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I. EDUCATION

- 1999 Ph.D. Chemistry, University of California at Berkeley and Materials Science Division, Lawrence Berkeley National Laboratory (Advisor: Gabor A. Somorjai)
- 1994 5 year Integrated M.S., Indian Institute of Technology (IIT) Kharagpur, India.

II. PROFESSIONAL EXPERIENCE

- July 2009- Present Associate Professor
Department of Chemical & Biomolecular Engineering
The Johns Hopkins University
- Dec 2004 –Present Joint Appointment
Department of Chemistry
The Johns Hopkins University
- Sept. 2003 – June 2009 Assistant Professor
Department of Chemical & Biomolecular Engineering
The Johns Hopkins University
- Sept 2001 - Aug 2003 Senior Engineer (Process Integration),
Research and Development
Intel Corporation, Hillsboro, Oregon
- June 1999 - Aug 2001 Postdoctoral Fellow (Advisor: George Whitesides)
Departments of Chemistry and Chemical Biology
Harvard University

III. SIGNIFICANT AWARDS

- 2008 NIH Director's New Innovator Award
2008 DuPont Young Professor Award
2007 Outstanding Young Engineer Award of the Maryland Academy of Sciences
2007 Maryland State Official Citation for Supporting Gifted Education (Senator Ulysses Currie)
2006 Camille Dreyfus Teacher-Scholar Award
2006 Beckman Young Investigator Award
2005 National Science Foundation Career Award
2003 Team Quality Award, Intel Corporation

IV. SIGNIFICANT NATIONAL AND INTERNATIONAL AWARDS GRANTED TO STUDENTS

PH.D. CANDIDATES

- 2007 Materials Research Society (MRS): Graduate Student Gold Award (Tim Leong)

UNDERGRADUATES

- 2006-2008 Four Defense Intelligence Agency (DIA) National Consortium for Measures and Signals Intelligence Research (NCMR) Scholars: [Bryan Benson (2008), \$10K]; Sasha Niemeyer (2007) \$10K; Travis Koh (2006) \$10K; Dan Slanac (2006) \$5K]
- 2008 Achievement Rewards for College Scientists (ARCS) Undergraduate Fellowship (Bryan Benson, \$15K)
- 2007 Fulbright Fellowship (Chih-Sheng Chiang)
- 2006 Howard Hughes Medical Institute (HHMI) Undergraduate Research Award (Travis Koh)

HIGH SCHOOL STUDENTS

- 2007 Intel Science Talent Search 2007: National Winner, 10th place overall, 1st in Engineering (Emma Call, \$20K)

V. PUBLICATIONS

JOURNAL ARTICLES

[Impact factor of the journal in 2008]

PUBLISHED WHILE AT JHU

48. D. J. Filipiak, A. Azam, T. G. Leong and D. H. Gracias, "Hierarchical self-assembly of complex polyhedral microcontainers," (2009) *Journal of Micromechanics and Microengineering* 19, 075012, 6 pp (2009).
47. P. Tyagi, N. Bassik, T. G. Leong, J.H. Cho, B. R. Benson, and D. H. Gracias, "Self-assembly based on chromium / copper bilayers", (2009) *Journal of the Microelectromechanical Systems (JMEMS)* accepted.
46. T. G. Leong, C. L. Randall, B. R. Benson, N. Bassik, G. M. Stern and D. H. Gracias, "Tetherless Thermo-chemically Actuated Microgrippers", *Proceedings of the National Academy of Sciences (PNAS)* **106**: 703-708 (2009) [9.598].
45. A. Azam, T. G. Leong, A. M. Zarafshar and D.H. Gracias, "Compactness Determines the Success of Cube and Octahedron Self-assembly", *PLoS ONE* 4 (2): e4451 (2009).
44. J. Wang, M. Patel and D. H. Gracias, "Self Assembly of Three Dimensional Nanoporous Containers", *Nano* 4, 1, 1-5 (2009) [N/A].
43. C. L. Randall, A. Gillespie, S. Singh, T. G. Leong and D. H. Gracias, "Size selective sampling using mobile, three-dimensional nanoporous membranes", *Analytical and Bioanalytical Chemistry* **393**: 1217–1224 (2009) [2.867].
42. J. S. Randhawa, T. Leong, N. Bassik, B. Benson, M. Jochmans and D. H. Gracias, "Pick-and-Place using Chemically Actuated Microgrippers", *Journal of the American Chemical Society (JACS)* **130**: (51), 7238–17239 (2008). [7.885].
41. N. Bassik, G. M. Stern, M. Jamal and D. H. Gracias, "Patterning thin film mechanical properties to drive assembly of complex 3D structures", *Advanced Materials* **20**: 4760-4764 (2008). [8.191].
40. T. G. Leong, C. Randall, B. Benson, Aasiyeh M. Zarafshar and D. H. Gracias, "Self-loading

