Adam R. Hall

~curriculum vitae~

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Professional Address:
Joint School of Nanoscience and Nanoengineering, University of North Carolina Greensboro, 2907 E Lee St., Greensboro, NC 27401, USA
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Education:

2007: PhD in Applied and Materials Sciences, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA

Dissertation Title: *"Material and Device Investigations on a Carbon Nanotube-Based Torsional Nanoelectromechanical System"*

Advisor: Sean Washburn

2002: BS in physics, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA

2000: AS in physics, Jamestown Community College, Jamestown, NY, USA

Employment:

2010- present: Assistant Professor of Nanoscience- Joint School of Nanoscience and Nanoengineering, University of North Carolina Greensboro, Department of Nanoscience, Greensboro, NC, USA

2007-2010: Postdoctoral fellow- Technische Universiteit Delft, Faculty of Applied Sciences, Kavli Institute of Nanoscience, Department of Bionanoscience, Delft, The Netherlands

2007: Postdoctoral fellow- University of North Carolina at Chapel Hill, Curriculum in Applied and Materials Sciences, Chapel Hill, NC, USA

2002-2007: Graduate Research Associate- University of North Carolina at Chapel Hill, Curriculum in Applied and Materials Sciences, Chapel Hill, NC, USA

2000-2002: Undergraduate Research Associate- University of North Carolina at Chapel Hill, Department of Physics and Astronomy, Chapel Hill, NC, USA

1999-2000: Physics Laboratory Assistant/Tutor- Jamestown Community College, Jamestown, NY, USA

1996-1999: Electronic Components Assembly- Falconer Electronics Inc, Falconer, NY, USA

Awards and Honors:

2012: Nano Letters Young Investigator award (nominated)

2006-7: Ross & Charlotte Johnson Family Dissertation Fellowship (UNC-CH)
- Funded final year of graduate school

2004-6: NASA Graduate Student Research Program (GSRP) Fellowship
- Externally funded two years of graduate school

2002: Graduate Merit Fellowship (UNC-CH)
- Funded one year of graduate school

2000: Outstanding Physics Student (JCC)

Research Interests:

- Disease screening technology
- Single-molecule detection and characterization
- DNA-protein interactions
- Solid-state nanopores
- Single molecule force spectroscopy
- Development of nanometer scale actuation schemes
- Nanosensing (force, mass and chemical)

Service & Society Membership:

- Director, JSNN microscopy labs (2010-present)
- *Ad hoc* referee for ten journals including: Nature Materials, Proceeding of the National Academy of Sciences, Nucleic Acids Research, Journal of the American Chemical Society, and Nano Letters
- Contributor to two science education books:
  Nanoscale Science: Activities for Grades 6-12, M. Gail Jones, M.R. Falvo, Amy R. Taylor, Bethany P. Broadwell, National Science Teacher Association Press, 2007.
  Extreme Science: From Nano to Galactic, M. Gail Jones, Amy R. Taylor, M.R. Falvo, National Science Teacher Association Press, 2009.
- Member of American Physical Society (APS), Materials Research Society (MRS), Biophysical Society (BPS), American Electrophoresis Society (AES)
- Session co-chair, AES meeting 2011
- Guest co-editor, NanoLife special issue on "Nanotechnology in Biological Detection and Characterization" (anticipated publication date March 2013)

Teaching Experience:

2011-present: NAN 604, Nanotechniques (UNCG)
- designed and implemented graduate course focused on topics in nanofabrication, nanocharacterization, and nanomanipulation

2010-present: NAN 611, Microscopy lab rotation (UNCG)
- graduate level laboratory course detailing practical use of advanced microscopes (e.g. SEM, AFM, etc)

2004: Teaching Assistant, PHYS 142L(UNC-CH)
- senior level physics and materials science lab

2001- 2007: Participated in outreach programs with local high schools (UNC-CH)

1999-2000: Tutor/grader for five classes, ranging from General Physics to Introductory Electronics and Magnetism and Modern Physics (JCC)

Student Oversight:

Lamar Mair (PhD, UNC-CH, 2011)
Alan Liu (BSc, UNC-CH, 2007)
Andrew Scott (Msc, TUD 2010)
Johannes Keegstra (BSc, TUD, 2010)
Mehrdad Tajkarimi (PhD, UNCG, anticipated)
Osama Zahid (PhD, UNCG, anticipated)
Kristen Alexander (MSc, UNC-CH, 2007)
Bas van Schie (BSc, TUD, 2009)
Bart Manintveld (BSc, TUD, 2010)
Michael Marshall (PhD, UNCG, anticipated)
Furat Sawafta (PhD, UNCG, anticipated)

