

# Randall M. Erb

PhD Candidate

Duke University

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## Curriculum Vitae

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### A. Education

- Ph. D. Candidate in Materials Science**, Duke University, Durham, NC, 2005-2009  
Center for Biologically Inspired Materials and Materials Science.  
*Will Graduate in May 2009.*  
Dissertation Topic: "Magnetic manipulation of multi-component particle suspensions". See research statement for details.  
Advisor: Professor Benjamin B. Yellen
- B.S. in Electrical Engineering**, University of Rochester, Rochester, NY 2000-2004  
Graduated with Distinction
- Minor in Computer Science**, University of Rochester, Rochester, NY 2000-2004

### B. Professional Experience

- Graduate Research Assistant**, Duke University, Center for Biologically Inspired Materials and Materials Science. 2005-2009
- Teaching Assistant**, Duke University, Intro to Materials Science 2006
- Electrical Engineer**, Washington Group International, Denver, CO. 2004-2005
- Teaching Assistant**, University of Rochester, Computer Science 2003
- Electrical Engineering Intern**, Washington Group International, Denver, CO. 2003

### C. Honors and Awards

- Medtronic Foundation Fellowship**, \$35K/yr. fellowship awarded for completed and proposed work in biologically inspired materials and material systems. 2009
- Travel Grant**, 2008 American Vacuum Society Conference (Boston, MA) Oct. 2008
- 2<sup>nd</sup> Place in Best Oral Presentation**, 2008 Soft Matter Symposium, (Raleigh, NC) June 2008
- Travel Grant**, 2008 ACS- Colloids and Surface Science Symposium (Raleigh, NC) June 2008

<b>Travel Grant</b> , 2008 Applied Physics Society Meeting (New Orleans, LA)	Mar. 2008
<b>Travel Grant</b> , 2008 NSF CMMI Conference (Knoxville, TN)	Jan. 2008
<b>Center for Biological Inspired Materials and Material Systems Fellowship</b> - \$35K/yr fellowship awarded for pursuing work in biologically related engineering.	2008
<b>NSF Graduate Fellowship</b> – Honorable Mention	Sept. 2006
<b>National Finalist</b> – National Inventors Hall of Fame’s Collegiate Inventors Competition. 1 of 3 Students Nationwide.	Nov. 2004
<b>1<sup>st</sup> Place in Forbes Entrepreneurial Competition</b> – University of Rochester	Mar. 2004
<b>Rush Rhees Presidential Scholarship</b> – University of Rochester	2000-2004
<b>10<sup>th</sup> Place University of Northern Colorado State Math Contest</b> – Statewide mathematics exam	1999
<b>National Merit Semi-finalist</b> – Perfect scores in Math on SAT, SAT II, ACT and GRE	1999

#### D. Popular Press Features

“Materials science: Let assemblies bloom” Stefano Tonzani. <b>News and Views – Nature</b> . Doi 10.1038/457974a.	Feb. 19, 2009
“Sophisticated Nanostructures assembled with magnets” – <b>Science Daily, Science News Daily, Sciencecentric, Eurekalert, Nanotech Wire, First Science, Physical Organization News, and others</b>	Feb. 19, 2009
“Magnetic field induced concentration gradients in magnetic nanoparticle suspensions: Theory and Experiment” published in <b>Virtual Journal of Nanoscale Science &amp; Technology</b> : to showcase the week’s most influential research in nanotechnology	Apr. 14, 2008
“Concentration gradients in mixed magnetic and nonmagnetic colloidal suspensions” published in <b>Virtual Journal of Nanoscale Science &amp; Technology</b> : to showcase the week’s most influential research in nanotechnology	Mar. 24, 2008
“New Magnetic Separation Technique Might Detect Multiple Pathogens At Once” – <b>Duke News, Purdue University News, Raleigh-Durham News, and others</b>	Oct. 29, 2007
“Digital microfluidics: is a true lab-on-a-chip possible”. R.B. Fair. <b>Microfluid. Nanofluid.</b> DOI 10.1007/s10404-0161-8. Work sited throughout.	2007
“The New College Try”. <b>Scientific American</b> . Research Highlighted.	Feb. 2005