- lithographically structured microcontainers: 3D patterned, mobile microwells”, *Lab Chip* **8**: 1621-1624 (2008). [Featured on the Cover] [5.068].
39. N. Bassik, B. Abebe and D. H. Gracias, “Solvent Driven Motion of Lithographically Fabricated Gels” *Langmuir* **24**: 21, 12158-12163 (2008) [4.009].
 38. T. G. Leong, B. R. Benson, E. K. Call and D. H. Gracias, “Thin Film Stress Driven Self-Folding of Microstructured Containers”, *Small* **4**: 10, 1605-1609 (2008) [6.4].
 37. J. H. Cho, S. Hu and D. H. Gracias, “Self-assembly of orthogonal 3-axis sensors”, *Applied Physics Letters* **93**: 4, 043505/1-043505/3 (2008) [3.596].
 36. J. Randhawa, A. Bernfeld, M. Keung, A. Volinsky and D. H. Gracias, “Concentric Ring Pattern Formation in Heated Chromium-Gold Thin Films on Silicon”, *Applied Physics Letters* **92**: 21, 211907/1-211907/3, (2008) [3.596].
 35. J.-R. Park, D. Slanac, T. Leong, H. Ye, D. Nelson and D. H. Gracias, “Reconfigurable Microfluidics With Metallic Containers”, *Journal of Microelectromechanical Systems* **17**: 2, 265-271 (2008) [1.964].
 34. D. Choi, J. Park, S. Kim, D. Gracias, M. Cho, Y. Kim, A. Fung, S. Lee, Y. Chen, S. Khanal, S. Baral and J. Kim, “Hyperthermia with magnetic nanowires for inactivating living cells”, *Journal of Nanoscience and Nanotechnology* **8**: 1-5 (2008) [1.987].
 33. D. Gracias, “On the Tracks of Carrier Transport”, *Nature Photonics* **1**: (10) 570-571 (2007). [N/A].
 32. B. Gimi, D. Artemov, T. Leong, D. H. Gracias and Z. Bhujwala, “MRI of regular-shaped cell-encapsulating polyhedral microcontainers”, *Magnetic Resonance in Medicine* **58**: 1283-1287 (2007). [3.131].
 31. C. L. Randall, T. G. Leong, N. Bassik and D. H. Gracias, “3D Lithographically Fabricated Nanoliter Containers for Drug Delivery”, *Advanced Drug Delivery Reviews* **59**: 15, 1547-1561 (2007) [Featured on the Cover] [8.224].
 30. H. Ye, J. Huang, J.-R. Park, H. Katz and D. H. Gracias, “Correlations Between Electrical Properties and SFG Spectra of Organic Field Effect Transistors”, *Journal of Physical Chemistry-C* **111**: 35, 13250-13255 (2007). [N/A].
 29. T. Leong, P. Lester, T. Koh, E. Call and D. H. Gracias, “Surface Tension Driven Self-Folding Polyhedra”, *Langmuir* **23**: 17, 8747-8751 (2007). [Featured on the Cover] [4.009].
 28. H. Ye, C. Randall, T. Leong, D. Slanac, E. Call and D. H. Gracias, “Remote Radio Frequency Controlled Nanoliter Chemistry and Chemical Delivery on Substrates”, *Angewandte Chemie-International Edition* **46**: 4991-4994 (2007) [10.031].
 27. B. Gimi, D. Artemov, T. Leong, D. H. Gracias, W. Gilson, M. Stuber and Z. M. Bhujwala, “Cell viability and non-invasive MRI tracking of 3D cell encapsulating self-assembled microcontainers”, *Cell Transplant* **16**: 4, 403-408 (2007) [3.871].
 26. Z. Gu, H. Ye, A. Bernfeld, K. J. T. Livi, and D. H. Gracias, “Three dimensional Electrically

Interconnected Nanowire Networks Formed by Diffusion Bonding”, *Langmuir* **23**: (3) 979-982 (2007) [4.009].

25. T. Leong, Z. Gu, T. Koh and D. H. Gracias, “Spatially Controlled Chemistry Using Remotely Guided Nanoliter Scale Containers”, *Journal of the American Chemical Society (JACS)* **128**: 35, 11336-11337 (2006) [7.885].
24. S. J. Papadakis, Z. Gu and D. H. Gracias, “Dielectrophoretic assembly of reversible and irreversible metal nanowire networks and vertically aligned arrays”, *Applied Physics Letters* **88**: 23, 233118/1-233118/3 (2006) [3.596].
23. H. Ye, A. Abu-Akeel, J. Huang, H. E. Katz and David H. Gracias, “Probing Organic Field Effect Transistors In-Situ During Operation Using SFG”, *Journal of the American Chemical Society (JACS)* **128**: 20, 6528-6529 (2006) [7.885].
22. H. Ye, Z. Gu and D. H. Gracias, “Kinetics of ultraviolet and plasma surface modification of poly(dimethylsiloxane) probed by sum frequency vibrational spectroscopy”, *Langmuir* **22**: 4, 1863-1868 (2006) [4.009].
21. Z. Gu, H. Ye, D. Smirnova, D. Small and D. H. Gracias, “Reflow and Electrical Characteristics of Nanoscale Solder”, *Small* **2**: 2, 225-229 (2006) [6.4].
20. H. Ye, Z. Gu, T. Yu and D. H. Gracias, “Integrating nanowires with substrates using directed assembly and nanoscale soldering”, *IEEE Transactions on Nanotechnology* **5**: 1, 62-66.(2006) [2.11].
19. Z. Gu, H. Ye and D. H. Gracias, “Nanowire assemblies bonded using adhesive and solder”, INVITED PAPER, *The Journal Of The Minerals Metals & Materials Society (JOM)* **57**: 12, 60-64 (2005) [1.081].
18. B. Gimi, T. Leong, Z. Gu, M. Yang, D. Artemov, Z. M. Bhujwala and D. H. Gracias, “Self-assembled three dimensional radio frequency (RF) shielded containers for cell encapsulation”, *Biomedical Microdevices* **7**: 4, 341-345 (2005) [3.073].
17. Z. Gu, Y. Chen and D. H. Gracias, “Surface Tension Driven Self-Assembly of Bundles and Networks of 200 nm Diameter Rods Using a Polymerizable Adhesive”, *Langmuir* **20**: 26, 11308-11311 (2004) [4.009].

PAPERS PUBLISHED AT HARVARD (POST-DOCTORAL RESEARCH)

16. M. Mayer, J. Yang, I. Gitlin, D. H. Gracias and G. M. Whitesides, “Micropatterned agarose gels for stamping arrays of proteins and gradients of proteins”, *Proteomics* **4**: 8, 2366-2376 (2004) [5.479].
15. M. Boncheva, D. H. Gracias, H. O. Jacobs and G. M. Whitesides, “Biomimetic self-assembly of a functional asymmetrical electronic device”, *Proceedings of the National Academy of Sciences* **99**: 4937-4940 (2002) [9.598].
14. D. H. Gracias, M. Boncheva, O. Omoregie and G.M. Whitesides, “Biomimetic self-assembly of helical electrical circuits using orthogonal capillary interactions”, *Applied Physics Letters* **80**: 2802-2804 (2002) [3.596].

