

Vanderbilt University
 Department of Biological Sciences
 Department of Cell & Developmental Biology
 Diabetes Research & Training Center
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Education

- 2003–2009 **Stanford University**, Stanford CA
 Ph.D., Neurosciences Program
- Advisor: Professor/HHMI Investigator Kang Shen
 - Thesis: Molecular mechanisms of presynaptic assembly at defined synapses in *C. elegans*
- 1997–2001 **Grinnell College**, Grinnell IA
 B.A., Cognitive Neurophilosophy

Employment

- 2015-Present **Vanderbilt University**, Nashville TN
 Assistant Professor of Biological Sciences
 Affiliations: Department of Cell and Developmental Biology
 Vanderbilt Diabetes Research and Training Center
- 2009-2014 **Fred Hutchinson Cancer Research Center**, Seattle WA
 Helen Hay Whitney Postdoctoral Fellow
- Advisor: Member/HHMI Investigator Harmit S. Malik
- 2001–2003 **Duke University**, Durham NC
 Research Technician
- Advisor: Professor/HHMI Investigator Lawrence C. Katz

Awards & fellowships

- 2021 Excellence in Mentoring Award, Dept of Biological Sciences, Vanderbilt University
- 2020 REAM Foundation Fellowship, Vanderbilt University
- 2010-2013 Helen Hay Whitney Foundation Postdoctoral Fellowship
- 2013 Young Investigator Travel Award to attend Society for Molecular Biology & Evolution Meeting in Chicago IL
- 2012 Keystone Symposia Scholarship to attend Innate Immunity: Sensing the Microbes & Damage Signals Meeting in Keystone CO
- 2010 Keystone Symposia Scholarship to attend HIV Vaccines & Viral Immunity Meeting in Banff CA
- 2010 Harold M. Weintraub Graduate Student Award
For outstanding achievement during graduate studies, awarded to 13 students chosen internationally from all areas in the life sciences
- 2007–2009 Ruth L. Kirschstein National Research Service Award, Stanford University
- 2004 NSF Graduate Research Fellowship – Honorable mention
- 1999–2001 Herman Muehlstein Foundation Scholarship, Grinnell College
- 2000 Associated Colleges of the Midwest Minority Scholar, Grinnell College

Research

Primary research articles from Vanderbilt

6. Held JP, Saunders BR, Pereira CV, & Patel MR. A tRNA processing enzyme is a central regulator of the mitochondrial unfolded protein response. **In revision at eLife (planned resubmission Jan 2022)**. Also on BioRxiv.
5. Tsyba N & Patel MR. Tissue-specific heteroplasmy dynamics is accompanied by a sharp drop in mtDNA copy number during development. **In revision at iScience (planned resubmission March 2022) (was in review for 4 months)**. Also on BioRxiv.
4. Kirby CS & Patel MR. Elevated mitochondrial DNA copy number found in ubiquinone-deficient *clk-1* mutants is not rescued by ubiquinone precursor 2-4-dihydroxybenzoate. **Mitochondrion**, 2021. 58: 38-48.
3. Gitschlag BL, Tate AT, & Patel MR. Nutrient status shapes selfish mitochondrial genome dynamics across different levels of selection. **eLife**, 2020. 9:256686. Also on BioRxiv.
 - Previewed by Camus. The perils of cheating. **eLife**, 2020. 9: e62222.
 - Highlighted by eLife Press (<https://elifesciences.org/for-the-press/ff55a479/cheater-mitochondria-may-profit-from-cellular-stress-coping-mechanisms>)
 - Highlighted by VU Press (<https://news.vanderbilt.edu/2020/09/25/vanderbilt-biologists-test-evolutionary-theories-with-novel-empirical-study-of-cheater-mitochondria/>)
 - BioRxiv preprint highlighted by Maiko Kitaoka. Cheater, cheater, pumpkin eater: How selfish mitochondrial DNA uses nutrient abundance and signaling to proliferate. **preLights**, 2020. doi: <https://doi.org/10.1242/prelights.8954>.
2. Held JP & Patel MR. Functional conservation of mitochondrial RNA levels despite divergent mtDNA organization. **BMC Research Notes**, 2020. 13:334.
1. Gitschlag BL, Kirby CS, Samuels DC, Gangula RD, Mallal SA, & Patel MR. Homeostatic responses regulate selfish mitochondrial genome dynamics in *C. elegans*. **Cell Metabolism**, 2016. 24: 91-103.
 - Previewed by Picard, Vincent & Turnbull. Expanding our understanding of mtDNA deletions. **Cell Metabolism**, 2016. 24: 3-4.
 - Highlighted by VU Press (<http://news.vanderbilt.edu/2016/07/when-mitochondrial-genes-act-up/>)

