JENNIFER MITCHEL

HARVARD T.H. CHAN SCHOOL OF PUBLIC HEALTH
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EDUCATION AND TRAINING

Harvard University *Boston, MA*
T.H. Chan School of Public Health, Department of Environmental Health
Program in Molecular and Integrative Physiology

Research Scientist *2020—Present*
Research Associate *2016—2020*
Postdoctoral Research Fellow *2013—2016*
Advisor: Jin-Ah Park, Ph.D., *Co-advisor*: Jeffrey Fredberg, Ph.D.

Brown University *Providence, RI*
Department of Molecular Pharmacology, Physiology, and Biotechnology
Center for Biomedical Engineering

Ph.D. in Biomedical Engineering *May 2013*
Advisor: Diane Hoffman-Kim, Ph.D.
Thesis Project: Influence of microfabricated cues on the motility and growth of cells of the nervous system

Massachusetts Institute of Technology *Cambridge, MA*
School of Engineering, Department of Mechanical Engineering

S.B. in Mechanical Engineering *June 2007*
Minor in Biomedical Engineering

RESEARCH EXPERIENCE

Project: Cell jamming in epithelial migration
Program in Molecular and Integrative Physiology, Harvard T.H. School of Public Health, Boston MA *2013—2020*

- Postdoctoral training. Titles held: Research fellow, Research Associate, Research Scientist.
- Goal: understand the physical and biological mechanisms of the epithelial unjamming transition.
- Main project: distinguishing between epithelial-mesenchymal transition and unjamming transition in confluent, differentiated epithelial tissues.
- Work resulted in a first-author publication in *Nature Communications*, plus five related contributing-author publications (*Nature Physics, Nature Materials, PLoS One, Frontiers in Cell and Developmental Biology, Scientific Reports*) and two review articles. Two contributing-author manuscripts currently under review.
- Techniques: Live-cell imaging, cell motility & morphology analysis, immunofluorescence, western blotting, RT-PCR/qPCR, primary human cell culture, mathematical modeling, traction force & monolayer stress microscopy.
- This work was funded through a T32 fellowship (2013—2016) and a Parker B. Francis Foundation Fellowship

Project: Mechanical compression triggers asthmatic airway remodeling
Program in Molecular and Integrative Physiology, Harvard T.H. School of Public Health, Boston MA *2013—2020*

- Goal: Investigate how mechanical compression resulting from asthmatic bronchoconstriction drives pathogenesis.
- Techniques: primary human bronchial epithelial (HBE) cells in air-liquid interface (ALI) culture, the gold standard in airway epithelial biology. Isolation of HBE cells from bronchial brushings and maintenance from passage 0.
- Work resulted in two first-author publications (*American Journal of Physiology – Lung Cellular and Molecular Physiology, American Journal of Respiratory Cell and Molecular Biology*), five contributing-author publications, and a review article. A third first-author manuscript is currently under review.

Project: Guidance of glial and neuronal growth and migration by micropatterned cues
Department of Molecular Pharmacology, Physiology, & Biotechnology, Brown University, Providence RI *2007—2013*

- Goal: Investigate the role of micropatterned topographical and biochemical cues on growth, alignment and migration of neuronal and glial cells with an eye towards tissue engineered therapies for nerve damage repair.
- Techniques: Isolation of primary rat neurons, culture of mammalian cell lines, soft lithography, micropatterning and microcontact printing, development of custom analysis algorithms.
- Work resulted in 2 first-author publications (*PLoS One, Journal of Neuroscience Methods*) and 2 contributing-author publications, and 1 review.

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HONORS AND AWARDS

Parker B. Francis Foundation Fellowship *2019—2022*
Fellowship awarded for the project entitled "Cell Jamming in Epithelial Migration and Repair". The PBF Fellowship is a competitive grant awarded to promising young scientists to support research training (3yr support, $156,000 total award)

American Thoracic Society Abstract Scholarship Award *2017*

"Red Alert" Highlighted manuscript in the American Journal of Respiratory Cell and Molecular Biology *2016*

Best poster Award – Gordon Research Conference on Lung Development, Injury and Repair *2015*

Harvard University School of Public Health Postdoc Association Travel Award *2014*

