, Dong-Weon Lee. IEEE NANOMED 2024, Hawaii, USA, 2024. Link: https://ieeexplore.ieee.org/abstract/document/10946052

- The hybrid cantilever of conductive graphene and su-8 for improving the maturity and electrical coupling of cardiomyocytes. Longlong Li, Jong-Yun Kim, Daeyun Lim, Chil-Hyoung Lee, and Dong-Weon Lee. MicroTAS 2023, Katowice, Poland, 2023

学术会议 - 海报展示

- Real-Time Electromechanical Monitoring of Engineered Heart Tissue Responses to Cardiac Drugs. Longlong Li, Haolan Sun, Jong-Yun Kim, Dong-Weon Lee. KSPE 2026, Jeju, Korea, 2026

- 3D Cardiac Tissue Platform for Monitoring Contractility and Assessing Cardiotoxicity. Longlong Li, Haolan Sun, Jong-Yun Kim, Dong-Weon Lee. KMEMS 2025, Jeju, Korea, 2025

- Origami-Inspired 3D Sensor Platform for Real-Time Electromechanical Coupling Analysis in Engineered Heart Tissues. Longlong Li, Fatima Tufail, Haolan Sun, Jongyun Kim, Hee-Gyeong Yi, Dong-Weon Lee. IEEE SENSORS 2025, Vancouver, Canada, 2025. Link: https://ieeexplore.ieee.org/abstract/document/11330375

- Integrated Bioelectronic Platform Utilizing PEDOT: PSS Strain Sensors for Real-Time Mechanostimulation and Sensing. Zhuji Qu, Jongyun Kim, Haolan Sun, Longlong Li, Dong-Weon Lee. IEEE SENSORS 2025, Vancouver, Canada, 2025. Link: https://ieeexplore.ieee.org/abstract/document/11331195

- Development of a Multi-Channel Wireless Monitoring Platform for Long-Term Cardiomyocyte Contraction Assessment Using a Polymer Cantilever with integrated Sensor. Ke Liu, Haolan Sun, Longlong Li, Dong-Weon Lee. MicroTAS 2025, Adelaide, Australia, 2025

- Enhancement of cardiomyocyte microenvironment and functional assessment using through-hole structures with integrated polymer cantilevers. Fusong Li, Haolan Sun, Longlong Li, Jong-Yun Kim, Dong-Weon Lee. MicroTAS 2025, Adelaide, Australia, 2025

- Polymer Cantilever Integrated with a Full-Bridge Sensor for Continuous Wireless Measurement of Cardiomyocyte Contractility. Ke Liu, Haolan Sun, Longlong Li, Dong-Weon Lee. MicroTAS 2024, Montreal, Canada, 2024

- MONITORING OF DRUG-IMFACTED CARDIOMYOCYTES CONTRACTILITY USING PI MICROCANTILEVER STRUCTURES WITH NANO-SILICON STRAIN SENSOR. Haolan Sun, Longlong Li, Dong-Weon Lee. MicroTAS 2024, Montreal, Canada, 2024

专利

- 15 项专利 | 3 项发明专利 | 3 项授权发明 | 11 项实用新型

- 一种基于纵向折叠的叠衣机. 发明人: Wu Mingge, Wei Jinliang, Li Longlong, Yang Yang, Huang Andong, Bao Haibo, Shen Yunde. 申请人/专利权人: Wenzhou University. 专利/申请号: CN113186699B / 202110624021.0. 状态: 授权发明专利. 申请日: 2021.06.04. 授权/公布日: 2023.02.07

- 一种家用玩具智能收纳机器人. 发明人: Li Longlong, Zhou Chen, Gao Kewei, Wu Yu, Chen Haodong, Zhang Zhiquan. 申请人/专利权人: Wenzhou University. 专利/申请号: CN112407980B / 202011170715.3. 状态: 授权发明专利. 申请日: 2020.10.28. 授权/公布日: 2022.01.18

- 自动马铃薯收获机. 发明人: Shen Yunde, Li Longlong, Yang Yang, Wu Mingge, Zhang Chenghao. 申请人/专利权人: Wenzhou University. 专利/申请号: CN113875385A / 202111383414.3. 状态: 发明专利申请. 申请日: 2021.11.22. 授权/公布日: 2022.01.04

- 一种无人机集群的智能收发管理装置. 发明人: Yang Yang, Zhou Chen, Li Longlong, Chen Haodong. 申请人/专利权人: Wenzhou University. 专利/申请号: CN216269980U / 202123168608.X. 状态: 实用新型专利. 申请日: 2021.12.16. 授权/公布日: 2022.04.12

- 用于马铃薯收获机的牵引装置. 发明人: Yang Yang, Ma Guang, Li Longlong, Yin Zhi, Wu Mingge, Shen Yunde. 申请人/专利权人: Wenzhou University. 专利/申请号: CN216232634U / 202122864096.4. 状态: 实用新型专利. 申请日: 2021.11.22. 授权/公布日: 2022.04.08

- 用于马铃薯收获机的薯土分离装置. 发明人: Li Longlong, Ma Guang, Yang Yang, Wang Tao, Wu Mingge, Shen Yunde. 申请人/专利权人: Wenzhou University. 专利/申请号: CN216253977U / 202122864125.7. 状态: 实用新型专利. 申请日: 2021.11.22. 授权/公布日: 2022.04.12

