

# Boyang Zhang, PhD

Assistant Professor  
Department of Chemical Engineering  
McMaster University

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Permanent resident of Canada

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## Education

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### University of Toronto, Canada

July 2010-April 2016

Doctor of Philosophy in Chemical Engineering & Applied Chemistry

- Doctoral thesis: "A microfluidic approach to tissue vascularization"

#### Awards:

- Canada's Distinguished Dissertation Award in Engineering/Medical science 2017
- MedTech's Rising Star 2016
- NSERC CREATE in Manufacturing, Materials and Mimetics (M3) Scholarship 2013-2015
- NSERC MATCH Innovation Award 2014
- Irving O. Shoichet Graduate Scholarship 2012-2014
- University of Toronto Inventor of the Year Award 2013
- Heart and Stroke Scholarship 2013
- NSERC MATCH Program Doctoral Scholarship 2010-2013

### Georgia Institute of Technology (Georgia Tech), U.S.A

August 2006-May 2010

Bachelor of Science in Chemical and Biomolecular Engineering

- Major GPA: 4.0/4.0
- Cumulative GPA 3.9/4.0

#### Awards:

- Air Products Undergraduate Sustainability Researcher Award 2009
- President's Undergraduate Research Award 2008
- Nien-Tseng Nelson Ku Scholarship 2007-2009

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## Experience

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### Assistant Professor (tenure-track), McMaster University

July 2018-Present

Lead investigator of the Laboratory of Tissue and Organ Assembly, [www.bzhanglab.com](http://www.bzhanglab.com)

- Lead the research in large-scale tissue regeneration and high-throughput organ-on-a-chip engineering
- Taught fundamental courses in Chemical Engineering

### Postdoctoral Fellow (Banting Fellow), University of Toronto

April 2016-Present

Supervisor: Dr. Milica Radisic

- Received the prestigious **Banting Postdoctoral Fellowship** (\$70,000 per year)
- Currently Developing a Kidney-on-a-Chip platform for perfusion culture of kidney biopsies containing a complete nephron structure *ex vivo* to probe patient specific drug response in real time.

- Leading a collaboration with GSK to develop a biomimetic 3D platform with out-of-plane curvature to induce nephrin upregulation in differentiating kidney podocytes *in vitro*
- Supervising 2 PhD students and leading two publications as the senior and co-corresponding author
- Wrote grant proposals (NSEC Engage and NSERC CRD) to support the next phase of the kidney project with GSK
- Developed **AngioTube 96-well-plate**, a novel multi-organ system for drug target validation.
  - Technology under option by TARA Biosystems, Inc.

## Co-founder of TARA Biosystem, Inc.

July 2014-Present

- Worked with a team of researchers and venture capitalists (Harris & Harris group) to commercialize a novel platform (**Biowire™**) for predictive cardiac drug testing
- Developed and supervised the manufacturing process of the **Biowire™** 96-well-plates.
- The company raised \$2.75 million to build commercial operations in New York City
  - Yahoo Finance (<http://finance.yahoo.com/news/harris-harris-group-portfolio-company-143421050.html>)
  - Xonomy (<http://www.xconomy.com/new-york/2016/01/05/with-2-25m-more-tara-bio-grows-and-hunts-for-nyc-lab-space/>)
- Nominated with co-founder, Kacey Ronaldson, by Columbia University for Forbes 30 under 30 and was selected as a semi-finalist.

## Graduate researcher, University of Toronto

July 2010-April 2016

Supervisor: Dr. Milica Radisic

- Developed **AngioChip**, a novel microfluidic scaffold with built-in vascular networks for tissue vascularization, organ-on-a-chip engineering and direct surgical anastomosis.
  - Featured on the cover the June issue of Nature Materials in 2016
  - Technology under option by TARA Biosystems, Inc.
  - Covered by various media agencies
    - **Toronto Star (2.3 million weekly readers in print and online):** <http://www.thestar.com/news/gta/2016/03/07/u-of-t-researchers-develop-homegrown-human-on-a-chip.html>
    - **CBC (both online, with 11M unique monthly visitors (UMV), and broadcast on The National):** <http://www.cbc.ca/news/technology/heart-on-a-chip-1.3461783>)
    - **MetroNews Toronto (2M UMV):** (<http://www.metronews.ca/news/toronto/2016/03/07/u-of-t-researchers-develop-homegrown-human-on-a-chip.html>)
    - **Yahoo! News (175M UMVs):** <https://in.news.yahoo.com/3-d-heart-liver-tissues-function-real-organs-094004488.html>
- Developed **Tissue Velcro™** for rapid assembly and disassembly of functional tissue co-culture.
  - Technology under option by TARA Biosystems, Inc.
  - Covered by various media agencies
    - **Popular Science:** <http://www.popsci.com/synthetic-heart-tissue-takes-inspiration-velcro>
    - **Motherboard Vice:** <http://motherboard.vice.com/read/this-lab-grown-tissue-snaps-together-like-velcro>



