

# DREW A. HALL

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*An updated version may be available online.*

## EDUCATION

<b>Stanford University</b> Stanford, CA	Ph.D. in Electrical Engineering Advisers: Shan X. Wang and Boris Murmann	2011
<b>Stanford University</b> Stanford, CA	MS in Electrical Engineering Advisers: Shan X. Wang and Boris Murmann	2008
<b>University of Nevada, Las Vegas</b> Las Vegas, NV	BS in Computer Engineering Minor in Applied Mathematics with honors, <i>summa cum laude</i>	2005

## RESEARCH INTERESTS

My broad research interests lie in the design of mixed-signal biomedical ICs and high performance biochips. I am interested in addressing applications such as *in-vitro* diagnostics, DNA sequencing, proteomics, point-of-care (POC) testing, neuronal detection and stimulation, healthcare monitoring, and smart medical devices. My general strategy is to leverage the advantages of IC design, VLSI systems, nanotechnology, and MEMS to improve the performance of existing technologies or develop new novel devices that can address the various challenges of biotechnology.

## AWARDS AND HONORS

ARCS Fellowship	<i>Recipient of the national Achievement Rewards for College Scientists (ARCS) fellowship for someone who will contribute to the nation's scientific and technological strength</i>	2010
1 <sup>st</sup> place Stanford BASES E-Challenge Business Plan Competition	<i>Winner of the Business Association of Stanford Entrepreneurial Students (BASES) business plan competition on the nanoLAB, a handheld point-of-care diagnostic device for global health</i>	2010
1 <sup>st</sup> place in IEEE Change the World Competition	<i>Winner (Student Humanitarian Supreme) of the inaugural international invention competition for "nanoLAB: A Hand-Held Diagnostic Laboratory."</i>	2009
1 <sup>st</sup> place in BME-IDEA Invention Competition	<i>Winner of the national bioengineering invention competition for "Lab-on-a-stick: A Hand-Held Diagnostic Laboratory"</i>	2009
Tau Beta Pi Fellow	<i>One of 35 engineering students selected nationally, Fife No. 70</i>	2005
1 <sup>st</sup> place in IEEE Micromouse Competition	<i>Winner of the southwest regional (region 6) Micromouse (an autonomous maze solving robot) competition</i>	2005

## PUBLICATIONS (H-INDEX: 7)

Ph.D. Thesis

**Drew A. Hall**, "GMR Spin-Valve Biochips and Interface Electronics for Ultrasensitive *in-vitro* Diagnostics," Ph.D. Thesis, Stanford University, 2011.

Committee: Shan X. Wang (Adviser), Boris Murmann (Co-Adviser), Bruce Wooley, Hector Garcia-Molina

Journal Papers (Peer Reviewed)