- 马铃薯挖掘装置. 发明人: Yang Yang, Wu Mingge, Li Longlong, Yang Demin, Shen Yunde. 申请人/专利权人: Wenzhou University. 专利/申请号: CN216313996U / 202122864112.X. 状态: 实用新型专利. 申请日: 2021.11.22. 授权/公布日: 2022.04.19

- 一种自动马铃薯收获机. 发明人: Li Longlong, Shen Yunde, Yang Yang, Wang Tao, Wu Mingge. 申请人/专利权人: Wenzhou University. 专利/申请号: CN216415123U / 202122859852.4. 状态: 实用新型专利. 申请日: 2021.11.22. 授权/公布日: 2022.05.03

- 基于凸轮轨道收口热封的垃圾桶. 发明人: Yang Yang, Han Yifei, Li Longlong, Pan Weijie, Liu Jintao, Shen Yunde. 申请人/专利权人: Cixi Zhuoshang Electric Appliance Co., Ltd.; Wenzhou University. 专利/申请号: CN216234167U / 202122813075.X. 状态: 实用新型专利. 申请日: 2021.11.17. 授权/公布日: 2022.04.08

- 一种锌合金扒渣机器人及其工作方法. 发明人: Ma Guang, Sun Haolan, Wei Jinliang, Chen Haodong, Li Longlong, Gao Kewei, Shen Yunde. 申请人/专利权人: Wenzhou University. 专利/申请号: CN111923063B / 202010801270.8. 状态: 授权发明专利. 申请日: 2020.08.11. 授权/公布日: 2021.07.16

- 一种用于叠衣机的对折打卷伸缩转臂. 发明人: Li Longlong, Wu Mingge, Bao Haibo, Shen Yunde. 申请人/专利权人: Wenzhou University. 专利/申请号: CN215163984U / 202121243359.3. 状态: 实用新型专利. 申请日: 2021.06.04. 授权/公布日: 2021.12.14

- 一种用于倾倒物体的车兜翻转机构. 发明人: Zhang Zhiquan, Jiang Rui, Wu Yu, Chen Haodong, Gao Kewei, Li Longlong. 申请人/专利权人: Wenzhou University. 专利/申请号: CN213443970U / 202022431595.X. 状态: 实用新型专利. 申请日: 2020.10.28. 授权/公布日: 2021.06.15

- 一种用于抬升物体的同步多剪叉式升降机装置. 发明人: Wu Yu, Zhou Chen, Chen Haodong, Zhang Zhiquan, Gao Kewei, Li Longlong. 申请人/专利权人: Wenzhou University. 专利/申请号: CN213446006U / 202022431602.6. 状态: 实用新型专利. 申请日: 2020.10.28. 授权/公布日: 2021.06.15

- 一种家用玩具智能收纳机器人的同步带玩具收集机构. 发明人: Gao Kewei, Cheng Taihong, Li Longlong, Chen Haodong, Zhang Zhiquan, Wu Yu. 申请人/专利权人: Wenzhou University. 专利/申请号: CN213536204U / 202022431641.6. 状态: 实用新型专利. 申请日: 2020.10.28. 授权/公布日: 2021.06.25

- 锌合金扒渣机器人. 发明人: Sun Haolan, Ma Guang, Wei Jinliang, Chen Haodong, Li Longlong, Gao Kewei, Shen Yunde. 申请人/专利权人: Wenzhou University. 专利/申请号: CN212763486U / 202021656863.1. 状态: 实用新型专利. 申请日: 2020.08.11. 授权/公布日: 2021.03.23

奖励荣誉

- 2025 | BK21 Fellowship Scholarship | BK21 | 奖学金 / 资助

- 2025 | RLRC Outstanding Graduate Student | Institute-level honor | RLRC | 学术荣誉
- 2025 | Outstanding Paper Award, KMEMS 2025 | Conference paper award | KMEMS 2025 | 因在 KMEMS 2025 发表的优秀会议论文获奖。
- 2025 | Best Poster Presentation Award, KSS 2025 | Conference paper award | KSS 2025 | 因在 KSS 2025 发表的优秀会议论文获奖。
- 2021 | 中国国家奖学金 | National-level scholarship | China | 国家级奖学金，中国
- 2021 | 浙江省第十八届机械设计大赛（厨房机械） | Provincial Second Prize | 省二等奖，参与
- 2020 | 中国第三届高校智能机器人创意大赛 | National Second Prize | 国家二等奖，参与
- 2020 | 第十二届全国大学生数学竞赛 | National Third Prize | 国家三等奖
- 2020 | 浙江省第十七届机械设计大赛（智能家居） | Provincial First Prize | 省一等奖，负责人
- 2019 | 浙江省政府奖学金 | Provincial-level scholarship | Zhejiang Provincial Government | 省级奖学金，浙江省，中国
- 2019 | 浙江省第十五届大学生运动会（轮滑球） | Provincial First Prize | 省一等奖，参与
- 2019 | 浙江省首届智能机器人创意大赛（循迹越障小车） | Provincial Second Prize | 二等奖，参与