Nikhil Munshi, M.D., Ph.D.

5323 Harry Hines Blvd. · Dallas, TX 75390-8573 · (214) 648-4001 · Nikhil.Munshi@UTSouthwestern.edu

Education

1995 **B.S. in Biomedical Engineering/B.S. in Molecular Biology (***Summa Cum Laude)***,** University of California at San Diego, La Jolla, CA

2001 **Ph.D. in Biochemistry (***With Distinction)***,** Department of Biochemistry and Molecular Biophysics, Columbia University, New York, NY

2003 **M.D.**, Columbia University College of Physicians & Surgeons, New York, NY (May 2003)

Academic Positions

2003-2004 **Post-Doctoral Fellow**, Dr. Andrew Marks, Department of Physiology and Cellular Biophysics, Columbia University, New York, NY

2004-2006 **Internal Medicine Intern and Resident**, UT Southwestern Medical Center, Dallas, TX

2006-2009 **Post-Doctoral Fellow**, Dr. Eric Olson, Department of Molecular Biology, UT Southwestern Medical Center, Dallas, TX

2009-2011 **Cardiology Fellow,** UT Southwestern Medical Center, Dallas, TX

2011-present **Assistant Professor**, Departments of Internal Medicine (Cardiology Division) and Molecular Biology, UT Southwestern Medical Center, Dallas, TX

2012-present **Member**, McDermott Center for Human Growth and Development, UT Southwestern Medical Center, Dallas, TX

2013-present **Assistant Cardiology Fellowship Program Director – Research**, Department of Internal Medicine (Cardiology Division), UT Southwestern Medical Center, Dallas, TX

2015-present **Member**, Hamon Center for Regenerative Science and Medicine, UT Southwestern Medical Center, Dallas, TX

2016-present **Content Editor**, *Circulation*, UT Southwestern Medical Center, Dallas, TX

Clinical Positions

2011-present Attending Physician, Department of Internal Medicine, Division of Cardiology, Parkland Memorial Hospital, Dallas, TX

2011-present Attending Physician, Department of Internal Medicine, Division of Cardiology, Clements University Hospital, Dallas, TX

Licensure and Certification

2006-present Medical License, TX

2008-present American Board of Internal Medicine

2011-present American Board of Internal Medicine (Cardiology)

Honors and Awards

1990 University of California Regent's Scholar

1993 Award for excellence in Undergraduate Research

1995 B.S. in Molecular Biology with Honors

1995 Medical Scientist Training Program trainee - full tuition and stipend for medical and graduate school

2001 Ph.D. in Biochemistry with Distinction

2003 Miriam Berkman Spotnitz Award for excellence in research of neoplastic diseases

2007 Grand Prize Winner, UT Southwestern Symposium on Cardiovascular Disease Poster Competition

2008 Fellows Basic Science Winner, Northwestern Cardiovascular Young Investigators' Forum

2009 Grand Prize Winner, UT Southwestern Symposium on Cardiovascular Disease Poster Competition

2009 Finalist, Burroughs Wellcome Fund - Career Award for Medical Scientists
2011 Young Investigator Award for Basic Science, American Association of Indian Cardiologists
2011 Joanne McWhorter Award for Excellence in Clinical Cardiology
2012 Finalist, Arnold and Mabel Beckman Foundation Young Investigator Award
2012 Finalist, Doris Duke Research Foundation Clinical Scientist Development Award
2013 March of Dimes Basil O'Connor Starter Scholar
2014 Faculty Basic Science Finalist, Northwestern Cardiovascular Young Investigators' Forum

Professional Societies

1995-present Phi Beta Kappa
2004-present American Medical Association
2006-present Alpha Omega Alpha
2006-present American College of Cardiology
2011-present Texas Medical Society
2011-present Dallas County Medical Society
2011-present American Heart Association