T32 Training Grant in Interdisciplinary Pulmonary Sciences *2013—2016*

GAANN Fellowship *2010—2012*

Robert and Susan Kaplan Fellowship *2011*

Brown Institute for Brain Science Graduate Research Award *2009*

PUBLICATIONS

First Author Peer-reviewed Research Articles

1. **Mitchel JA**, Das A, O'Sullivan MJ, Stancil I, Koehler S, Nieto MA, Fredberg JJ, Butler JP, Bi D, Park J-A. In Airway Epithelial cells, the Unjamming Transition is Distinct from the Epithelial-to-Mesenchymal Transition. ***Nature Communications*** 2020, Oct 7.
2. Lan B*, **Mitchel JA***, O'Sullivan MJ, Park CY, Kim JH, Cole WC, Butler JP, Park J-A. Airway epithelial compression promotes airway smooth muscle proliferation and contraction. ***AJP Lung Cellular and Molecular Physiology***. 2018 Nov 1;315(5):L645-L652. **(*Equal contribution)**
3. **Mitchel JA**, Antoniak S, Lee JH, Kim SH, McGill M, Kasahara DI, Randell SH, Israel E, Shore SA, Mackman N, Park J-A. IL-13 Augments Compressive Stress-Induced Tissue Factor Expression in Human Airway Epithelial Cells. ***American Journal of Respiratory Cell and Molecular Biology*** 2016 Apr; 54:524-31.
4. **Mitchel JA**, Martin IS, Hoffman-Kim D. Neurient: an algorithm for automatic tracing of confluent neuronal images to determine alignment. ***Journal of Neuroscience Methods***. *2013 Apr; 214:210-22.*
5. **Mitchel JA**, Hoffman-Kim D. Cellular Scale Anisotropic Topography Guides Schwann Cell Motility. ***PLoS ONE*** 2011 Sept; 6(9): e24316

Contributing Author Peer-reviewed Research Articles

6. DeCamp SJ, Tsuda V, Ferruzzi J, Koehler SA, Giblin JT, Roblyer D, Zaman MH, Ogassavara NC, **Mitchel JA**, Butler JP, Fredberg JJ. Epithelial layer unjamming shifts energy metabolism toward glycolysis. ***Scientific Reports*** 2020.
7. O'Sullivan MJ, **Mitchel JA**, Das A Koehler S, Levine H, Bi D, Nagel ZD, Park J-A. Irradiation induces epithelial cell unjamming. ***Frontiers in Cell and Developmental Biology***, 2020 Feb 22.
8. Kılıç A, Ameli A, Park J-A, Koh A, Tantisira K, Santolini M, Cheng F, **Mitchel JA**, McGill M, O'Sullivan MJ, De Marizo M, Sharma A, Randell SH, Drazen JM, Fredberg JJ, Weiss ST. Mechanical forces induce an asthma gene signature in healthy airway epithelial cells. ***Scientific Reports***, 2020 Jan 22.
9. Kim SH, **Mitchel JA**, McGill M, Cremona T, Tan LH, Kasahara D, Anathy V, Israel E, Park J-A. Mechanical compression induces maspin secretion from well-differentiated bronchial epithelial cells. ***Journal of Allergy and Clinical Immunology***, 2019.
10. He S, Carman CV, Lee JH, Lan B, Koehler S, Atia L, Park CY, Kim JH, **Mitchel JA**, Park J-A, Butler JP, Lu Q, Fredberg JJ. The tumor suppressor p53 can promote collective cellular migration. ***PLoS One***. February 1, 2019.
11. Barrios J, Kho A, Aven L, **Mitchel JA**, Park J-A, Randell SH, Miller LA, Tantisira K, Ai X. Pulmonary neuroendocrine cells provide GABA for goblet cell hyperplasia in primate models. ***American Journal of Respiratory Cell and Molecular Biology***. 2018 Dec 20
12. Glass K, Thibault D, Guo F, **Mitchel JA**, Pham B, Qiu W, Li Y, Jiang S, Castaldi P, Silverman EK, Raby B, Park J-A, Yuan GC, Zhou X. Integrative epigenomic analysis in differentiated human primary bronchial epithelial cells exposed to cigarette smoke. ***Scientific Reports***, *2018.*
13. Panganiban RA, Sun M, Dahlin A, Park H-R, Kan M, Himes BE, **Mitchel JA**, Iribarren C, Jorgenson E, Randell SH, Israel E, Tantisira K, Shore S, Park J-A, Weiss ST, Wu AC, Lu Q. A functional splice variant associated with decreased asthma risk abolishes the ability of gasdermin B to induce epithelial cell pyroptosis. ***Journal of Allergy and Clinical Immunology***. 2018 Jan.