- J9. Dokyoon Kim, Francesco Marchetti, Zuxiong Chen, Sasa Zaric, Robert J. Wilson, **Drew A. Hall**, Richard S. Gaster, Jung-Rok Lee, Junyi Wang, Sebastian J. Osterfeld, Heng Yu, Robert M. White, William F. Blakely, Leif Peterson, Sandhya Bhatnagar, Brandon Manion, Serena Tseng, Kristen Roth, Matthew Coleman, Antoine Snijders, Andrew J. Wyrobek, Francesco Marchetti, and Shan X. Wang, "Nanosensor dosimetry of mouse blood proteins after exposure to ionizing radiation," *Scientific Reports*, 3, 2013.
- J8. **Drew A. Hall**, Richard S. Gaster, Kofi Makinwa, Shan X. Wang, and Boris Murmann, "A 256 pixel magnetoresistive biosensor microarray in 0.18 $\mu$ m CMOS," *Journal of Solid State Circuits*, 48, 1290-1301, 2013.
- J7. Richard S. Gaster, Liang Xu, Shu-Jen Han, Robert J. Wilson, **Drew A. Hall**, Sebastian J. Osterfeld, Heng Yu, and Shan X. Wang, "Quantification of Protein Interactions and Solution Transport Using High-Density GMR Sensor Arrays," *Nature Nanotechnology*, 6, 314-320, 2011.\*  
\*This paper is highlighted in *Nature Nanotechnology* – 6, 266-267 (2011).
- J6. R.S. Gaster, ‡ **D.A. Hall**, ‡ Shan X. Wang, "nanoLAB: An ultraportable, hand-held diagnostic laboratory for global health," *Lab on a Chip*, 11, 950-956, 2011.\*\*  
‡These authors contributed equally to this work.  
\*\*This article was one of the top ten accessed articles in February 2011.
- J5. Richard S. Gaster, **Drew A. Hall**, Shan X. Wang, "Autoassembly Protein Arrays for Analyzing Antibody Cross-Reactivity," *Nano Letters*, 11, 2579-2583, 2011.  
\*Selected for June 2011 cover art.
- J4. **D.A. Hall**, R.S. Gaster, T. Lin, S.J. Osterfeld, S. Han, B. Murmann, and S.X. Wang, "GMR biosensor arrays: a system perspective," *Biosensors and Bioelectronics*, 25, 2051-2057, 2010.
- J3. **D.A. Hall**, R.S. Gaster, S.J. Osterfeld, B. Murmann, and S.X. Wang, "GMR biosensor arrays: correction techniques for reproducibility and enhanced sensitivity," *Biosensors and Bioelectronics*, 25, 2177-2181, 2010.
- J2. Richard S. Gaster, ‡ **Drew A. Hall**, ‡ Carsten Neilson, Sebastian J. Osterfeld, Heng Yu, Kathleen Mach, Robert J. Wilson, Boris Murmann, Joseph C Liao, Sanjiv S. Gambhir, Shan X. Wang, "Matrix-insensitive protein assays push the limits of biosensors in medicine," *Nature Medicine*, 15, 1327-1332, 2009.\*\*  
‡These authors contributed equally to this work.  
\*\*This paper is highlighted in *Nature* – 461, 890-891 (2009).
- J1. S. J. Osterfeld, H. Yu, R. S. Gaster, S. Caramuta, L. Xu, S.-J. Han, **D. A. Hall**, R. J. Wilson, S. Sun, R. L. White, R. W. Davis, N. Pourmand, and S. X. Wang, "Multiplex Protein Assays Based on Real-Time Magnetic Nanotag Sensing," *PNAS*, 105, 20637-20640, 2008.

**Conference Papers (Peer Reviewed)**

- C2. **Drew A. Hall**, Richard S. Gaster, Sebastian J. Osterfeld, Kofi Makinwa, Shan X. Wang, Boris Murmann, "A 256 Channel Magnetoresistive Biosensor Microarray for Quantitative Proteomics," Symp. VLSI Circuits Dig., Kyoto, Japan, July 15-17, 2011.
- C1. **Drew A. Hall**, Richard S. Gaster, Shan X. Wang, Boris Murmann, "Portable biomarker detection with magnetic nanotags," *IEEE International Symposium on Circuits and Systems (ISCAS)*, Paris, France, June 3<sup>rd</sup>, 2010.

**Conference Talks**

- CT4. S.X. Wang, R.S. Gaster, **D.A. Hall**, "Wash-free multiplex protein assay based on magnetic nanotechnology and its applications in cancer research," *Digest of International Magnetism Conf.*, \* Taipei, Taiwan, April 25-29, 2011.  
\*Invited talk.
- CT3. **Drew A. Hall**, Calvin Chu, Andrew Dotey, Jr., Richard S. Gaster, Kofi Makinwa, Boris Murmann, Shan X. Wang, "A GMR Spin-Valve Integrated into a Continuous Time  $\Sigma\Delta$  Modulator for Quantitative, Real-Time Biosensing," *Digest of International Magnetism Conf.*, Taipei, Taiwan, April 25-29, 2011.
- CT2. **D. A. Hall**, R. S. Gaster, H. Yu, S. J. Osterfeld, B. Murmann, S. X. Wang, "Multiplexed GMR Biosensor Arrays," *Digest of International Magnetism Conf.*, Sacramento, CA, May 5-8, 2009.
- CT1. **Drew A. Hall**, Tondra De, "A New Approach to Maze Searching and Solving Techniques for Small Autonomous Mobile Robots," *IEEE Southwest Region Meeting*, \* Los Angeles, CA, September 9-10, 2005.  
\*Best Student Paper Award Winner.