13. H. O. Jacobs, A. R. Tao, A. Schwartz, D. H. Gracias and G. M. Whitesides, "Fabrication of a cylindrical display by patterned assembly", *Science* **296**: 323-325 (2002) [26.372].
12. D. H. Gracias, V. Kavthekar, C. J. Love, K. E. Paul and G. M. Whitesides, "Fabrication of micrometer-scale, patterned polyhedra by self-assembly", *Advanced Materials* **14**: 235-238 (2002) [8.191].
11. R. F. Ismagilov, D. Rosmarin, D. H. Gracias, A. D. Stroock and G. M. Whitesides, "Competition of intrinsic and topographically imposed patterns in Benard-Marangoni convection", *Applied Physics Letters* **79**: 439-441 (2001) [3.596].
10. D. H. Gracias, J. Tien, T. L. Breen, C. Hsu and G. M. Whitesides, "Forming electrical networks in three dimensions by self-assembly", *Science* **289**: 1170-1172 (2000) [26.372].

PAPERS PUBLISHED AT UC BERKELEY (PH.D. RESEARCH)

9. Z. Chen, R. Ward, Y. Tian, F. Malizia, D. H. Gracias, Y. R. Shen and G. A. Somorjai, "Interaction of fibrinogen with surfaces of end-group-modified polyurethanes: a surface-specific sum-frequency-generation vibrational spectroscopy study", *Journal of Biomedical Materials Research* **62**: 254-264 (2002) [2.612].
8. S. Niederberger, D. H. Gracias, K. Komvopoulos and Somorjai GA, "Transitions from nanoscale to microscale dynamic friction mechanisms on polyethylene and silicon surfaces", *Journal of Applied Physics* **87**: 3143-3150 (2000) [2.171].
7. Z. Chen, D. H. Gracias, and Gabor A. Somorjai "Sum Frequency Generation (SFG)-Surface Vibrational Spectroscopy Studies of Buried Interfaces: Catalytic Reaction Intermediates on Transition Metal Crystal Surfaces at High Reactant Pressures; Polymer Surface Structures at the Solid-Gas and Solid-Liquid Interfaces", INVITED PAPER *Applied Physics B-Lasers and Optics* **68**: 3 549 – 557 (1999) [2.28].
6. D. H. Gracias, Z. Chen, Y. R. Shen and G. A. Somorjai, "Molecular Characterization of Polymer and Polymer Blend Surfaces. Combined Sum Frequency Generation Surface Vibrational Spectroscopy and Scanning Force Microscopy Studies", *Accounts of Chemical Research* **32**: 930-940 (1999) [16.214].
5. D. H. Gracias, D. Zhang, L. Lianos, W. Ibach, Y. R. Shen and G. A. Somorjai, "A study of the glass transition of polypropylene surfaces by sum-frequency vibrational spectroscopy and scanning force microscopy", *Chemical Physics* **245**: 277-284 (1999) [1.805].
4. D. Zhang, D. H. Gracias, R. Ward, M. Gauckler, Y. Tian, Y. R. Shen and G. A. Somorjai, "Surface Studies of Polymer Blends by Sum Frequency Vibrational Spectroscopy, Atomic Force Microscopy, and Contact Angle Goniometry", *Journal of Physical Chemistry B* **102**: 6225-6230 (1998) [4.086].
3. M. X. Yang, D. H. Gracias, P. W. Jacobs and G. A. Somorjai, "Lithographic Fabrication of Model Systems in Heterogeneous Catalysis and Surface Science Studies", *Langmuir* **14**: 1458-1464 (1998) [4.009].
2. D. H. Gracias and G. A. Somorjai, "Continuum Force Microscopy Study of the Elastic

Modulus, Hardness and Friction of Polyethylene and Polypropylene Surfaces”, *Macromolecules* **31**: 1269-1276 (1998) [4.411].

1. D. H. Gracias, D. Zhang, Y. R. Shen and G. A. Somorjai, “Surface Chemistry-Mechanical Property Relationship of Low Density Polyethylene (LDPE): An IR+Visible Sum Frequency Generation (SFG) Spectroscopy and Atomic Force Microscopy (AFM) study”, *Tribology Letters* **4**: 231-235 (1998) [1.345].

PEER-REVIEWED CONFERENCE PROCEEDINGS

6. C. Randall, T. Leong, S. Singh and D. H. Gracias, “Biocompatibility Characterization of 3D Microcontainers for Cell Encapsulation Therapy”, 1st, IEEE Nanomedicine Conference, Macau, August 2007, in press.
5. E. Choi, Z. Gu and D. Gracias, A. Andreou, "Chip-Scale Magnetic Sensing and Control of Nanoparticles and Nanorods", *18th IEEE International Conference on Circuits and Systems (ISCAS)*, Greece, May 21-24 (2006).
4. T. Leong, H. Ye, E. Call, B. Gimi, Z. Bhujwala and D. H. Gracias, "Microfabrication and Self-Assembly of 3D Microboxes for Biomedical Applications", *18th IEEE International Conference on Microelectromechanical Systems (MEMS)*, Istanbul, Jan 22-26 (2006).
3. S. J. Papadakis, J. A. Miragliotta, Z. Gu and D. H. Gracias, "Scanning surface-enhanced Raman spectroscopy of silver nanowires" , *Proceedings of SPIE-The International Society for Optical Engineering* 5927, 337-344 (2005).
2. H. Ye, Z. Gu, T. Yu, A. Bernfeld, T. Leong and D. H. Gracias, "Forming Low Resistance Nano-Scale Contacts Using Solder Reflow", *Proceedings of the 5th IEEE International Conference on Nanotechnology, Nagoya*, July 11-15 (2005), 715 – 718 (2005).
1. D. H. Gracias, D. Zhang, Y. R. Shen and G.A. Somorjai, “Correlation of structure and mechanical properties of polyolefin surfaces by IR + visible sum frequency generation vibrational spectroscopy and atomic force microscopy”, *Materials Research Society Symposium Proceedings* (1998), 522(Fundamentals of Nanoindentation and Nanotribology), 175-180.