Previews and peer-reviewed reviews from Vanderbilt

3. Pereira CV, Gitschlag BL, Patel MR. Cellular mechanisms of mtDNA heteroplasmy dynamics. **Critical Reviews in Biochemistry & Molecular Biology**, 2021. 56: 510-525.
2. Gitschlag BL & Patel MR. Mitochondria: A microcosm of Darwinian competition. **Current Biology**, 2019. 29: R1316-R1318.
1. Patel MR. Inheritance: Male mtDNA just can't catch a break. **Current Biology**, 2017. 27: R264-R266.

Primary research articles from post-doc and graduate work

4. Patel MR^{*}, Miriyala GK, Littleton AJ, Yang H, Trinh K, Young JM, Kennedy SR, Yamashita YM, Pallanck L & Malik HS^{*}. A mitochondrial DNA hypomorph of cytochrome oxidase specifically impairs male fertility in *Drosophila melanogaster*. **eLife**, 2016. 5. Pii: e16923. (*corresponding authors)
 - Recommended by Faculty of 1000.
 - Highlighted by VU News (<http://news.vanderbilt.edu/2016/08/discovery-of-male-harming-dna-mutation-reinforces-mothers-curse-hypothesis/>)
 - Highlighted by Fred Hutch News (<https://www.fredhutch.org/en/news/center-news/2016/08/mothers-curse-mutation-identified-animals.html>)
3. Patel MR, Loo YM, Horner SM, Gale M Jr & Malik HS. Convergent evolution of escape from hepaciviral antagonism in primates. **PLoS Biology**, 2012. 10: e1001282.
 - Recommended by Faculty of 1000.
 - Previewed by Sedwick C. War Archives: How some primates fought off ancient viruses. **PLoS Biology**, 2012. 10(3): e1001285.

2. Patel MR & Shen K. RSY-1 is a novel local inhibitor of presynaptic assembly. **Science**, 2009. 323: 1500-3.
 - Previewed by Sigrist SJ. The yin and yang of synaptic active zone assembly. *Sci Signal*, 2009. 2: pe32.
1. Patel MR, Lehrman EK, Poon VY, Crump JG, Zhen M, Bargmann CI & Shen K. Hierarchical assembly of presynaptic components in defined *C. elegans* synapses. **Nature Neuroscience**, 2006. 9: 1488-98.

Reviews and previews from graduate school and post-doc

2. Patel MR, Emerman M & Malik HS. Paleovirology – Ghosts & gifts of viruses past. **Current Opinion in Virology**, 2011. 1: 304-309.
1. Patel MR & Shen K. Neurite extension: Starting at the finish line. **Cell**, 2009. 137: 207-9.

Other contributions to peer-reviewed publications

3. Harris KG, Morosky SA, Drummond C, Patel MR, Kim C, Stolz DB, Bergelson JM, Cherry S & Coyne CB. RIP3 regulates autophagy and is required for Coxsackievirus B3 infection of polarized intestinal epithelial cells. **Cell Host & Microbe**, 2015. 18: 221-32.
2. Chia PH, Patel MR, Wagner OI, Klopfenstein DR & Shen K. Intramolecular regulation of presynaptic scaffold protein SYD-2/Liprin- α . **Mol Cell Neurosci**, 2013, 56C: 76-84.
1. Chia PH, Patel MR & Shen K. NAB-1 instructs synapse assembly by linking adhesion molecules and F-actin to active zone proteins. **Nature Neuroscience**, 2012. 15: 234-42.