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14. Atia L, Bi D, Sharma Y, **Mitchel JA**, Gweon B, Koehler S, DeCamp SJ, Lan B, Hirsch R, Pegoraro AF, Lee KH, Starr J, Weitz DA, Martin AC, Park J-A, Butler JP, Fredberg JF. Geometrical constrains during epithelial jamming. ***Nature Physics***. 2018 Apr;14: 613–620
15. Park J-A, Kim JH, Bi D, **Mitchel JA**, Qazvini NT, Tantisira K, Park CY, McGill M, Kim SH, Gweon B, Notbohm J, Steward R Jr, Burger S, Randell SH, Kho AT, Tambe DT, Hardin C, Shore SA, Israel E, Weitz DA, Tschumperlin DJ, Henske EP, Weiss ST, Manning ML, Butler JP, Drazen JM, Fredberg JJ. Unjamming and cell shape in the asthmatic airway epithelium. ***Nature Materials*** 2015 Oct; 14:1040-8
16. López-Fagundo C, **Mitchel JA**, Ramchal TD, Dingle YT, Hoffman-Kim D. Navigating neurites utilize cellular topography of Schwann cell somas and processes for optimal guidance. *Acta Biomaterialia.* 2013 July; 9:7158-68.
17. Kofron CM, Liu YT, López-Fagundo CY, **Mitchel JA**, Hoffman-Kim D. Neurite outgrowth at the biomimetic interface. ***Annals of Biomedical Engineering*** 2010 June; 38(6):2210-25

Reviews and Perspectives

1. Veerati PC, **Mitchel JA**, Reid A, Knight DA, Bartlett NW, Park J-A, Grainge CL. Airway mechanical compression; its role in asthma pathogenesis and progression. ***European Respiratory Review***, 2020.
2. Sharma Y, Atia L, Sims-Rhodes C, DeCamp SJ, **Mitchel JA**, Fredberg JJ. Scaling Physiologic Function from Cell to Tissue in Asthma, Cancer, and Development. ***Annals of the American Thoracic Society***. 2018 Feb.
3. Park J-A, Atia L, **Mitchel JA**, Fredberg JJ, Butler JP. Collective migration and cell jamming in asthma, cancer and development. ***Journal of Cell Science***. 2016 Sept; 129:3375-83.
4. Hoffman-Kim D, **Mitchel JA**, Bellamkonda RV. Topography, Cell Response, and Nerve Regeneration. ***Annual Reviews of Biomedical Engingeering*** 2010 Aug; 12:203-31.

Manuscripts under review

1. O'Sullivan MJ*, **Mitchel JA***, Mwase C, McGill M, Kanki P, Park J-A. In well-differentiated human bronchial epithelial cells, TGF-β induces expression of Furin. **(*Equal contribution)**
2. De Marzio M, Kilic A, Maiorino E, **Mitchel JA**, Chase R, Fredberg JJ, Park J-A, Glass K, Weiss ST. The genomic signature of unjamming in compressed Human Bronchial Epithelial Cells. BioRxiv, September 2020.
3. Kang W, Ferruzzi J, Spatarelu C-P, Han YL, Sharma Y, Koehler A, **Mitchel JA**, Butler JP, Roblyer D, Zaman MH, Park J-A, Guo M, Chen A, Pegoraro AF, Fredberg JJ. Tumor invasion as non-equilibrium phase separation.
4. Das A, **Mitchel JA**, Bi D. Rigidity, jamming, glassy behavior in biological tissues. (Invited review, Physical Biology).

CONFERENCE PRESENTATIONS

Podium Presentations

1. **Biomedical Engineering Society Annual Meeting**. Philadelphia, PA, 2019. The Unjamming Transition is Distinct from the Epithelial-to-Mesenchymal Transition.
2. **World Congress of Biomechanics**. Dublin Ireland, 2018. The Unjamming Transition is Distinct from the Epithelial-to-Mesenchymal Transition.
3. **Gordon Research Conferenced on Cell Polarity Signaling**. Dover, VT, 2018. Pseudostratified Epithelia Maintain Polarity During Collective Migration Through an Unjamming Transition.
4. **American Thoracic Society Annual Meeting**. Washington DC, 2017. The Unjamming Transition is Distinct from the Epithelial-to-Mesenchymal Transition.
5. **Flow-Volume Underworld Conference**. Boston MA, 2017. The Unjamming Transition is Distinct from the Epithelial-to-Mesenchymal Transition.
6. **Gordon Research Conferenced on Directed Cell Migration**. Galveston TX, 2017. The Unjamming Transition is Distinct from the Epithelial-to-Mesenchymal Transition.
7. **Biomedical Engineering Society Annual Meeting**. St Louis MO, 2008 Schwann Cells and Neurons Exhibit Distinct Horizontal and Vertical Motilities.