## E. List of Journal Publications

### a. Peer Reviewed Journal Contributions, Published, In Press, Accepted:

- 8 M. D. Krebs\*, R. M. Erb\*, B. Samanta, V. M. Rotello, B. B. Yellen, E. Alsberg. "Formation of ordered cellular structures in suspension via label-free negative magnetophoresis". *NanoLetters*. *In Press*. \*Co-First Authors
- 7 R. M. Erb\*, H. S. Son\*, B. Samanta, V. M. Rotello, B. B. Yellen. "Magnetic assembly of colloidal superstructures with multipole symmetry", *Nature*, **457**, 999-1002, 2009.
- 6 R. M. Erb, D. Sebba, A. Lazarides, B.B. Yellen. "Magnetic field induced concentration gradients in magnetic nanoparticle suspensions: Theory and Experiment". *Journal of Applied Physics*, **103**, 063916, 2008.
- 5 R. M. Erb and B. B. Yellen. "Concentration Gradients in Mixed Magnetic and Nonmagnetic Colloidal Suspensions". *Journal of Applied Physics* **103**, 07A412, 2008.
- 4 C.C. Ooi, R. M. Erb, and B. B. Yellen. "On the controllability of nanorod alignment in magnetic fluids". *Journal of Applied Physics* **103**, 07E910 2008.
- 3 B.B. Yellen, R. M. Erb, H. Son, R. Hewlin Jr., H. Shang, Gil U. Lee "Traveling wave magnetophoresis for high resolution chip based separations". *Lab on a Chip*, **7**, 1681 - 1688, 2007.
- 2 R. M. Erb, B. B. Yellen. "Model of Detecting Nonmagnetic Cavities in Ferrofluid for Biological Sensing Applications". *IEEE Transactions on Magnetics* **42-10**, October 2006: 3554-3556.
- 1 B. Yellen, R. M. Erb, D. Halverson, O. Hovorka, G. Friedman. "Arraying Nonmagnetic Colloids by Magnetic Nanoparticle Assemblers". *IEEE Transactions on Magnetics* **42-10**, 3548-3553, 2006.

### b. Peer Reviewed Journal Contributions, In Review, In Submission:

- 3 R. M. Erb, S. Zauscher, B. B. Yellen. "Harnessing Magnetic Image Force for calibrating chemical binding affinity", *Applied Physics Letters*. *In submission*.
- 2 R. M. Erb, M. D. Krebs, E. Alsberg, B. Samanta, V. M. Rotello, B. B. Yellen. "Beyond diffusion-limited cluster aggregation in microparticle suspensions". *Physical Review Letters*. *In Submission*.
- 1 R. M. Erb\*, N. Jenness\*, R. Clark, B. B. Yellen. "Towards holonomic control of Janus particles in optomagnetic traps", *Advanced Materials*. *In Review*.

### c. Journal Contributions, In Preparation:

- 2 R. M. Erb, B. B. Yellen. "Fluctuations of magnetically actuated assembly of ring micro- and nano-structures", *In Progress*.
- 1 R. M. Erb, R. Ducker, S. Zauscher, B. B. Yellen. "Ensemble Magnetic Tweezers for Measuring Molecular Binding Kinetics", *In Progress*.

## F. Book Chapters:

- 2 R. M. Erb and B. B. Yellen. "Magnetic Manipulation of Colloidal Particles", *Nanoscale Magnetic Materials and Applications*. Edited by J. P. Liu, et. al. *Springer Publishing Company*, *In Press*.
- 1 B. B. Yellen and R. M. Erb. "Manipulation and Detection of Magnetic Nanoparticles for Diagnostic Applications." *Handbook of Biosensors and Biochips*. Edited by R. Marks, et al. John Wiley & Sons, Ltd. © 2007.