Grants planned

NIH/NIA R01 resubmission
“A new player in mitochondrial stress response”
Role: Principal Investigator
Budget: \$1,000,000 total direct costs, \$570,000 total indirect costs
January 1, 2023 – December 31, 2026

Grants pending

NIH/NIGMS R35
“Mechanisms of mutant mitochondrial genome modulation”
Role: Principal Investigator
Budget: \$1,979,305 total direct costs, \$1,156,665 total indirect costs
April 1, 2022 – March 31, 2027

Impact score: 37

Evolutionary Studies Initiative Pilot Research Grant

“Molecular basis of an evolutionary trade-off”

Role: Principal Investigator
Budget: \$5,000 total direct costs
January 4, 2022 – June 30, 2022

Grants awarded

1. NIH/NIGMS R01
“Regulation of mitochondrial heteroplasmy dynamics”
Role: Principal Investigator
Budget: \$962,500 total direct costs, \$548,165 total indirect costs
March 1, 2017 – Feb 28, 2022

2. DoD Peer Reviewed Medical Research Program, Discovery Award

“How mtDNA mutations cause mitochondrial disease”

Role: Principal Investigator

Budget: \$200,000 total direct costs, \$114,000 total indirect costs

August 1, 2018 – January 31, 2021

3. Vanderbilt TIPS Single Cell Biology

“Single cell mitochondrial heteroplasmy dynamics”

Role: Principal Investigator

Budget: \$30,000 total direct costs

July 1, 2018 – June 30, 2019

4. Vanderbilt Diabetes Research & Training Center Pilot and Feasibility Grant

“Mechanisms underlying metabolic regulation of mutant mitochondrial genome dynamics”

Role: Principal Investigator

Budget: \$45,000 total direct costs

July 1, 2018 – June 30, 2021

Invited seminar presentations

2021	Interdisciplinary Program in Genetics & Genomics, Texas A& M University, College Station, TX
2020	Department of Cell Biology, NYU School of Medicine, New York, NY (postponed until 2022)
2020	Department of Biology, University of Pennsylvania, Philadelphia, PA
2020	Genome Sciences, University of Washington, Seattle, WA
2019	Mitochondrial Biology Unit, Medical Research Council, Cambridge, UK
2018	National Heart, Lung, and Blood Institute, NIH, Bethesda, MD
2018	Department of Biology, University of the South, Sewanee, TN
2017	Department of Human Genetics, University of Utah, UT
2017	Department of Biology, Harding University, Searcy AK
2015	Vanderbilt Diabetes and Research Training Center
2015	Center for Quantitative and Systems Biology, Vanderbilt University
2015	Department of Cell and Developmental Biology, Vanderbilt University
2015	Mitochondrial Interest Group, Vanderbilt University
2015	Department of Biological Sciences, Tennessee State University
2014	Lewis-Sigler Institute for Integrative Genomics, Princeton University (Job seminar)
2014	FAS Center for Systems Biology, Harvard University (Job seminar)
2014	Department of Molecular and Genetics and Cell Biology, U of Chicago (Job seminar)
2014	Department of Biological Sciences, Vanderbilt University (Job seminar)
2014	Department of Biology, MIT (Job seminar)
2014	Department of Biochemistry and Biophysics, UCSF (Job seminar)
2014	Green Center for Systems Biology, UT Southwestern (Job seminar)

Conference and retreat talks

2021	American Society for Cell Biology, Symposia on mito-nuclear crosstalk, Virtual
2020	Keystone Symposia, Mitochondrial Biochemistry in Health and Disease, BC Canada (<i>Invited, full support</i>) (<i>canceled</i>)
2019	Society of Molecular Biology and Evolution, Manchester UK
2019	22 nd International <i>C. elegans</i> Conference, UCLA, Los Angeles CA
2019	Faculty Address, Dept of Biological Sciences retreat, Vanderbilt University
2019	Single Cell Biology Symposium, Vanderbilt University
2017	Vanderbilt Diabetes: Molecules to People, Vanderbilt University
2017	21 st International <i>C. elegans</i> Meeting, UCLA, Los Angeles CA
2017	Chan Zuckerberg Initiative Workshop on Neurodegeneration, San Francisco, CA (<i>Invited, full support</i>)