Peer-Reviewed Journal Publications:

1. "*In situ* Thickness Assessment During Ion Milling of a Free-Standing Membrane Using Helium Ion Microscopy", **A. R. Hall**, *in press*, 2012

2. "Direct- and Transmission-milling of Suspended Silicon Nitride Membranes with a Focused Helium Beam", M. M. Marshall, J. Yang, **A. R. Hall**, *Scanning*, 34(2), 101-106, 2012

3. "Rapid and Precise Scanning Helium Ion Microscope Milling of Solid-State Nanopores for Biomolecule Detection", J. Yang, D. C. Ferranti, L. A. Stern, C. A. Sanford, J. Huang, Z. Ren, L.-C. Qin and **A. R. Hall**, *Nanotechnology*, 22 (28), 285310 2011

4. "Translocation of Single-Wall Carbon Nanotubes Through Solid-State Nanopores", **A . R. Hall**, J. M. Keegstra, M. C. Duch, M. C. Hersam, C. Dekker, *Nano Letters,* 11 (6) 2446, 2011

5. "Highly Controllable Near-Surface Swimming of Magnetic Janus Nanorods: Application to Payload Capture and Manipulation", L. O. Mair, B. A. Evans, **A. R. Hall**, J. Carpenter, A. R. Shields, M. Millard, K. Ford, R. Superfine, *J. Phys. D: Appl. Phys.*, 44(12), 125001, 2011

6. "Hybrid Pore Formation by Directed Insertion of Alpha-haemolysin into Solid-state Nanopores", **A. R. Hall**, A. Scott, D. Rotem, K. Metah, H. Bayley, C. Dekker, *Nature Nanotechnology*, 5 (12), 874-7, 2010

7. "Controlling Nanopore Size, Shape and Stability", M. van den Hout, **A. R. Hall**, M. Y. Wu, H. W. Zanbergen, C. Dekker, N. H. Dekker, *Nanotechnology*, 21(11), 115304, 2010

8. "Detection of Local Protein Structures Along DNA Using Solid-State Nanopores", S. Kowalczyk, **A. R. Hall**, C. Dekker, *Nano Letters*, 10 (1), 324-8, 2010

9. "Electrophoretic Force on a Protein-Coated DNA Molecule in a Solid-State Nanopore", **A. R. Hall**, S. van Dorp, S. G. Lemay, C. Dekker, *Nano Letters*, 9 (12), 4441-5, 2009

10. "Translocation of RecA-Coated dsDNA through Solid-State Nanopores", R. M. M. Smeets, S. Kowalczyk, **A. R. Hall**, N. H. Dekker, C. Dekker, *Nano Letters*, 9 (9), 3089-95, 2009

11. "A Self-Sensing Nanomechanical Resonator Built on a Single-Walled Carbon Nanotube", **A. R. Hall**, M. R. Falvo, R. Superfine, and S. Washburn, *Nano Letters*, 8 (11), 3726-9, 2008

12. "Electromechanical Response of Single-Wall Carbon Nanotubes to Torsional Strain in a Self-Contained Device", **A. R. Hall**, M. R. Falvo, R. Superfine, and S. Washburn, *Nature Nanotechnology*, 2 (7), p. 413, 2007

13. "Experimental Measurement of Single-wall Carbon Nanotube Torsional Properties," **A. R. Hall**, L. An, J. Liu, L. Vicci, M. R. Falvo, R. Superfine, and S. Washburn, *Phys. Rev. Lett.*, 96, 256102, 2006

14. "Resonant Oscillators with Carbon-Nanotube Torsion Springs," S. J. Papadakis, **A. R. Hall**, P. A. Williams, L. Vicci, M. R. Falvo, R. Superfine, and S. Washburn, *Phys. Rev. Lett.*, 93, 146101, 2004

15. "A Simple and Efficient Method for Carbon Nanotube Attachment to Scanning Probes and Other Materials," **A. Hall**, W.G. Matthews, M.R. Falvo, R. Superfine, S. Washburn, *Appl. Phys. Lett.*, 82(15), 2506-8, 2003

Review Articles:

1. "Torsional electromechanical systems based on carbon nanotubes", **A. R. Hall**, S. A. Paulson, T. Cui, J. P. Lu, L.-C. Qin, S. Washburn, *Reports on Progress in Physics*, 75, 116501, 2012

2. "Solid-state nanopores: From fabrication to application", **A. R. Hall**, *Microscopy Today*, 20 (5), 24-29, 2012

Book Chapters:

1. "Molecular Detection and Force Spectroscopy in Solid-State Nanopores with Integrated Optical Tweezers", **A. R. Hall** and C. Dekker, in Nanopores: Sensing Fundamental Biological Interactions at the Single Molecule Level (Eds. R. Bashir, S. Iqbal; Springer, 2011)

2. "Measuring Single-Wall Carbon Nanotubes with Solid-State Nanopores", **A. R. Hall**, J.M. Keegstra, M.C. Duch, M.C. Hersam, C. Dekker, in Nanopore-based technology: single molecule characterization and DNA sequencing, (Ed. M. Gracheva,; Humana Press, 2011) Vol. "Nanopore Sequencing technology", Series 'Methods in Molecular biology ' (series editor J.M. Walker)

Patents:

1. "Method of nucleic acid analysis", Inventors: **A. R. Hall**, Vincent Henrich, SN: 61/593,695, Filed: February 1, 2012

2. "Nanopore fabrication and applications thereof", Inventors: **A. R. Hall**, Jijin Yang, David Ferranti, Colin Sanford, SN: 61/493,811, Filed: June 6, 2011

Invited Talks:

3. "Helium Ion Milling of Solid-State Nanopores for Single-Molecule Detection", **A. R. Hall**, Orion User Group Meeting, Twente, The Netherlands, February, 2012

4. "Helium Ion Milling of Solid-State Nanopores for Single-Molecule Detection", **A. R. Hall**, Zing Nanopores Conference, Lanzarote, Spain, February, 2012

5. "Threading the Needle: Single-Molecule Biophysics with Solid- State Nanopores", **A. R. Hall**, Microscopy & Microanalysis, Nashville, TN, August, 2011

6. "Threading the Needle: Single-Molecule Detection and Force Spectroscopy with Solid-State Nanopores", **A. R. Hall**, Biophysics seminar, Cavendish Laboratories, Cambridge University, Cambridge, UK, November, 2009

7. "Single-Molecule Detection and Force Spectroscopy with Solid-State Nanopores", **A. R. Hall**, Dag van Biofysica en Biomediche Technologie, Nijmegen, The Netherlands, November 2009

8. "Solid-State Nanopores for Single-Molecule Detection and Force Spectroscopy", **A. R. Hall**, Biophysics seminar, Physics Department, Duke University, Durham, NC, July 2009

9. "Solid-State Nanopores", **A. R. Hall**, Biophysics seminar, Department of Biophysics and Biochemistry, University of North Carolina at Chapel Hill, Chapel Hill, NC, July 2009

10. "Single-Molecule Investigations of Protein-DNA Complexes With a Solid-State Nanopore", **A. R. Hall**, FOM Annual Dutch Meeting on Molecular and Cellular Biophysics, Veldhoven, The Netherlands, September 2008

11. "Autonomous Carbon Nanotube-based Nanoelectromechanical Devices", **A. R. Hall**, Physics seminar, Department of Physics, University of Virginia, Charlottesville, VA, April 2007

12. "Autonomous Carbon Nanotube-based Nanoelectromechanical Devices", **A. R. Hall**, seminar, Department of Physics, University of Maryland, Baltimore, MD, April 2007

13. "Autonomous Carbon Nanotube-based Nanoelectromechanical Devices", **A. R. Hall**, seminar, Delft University of Technology, Delft, The Netherlands, April 2007

14. "Autonomous Carbon Nanotube-based Nanoelectromechanical Devices", **A. R. Hall**, seminar, University of Pennsylvania, Philadelphia, PA, April 2007

Professional Conference Talks and Posters:

1. "Helium Ion Microscope (HIM) Milling of Solid-State Nanopores for Single-Molecule Detection Devices", **A. R. Hall**, J. Yang, D. C. Ferranti, L. A. Stern, J. Huang, C. A. Sanford, *(Poster Presentation)*, American Vacuum Society Meeting, Nashville, TN, October 2011