- **New Scientist:** <https://www.newscientist.com/article/dn28111-live-cells-stuck-together-like-velcro-could-mend-broken-hearts/>
- **The Scientist:** <http://www.the-scientist.com/?articles.view/articleNo/43858/title/Next-Generation--Cell-Covered-Fastener/>
- Developed a standalone microfluidic perfusion platform for drug testing and target validation in microvessel networks.
- Developed a microfluidic cell-sorting device used to purify cardiomyocytes from digested heart tissue of neonatal rats.
- Contributed to the writing of a Canada Foundation for Innovation (CFI) grant.
- Supervised 4<sup>th</sup> year thesis students and summer students on projects that resulted in a number of publications.
- Organized the 16th annual CSChE Ontario-Quebec Biotechnology Meeting (2014) as an integral member of the organization committee.

## **Process Technology Committee (PTC), Toronto Microfluidic Foundry** 2012-2014

Advisor: Dr. Axel Guenther, University of Toronto

- Provided monthly orientation & training for new users.
- Student representative on a panel for selection & hiring of two new technicians.
- Organized annual micro-fabrication technique student talks.
- Advised on user policies and fabrication protocols where needed.

## **Undergraduate researcher, Lu Fluidics Groups** August 2007-May 2010

Advisor: Dr. Hang Lu, Georgia Tech

- Developed a novel image acquisition technique that can track and map the flow pattern of micro-particles in a microfluidic mixer. This technique was used to understand the solid/fluid dynamic under complex flow conditions in microfluidic systems.
- Analyzed the performance of a novel microfluidic device used for multiple time-point stimulation of T-cells.

## **Patents**

- **Zhang B**, Miles M, Radisic M: “An elastic scaffold with shape-memory for functional tissue delivery” Provisional patent filed in 2014
- **Zhang B**, Miles M, Radisic M: “Tissue velcro for rapid 3D patterning of functional co-culture” Provisional patent filed in 2014
- **Zhang B**, Miklas J, Radisic M, Thavandiran N, Vasconcelos S, Xiao Y, Zhao Y: “Platform for cultivation of tissue” United States patent pending. Filed 2013.
- **Zhang B**, Axel Guenther, Lian Leng, Arianna McAllister, Milica Radisic: “A device and methods for producing controlled heterogeneity” United States patent pending. Filed 2012.

## **Peer-reviewed journal articles** (4734 citations, h-index = 13, \*corresponding author)

1. **Zhang B.**, Lai B., Xie R., Davenport L., Montgomery M., Radisic M., Microfabrication of AngioChip, a biodegradable polymer scaffold with microfluidic vasculature. (In press, **Nature Protocol**)