Funding

1997-2001 NIH 5T32GM07367, Medical Scientist Training Program Grant, Trainee (PI: Dimitris Thanos)
2003-2004 New York Academy of Medicine, Glorney-Raisbeck Fellowship in Cardiovascular Disease, Trainee (PI: Andrew Marks)
2006-2009 UT Southwestern Medical Center, Physician Scientist Training Program, Trainee (PI: Eric Olson)
2009-2014 NIH 5K08HL094699, Mentored Clinical Scientist Award
2010-2011 NIH 5UL1RR024982-03, Pilot Award, Co-Investigator (PI: Milton Packer)
2011-2017 1009838, Burroughs Wellcome Fund, Career Award for Medical Scientists
2011-2014 UT Southwestern Medical Center, Disease-Oriented Clinical Scholar
2013-2015 #5-FY13-203, March of Dimes Foundation, Basil O'Connor Starter Scholar Research Award
2014-2018 1000165336, NSF GRFP Award (Trainee: Antonio Fernandez-Perez)
2016-2018 NIH 2R03HL1336429-01, Small Grant Program
2016-2018 NIH 2R03HL135217-01, Small Grant Program
2017-2018 NIH 3R03HL133642-01S1, Diversity Supplement (Trainee: Magid Mohamed)
2017-2019 AHA 17PRE33670730, Predoctoral Research Grant (Trainee: Samadrita Bhattacharyya)
2017-2019 AHA 17IRG33460080, Innovative Research Grant
2017-2022 NIH 1R01HL136604-01A1, Research Project Grant

Mentoring

Post-Doctoral Researchers: Mahesh Padanad (2011-2013)
Young-Jae Nam (2011-2014)

Graduate Students: Antonio Fernandez-Perez (2013-present; **NSF Awardee**)
Magid Mohammed (2016-present; **CRSM Travel Award; Diversity Supplement Awardee**)
Samadrita Bhattacharyya (2016-present; **AHA Awardee**)

Rotation Students: Antonio Fernandez-Perez (GD&D, 2013)
Magid Mohammed (MSTP, Integrative Biology, 2015)
Samadrita Bhattacharyya (GD&D, 2016)

Ph.D. Thesis Committees: Ahmed Mahmoud* (Genetics & Development, graduated 2012)
Jason Nagati (Genetics, Development, and Disease, graduated 2015)
Esther Kim (Integrative Biology, 2016-present)

	Mercedes Quintana-Serrano (Integrative Biology, 2016-2017)
M.D. Thesis Committees:	Kamran Ahmed (2015)
Qualifying Exam Committees:	Danyang He* (Genetics & Development, 2013) Junyao Ren (Integrative Biology, 2013) Philip Cheng (Integrative Biology, 2014) Hema Manjunath* (Genetics & Development, 2014) Yi-Li Min* (Genetics, Development, & Disease, 2015) Andres Ramirez Martinez* (Genetics, Development, & Disease, 2016)
Cardiology Fellow Advisory Committees:	Benjamin Winders (2012-2014) Matthew Dickson (2012-2015) Douglas Stoller (2012-2015) Christopher French (2012-2016) Gregory Aubert (2013-2015) Shah Ali (2015-present) Maimon Hubbi (2015-present) Jainy Savla (2016-present) Amanda Tong (2016-present) Glynnis Garry (2016-present)
Fellows:	Nitin Kulkarni (2016-present) Matthew Cain (2016-present)
Residents:	Rohan Chaubey (2013)
Medical Students:	Siddharth Chauhan (2015) Denise Li (2015) Luis Juarez (2015)
Undergraduate Students:	John Harris/Green Fellowship Program (2013) Blake Wall/SURF Program (2015) Kartik Kulkarni (2017)
High-School Students:	Daniel Larson/STARS Program (2012) Kartik Kulkarni/STARS Program (2015)

(*committee chairperson)

Service and Teaching

2011-present	Genes, Development, and Disease Graduate Program Faculty Member
2011-present	Integrative Biology Graduate Program Faculty Member
2011-present	Interviewer, Internal Medicine Residency Program
2011-present	Interviewer, Cardiology Fellowship Program
2011-present	Interviewer, Medical Scientist Training Program
2012-present	Director, Cardiology Physician Scientist Training Program
2013-present	Group Discussion Leader, "Responsible Conduct of Research" Graduate Student Course
2017-present	Lecturer, Developmental Principles in Regenerative Science and Medicine

Presentations

1998 *Recruitment of CBP/p300 by the IFN-β enhanceosome directs synergistic activation of transcription and specific acetylation of the HMG I(Y) protein*, Cold Spring Harbor, NY

1998 *Acetylation of HMG I(Y) by CBP turns off IFN beta expression by disrupting the enhanceosome*, Columbia University, New York, NY

1999 *Acetylation of HMG I(Y) by P/CAF stabilizes formation of the enhanceosome*, Cold Spring Harbor, NY

2007 *Mapping of the Cx30.2 minimal enhancer reveals determinants of cardiac conduction system development*, UT Southwestern Medical Center, Dallas, TX

2009 *Using zebrafish to dissect the molecular mechanisms underlying AVN formation*, UT Southwestern Medical Center, Dallas, TX

2012 *Transcriptional profiling of Cx30.2^{+} AVC cells uncovers MyoR as a potential regulator of AV conduction*, Weinstein Conference, Chicago, IL.

