MICHIGAN ENGINEERING
MECHANICAL ENGINEERING
UNIVERSITY OF MICHIGAN

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Chongjian Gao

Curriculum Vitae

(Google Scholar)

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EDUCATION

University of Michigan, Ann Arbor, MI, USA — Sept. 2024 - present
Doctor of Philosophy (Ph.D.) in Mechanical Engineering
Research Area: Biomechanics & Biosystems Engineering

The Hong Kong Polytechnic University, Kowloon, Hong Kong — Jul. 2024
Master of Philosophy (M.Phil.) in Biomedical Engineering
Research Area: Molecular and Cellular Engineering

Chongqing University, Chongqing, China — Jun. 2019
Bachelor of Engineering (B.E.) in Bioengineering

ACADEMIC EXPERIENCE — Google Scholar Citations: 276

University of Michigan, Ann Arbor
PhD Student | ***Department of Mechanical Engineering*** — Sept. 2024 - present
Integrated Biosystems and Biomechanics Laboratory
Research: Stem Cell and Biosystem | *3D Stem Cell System via Microfluidics*
Supervisor: Prof. Jianping Fu (https://me-web.engin.umich.edu/ibbl/)

The Hong Kong Polytechnic University
MPhil Student | ***Department of Biomedical Engineering*** — Sept. 2022 - Jul. 2024
Ageing Research and Therapy Laboratory
Research: Osteoarthritis and Aging | *3D Bioprinted Joint-on-a-Chip System*
Supervisor: Prof. Chunyi Wen (https://www.chunyi-wen-lab.com/)
Thesis: "The Manufacture and Application of Joint-on-a-Chip *via* 3D Bioprinting"

① With coaxial 3D bioprinting technology, we integrated both blood flow and synovial flow, that is a double flow system, into this joint-on-a-chip. The relevance between osteoarthritis and this double flow system was firstly revealed. Two kinds of drug delivery methods, blood delivery system and synovial delivery system, were compared. With the help of this chip, high-throughput OA drug screening was performed.

Chinese Academy of Sciences, Shenzhen Institute of Advanced Technology

Research Assistant (RA) | ***Institute of Biomedicine and Biotechnology*** Jul. 2019 - Aug. 2022

Human Tissue and Organ Degeneration Research Center

Research: New Bioprinting Technology | *Gelatin-based Bio-ink and Multifunctional Co-axial Printing Nozzle*

Supervisor: Prof. Changshun Ruan (https://www.x-mol.com/groups/csruan)

① To construct a high-strength microtube for load-bearing tissue regeneration, we synthesized a high strength hydrogel — H-bonding monomer N-acryloyl glycinamide (NAGA) and composed it with nano-clay and GelMA as a customized biohybrid hydrogel ink. Through co-axial extrusion, microtubes with sufficient mechanical properties, controllable inherent swelling attribute, and functional endothelialization could be fabricated.

② Extrusion-based bioprinting is limited by its efficiency and fidelity, while the using of co-axial nozzle could be an improvement. However, direct co-axial printing could only plot tubes without interconnection between channels. Therefore, I redesigned the co-axial nozzle which could direct bioprinting complex tissue with interpenetrating fluidic networks. To maximize the potential of the new co-axial nozzle, I also designed bioinks with good shear-thinning behavior and self-supporting property based on methacrylated gelatin (GelMA)/β-cyclodextrin (β-CD) and methacrylated alginate (AlgMA)/methacrylated ε-polylysine (PLMA).

Chongqing University

Undergraduate Student | ***Bioengineering College*** Sept. 2017 - Nov. 2018

Research: Microfluidics and Lab on a Chip | *Microfiber and Microdroplet*

Supervisor: Prof. Jiahuan Jiang

Thesis: "The Preparation of Biological Hollow Microfibers *via* Microfluidic 3D Printing"

① A double co-axial microfluidic device was developed and its flow-control method was discussed. As a result, I can fabricate hollow fiber with size and shape (straight or helical inner channel) on demand. Furthermore, to facilitate continuous perfusion in the micron-level inner tube via the same device, I proposed a seamless flow connector on the end of the newly formed hollow microfiber by using the flow mode "extraction".