2. **Zhang B.**, Korolj A., Lai F., Radisic M., Advances in organ-on-a-chip engineering. (In press, **Nature Review Materials**)
3. Korolj A., Lanschinger C., James C., Hu E., Willet R., Smith N., Ahadian S., Radisic M.\*, **Zhang B.\*** Biomimetic 3D platform induces nephrin upregulation in differentiating podocytes *in vitro*. (Under review at **Lab on a Chip**). 2016.
4. Lai B., Davenport L., Drecun S., Pancke A., Radisic M.\*, **Zhang B.\***. InVADE: Integrated Vasculature for Assessing Dynamic Events. **Advanced Functional Materials**, 2017.
5. Takebe T., **Zhang B.**, Radisic M., Synergistic Engineering: Organoids meets Organs-on-a-Chip, **Cell Stem Cell**, 2017.
6. **Zhang B.\***, Radisic M.\*, Organ-on-a-Chip devices advance to market. **Lab on a Chip**, 2017.
7. Ahadian S., Civitarese R., Bannerman D., Mohammadi M., Rick L., Wang Y., Huyer L., Lai F., **Zhang B.**, Zhao Y., Mandla S., Korolj A., Radisic, M., Organ-on-a-chip Platforms: A Convergence of Advanced Materials, Cells, and Microscale Technologies, **Advanced Healthcare Materials** (in press), 2017.
8. Massé S., Magtibay K., Jackson N., Asta J., Kusha M., **Zhang B.**, Balachandran R, Radisic M., Deno D. C., and Nanthakumar K. Resolving myocardial activation with novel omnipolar electrograms. **Circulation – Arrhythmia and Electrophysiology**. 2016.
9. Davenport Huyer L, **Zhang B**, Korolj A, Montgomery M, Drecun S, Conant G, Zhao Y, Reis L, Radisic M. A highly elastic and moldable polyester biomaterial for cardiac tissue engineering applications. **ACS Biomaterials Science & Engineering**. 2016.
10. **Zhang B**, Montgomery M, Chamberlain M.D., Ogawa S., Korolj, A., Pahnke A, Wells L.A., Massé S, Kim J, Reis L, Abdulah M, Nunes S.S., Nanthakumar K, Gordon, K., Sefton M.V., Radisic M. Biodegradable scaffold with built-in vasculature for organ-on-a-chip engineering and direct surgical anastomosis. **Nature Materials (Featured on the cover)**. 2016.
11. **Zhang B**, Montgomery M, L Davenport-Huyer, A Korolj, Radisic M. Platform technology for scalable assembly of instantaneously functional mosaic tissues. **Science Advances**. 2015; 1 (7), e1500423.
12. **Zhang B** (co-first author), Montgomery M, Radisic M. Cardiac Tissue Vascularization: from Angiogenesis to Microfluidic Blood Vessels. **Journal of Cardiovascular Pharmacology and Therapeutics**. 2014; 1074248414528576.
13. Miklas JW, Nunes SS, **Zhang B**, Radisic M. Design and fabrication of biological wires. **Cardiac Tissue Engineering: Methods and Protocols**. 2014; 157-165.
14. Dang LT, Feric NT, Laschinger C, Chang WY, **Zhang B**, Wood GA, Stanford WL, Radisic M. Inhibition of apoptosis in human induced pluripotent stem cells during expansion in a defined culture using angiopoietin-1 derived peptide QHREDGS. **Biomaterials**. 2014; 35 (27), 7786-7799.
15. Xiao Y, **Zhang B**, Liu H, Miklas JW, Gagliardi M, Pahnke A, Thavandiran N, Sun Y, Simmons C, Keller G, Radisic M. Microfabricated perfusable cardiac biowire: a platform that mimics native cardiac bundle. **Lab on a Chip (Cover article)**. 2014; 14 (5), 869-882.
16. **Zhang B**, Peticone C, Murthy SK, Radisic M. A standalone perfusion platform for drug testing and target validation in micro-vessel networks. **Biomicrofluidics**. 2013; 7 (4), 044125.
17. Nunes S, Miklas JW, Liu J, Aschar-Sobbi R, Xiao Y, **Zhang B**, Jiang J, Massé S, Gagliardi M, Hsieh A, Thavandiran N, Laflamme MA, Nanthakumar K, Gross GJ, Backx PH, Keller G, Radisic M. Biowire: a platform for maturation of human pluripotent stem cell-derived Cardiomyocytes. **Nature Methods**. 2013; 10 (8), 781-787.
18. Martin C, Sofla A, **Zhang B**, Nunes S, Radisic M. Fusible core molding for fabrication of branched three-dimensional perfusable microvessels for vascular tissue engineering. **International Journal of Artificial Organs**. 2013; 36 (3), 159-165.
19. Leng L, McAllister A, **Zhang B**, Radisic M, Günther A. Mosaic hydrogels: Dynamic tessellation and coding. **Advanced Materials (Cover Article)**, 2013; 24 (27), 3650-3658.

20. Tandon V, **Zhang B**, Radisic M, Murthy SK. Generation of Tissue Constructs for Cardiovascular Regenerative Medicine: From Cell Procurement to Scaffold Design. **Biotechnology Advances**, 2013; 31 (5), 722-735.
21. **Zhang B**, Green J, Murthy S, Radisic M. Label-free enrichment of functional cardiomyocytes using microfluidic deterministic lateral flow displacement. **Plos-One**. 2012; 7 (5), e37619.
22. **Zhang B**, Xiao Y, Hsieh A, Thavandiran N, Radisic M. Micro and nanotechnology in cardiovascular tissue engineering. **Nanotechnology**. 2011; 22 (49), 494003.
23. Hirsch A, Rivet CA, **Zhang B**, Kemp ML and Lu H. Parallel Multi-time Point Cell Stimulation and Lysis on-chip for Studying Early Signaling Events in T Cell Activation. **Lab on a Chip**. 2009; 9 (4), 536-544.