2012 *Transcriptional profiling of Cx30.2^{+} AVC cells uncovers MyoR as a potential regulator of AV conduction*, K Investigators Meeting, Bethesda, MD.

2013 *PouC is a novel regulator of zebrafish atrioventricular canal morphogenesis*, Keystone Symposium, Snowbird, UT.

2013 *PouC regulates Bmp4 expression to orchestrate atrioventricular canal development*, AHA Scientific Sessions, Dallas, TX.

Lectures

1999 *Acetylation of HMG I(Y) by P/CAF stabilizes formation of the enhanceosome*, Penn State University, State College, PA

2000 *HMG I(Y) acetylation coordinates a transcriptional switch*, Columbia University, New York, NY

2008 *Mapping of the Cx30.2 minimal enhancer uncovers a critical role for GATA4 in development of the atrioventricular node*, Weinstein Conference, Houston, TX

2008 *A GATA4-dependent transcriptional pathway regulates normal atrioventricular delay*, Northwestern Cardiovascular Young Investigators' Forum, Chicago, IL

2009 *A GATA4-dependent transcriptional pathway regulates normal atrioventricular delay*, Keystone Symposium, Keystone, CO

2011 *A GATA4-dependent transcriptional pathway regulates normal atrioventricular delay*, Columbia University, New York, NY

2011 *Understanding cardiac conduction system development and its impact on arrhythmogenesis*, Genes & Development Works in Progress, UTSW Medical Center, Dallas, TX

2011 *Understanding cardiac conduction system development and its impact on arrhythmogenesis*, Medical Scientist Training Program Works in Progress, UTSW Medical Center, Dallas, TX

2012 *Transcriptional regulation of cardiac rhythm*, McDermott Center for Human Growth and Nutrition Works in Progress, UTSW Medical Center, Dallas, TX

2012 *Transcriptional regulation of cardiac rhythm*, New Faculty Research Forum, UTSW Medical Center, Dallas, TX

2012 *Molecular cardiology primer*, Cardiovascular Research Forum, UTSW Medical Center, Dallas, TX

2012 *The WPW syndrome: concepts and controversies*, Internal Medicine Grand Rounds, UTSW Medical Center, Dallas, TX

2013 *Molecular cardiology primer*, Cardiovascular Research Forum, UTSW Medical Center, Dallas, TX

2013 *Cardiac conduction system: mechanisms, models, and manipulation*, Cardiovascular Research Forum, UTSW Medical Center, Dallas, TX

2013 *Elucidating gene regulatory networks that establish cardiac rhythm*, McDermott Center for Human Growth and Nutrition Works in Progress, UTSW Medical Center, Dallas, TX