BOOK CHAPTERS

3. N. Bassik and D. H. Gracias, “3D Lithographically Structured Self-Assembled Biomedical Devices”, in *“Nanomedicine Science and Engineering: Design of Capsules, Motors, Implants, Robots & Devices”*, editor Mark Schultz, Artech House (2008), Invited book chapter submitted to editor.
2. Z. Gu and D. H. Gracias, "Nanowire Assembly and Integration", in *Nanofabrication: Fundamentals and Applications*, Editor: Ampere A. Tseng, World Scientific Publishing Co., Singapore, 2008, Chapter 6, pp. 187-212.
1. D. H. Gracias, I. Choi, M. Weck and G. M. Whitesides, “Meso-Scale Self-Assembly”, in *Algorithmic and Computational Robotics, New Directions*, Editors B. R. Donald, K. M. Lynch and D. Rus., A. K. Peters, Ltd. (2001) pp. 1-7.

VI. PATENTS

PATENTS GRANTED

19. K. O'Brien and D. H. Gracias, "Reducing line to line capacitance using oriented dielectric films", *U.S. Patent No. 7,518,244* Granted April 14, 2009. (Divisional Application of U.S. Patent No. 6,927,180)
18. D. H. Gracias, "Fabricating stacked chips using fluidic templated-assembly", *U.S. Patent No. 7,375,425* Granted May 20, 2008. (Divisional Application of U.S. Patent No. 7,018,867)
17. D. H. Gracias and C.-I Wu, "Method to reduce the copper line roughness for increased electrical conductivity of narrow interconnects (<100nm)", *U.S. Patent No. 7,268,075* Granted Sept. 11, 2007.
16. J. Leu, G. M. Kloster, David H. Gracias, Lee D. Rockford, Peter K. Moon and Chris E. Barns "Selectively converted inter-layer dielectric", *U.S. Patent No. 7,239,019* Granted July 3, 2007. (Divisional Application of *U.S. Patent No. 6,943,121*)
15. G. Kloster, K. P. O'Brien, D. H. Gracias, H.-M. Park; Hyun-Mog and V. S. Ramachandrarao, "Forming thin hard mask over air gap or porous dielectric", *U.S. Patent No. 7,238,604* Granted July 3, 2007.
14. D. H. Gracias, "Method to increase electromigration resistance of copper using self-assembled organic thiolate monolayers", *U.S. Patent No. 7,208,455* Granted April 24, 2007. (Divisional Application of *U.S. Patent No. 7,175,680*)
13. D. H. Gracias, "Method to increase electromigration resistance of copper using self-assembled organic thiolate monolayers", *U.S. Patent No. 7,205,663* Granted April 17, 2007. (Divisional Application of *U.S. Patent No. 7,175,680*)
12. V. S. Ramachandrarao and D. H. Gracias, "Replenishment of surface carbon and surface passivation of low-k porous silicon-based dielectric materials", *U.S. Patent No. 7,179,757* Granted February 20, 2007. (Divisional Application of *U.S. Patent No. 7,005,390*)
11. D. H. Gracias, "Method to increase electromigration resistance of copper using self-assembled organic thiolate monolayers", *U.S. Patent No. 7,175,680* Granted February 13, 2007.
10. G. M. Kloster, K. P. O'Brien, M. D. Goodner, D. Michael, J. Leu, D. H. Gracias, L. D. Rockford, P. K. Moon and C. E. Barns, "Method of forming a selectively converted inter-layer dielectric using a porogen material", *U.S. Patent No. 7,018,918* Granted March 28, 2006.
9. D. H. Gracias, "Fabricating stacked chips using fluidic templated-assembly", *U.S. Patent No. 7,018,867* Granted March 28, 2006.
8. D. H. Gracias, J. Tien and G. M. Whitesides, "Self-assembled electrical networks", *U.S. Patent No. 7,007,370* Granted March 07, 2006.
7. V. S. Ramachandrarao and D. H. Gracias, "Replenishment of surface carbon and surface passivation of low-k porous silicon-based dielectric materials", *U.S. Patent No. 7,005,390* Granted February 28, 2006.

6. D. H. Gracias and V. S. Ramachandrarao, "Adhesion of carbon doped oxides by silane coupling agents in damascene integration of microelectronic devices", *U.S. Patent No. 6,974,762* Granted December 13, 2005.
5. J. Leu, G. M. Kloster, David H. Gracias, Lee D. Rockford, Peter K. Moon and Chris E. Barns, "Selectively converted inter-layer dielectric", *U.S. Patent No. 6,943,121* Granted September 13, 2005.
4. K. O'Brien and D. H. Gracias, "Reducing line to line capacitance using oriented dielectric films", *U.S. Patent No. 6,927,180* Granted August 9, 2005
3. David H. Gracias, Grant Kloster, "Protecting metal conductors with sacrificial organic monolayers", *U.S. Patent No. 6,905,958* Granted June 14, 2005.
2. David H. Gracias, "Method to increase electromigration resistance of copper using self assembled organic thiolate monolayers", *U.S. Patent No. 6,858,527* Granted February 22, 2005.
1. D. H. Gracias, H-M. Park and V. S. Ramachandrarao, "Method for controlling etch bias of carbon doped oxide films", *U.S. Patent No. 6,620,741* Granted September 16, 2003.

PATENTS PENDING

4. T. Leong, H. Ye and D. H. Gracias, "A Microcontainer Technology for Remote Spatially Controlled Chemical Delivery", *Provisional Patent Application 60/816,063* filed June 23, 2006
3. B. Gimi, Z. M. Bhujwala and D. H. Gracias, "Self-Assembled, Micropatterned, and Radio Frequency (RF) Shielded BioContainers", *Published Patent Application 20070020310* (2007).
2. J. Leu, C.-I. Wu, M. Y. Liu, K. J. Fischer, J. Chia-Hong and D. H. Gracias, "Interconnect adapted for reduced electron scattering" *Published Patent Application 20050224980* (2005).
1. D. H. Gracias and C.-I Wu, "Method to reduce the copper line roughness for increased electrical conductivity of narrow interconnects (<100nm)", *Published Patent Application 20040229462* (2004), 17 pp.