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Poster Presentations

1. **European Respiratory Society**. London UK, 2016. **Mitchel JA**, Notbohm JK, Butler JP, Fredberg JJ, Park J-A. Priming of airway epithelial cells transforming growth factor-beta recapitulates the biophysical properties of cells as detected in the asthmatic cells.
2. **American Thoracic Society.** San Francisco, CA, 2016. **Mitchel JA**, Notbohm JK, Butler JP, Fredberg JJ, Park J-A. In the maturing layer of primary human bronchial epithelial cells, TGF-β priming of normal cells recapitulates delayed jamming as seen in asthmatic cells.
3. **American Thoracic Society.** Dever CO, 2015. **Mitchel JA**, Antoniak S, Kim SH, McGill M, Randell SH, Shore SA, Mackman N, Park J-A. IL-13 augments compressive stress-induced exosomal tissue factor release from bronchial epithelial cells.
4. **Gordon Research Conference, Directed Cellular Migration.** Galveston TX, 2015**. Mitchel JA**, Qazvini NT, Kim JH, Bi D, Park CY, Butler JP, Israel E, Randell SH, Shore SA, Manning ML, Drazen JM, Fredberg JJ, Park J-A. Maturation of the human bronchial epithelial cell layer causes a jamming transition, but compression of the layer, as in bronchospasm, causes unjamming.
5. **American Thoracic Society**. San Diego CA**,** 2014. **Mitchel JA**, McGill M, Shore SA, Fredberg JJ, Park J-A. Compressive Stress Induces Reactive Oxygen Species-Dependent Release of Tissue Factor in Airway Epithelial Cells from Normal and Asthmatic Donors.
6. **Biomedical Engineering Society.** Atlanta GA, 2012. **Mitchel JA**, Hoffman-Kim D. Schwann cell motility is directed by asymmetric micropatterns.
7. **Biomedical Engineering Society**. Hartford CT, 2011. **Mitchel JA**, Hoffman-Kim D. A Matlab-Based Algorithm for Automatic Tracing of Confluent Neuronal Images.
8. **Gordon Research Seminar, Signal Transduction Engineered Extracellular Matrices**, Biddeford ME, 2010. **Mitchel JA**, Hoffman-Kim D. Schwann Cell Guidance by Interactions with Cellular-Scale Anisotropic Topographical Cues.
9. **Biomedical Engineering Society**. Austin TX, 2010. **Mitchel JA**, Ramchal TD, Hoffman-Kim D. Guided Schwann Cell Motility on Cellular-Scale Anisotropic Topography.
10. **Biomedical Engineering Society**. Pittsburg, PA, 2009. **Mitchel JA**, Tripathi A, Hoffman-Kim D. Motility of Schwann Cells on Micropatterned and Microgrooved Culture Platforms.