**Books and Book Chapters**

- B2. Richard S. Gaster, **Drew A. Hall**, and Shan X. Wang, "Magnetic Nanoparticle Diagnostic Chips," invited book chapter in *Point of Care Diagnostics on a Chip*, Springer (Edited by Robert Westervelt and David Issadore), 2013.
- B1. **Drew A. Hall**, Richard S. Gaster, and Shan X. Wang, "GMR Biosensors," invited book chapter in *Handbook of Spin Transport and Magnetism*, Taylor & Francis (Edited by Evgeny Tsymbal and Igor Žurić), 2011.

**Patents**

- P2. **Drew A. Hall**, Richard Gaster, Sebastian J. Osterfeld, and Shan X. Wang, "Temperature and Drift Compensation in Magnetoresistive Sensors," US Utility Patent No. 8,405,385 (International Pending).
- P1. Richard Gaster, Shan X. Wang, and **Drew A. Hall**, "Wash-free Analyte Detection Assay," US Patent (Provisional Filed, US and International Pending).

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**INVITED TALKS (ONLY A SELECT FEW LISTED)**

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- T11. "Point-of-Care Biosensing," Center for Wireless Communications (CWC), October 25, 2013. La Jolla, CA.
- T10. "Low-Field Magnetic Sensors for Proteomics and Low-Noise Transimpedance Amplifiers for Genomics," Texas Instruments, September 13, 2013. Sunnyvale, CA.
- T9. "Point-of-Care Medical Diagnostics," UCSD Research Expo, April 18, 2013. La Jolla, CA.

## Hall - Curriculum Vitae

- T8. "Magnets in Medicine: Ultrasensitive Point-of-Care Diagnostics," Illumina, January 30, 2013. San Diego, CA.
- T8. "GMR SV sensors and magnetic nanotags for ultrasensitive in-vitro diagnostics," Intel, March 10, 2011. Santa Clara, CA.
- T7. "Sensing Your Future: Biomarker Detection using Magnetic Nanotags," Delft University, June 4, 2010. Delft, Netherlands.
- T6. "The nanoLAB: A Hand-Held Diagnostic Laboratory," Agilent Technologies, November 6, 2009. Santa Clara, CA.
- T5. "nanoLAB: Personalized Medicine and Diagnostics," Stanford Nanosociety, May 22, 2009. Stanford, CA.
- T4. "Lab-on-a-chip with GMR Biosensors," National Semiconductor Corporation, April 22, 2009. Sunnyvale, CA.
- T3. "GMR Biosensor Arrays," Bosch, February 2, 2009. Palo Alto, CA.
- T2. "GMR Biosensor Arrays for Lab on a Chip Applications," CIS Advisory Committee Meeting, November 11, 2008. Stanford, CA.
- T1. "GMR Biosensors," Analog Devices, September 16, 2008. Willmington, MA.

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## PROFESSIONAL EXPERIENCE

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Conducted paper reviews for:

IEEE Journal of Solid State Circuits (JSSC), IEEE International Magnetics Conference (InterMag), Journal of Applied Physics (JAP), Journal of Analytical Chemistry (AnalChem), Biosensors, International Symposium on Circuits and Systems (ICSAS), Transaction of Biomedical Circuits and System (BioCAS)

Served on UCSD Academic Integrity Review Board (2013-2014)

Served on NSF CAREER review panel (2013)

Served on UCSD ECE Undergraduate Affairs Committee (2013-2014)

Conducted book review for Springer (2013)

Served on UCSD ECE Undergraduate Affairs Committee (2012-2013)

Served as a student representative on Stanford's Faculty Search Committee (2010-2011)