2. "Scanning Helium Ion Microscope (HIM)-Milled Solid-State Nanopores: Fabrication and Application to Biomolecule Detection", **A. R. Hall**, J. Yang, D. C. Ferranti, L. A. Stern, J. Huang, C. A. Sanford, American Electrophoresis Society Meeting, Minneapolis, MN, October 2011

3. "Helium Ion Microscope Milling of Solid-State Nanopores for Single-Molecule Devices",

A. R. Hall, J. Yang, D. C. Ferranti, L. A. Stern, J. Huang, C. A. Sanford, COMS Conference, Greensboro, NC, August 2011

4. "Hybrid Biological/Solid-State Nanopores", **A. R. Hall**, A. Scott, D. Rotem, K. Mehta, H. Bayley, C. Dekker, *(Poster Presentation),* Biophysical Society Meeting, Baltimore, MD, March 2011

5. "Hybrid Biological/Solid-State Nanopores", **A. R. Hall**, A. Scott, D. Rotem, K. Mehta, H. Bayley, C. Dekker, *(Poster Presentation),* Gordon Research Conference: Single Molecule Approaches to Biology, Lucca, Italy, June 2010

6. "Nanopores as a Single-Molecule Probe for Protein-DNA Complexes", **A. R. Hall**, S. W. Kowalczyk, R. M. M. Smeets, N. H. Dekker, C. Dekker, American Physical Society March Meeting, Pittsburgh, PA, March 2009

7. "Investigating Nanopore Spatial Resolution Using Locally Coated RecA-dsDNA Filaments", **A. R. Hall**, S. W. Kowalczyk, C. Dekker, American Physical Society March Meeting, Pittsburgh, PA, March 2009

8. "Electromechanical Response of Single-Wall Carbon Nanotubes to Torsional Strain in a Self-Contained Device", **A. R. Hall**, M. R. Falvo, R. Superfine, and S. Washburn, American Physical Society March Meeting, Denver, CO, March 2007

9. "Nanotorsional Actuator Devices Built on Individual Singlewall Carbon Nanotubes**," A. Hall**, M. R. Falvo, R. Superfine, S. Washburn, American Physical Society March Meeting, Baltimore, MD, March 2006

10. "Singlewall Carbon Nanotubes As Springs In A Nanotorsional Device**," A. Hall**, M. R. Falvo, R. Superfine, S. Washburn, Annual Southeastern Section of American Physical Society, Gainesville, FL, November 2005

11. "Singlewall Carbon Nanotubes as Torsional Springs in a Nanoelectromechanical Device**," A. Hall**, S. J. Papadakis, M. R. Falvo, R. Superfine, S. Washburn, American Physical Society March Meeting, Los Angeles, CA, March 2005

12. "Carbon-nanotube based nano-electro-mechanical devices**,"** S. J. Papadakis, **A. Hall**, D. Spivak, M. R. Falvo, R. Superfine, S. Washburn, Materials Research Society Spring Meeting, San Fransisco, CA, April 2004

13. "Effect of Torsional Stress on Transport Properties in Individual Carbon Nanotubes," **A. Hall**, S. J. Papadakis, D. Spivak, R. Superfine, S. Washburn, American Physical Society March Meeting, Montreal, Quebec, Canada, March 2004

14. "Conductivity Response to Torsional Stress in Individual Carbon Nanotubes," **A. Hall**, S. J. Papadakis, M.R. Falvo, R. Superfine, S. Washburn, Annual Southeastern Section of American Physical Society, Wilmington, NC, November 2003

15. "Magnetic Attachment of Carbon Nanotubes to Scanning Probes: Method and Applications," **A. Hall**, W.G. Matthews, M.R. Falvo, R. Superfine, S. Washburn, American Physical Society March Meeting, Austin, TX, March 2003

16. "High Yield Carbon Nanotube Probe Fabrication Through Magnetic Field Induction," **A. Hall**, W.G. Matthews, M.R. Falvo, R. Superfine, S. Washburn, Third Annual University of North Carolina at Chapel Hill Undergraduate Research Symposium, Chapel Hill, NC, April 2002

17. "High Yield Carbon Nanotube Probe Fabrication Through Flow Effects and Magnetic Field Induction," **A. Hall**, W.G. Matthews, M.R. Falvo, R. Superfine, S. Washburn, Annual Southeastern Section of American Physical Society, Charlottesville, VA, October 2001