VII. SELECTED RESEARCH HIGHLIGHTS IN JOURNALS AND THE PRESS

ON RESEARCH DONE AT JHU

1. Journal Research Highlights

Science, "Get a grip", January 30, 2009

Nature Nanotechnology, "*Thin Films: Boxing Clever*", August 29, 2008

Nature Physics, "*Loaded Dice*", July, 2007

Lab on a chip, "*Metallic microcontainers*", November, 2006

Analytical Chemistry, "*Nanoliter containers for controlled chemical reactions*", Nov. 1, 2006

Science, "*Microscale Origami*", September 1, 2006

Science, "*Self-folding delivery boxes*", August 25, 2006

2. Press

National Geographic, "Dust-Size "Crabs" Grab Living Cells in Lab Video", Jan 26, 2009.

Forbes Magazine, "Building Vessels For An Incredible Journey", Jan 20, 2009.

Scientific American, "Getting a Teeny Tiny Grip", Jan 15, 2009.

Discover Magazine, "Step One in Surgery: Swallow the Microscopic hands", Jan 14, 2009.

The New York Times, "A Microscopic Tool Inspired by the Human Hand", Jan 13, 2009.

Chemical Technology, "*Microcontainers hold cells captive*", September 19, 2008

MIT Technology Review, "*A Helping Hand For Surgery*", August 2008

C&EN, "*Tetherless Grippers: Grab Wee Objects*", September 01, 2008

C&EN, "*A Material World*", December 24, 2007

Science News, "*Chemical Pop-Up Books*", November 25, 2006

Washington Times, "Nanotechnology building blocks", January 19, 2006

EE Times, UK, "Self-Assembling MEMS target biomed therapies", Jan 09, 2006

Discovery Channel, "*Tiny cube delivers drugs*", December 28, 2005

ON RESEARCH PRE-JHU

Discover Magazine, "*Computer screens get ready to roll*", August 1, 2002

C&EN, "*Self-Assembly Required*", April 15, 2002

The Boston Globe, "*No Assembly Required*", October 16, 2001

Forbes Magazine, "*Nanotechnology*", July 23, 2001

C&EN, "*Chemistry Highlights 2000*", December 19, 2000

EE Times, UK, "*3D Network Technique*", April 9, 2000

Chemical and Engineering News, "*Self-Assembling Electronics*", Aug 21, 2000

Carnegie Mellon, School of Computer Science, "*Meso-Scale Self-Assembly*", One of the Top Five Must Read Papers, 2000

VIII. RESEARCH SUPPORT

RESEARCH GRANTS AND SUPPORT, AWARDED

External Grants

1. NSF CMMI-0854881, "*Nanomanufacturing Using Solder Based Three Dimensional Self-Assembly*", Role: (06/01/09-05/31/12) Single PI, Amount: \$297K.
2. NIH Director's New Innovator Award, "*Minimally Invasive Micro-Nanoscale Tools and Devices for Medicine*" (10/01/08 - 09/30/13) Role: Single PI, Amount: \$1.5 million direct
3. Dupont Young Professor Award, "*Miniaturization in Electronics and Medicine*" (08/01/08 - 07/31/10) Role: Single PI, Total Amount: \$75,000.

4. NIH-R21 Nanoscience and Nanotechnology in Biology and Medicine, “3D Nanoporous microcontainers for cell encapsulation therapy” (02/15/08 - 12/31/09) Role: Single PI, Amount: \$275,000
5. Defense Threat Reduction Agency (DTRA), “Tailored Nanowire Junctions for Selective Sensors” (2007 - 2008) Role: co-PI, PI Stergios Papadakis, APL, Gracias Amount: \$192,000
6. Defense Intelligence Agency Measures and Signatures Intelligence, “Selective Nanowire Sensors for Chemical Agent Detection” (2006 - 2009) Role: PI, Total Amount: \$435,000
7. National Science Foundation – NER, “Nanowire Spectrophotometer for Lab-on-a-Chip Chemical Analysis” (2006 - 2007) Role co-PI, PI: Ritesh Agarwal, UPenn, Total Amount: \$108,000
8. Camille and Henry Dreyfus Foundation, “A research and education program in Nano and Microscale Self-Assembly: Integrated circuits, chemical sensors and remote controlled chemistry” (2006 - 2009) Role: Single PI , Total Amount: \$75,000
9. Arnold and Mabel Beckman Foundation, “Self-assembled microcontainers for encapsulation and remote controlled release of chemicals” (2006 - 2009) Role: Single PI, Total Amount: \$264,000
10. Charles E. Culpeper Biomedical Pilot Initiative, “Implantable 3D Microdevices for Diabetes Therapy” (2006 - 2007) Role Co: PI, PI: Barjor Gimi, Total Amount: \$25,000
11. National Science Foundation-CAREER, CMMI-0448816, “A Research and Education Program in Surface Tension Driven Fluidic Assembly of Functional Nano-Scale Components” (07/01/05 - 06/30/10) Role: Single PI, Total Amount: \$400,000
12. National Science Foundation-MRI, Major Research Instrumentation, “Acquisition of a Sum Frequency Non-Linear Optical Spectroscopy System to Probe Interfaces of Nano, Bio and Environmental Materials” (07/01/04 - 06/30/05) Role: PI, Total Amount: \$251,950
13. American Chemical Society, Petroleum Research Fund Type “G”, “Investigation of Defect Tolerance in Chemically Self-Assembled Three Dimensional Nanowire networks” (06/01/04 – 05/31/06) Role: Single PI, Total Amount: \$35,000

JHU Internal Grants

1. JHU-APL Partnership, “Lithographically Fabricated Tunable THz Structures” (02/01/08 - 01/31/09) Role: PI, Total Amount: \$187,500
2. JHU-MRSEC seed grant, “Fabrication of lithographically structured 3D Magnetic Particles” (01/01/08 - 12/31/08), Role: PI, Total Amount: \$30,000
3. JHU-Applied Physics Laboratory Partnership, “Nanowire Networks as Selective Sensors” (2006) Role: PI, Total Amount: \$150,000
4. JHMI-ICMIC Center National Institutes of Health (NIH), “Molecular Imaging with Magnetic Resonance Microsystems” (07/01/05 - 6/30/07) Role: PI, Total Amount: \$32,800
5. William R. Kenan, Jr. Fund, “Development of a Laboratory Course in Nanotechnology” (10/01/05 - 09/30/07) Role: PI , Total Amount: \$9,000
6. JHU-Applied Physics Laboratory Partnership, “Nanowire Networks as Selective Sensors” (2005) Role: PI, Total Amount: \$150,000