② In my undergraduate thesis, I further improved this microfluidic device into a 3D printing nozzle that could control three different cells' suspended media simultaneously. Subsequently, hybrid hollow microfibers were directionally arranged along an auxiliary collecting roller. As a result, I could directly 3D print a three-layer vessel structure with nutrient vessels embedded in the tubular wall.

WORKING EXPERIENCE

University of Michigan, Ann Arbor

Graduate Research Assistant (RA) | ***Department of Mechanical Engineering*** Sept. 2024 - present

Chinese Academy of Sciences, Shenzhen Institute of Advanced Technology

Research Assistant (RA) | ***Institute of Biomedicine and Biotechnology*** Jul. 2019 - Aug. 2022

TEACHING EXPERIENCE

The Hong Kong Polytechnic University

Teaching Assistant (TA) | **BME1D04** Sept. 2023 - Dec. 2023

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Skin-Care Technologies: Principles, Applications and Safety
Instructor: Prof. Xin Zhao, Dr. Yuhe Yang, Dr. Dexter Siu Hong Wong

SKILLS

Microfluidic chip based on PDMS or pulled glass capillary/PMMA, CNC milling machine
Polymer modification, NMR spectrum, FT-IR spectra, Rheological measurements, Mechanical characterization
Bioprinting, G-coding, 3D Modeling, Organ-on-a-Chip
Cell culture (Live/Dead, DAPI/F-actin, CCK-8, etc.), Immunostaining, Subcutaneous implantation
Auto CAD, Solid Works, Rhinoceros 6, Grasshopper

FUNDED PROJECT

Host

Student Research Training Program (SRTP) - Project Budget: **2, 000 RMB** Jul. 2017 - Jul. 2018
Topic: "Generating a Segment of Renal Tubule *In Vitro* with Microfluidics"

Main participation

National Key Research and Development Program - International Collaboration Jan. 2024 - Jan. 2026
Mainland-Hong Kong Joint Funding Scheme (MHKJFS)
Project Budget: **1.5 M HKD** and **2 M RMB**
Topic: "3D Bioprinting Human Joint-on-a-chip Platform for Drug Screening towards Personalized Osteoarthritis Therapy", MHP/037/23 and 2023YFE0210500.

Shenzhen Science and Technology Plan Project - Project Budget: **300, 000 RMB** Oct. 2022 - Oct. 2025
Topic: "3D Bioprinting Active Gradient Scaffold Regulates Inflammation and Promotes Cartilage Repair in Osteoarthritis", JCYJ20220531100602004.

PUBLICATIONS

(#: *co-first author*; *: *corresponding author*)

First-author Journal Article

1. ***Chongjian Gao***#, Huawei Qu#, Pinpin Wang#, Zhongqing Wu, Juan Liu, Kaizheng Liu, Zhengwei Li, Xiao Wang, Shun Li, Hongjing Zhang, Changshun Ruan*, "Multi-Nozzle Aided Parallel Co-Axial Additive Manufacture," (in progress).
2. ***Chongjian Gao***, Zhongqing Wu, Chunyi Wen, Haobo Pan, Changshun Ruan*, "Multiscalar Circulation System: A Key Issue in Artificial Organ Manufacturing," ***The Innovation Life***, 2025, 3(1), 100121. (**Editorial**)
3. ***Chongjian Gao***#, Lan Tang#, Huawei Qu, Mingming Wu, Tian Zhou, Chunyi Wen, Pinpin Wang*, Nan Xu*, Changshun Ruan*, "A Small-Molecule Polycationic Crosslinker Boosts Alginate-Based Bioinks for Extrusion Bioprinting," ***Advanced Functional Materials***, 2024, 34(9), 2310369. (**Back Cover**)
4. ***Chongjian Gao***, Xuedong Wang, Qian Du, Junying Tang, Jiahuan Jiang*, "Generation of Perfusable Hollow Calcium Alginate Microfibers with a Double Co-Axial Flow Capillary Microfluidic Device," ***Biomicrofluidics***, 2019, 13(6), 064108. (**Editor's Pick**)