INVITED TALKS

1. **CRICK London Cell Motility Club**. "Emergent collective migration in a confluent epithelium: Unjamming of differentiated human epithelial cells". 10/1/2020.
2. **Brigham and Women's Hospital, Pulmonary Works in Progress Seminar**: "Mechanisms of epithelial unjamming induced by mechanical compression". Boston, MA 11/8/2019
3. **Brigham and Women's Hospital, Pulmonary Works in Progress Seminar**: "Positive feedback loop between bronchoconstriction and airway remodeling in asthma". Boston, MA 11/9/2018
4. **Harvard University, Program in Molecular and Integrative Physiological Sciences**: "Jamming in the Airway Epithelium". 5/1/2018.
5. **Harvard University, Program in Molecular and Integrative Physiological Sciences**: "The Unjamming Transition is Distinct from the Epithelial-to-Mesechymal Transition". 5/2/2017.
6. **Brigham and Women's Hospital Collaborative Asthma Research Group:** "Cooperative Actions of IL-13 and Mechanical Compression on the Release of Exosomal Tissue Factor from Airway Epithelial Cells." Boston, MA 6/6/2016.
7. **Harvard University, Program in Molecular and Integrative Physiological Sciences**: **"**Role of TGF-β Signaling in the Biophysics of Airway Epithelial Cells in Asthma". 4/12/2016.
8. **Harvard University, Program in Molecular and Integrative Physiological Sciences**: **"**Investigating Mechanisms of Jamming and Unjamming in Human Airway Epithelial Cells". 5/5/2015.
9. **Brown University, Course BIO 114: Tissue Engineering.** Guest lecture: "Design Considerations: Cell Therapy and Mechanics." Lecture invited by Diane Hoffman-Kim, Ph.D. 4/12/2012
10. **Brown University, Course EN2: Transforming Society: Technology and Choices for the Future**. Guest Lecture: "Neurite Outgrowth at the Biomimetic Interface." Lecture invited by Karen Haberstroh, Ph.D. on Tissue Engineering. 3/18/2011.
11. **Brown University, Course BIO 114: Tissue Engineering**. Guest Lecture: "Neurite Outgrowth at the Biomimetic Interface." Lecture and primary literature discussion invited by Eric Darling, Ph.D. 3/15/2011.

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TEACHING AND LEADERSHIP EXPERIENCE

Cell Migration Seminars Online Series *2020—Present*
Co-organizer. Started during the 2020 global Covid-19 pandemic, organize and host an online seminar series on the topic of cell migration. Evaluate and choose abstracts, organize schedule, invite speakers, publicize series, run weekly meeting. Series is on-going and consistently well attended by 100-300 live attendees.

Harvard University, Boston MA *2013—Present*
Research Mentor, Park Lab, Harvard T.H. Chan School of Public Health
Mentored trainees—responsible for hands-on lab training, experimental planning and data interpretation of the following projects:

- Maureen McGill–Investigating the transcriptional responses of compress airway epithelial cells (6/13-6/16)
- Sae-Hoon Kim–Secretion of maspin from compressed epithelial cells (1/14-7/15)
- Christalyn Rhodes–Rhinovirus as a novel inducer of airway epithelial unjamming (1/16-1/18)
- Ian Stancil–Pilot investigations into activation of mechanosensitive proteins during unjamming (6/16-5/17)
- Rebecca Hirsch–Measuring cell shape and proliferation during airway epithelial maturation (6/16-12/16)
- Chimwemwe Mwase–Tissue factor in airway epithelial cells and asthma (1/19-present)

Brown University, Providence RI *2011—2012*
Teaching Certificate Programs I&III, Harriet W. Sheridan Center for Teaching and Learning

- Program on the elements of a reflective teaching practice.

Brown University, Providence RI *2008—2009*
Research Mentor, Hoffman-Kim Lab, Center for Biomedical Engineering

- Mentored student summer projects: Ryan Din, Renan Ribiero y Ribiero, Talisha Ramchal, Nupur Shridar

MIT, Cambridge MA *2003—2007*
Teaching Assistant, Edgerton Center Outreach Program

- Instruction of K-12 students on science and engineering projects

MIT, Cambridge MA *2005—2006*
Summer Resident Advisor, Student Life Programs

RESEARCH EXPERIENCE (UNDERGRADUATE)

Biotechnology Process Engineering Center, MIT, Cambridge MA *2006—2007*
Advisor: Linda Griffith, Ph.D.

- Undergraduate thesis project focused on optimization of a high throughput in vitro liver bioreactor system and manipulation of the adhesive microenvironment to affect tissue morphology and function

Intercollegiate Genetically Engineered Machine Competition *2005*
MIT, Cambridge MA. Teaching Assistant. *Advisors:* Andrew Endy, Ph.D; Tom Knight, Ph.D

- Facilitator, organizer, and researcher for the MIT iGEM team.
- Project: design and implementation of a genetically-based sensing system with variable molecular input

Synthetic Biology Competition, MIT, Cambridge MA. *2004*
Advisors: Andrew Endy, Ph.D; Tom Knight, Ph.D; Pamela Silver, Ph.D

- Large team effort to design a synthetic system in E. coli using the BioBricks system of standard assembly.
- Award for Most Integrated System for the "Chemotactic Oscillator" system

PROFESSIONAL AFFILIATIONS

American Thoracic Society *2014—Present*
Biomedical Engineering Society *2008—2013, 2017—Present*