IX. TALKS (49 INVITED AND OVER 50 CONTRIBUTED PRESENTATIONS)

LIST OF 35 INVITED TALKS WHILE AT JHU

35. 06/16/2009, ECI conference on Nanotechnology for the Study of Cellular and Molecular Interactions, *"Lithographically micro-nanostructured tools and devices for medicine"*, Barga, Italy.
34. 04/16/2009, Surface Science Seminar, *"Utilizing chemistry to put thin films in motion"*, UC Berkeley and Lawrence Berkeley National Laboratory, California.
33. 04/14/2009, Materials Research Society (MRS), *"Tetherless, 3D Micro-Nanoscale Tools and Devices for Lab on a Chip Applications"*, Spring National Meeting, Symposium OO, San Francisco, California
32. 03/11/2009, Princeton Institute for the Science and Technology of Materials, *"Lithographically-Patterned Self-Assembling and Chemo-Mechanical Devices"*, Princeton, New Jersey.
31. 10/09/2008, Mechanical Engineering Fall Seminar Series, *"Lithographically Structured 3D Biomedical Microdevices Lithographically Structured 3D Biomedical Microdevices"*, Johns Hopkins University.
30. 08/20/2008, American Chemical Society, Fall 2008 National Meeting, *"Spatial and temporal control of chemistry and chemical delivery with metallic containers"*, Philadelphia, Pennsylvania.
29. 08/14/2008, SPIE National Meeting, *"Lithographically structured 3D self-assembled biomedical devices"*, San Diego, California.
28. 07/24/2008, AIChE Society for Biological Engineers, International Conference on Bioengineering and Nanotechnology, *"Lithographically Structured 3D Nanoliter Scale Biomedical Devices"*, University College, Dublin, Ireland.
27. 06/23/2008, Telluride Conference on Non-Linear Optics, *"SFG as an in-situ probe for organic field effect transistors (OFETs)"*, Telluride, Colorado.
26. 06/18/2008, Army Research Laboratory (ARL), *"Nano to Millimeter Scale Self-Assembling and Self-Actuating Systems"*, Adelphi, Maryland.
25. 04/18/2007, Washington University, Biomedical Engineering (Graduate Student Invited), *"Lithographically Structured 3D Biomedical Microdevices"*, St. Louis, Missouri.
24. 04/07/2008, American Chemical Society, Division of Colloid & Surface Chemistry, Spring National Meeting, *"Interfacial engineering of functional electronic and biomedical devices"*, New Orleans, Louisiana.
23. 12/24/2008, University of Maryland, Physical Chemistry/Chemical Physics seminar series, *"Interfacial engineering of functional electronic and biomedical devices"*, College Park, Maryland
22. 12/06/2007, Penn State, Department of Chemical Engineering, *"Interfacial Engineering of Functional Electronic and Biomedical Devices"*, University Park, Pennsylvania.
21. 11/29/2007, Rensselaer Polytechnic Institute, Department of Materials Science and Engineering, *"Interfacial Engineering of Functional Electronic and Biomedical Devices"*, Troy, New York.
20. 10/30/2007, University of Wisconsin, Department of Chemical and Biological Engineering, *"Interfacial Engineering of Functional Electronic and Biomedical Devices"*, Madison, Wisconsin.

19. 10/08/2007, 212th National Meeting of the Electrochemical Society, *"Fabrication and Assembly of Electrodeposited Multisegmented Nanostructures"*, Washington, DC.
18. 09/08/2007, 3rd Annual Meeting of American Academy of Nanomedicine, *"3D Lithographically Fabricated Nanoliter Containers for Drug Delivery"*, San Diego, California.
17. 03/20/2007, Defense Advanced Research Projects Administration, (DARPA) workshop on Biological Geometry, *"Radio Frequency Remote Controlled Nanoliter Scale Chemical Delivery"*, Arlington, Virginia.
16. 03/06/2007 Maryland State Department of Education, Maryland Summer Centers for Gifted and Talented Students Directors' Meeting, *"Micro and Nanotechnology"*, Baltimore, Maryland.
15. 02/26/2007, Pittcon 2007, *"SFG on functional organic interfaces"*, Chicago.
14. 11/01/2006, NEC Fundamental and Environmental Labs, *"Remote controlled chemistry and chemical delivery"*, Tsukuba, Japan.
13. 10/30/2006, US-Japan Young Scientists Symposium on Nanotechnology and Nanomanufacturing, *"Micro and Nanoscale Engineering: Nanowire assembly, organic field effect transistors and remote controlled chemistry"*, Tokyo, Japan.
12. 09/10/2006, Fall 2006 National Meeting, American Chemical Society (ACS), *"Probing organic field effect transistors (OFETs) in situ using SFG"*, San Francisco.
11. 06/18/2006, Gordon Conference, Energetic Materials, *"Nanotechnology in Chemical Encapsulation, Delivery and Analysis"*, Tilton, New Hampshire.
10. 04/13/2006, National Institute of Standards and Technology (NIST), Electronic Materials Group, *"Interfacial science and fluidic assembly in electronics: OFET interfaces, 3D microcontainers and integrated nanowire networks"*, Gaithersburg, Maryland,
9. 04/03/2006, 3rd Korea-US Nano Forum: Nano Devices and Systems, *"Fluidic Assembly and Interfacial Science of Nano-Microstructured Systems for Electronics and Medicine"*, Seoul, Korea.
8. 03/30/2006, MITRE biodelivery conference, *"Nanoliter scale trackable containers for encapsulation and remote controlled release of chemicals"*, MITRE headquarters, Mclean, Virginia.
7. 03/06/2006, NSF-MEXT US-Japan Young Researcher Exchange Program, *"Fluidic Assembly and Interfacial Science of Nano-Microstructured Systems for Electronics and Medicine"*, University of Massachusetts, Lowell.
6. 10/27/2005, Johns Hopkins University, Physics Colloquium, Department of Physics and Astronomy, *"Self-Assembling Nano and Micro Scale Systems for Electronics and Medicine"*,
5. 09/29/2005, Biomedical Engineering Society (BMES) Annual Fall Meeting (2005) *"Self-Assembly of Integrated and 3D Systems for Sensing, Tracking and Encapsulation"*, Baltimore, Maryland.
4. 01/07/2005, Workshop on Nanotechnology, Indian Institute of Technology, *"Self-Assembly of Nano and Micro Integrated Systems and 3D structures for Electronics and Medicine"*, Bombay, India.
3. 12/09/2004, National Aeronautics and Space Administration (NASA), Goddard Space Flight Center, *"Fluidic Self Assembly: A Bio-Inspired Approach to Building Complex 3-D Structures"*