Other Journal Article

1. Xiang Gao#, Jirong Yang#, Lingna Liu#, Zilong Hu, Rui Lin, Lan Tang, Mei Yu, Zhiping Chen, ***Chongjian Gao***,

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Min Zhang, Li Li*, Changshun Ruan*, Yanzhi Liu*, "An Electrostatic Encapsulation Strategy to Motivate 3D-Printed Polyelectrolyte Scaffolds for Repair of Osteoporotic Bone Defects," ***Bioactive Materials***, 2025, 46, 1-20.

2. Huawei Qu, Kaizheng Liu, Juan Liu, ***Chongjian Gao***, Changshun Ruan*, "A Heterogeneous Pore Design Algorithm for Material Extrusion Additive Manufacturing," ***Additive Manufacturing***, 2024, 94, 104449.
3. Zhengwei Li, Shun Li, ***Chongjian Gao***, Juan Liu, Huawei Qu, Jirong Yang, William Weijia Lu, Changshun Ruan*, Xufeng Niu*, "Continuous Manufacturing of Bioinspired Bone-Periosteum Integrated Scaffold to Promote Bone Regeneration," ***Advanced Functional Materials***, 2024, 2403235.
4. Huawei Qu, ***Chongjian Gao***, Kaizheng Liu, Hongya Fu, Zhiyuan Liu, Paul H. J. Kouwer, Zhenyu Han* and Changshun Ruan*, "Gradient Matters *via* Filament Diameter-Adjustable 3D Printing," ***Nature Communications***, 2024, 15, 2930.
5. Jirong Yang, Zhigang Chen, ***Chongjian Gao***, Juan Liu, Kaizheng Liu, Xiao Wang, Xiaoling Pan, Guocheng Wang, Hongxun Sang, Haobo Pan, Wenguang Liu and Changshun Ruan*, "A Mechanical-Assisted Post-Bioprinting Strategy for Challenging Bone Defects Repair," ***Nature Communications***, 2024, 15, 3565.
6. Pinpin Wang, Hao Rui, ***Chongjian Gao***, Chunyi Wen, Haobo Pan, Wenguang Liu, Changshun Ruan* and William Weijia Lu*, "Bioprinting Living Organs: The Next Milestone in Organ Transplantation?" ***The Innovation Life***, 2023, 1(2), 100019. (Perspectives)
7. Zhengwei Li, Tianming Du, ***Chongjian Gao***, Lan Tang, Kinon Chen, Juan Liu, Jirong Yang, Xiaoli Zhao, Xufeng Niu*, and Changshun Ruan*, "*In-situ* Mineralized Homogeneous Collagen-Based Scaffolds for Potential Guided Bone Regeneration," ***Biofabrication***, 2022, 14, 045016.
8. Duomei Tian[#], Huanhuan Wan[#], Jiareng Chen[#], Yongbin Ye[#], Yong He, Yu Liu, Luyao Tang, Zhongyuan He, Kaizheng Liu, ***Chongjian Gao***, Shenglin Li, Qian Xu, Zheng Yang, Chen Lai, Xiaojun Xu, Changshun Ruan, Yunsheng Xu*, Chao Zhang*, Liang Luo*, Leping Yan*, "*In-situ* Formed Elastin-Based Hydrogels Enhance Wound Healing *via* Promoting Innate Immune Cells Recruitment and Angiogenesis," ***Materials Today Bio***, 2022, 15, 100300.
9. Huawei Qu, Zhenyu Han, Zhigang Chen, Lan Tang, ***Chongjian Gao***, Kaizheng Liu, Haobo Pan*, Hongya Fu*, Changshun Ruan*, "Fractal Design Boosts Extrusion-Based 3D Printing of Bone-Mimicking Radial-Gradient Scaffolds," ***Research***, 2021, 2021, 9892689.
10. Qingfei Liang, Fei Gao, Zhiwen Zeng, Jirong Yang, Mingming Wu, ***Chongjian Gao***, Delin Cheng, Haobo Pan*, Wenguang Liu*, and Changshun Ruan*, "Coaxial Scale-Up Printing of Diameter-Tunable Biohybrid Hydrogel Microtubes with High Strength, Perfusability, and Endothelialization," ***Advanced Functional Materials***, 2020, 30(43), 2001485.