2017 115th ITC Evolutionary Mitochondrial Biology, Titisee Germany (*Invited, full support*)
 2016 *C. elegans* Topic Meeting on aging, metabolism, stress, pathogenesis, and small RNAs, Madison WI
 2016 Evolution Meeting, Austin TX (Invited)
 2014 Department of Biological Sciences Annual Retreat, Vanderbilt University
 2013 Annual Meeting for Society for Molecular Biology & Evolution, Chicago IL
 2013 NHLBI Mitochondrial Biology Symposium, Bethesda MD
 2013 Annual Meeting of the American Association of Physical Anthropologists, Knoxville Tn
 2012 Annual Helen Hay Whitney Foundation Fellows Meeting, Boston MA
 2012 Keystone Symposia, Innate Immunity: Sensing the Microbes & Damage Signals, Keystone CO
 2010 Keystone Symposia, HIV Vaccines & Viral Immunity, Banff Canada
 2010 Division of Basic Sciences Retreat, Fred Hutch
 2010 Harold M. Weintraub Graduate Student Award Symposium, Fred Hutch
 2008 Neural Circuits: From Structure to Function, CSHL, NY

Teaching

Primary teaching activities

2021 Fall Principles of Human Disease (BSCI3243/5243)

- 3 hour course (Instructor)
- 23 undergraduate and graduate students, 28 sessions

2021 Spring Introduction to Cell Biology (BSCI2201)

- 3 hour course (Instructor)
- >90 undergraduate students, 21 sessions

2020 Spring Introduction to Cell Biology (BSCI2201)

- 3 hour course (Instructor)
- >90 undergraduate students, 21 sessions

2019 Fall Principles of Human Disease (BSCI3243/5243)

- 3 hour course (Instructor)
- 19 undergraduate and graduate students, 28 sessions

2019 Spring Introduction to Cell Biology (BSCI2201)

- 3 hour course (Instructor)
- 66 undergraduate students, 21 sessions

2018 Fall Biology of Disease (BSCI3890/5890)

- 3 hour course (Instructor)
- 12 undergraduate and graduate students, 28 sessions

2018 Spring Introduction to Cell Biology (BSCI2201)

- 3 hour course (Instructor)
- 50 undergraduate students, 21 sessions

2017 Spring Introduction to Cell Biology (BSCI2201)

- 3 hour course (Instructor)
- 80 undergraduate students, 21 sessions

2016 Fall Principles of Human Disease (BSCI3965)

- 2 hour course (Instructor)
- 13 undergraduate students, 15 sessions

- 2016 Spring Introduction to Cell Biology (BSCI2201)
- 3 hour course (Instructor)
 - 80 undergraduate students, 21 sessions

- 2015 Fall Graduate Seminar in Biological Sciences (BSCI6320)
- 1 hour course (Instructor)
 - 17 graduate students, 15 sessions

Secondary teaching activities

- 2018-19 Sum Program In Developmental Biology Bootcamp
- One 2hr lecture, one 2hr hands-on lab exercises
 - ~8 students, 2 sessions

- 2016-20 Fall FOCUS
- 1 hour (Visiting lecturer)
 - 12 FOCUS leaders, 1 session

- 2015-20 Fall Bioregulation I
- 1 hour lecture (Visiting lecturer)
 - ~50-70 graduate students, 1 session

- 2015-21 Fall Biochemical and Molecular Toxicology (BCHM8336)
- 1 hour lecture (Visiting lecturer)
 - ~5-10 graduate students, 1 session

Mentoring

Graduate Students

- 2021 - Lantana Grub
- Honorable Mention, Ford Foundation Fellowship, 2021
 - Environmental Toxicology Training Grant, 2021-2023
- 2018 - James Held
- Selected for oral presentation, Cell & Developmental Biology retreat, Vanderbilt University, 2021
 - Selected for oral presentation, Program in Developmental Biology Retreat, Vanderbilt University, 2019
 - Honorable Mention, Graduate Research Fellowship Program, NSF, 2019
 - Environmental Toxicology Training Grant, 2018-2020
- 2016 - Nikita Tsyba
- Graduate Student Summer Research Award, 2018
 - Vanderbilt International Scholar, 2016
- 2016 - 2021 Cait Kirby
- NIH supported National Research Service Award (F31 Diversity Award). Supports graduate education 2019 – 2021
 - 2018 Best Short Research In Progress (RIP) Talk, Biological Sciences Annual Retreat
 - 2018 Outstanding Graduate Student Lab Instructor Award, College of Arts & Sciences, Vanderbilt University