(3D Electronics, Networks, Photonic Devices and Tools for Medicine) Using Nano-MM Scale components, , Greenbelt, Maryland.

2. 10/06/2004, Applied Physics Laboratory, "Fluidic Self-Assembly: A Bottom-Up Approach to Fabricating Micro- and Nano-Structures and Integrated Systems", Laurel, Maryland.
1. 8/13/2004, National Institute of Standards and Technology (NIST), "Fluidic Self-Assembly: A Bottom-Up Approach to Fabricating Micro- and Nano-Structures and Integrated Systems", Gaithersburg, Maryland.

14 TALKS WERE INVITED AND DELIVERED PRE-JHU

OVER 50 CONTRIBUTED TALKS WERE DELIVERED WHILE AT JHU AT NATIONAL CONFERENCES OF THE ACS, AICHE, IEEE, MRS, BMES AND ECS; 5 WERE DELIVERED PRE-JHU.

X. RESEARCH SUPERVISION

POST-DOCTORAL FELLOWS

1. Zhiyong Gu (2004-2006)
Ph.D. in Chemical Engineering, SUNY, Stonybrook
Current Position: Assistant Prof, Chemical Engineering, University of Massachusetts, Lowell.
2. Hongke Ye (2005-2007)
Ph.D. in Physics, University of Colorado, Boulder
Current Position: Research Scientist, Energetiq Technology, Inc., Woburn, Massachusetts.
3. Jung-Rae Park (2006-2007)
Ph.D. in Electrical and Computer Engineering, University of Rochester
Current Position: Researcher, Plastics Engineering, University of Massachusetts, Lowell.
4. Trupti Madanimath (2006-2007)
Ph.D. in Chemistry, NCL, India
Current Position: Homebuilder
5. JiaHai Wang (2008)
Ph.D. In Chemistry, University of Florida
Current Position: Faculty, Chinese Academy of Sciences
6. Jeong-Hyun Cho (2008-present)
Ph.D. Mechanical Engineering, Washington State University
7. Pawan Tyagi (2008-present)
Ph.D. Materials Science and Engineering, University of Kentucky

GRADUATE RESEARCHERS

PH.D. STUDENTS

1. Timothy Leong B.S. Northeastern University
Graduated - September, 2008.
Current Position: Technology Innovation Program Manager, Defense Threat Reduction Agency (DTRA), U.S. Department of Defense.
2. Christina Randall (2004-present) Biomedical Engineering Grad, M.S. Drexel
Anticipated Graduation - December, 2009

3. Noy Bassik (2006-present) MD/Ph.D. (B.S. Rutgers)
Anticipated Graduation – December, 2010
4. Jatinder Randhawa (2007-present) B.S. IIT, Kanpur, India
Anticipated Graduation – December, 2011
5. Mustapha Jamal (2007-present) B.S. University of Maryland
Anticipated Graduation– December, 2011
6. Kate Laflin (2008-present) B.S. Virginia Tech
Anticipated Graduation– December, 2012
7. Teena James (2009-present) M.S. NJIT
Anticipated Graduation– December, 2013

MASTERS STUDENTS

1. Ashraf Abu-Akeel (2004-2006): Current Position: Analyst, Accenture
2. BS/MS program: Adam Bernfeld (2002-2007): Current Position: Engineer, DuPont
3. BS/MS program: Devin Demers (2003-2008): Graduated - August 2008
4. BS/MS program: George Stern (2004-2009) Current Position: Engineer, Cook Medical
5. BS/MS program: Siddharth Singh (2003-present)
6. BS/MS program: Beza Abebe (Materials Science, 2007-present)

UNDERGRADUATE RESEARCHERS

1. Michael Yang: 2004, Current: Graduate Student, Bioengineering, UPenn.
2. Diana Smirnova: 2004-05, Current: Graduate Student, Chemical Engineering, Caltech
3. Liz Morel: 2005, NSF Research Experience for Undergraduates (REU), University of Kansas
4. Thomas Yu: 2005-06, Current: Engineer, Wyeth, NY
5. Sean Cheng: 2005-06, Current: Graduate Student, University of Cambridge
6. Travis Koh: 2006-07, Current: Graduate Student, Chemical Engineering, UC Santa Barbara
7. Chih-Sheng Chiang: 2006-07, Current: Fulbright Fellowship, Germany
8. Daniel Slanac: 2006-07, Current: Graduate Student, Chemical Engineering, UT Austin
9. Aniruddha Rajan: 2006-2008, Current: Fall 2008 Graduate Student, Biotechnology, Northwestern
10. David Filipiak: 2007-2009, Current: Fall 2009, Graduate Student, Cornell University

Current Undergraduate Researchers (17)

JHU: Bryan Benson, Aasiyeh Zarafshar, David Fillipiak, Beza Abebe, David Postetter, Anum Azam, Steve Hu, Aubri Gillespie, Alla Brafman, Mira Patel, Michael Keung, Natasha Bhutani, Daniel Saragnese, Rohit Dasgupta, Elizabeth Cha

REU 2008: Casey Parker (Lehigh University) and Casey Kirkpatrick (North Carolina State University)

HIGH SCHOOL TEACHER RESEARCHES

1. Sharon Ball (summer 2004, Southwestern High School)
2. Jacqueline Bilberry (summer 2005, Harbor City High School)
3. David Nelson (summer 2006, Baltimore Polytechnic Institute)
4. Matt Jochmans (summer 2008, Towson High School)