PATENTS

Issued

1. Changshun Ruan, ***Chongjian Gao***, and Lan Tang, "A Co-axial Nozzle, 3D Printing Method and Its Application," CN Patent Application No. CN202110956357.7 (filed 8/19/2021) and Publication No. CN115707570A; International Patent Application No. PCT/CN2021/113526 (filed 8/19/2021) and Publication No. WO2023019512A1.
2. Changshun Ruan, Lan Tang, Zhigang Chen, ***Chongjian Gao***, Jirong Yang, "Composition and Method for 3D Printing of Living Cells," CN Patent Application No. CN202111180495.7 (filed 10/11/2021) and Publication No. CN114053483A; International Patent Application No. PCT/CN2021/138115 (filed 12/14/2021) and Publication No. WO2023060747A1.

In-progress (pending)

1. Changshun Ruan, ***Chongjian Gao***, Pinpin Wang, Zhongqing Wu, Kaizheng Liu, "A Preparation Method of a

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Bioink and 3D Biomaterial Scaffold," CN Patent Application No. CN202311674094.6 (filed 12/06/2023).

2. Changshun Ruan, ***Chongjian Gao***, Huawei Qu, Pinpin Wang, Kaizheng Liu, "A Tubular Structure Printing Method, Device, Computer Equipment and Storage Medium," CN Patent Application No. CN202311502942.5 (filed 11/10/2023).
3. Changshun Ruan, Pinpin Wang, ***Chongjian Gao***, Mingming Wu, "A Preparation Method of Controllable Gradient Stent and Controllable Gradient Stent," CN Patent Application No. CN202311221438.8 (filed 9/20/2023); International Patent Application No. PCT/CN2023/137704 (filed 12/09/2023).
4. Changshun Ruan, Kaizheng Liu, ***Chongjian Gao***, Huawei Qu, Xinyi Fang, "A Preparation Method of a Photo-Crosslinked Polyisocyanide Hydrogel for 3D Printing," CN Patent Application No. CN202311252471.7 (filed 9/26/2023); International Patent Application No. PCT/CN2023/137586 (filed 12/08/2023).

PRESENTATIONS

Poster

1. ***Chongjian Gao***, Xuedong Wang, Qian Du, Junying Tang, Jiahuan Jiang*, "Fabrication of Flow Connector for Microfluidic Usage of Hollow Ca-Alginate Microfibers," ***The Second International Conference of Microfluidics, Nanofluidics and Lab-on-a-Chip***, Beijing, China (June 2018).
2. ***Chongjian Gao***, Chunyi Wen, Pinpin Wang, Changshun Ruan*, "A Small-Molecule Polycationic Crosslinker Boosts Alginate-Based Bioinks for Extrusion Bioprinting," ***Chinese Biomaterials Congress 2023***, ***Chinese Society for Biomaterials (CSBM)***, Chongqing, China (October 2023).

AWARDS

Excellent Staff Award - *Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences*
Top Papers Award - *Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences*
Graduate Student Research Assistantship (GSRA) - *University of Michigan, Ann Arbor*
Excellent Posters Award - *The 2024 Regenovo (7th) 3D BioPrinting Conference*

REFERENCE MEMEBERS

Prof. Jianping Fu (jpfu@umich.edu) **Professor |** University of Michigan, Ann Arbor
Prof. Changshun Ruan (cs.ruan@siat.ac.cn) **Professor |** Chinese Academy of Sciences
Prof. Chunyi Wen (chunyi.wen@polyu.edu.hk) **Associate Professor |** The Hong Kong Polytechnic University
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