## Invited book chapter

1. Miklas JW, Nunes SS, **Zhang B** and Radisic M. Design and fabrication of biological wires. *Cardiac Tissue Engineering Methods and Protocols*. 2014.
2. Chiu LLY, **Zhang B**, Xiao Y, Radisic M. Cardiac Tissue Regeneration in Bioreactors. *Biomaterials and Regenerative Medicine*. 2014.
3. Xiao Y, **Zhang B**, Hsieh A, Thavandiran N, Marin C, Radisic M. Microfluidic Cell Culture Techniques. *Microfluidic Cell Culture Systems*. 2nd Edition. 2012.

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## Selected public presentations and conference talks

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- **Ask a Laurate Lecture**, Toronto, “Engineering functional tissue for therapy and drug discovery”, 2017 (invited)
- **Printing the future of Therapeutics in 3D**, Vancouver, “Vascularized tissue for medical therapy and drug discovery”, 2017 (Invited).
- **10th World Biomaterials Congress**, Montreal, “AngioChip: a biodegradable scaffold with built-in vasculature for cardiac tissue vascularization and surgical vascular anastomoses”, 2016.
- **Nature Conference on Tissue Engineering and Regenerative Medicine**, Guangdong, “AngioChip: a biodegradable scaffold with built-in vasculature for cardiac tissue vascularization and surgical vascular anastomoses”, 2016. (Invited)
- **The 9<sup>th</sup> Ontario-on-a-Chip and MATCH Symposium**, Toronto, “AngioChip: a biodegradable scaffold with built-in vasculature for cardiac tissue vascularization and surgical vascular anastomoses”, 2014.
- **The 17<sup>th</sup> international conference on miniaturized system for chemistry and life sciences**, Freiburg, “Microfluidic tissue: a biodegradable scaffold with built-in vasculature for cardiac tissue vascularization and surgical vascular anastomoses”, 2013.
- **The 8<sup>th</sup> Ontario-on-a-Chip and MATCH Symposium**, Toronto, “Microfluidic tissue: a biodegradable scaffold with built-in vasculature”, 2013.
- **The 6<sup>th</sup> Ontario-on-a-Chip and MATCH Symposium**, Toronto, “Label-free size-based separation of cardiomyocytes in microfluidic system”, 2011.
- **Soft Material Annual Conference**, Atlanta., “Particle Mixing in Microfluidic Herringbone Array”, 2009.
- **Air Products Symposium**, Atlanta, 2009.
- **UROP undergraduate research**, Atlanta, 2009.

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## Professional development activity

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- **Supervisory Experiences:**

(\*denotes work which has contributed towards an accepted / submitted publication to date)

- **Anastasia Korolj\***, PhD student, University of Toronto
- **Benjamin Lai**, PhD student, University of Toronto
- **Camilla Parpia**, summer undergraduate student, University of Toronto
- **Stasja Drecun\***, undergraduate thesis student, University of Toronto
- **Nathaniel Smith\***, summer undergraduate student, University of Toronto
- **Steven Liao**, summer undergraduate student, University of Toronto
- **Carlotta Peticone\***, undergraduate thesis student, University of Toronto

- **Professional development activities**

- Microfluidic Applications and Training in Cardiovascular Health (MATCH) Collaborative Research & Training Experience (NSERC-CREATE) program
- Manufacturing Materials and Mimetics (M3) training program Collaborative Research & Training Experience (NSERC-CREATE) program
- Entrepreneurship 101 MaRS

- **Journal reviews:**

- Served as independent reviewer for the following journals
  - Lab on a Chip
  - ACS Biomaterials Science & Engineering
  - Plos One
  - Advanced Drug Delivery Review
  - Biomedical Materials
- Assisted the reviewing for the following journals
  - Nature Biomedical Engineering
  - PNAS

- **Professional association memberships**

- Member of Canadian Biomaterial Society, Toronto, CANADA *2016-Present*
- Member of Tau Beta Pi Engineering Honor Society *2009-Present*
- Member of American Institute for Chemical Engineers *2008-Present*