## G. Conference Presentations

- 16 R. M. Erb, R. E. Ducker, S. Zauscher, B. B. Yellen. "Magnetic Tweezer Sensor for Ensemble Binding Events of Nonmagnetic Particles". Oral and Poster Presentation at AVS 55<sup>th</sup> International Symposium & Exhibition, (Boston, MA) October 2008.
- 15 R. M. Erb. "Concentration Gradients in Magnetic and Nonmagnetic Colloidal Suspensions". Oral Presentation at Soft Matter Symposium (Raleigh, NC) June 2008.
- 14 R. M. Erb, B. B. Yellen. "Traveling wave magnetophoresis for high resolution chip-based separations of particles". Oral Presentation at ACS – Colloids and Surface Science Symposium (Raleigh, NC) June 2008.
- 13 R. M. Erb, B. B. Yellen. "Numerical Methods for Magnetic Particle Concentration Gradients", Oral Presentation at ACS – Colloids and Surface Science Symposium (Raleigh, NC) June 2008.
- 12 B. B. Yellen, R. M. Erb, H. S. Son. "Self-Organized Magnetic Structures". Oral Presentation at ACS – Colloids and Surface Science Symposium (Raleigh, NC) June 2008.
- 11 R. M. Erb, M. D. Krebs, E. Alsberg, B. Samanta, V. M. Rotello, B. B. Yellen. "Kinetics of Nonmagnetic Particle Chain Growth in Biocompatible Ferrofluid", Oral Presentation at 7<sup>th</sup> International Conference on the Scientific and Clinical Applications of Magnetic Carriers (Vancouver, Canada) May 2008.
- 10 G. U. Lee, B. B. Yellen, R. M. Erb, H. S. Son, R. Hewlin, and H. Shang. "Non-linear magnetophoretic separation using micro-magnet arrays", Oral Presentation at 7<sup>th</sup> International Conference on the Scientific and Clinical Applications of Magnetic Carriers (Vancouver, Canada) May 2008.
- 9 R. M. Erb, B. B. Yellen. "Concentration Gradients in Mixed Magnetic and Nonmagnetic Colloidal Suspensions". Oral Presentation at APS Conference (New Orleans, LA) March 2008.
- 8 H. S. Son, R. M. Erb, B. B. Yellen. "Magnetically assembled "ring-shaped" colloidal particle structures". Oral Presentation at APS Conference (New Orleans, LA) March 2008.
- 7 R. M. Erb, B. B. Yellen. "Concentration Gradients in Mixed Magnetic and Nonmagnetic Colloidal Suspensions". Poster Presentation at NSF CMMI Conference (Knoxville, TN) January 2008.
- 6 R. M. Erb, B. B. Yellen. "Concentration Gradients in Mixed Magnetic and Nonmagnetic Colloidal Suspensions". Poster Presentation at MMM Conference (Tampa, FL) November 2007
- 5 C. C. Ooi, R. M. Erb, B. B. Yellen. "On the controllability of nanorod alignment in magnetic fluids". Poster Presentation at MMM Conference (Tampa, FL) November 2007
- 4 R. M. Erb, D. Sebba, A. Lazarides, J. Xu, S. Craig, B. B. Yellen. "Concentration Gradients Evolving in Magnetic Nanoparticle Suspensions". Poster Presentation at 10<sup>th</sup> Joint MMM/Intermag Conference, (Baltimore, MD) January 2007.
- 3 J. Lim, R.D. Tilton, A.Eggeman, F.Lanni, R. M. Erb, B.Yellen, S.A. Majetich. "Design and Imaging of Plasmonic Magnetic Nanoparticles". Oral Presentation at 10<sup>th</sup> Joint MMM/Intermag Conference, (Baltimore, MD) January 2007.
- 2 R. M. Erb, B. B. Yellen. "Equilibrium Concentration Profiles in Mixed Magnetic and Nonmagnetic Colloidal Systems". Oral Presentation at 80<sup>th</sup> ACS – Colloid & Surface Science Symposium, (Boulder, CO) June 20, 2006.
- 1 R. M. Erb, B. B. Yellen, "Model of Detecting Nonmagnetic Cavities in Ferrofluid for Biological Sensing Applications". Oral Presentation at IEEE International Magnetism Conference, (San Diego, CA) May 10, 2006.

## H. Patents

- 1 G. U. Lee, B. B. Yellen, R. M. Erb "Device and Methods for Separation and Detection of target Biological Species". In Progress.

## I. Professional Societies

American Physics Society

Current

IEEE – Student Member

2003-2004