2014 *Reprogramming cardiac cell-type specificity*, Gordon Research Conference, New London, NH
2014 *The promise and pitfalls of cardiac lineage reprogramming*, McDermott Center for Human Growth and Nutrition Works in Progress, UTSW Medical Center, Dallas, TX
2014 *Reprogramming cardiac cell-type specificity*, Cardiovascular Research Forum, UTSW Medical Center, Dallas, TX
2014 *pouC regulates atrioventricular canal formation by activating bmp4 expression*, Northwestern Cardiovascular Young Investigators' Forum, Chicago, IL
2015 *Induction of diverse cardiac cell types by reprogramming fibroblasts with cardiac transcription factors*, Keystone Symposium, Copper Mountain, CO
2015 *pouC is a novel regulator of zebrafish atrioventricular canal morphogenesis*, Pediatric Academic Societies Meeting, San Diego, CA
2015 *Transcriptional control of cardiac rhythm*, ARM60: calcium signaling in health and disease, Columbia University, New York, NY
2015 *Establishing cardiac rhythm: What makes the ticker keep ticking*, STARS Summer Seminar Series, UTSW Medical Center, Dallas, TX
2015 *Molecular cardiology primer*, Cardiovascular Research Forum, UTSW Medical Center, Dallas, TX
2015 *Transcriptional control of cardiac rhythm*, The mojo of muscle: past, present, and future, UTSW Medical Center, Dallas, TX
2015 *Generation, Disease, and Re-generation of cardiac rhythm*, Medical Scientist Training Program Works in Progress, UTSW Medical Center, Dallas, TX
2015 *Generation and Re-generation of cardiac rhythm*, Cardiovascular Research Forum, UTSW Medical Center, Dallas, TX
2015 *Establishing cardiac rhythm: What makes the ticker keep ticking*, UTSW Medical School Cardiology Interest Group, UTSW Medical Center, Dallas, TX
2016 *Generation and Re-generation of cardiac rhythm*, Internal Medicine Department Research Conference, UTSW Medical Center, Dallas, TX
2016 *Career Development for Physician-Scientists*, Physician-Scientist Training Program (PSTP), UTSW Medical Center, Dallas, TX
2016 *Translational Opportunities in Molecular Electrophysiology*, Electrophysiology Morning Conference, UTSW Medical Center, Dallas, TX
2016 *Generation and Re-generation of cardiac rhythm*, McDermott Center for Human Growth and Nutrition Works in Progress, UTSW Medical Center, Dallas, TX
2016 *Establishing cardiac rhythm: What makes the ticker keep ticking*, STARS Summer Seminar Series, UTSW Medical Center, Dallas, TX
2016 *Molecular cardiology primer*, Cardiovascular Research Forum, UTSW Medical Center, Dallas, TX
2016 *Developing plasma biomarkers for cardiac arrhythmias*, Cardiovascular Research Forum, UTSW Medical Center, Dallas, TX
2016 *Minimal determinants of cardiac reprogramming*, American Heart Association Scientific Session, New Orleans, LA
2017 *Direct reprogramming*, Developmental Principles in Regenerative Medicine Course, Dallas, TX.

Invited Participant

2012 *Research residency information & translational opportunities*, Panelist, APSA Regional Conference, UTSW Medical Center, Dallas, TX
2012 *Role of the general practitioner in the prevention of sudden cardiac death*, Session Chair, Arrhythmia Symposium, Cedars-Sinai Medical Center, Beverly Hills, CA

Invited reviewer - Journals

BioMed Research International
Cardiovascular Research
Cell
Circulation
Circulation Cardiovascular Genetics
Circulation Research
Developmental Biology
International Journal of Molecular Sciences
Journal of Cardiac Failure
Journal of Cardiovascular Disease and Development
Journal of Computer Science and System Biology
Journal of Visualized Experiments
Molecular Genetics and Genomics
NPJ Regenerative Medicine
Physiological Reports
Science
Scientific Reports
Stem Cell Research

Invited reviewer - Grants

Netherlands Organization for Scientific Research
March of Dimes

Publications

1. **Munshi N**, Merika M, Yie J, Senger K, Chen G, Thanos D. Acetylation of HMG I(Y) by CBP turns off IFN beta expression by disrupting the enhanceosome. (1998) *Mol Cell* 2: 457-67.
2. Yie J, Merika M, **Munshi N**, Chen G, Thanos D. The role of HMGI(Y) in the assembly and function of the IFN-beta enhanceosome. (1999) *EMBO J* 18: 3074-89.
3. **Munshi N**, Yie J, Merika M, Senger K, Lomvardas S, Agalioti T, Thanos D. The IFN-beta enhancer: a paradigm for understanding activation and repression of inducible gene expression. (1999) *Cold Spring Harb Symp Quant Biol* 64: 149-59.
4. Chau KY, **Munshi N**, Keane-Myers A, Cheung-Chau KW, Tai AK, Manfioletti G, Dorey CK, Thanos D, Zack DJ, Ono SJ. The architectural transcription factor high mobility group I(Y) participates in photoreceptor-specific gene expression. (2000) *J Neurosci* 20: 7317-24.
5. O'Neill DW, Shoetz SS, Lopez RA, Castle M, Rabinowitz L, Shor E, Krawchuk D, Goll MG, Renz M, Seelig HP, Han S, Seong RH, Park SD, Agalioti T, **Munshi N**, Thanos D, Erdjument-Bromage H, Tempst P, Bank A. An ikaros-containing chromatin-remodeling complex in adult-type erythroid cells. (2000) *Mol Cell Biol* 20: 7572-82.
6. **Munshi N**, Agalioti T, Lomvardas S, Merika M, Chen G, Thanos D. Coordination of a transcriptional switch by HMGI(Y) acetylation. (2001) *Science* 293: 1133-6.
7. Fedele M, Pierantoni GM, Berlingieri MT, Battista S, Baldassarre G, **Munshi N**, Dentice M, Thanos D, Santoro M, Viglietto G, Fusco A. Overexpression of proteins HMGA1 induces cell cycle deregulation and apoptosis in normal rat thyroid cells. (2001) *Cancer Res* 61: 4583-90.
8. **Munshi NV**, McAnally J, Bezprozvannaya S, Berry JM, Richardson JM, Hill JA, Olson EN. Cx30.2 enhancer analysis identifies Gata4 as a novel regulator of atrioventricular delay. (2009) *Development* 136: 2665-2674.
9. **Munshi NV**. Gene regulatory networks in cardiac conduction system development. (2012) *Circ Res* 110: 1525-1537.