- 2018 Hickory Stick Award for Outstanding Teaching Assistant, Department of Biological Sciences, Vanderbilt University
- 2017 Best Poster Award, Department of Biological Sciences Annual Retreat

2015 - 2021 Bryan Gitschlag

- Graduate Research Excellence Award, Dept of Biological Sciences, Vanderbilt University, 2019
- Ruth L. Kirschstein National Research Service Award Individual Predoctoral Fellowship (F31), National Institute of General Medical Sciences, NIH, 2017
- Scholar in Diabetes Award, Diabetes Day (annual symposium), Vanderbilt University, 2017
- Ann Bernard Martin Award for Excellence in Graduate Research, Vanderbilt University, 2017
- Honorable mention (talk), Program in Developmental Biology Retreat, Vanderbilt University, 2017
- Honorable mention (poster), Genetics Society of America 21st International *C. elegans* Meeting, 2017
- Second place (poster), Diabetes Day (annual symposium), Vanderbilt University, 2016
- First place (poster), *C. elegans* Topical Meeting: Aging, Metabolism, Stress, Pathogenesis and Small RNAs, Madison WI, 2016
- Vanderbilt Cellular, Biochemical and Molecular Sciences Training Grant, 2016

Undergraduate research students

2021 Fall	Maya Reddy (BSCI 3861)
2021 Summer	Hyon Ryou (VSSA summer research student)
2019 Summer	Olivia Bruno (VSSA summer research student)
2018 – 2022	Cassidy Johnson (BSCI 3860, 3861, MARC Scholar)
2018 Fall	Seungyeon Jung (BSCI 3850)
2016 Summer-Spring 2018	Bhaavya Srivastava (BSCI 3860, 3861, 3961)
2015 Summer-Spring 2017	Pavan Anand (BSCI 3860, BSCI 3861)
2017 Fall – 2018 Spring	Danzhu Zhao (BSCI 3860)

Undergraduate research co-mentor

2021 Fall	Cindy Nwokedi (BSCI 3861)	PI: Andrea Page-McCaw
2020	Lilly He (BSCI 3961)	PI: Takamune Takahashi
2019 Fall	Cathryn McDowell (BSCI 3860)	PI: Matthias Reiss
2017 Fall-2018 Fall	Danzhu Zhao (BSCI 3861, 3961)	PI: Justin Balko
2017 Spring	Rachel Kim (BSCI 3961)	PI: Takamune Takahashi

Undergraduate Honors Research

2022	Undergraduate Honors Committee, Bradley Moon	PI: Jason MacGurn
2021	Undergraduate Honors Committee, Mary Grace Carroll	PI: Justin Balko
2020	Undergraduate Honors Committee, Raymar Turangan	PI: Julian Hillyer
2019	Undergraduate Honors Committee, Faith Rovenolt	PI: Ann Tate
2017	Undergraduate Honors Committee, Nick Dian	PI: Todd Graham
2016	Undergraduate Honors Committee, Alexandra Amitha Ruff	PI: Lawrence Zwiebel
2016	Undergraduate Honors Committee, Justin Yeh	PI: James Patton

Undergraduate Advisor

2020	Undergraduate advisor, Cassidy Johnson
2020	Undergraduate advisor, Bryan Diaz
2020	Undergraduate advisor, Emily Layton
2019	Undergraduate advisor, Anoop Vemulapalli
2018	Undergraduate advisor, Lester Watch

2016 Undergraduate advisor, Taehun Yoo
2016 Undergraduate advisor, Toby Barrack
2016 Undergraduate advisor, Marielle Cohen
2015 Undergraduate advisor, Brock Preheim
2015 Undergraduate advisor, Grayson Thompson