10. Nam YJ, **Munshi NV**. Chemical biology in regenerative medicine. First ed. Hong CC, Ao AS, Hao J, editors. West Sussex, United Kingdom: John Wiley & Sons; 2014. Chapter 4, Challenges and new directions for cardiac reprogramming; p.49-58. 219p.
11. **Munshi NV** and Olson EN. Translational medicine. Improving cardiac rhythm with a biological pacemaker. (2014) *Science* 345: 268-9.
12. Nam YJ, Lubczyk C, Bhakta M, Zang T, Fernandez-Perez A, McAnally J, Bassel-Duby R, Olson, EN, **Munshi NV**. Induction of diverse cardiac cell types by reprogramming fibroblasts with cardiac transcription factors. (2014) *Development* 141: 4267-78.
13. Harris JP, Bhakta M, Bezprozvannaya S, Wang L, Lubczyk C, Olson EN, **Munshi NV**. MyoR Modulates Cardiac Conduction by Repressing Gata4. (2015) *Mol Cell Biol* 35: 649-61.
14. **Munshi NV**. CRISPR (Clustered Regularly Interspaced Palindromic Repeat)/Cas9 System: A Revolutionary Disease-Modifying Technology. (2016) *Circulation* 134:777-9.
15. Nam YJ and **Munshi NV**. The promise of cardiac regeneration by in situ lineage conversion. (2017) *Circulation* 135: 914-6.
16. Bhattacharyya S, Bhakta M, and **Munshi NV**. Phenotypically silent Cre recombination within the postnatal ventricular conduction system. (2017) *PLoS One* 12: e0174517.
17. Fernandez-Perez A and **Munshi NV**. Assessing cardiomyocyte subtypes following transcription factor-mediated reprogramming of mouse embryonic fibroblasts. (2017). *J Vis Exp* 121.
18. **Munshi NV**. Resident macrophages: near and dear to your heart. (2017). *Cell* 169: 376-7.

Media Citations

Voice of America: http://www.voanews.com/content/normal-heart-cells-transformed-into-biological-pacemaker/1959129.html.
SWR German Public Radio
New York Times: http://www.nytimes.com/2014/07/17/health/gene-therapy-used-to-create-biological-pacemaker-in-pigs.html?ref=science&_r=0.
Popular Mechanics: http://www.popularmechanics.com/science/health/med-tech/reprogramming-cells-to-make-a-bio-pacemaker-16991220?click=pm_latest
Science Friday
Live Science: http://www.livescience.com/46833-biological-pacemaker-heart.html.
Bloomberg News: http://www.bloomberg.com/news/2014-07-16/biological-pacemaker-that-works-in-pigs-offers-promise.html
Scientific American: http://www.scientificamerican.com/article/heart-cells-transformed-into-biological-pacemaker/
The Wall Street Journal: http://online.wsj.com/articles/gene-therapy-corrects-irregular-heartbeat-in-pigs-1405533603
Los Angeles Times: http://touch.latimes.com/#section/621/article/p2p-80824528/
International Business Times: http://www.ibtimes.co.in/single-gene-injection-could-soon-replace-electronic-pacemakers-cure-heart-diseases-604653
ABC News: http://abcnews.go.com/Health/wireStory/gene-therapy-create-biological-pacemaker-24586229