Service

Departmental service

2021 Departmental website committee, Dept of Biological Sciences
2018-20 Graduate Admission Committee, Dept of Biological Sciences
2019-20 DGS Advisory Committee
2018-19 Tenure Track Faculty Search Committee for Microbial Biology
2017 Curriculum Committee
2015-21 Departmental graduate student recruitment – one-on-one interviews and dinners with candidates
2015-21 Departmental faculty search – attend seminars, chalk talks, dinners, and held one-on-one meetings with each of the candidates
2016 Departmental faculty seminar committee

Department seminar host

2022 Host seminar speaker Meng Wang (HHMI Investigator/Professor, Baylor College of Medicine)
2021 Host seminar speaker Dan Sloan (Associate Professor, Colorado State University)
2021 Host seminar speaker Pat O'Farrell (Professor, UCSF)
2021 Host seminar speaker Stacey Satchell (Academic Life Coach, Vanderbilt University)
2021 Host seminar speaker Cara Tuttle Bell (Director, Project Safe, Vanderbilt University)
2021 Host seminar speaker Mia Levine (Assistant Professor, University of Pennsylvania)
2019 Host seminar speaker Eric Haag (Professor, University of Maryland)
2018 Host seminar speaker Patrick Phillips (Professor, University of Oregon)
2018 Co-host seminar speaker Kristi Montooth (Associate Professor, University of Nebraska)
2016 Host seminar speaker Hong Xu (Investigator, NIH)
2016 Host seminar speaker Asher Cutter (Associate Professor, University of Toronto)
2016 Host seminar speaker David Rand (Professor and Chair of Department of Ecology and Evolutionary Biology, Brown University)
2015 Host seminar speaker Susanne Rafelski (Assistant Professor, University of California, Irvine)
2015 Host seminar speaker Adam Hughes (Assistant Professor, University of Utah)

University service

2016 Participated in Departmental of Biochemistry faculty search
2015 - Mitochondrial Interest Group at Vanderbilt
2015 - Program in Developmental Biology Journal Club – weekly journal clubs.
2015 - Center of Quantitative and Systems Biology – biweekly research presentations
2015 - Cell and Developmental Biology REx – biweekly student/postdoc presentations
2015 - Cellular, Biochemical and Molecular Sciences Training Grant – weekly JC
2020 PhD committee, Shannon Leahy (Broadie Lab)
2020 PhD committee, Adrianna Norris (Graham Lab)
2017 PhD committee, Sierra Palumbos (Miller Lab)
2016 PhD committee, Kalen Patersen (Miller Lab)

2016 PhD committee, Jessie Perlmutter (Bordenstein Lab)
2016 PhD committee, Roger Burcham (Jackson Lab)
2016 PhD committee, Juan Ortiz (Rokas Lab)
2016 PhD committee, Michelle Moon (Rokas Lab)
2016 PhD committee, Ling Chen (Capra Lab)
2016 PhD committee, Amanda Erwin (Melanie Ohi Lab)
2015 PhD committee, Jessica Tumolo (MacGurn Lab)
2015 PhD committee, Teddy Van Opstal (Bordenstein Lab)
2015 PhD committee, Dominic Vita (Broadie Lab)
2015 PhD committee, Danielle Kopke (Broadie Lab)
2020 Masters committee, Jamarcus Robertson (Nelms Lab, Fisk University)
2016 Masters committee, Casey Paton (Nelms Lab, Fisk University)
2015 - Letters of recommendation for >20 undergraduate students

Professional service

2015 - Member of United Mitochondrial Disease Foundation
2015 - Member of Genetics Society of America
2019 - Member of Society for Molecular Biology and Evolution
2015 - Ad hoc reviewer for:

- *Nature Cell Biology*
- *PLOS Biology*
- *Current Biology*
- *PLOS Genetics*
- *Proc Natl Acad USA*
- *Cell Systems*
- *The Journal of Clinical Investigations*
- *Molecular Biology and Evolution*
- *Philosophical Transactions of the Royal Society B*
- *BMC Developmental Biology*
- *BMC Biology*
- *Integrative and Comparative Biology*
- *Mutation Research*

2015- Ad hoc grants reviewer for:

- *National Science Foundation*
- *European Research Council*