HIGH SCHOOL STUDENT RESEARCHERS

1. Emma Call (Baltimore Polytechnic Institute, Ingenuity Program, 2004-2007), Currently at Case Western
2. Jonathan Cohen (Baltimore Polytechnic Institute, Ingenuity Program, 2006-07)
3. Susannah Lohr (Garrison Forest School, Women in Science and Engineering (WISE) program, 2006-07)
4. Jillian Epstein (Garrison Forest School, WISE program, 2007-08)
5. Katherine Mitchell (St. Paul's School, summer 2008)
6. Mooney Choi (Garrison Forest School, WISE program, Fall 2008)

XI. Professional Activities and Outreach

SYMPOSIA CHAIRED / ORGANIZED

8. Session Chair. "Micro- and Nanofabricated Sensors II", American Institute of Chemical Engineers (AIChE), November 2008.
7. Session Co-Chair and Organizer: "Nanowires I: Synthesis", American Institute of Chemical Engineers (AIChE), November 2008.
6. Symposium Organizer: "Biosensing", International Society for Optical Engineering (SPIE) national meeting, August 10-14, 2008.
5. Symposium Organizer: "Reconfigurable Microfluidics" American Chemical Society, National Meeting, Philadelphia, August 17-21, 2008.
4. Symposium Organizer: "Nanowires--Novel Assembly Concepts and Device Integration", Materials Research Society (MRS) Fall Meeting, Boston, November 26 - 30, 2007.
3. Session Co-Chair and Organizer: "Nanowires I: Synthesis", American Institute of Chemical Engineers (AIChE), Salt Lake City, November 4-9, 2007.
2. Session Chair: "Characterization and Parameter Extraction" in Symposium: Organic Semiconductor Materials and Devices, 212th National Meeting of the Electrochemical Society, Washington DC, Oct 7-12, 2007.
1. Symposium Organizer: "Processes at Functional Plasmonic and Electronic Interfaces", American Chemical Society, National Meeting, Boston, August 2007.

REVIEWER FOR THE FOLLOWING JOURNALS AND RESEARCH GRANTS

Science, Nature Photonics, Proceedings of the National Academy of Sciences (PNAS), Journal of the American Chemical Society (JACS), Angewandte Chemie, Nanoletters, Nanotechnology, Nano, Langmuir, Journal of Physical Chemistry, Physical Chemistry Chemical Physics, Analytical Chemistry, Lab on a Chip, Small, Soft Matter, Journal of Polymer Science, Journal of Applied Physics, Applied Physics Letters, Biomedical Microdevices, Biomembranes, IEEE Transactions on Nanotechnology, Advanced Materials, Advanced Functional Materials, Journal of Electronic Materials, Journal of the Electrochemical Society, Chemical Engineering Progress, Journal of Intelligent Materials Systems and Structures, Journal of Physics D: Applied Physics, ISCAS 2007, NSF-DMI grants (2005), NSF-ECE MRI grants (2005), NSF-CHE-MRI grants, ACS-PRF grants (2005-2008), NSF-DMI-NIRT grants, US-CRDF grants, NASA post-doctoral fellowship grants, U.S. Civilian Research & Development Foundation (Basic Research and Higher Education Proposal Review Program (BRHE)), NSF-Chemical Engineering graduate fellowships (2007-2009), DOD-SMART Biosciences Fellowships, AAAS-Life Sciences Discovery Fund Review

SCIENTIFIC ADVISORY BOARD

Lifeboat foundation (<http://lifeboat.com/ex/>)

OUTREACH

1. Participated in Research Experience for Undergraduates (REU) (2004, 2008).
2. Invited Public Lecture, Maryland Science Center, Tuesday Talks, April 01, 2008, "*Tiny Talk: A Glimpse into the Emerging Field of Nanotechnology*"
3. Invited Public Lecture, Johns Hopkins University, Center for Talented Youth (CTY), Nanoday, Feb 23, 2008, "*Self-Assembling Biomedical Devices*"
4. 10/05/2007, 2007-2008 JHU Center for Talented Youth, Pathways to College, Public Lecture, "*Micro and Nanotechnology—A glimpse into the future*", Baltimore.
5. Participated in Research Experience for Teachers (RET) (2004, 2005, 2008). Mentored 4 high school teachers in research projects in our laboratory.
6. Delivered lecture on Nanotechnology at Dunbar Public School (July 17, 2006).
7. Organized a Workshop for RET Baltimore Public High School Teachers titled, "*Micro and Nanotechnology-A Glimpse into the Future*" (2004 and 2005).
8. 11/20/2004, "*Self-Assembly: Fabricating Structures from the Bottom-Up*", Public Lecture in Explorations in Nanoscale Science and Technology, Center for Talented Youth, Johns Hopkins University.

XII. TEACHING

NEW COURSE DEVELOPED

540.440/640 "MICRO AND NANOTECHNOLOGY" (2003-present)

Nanotechnology is the field of fabrication, characterization and manipulation of extremely small objects (dimensions on the micron to nanometer length scale). Microscale objects, because of their small size are expected to be at the frontier of technological innovation for the next decade. This course includes a description of the materials used in microtechnology, methods employed to fabricate nanoscale objects, techniques involved in characterizing and exploiting the properties of small structures, and examples of how this technology is revolutionizing the areas of Electronics and Medicine. The course is cross listed for grad / undergrad students and the students come from the Departments of Chemical Engineering, Electrical Engineering, Mechanical Engineering, Materials Science, Physics, Biomedical Engineering and JHU Medicine. The course has a laboratory component to it; this course represents one of the first laboratory courses in Nanotechnology in the country.

XIII. PROFESSIONAL SOCIETY MEMBERSHIPS

American Chemical Society (ACS), American Institute of Chemical Engineers (AIChE) , American Physical Society (APS), Materials Research Society (MRS), Institute of Electrical and Electronics Engineers (IEEE)

XIV. COLLABORATORS

At Johns Hopkins University

Howard Katz, Department of Materials Science, JHU
Andreas Andreou, Electrical Engineering, JHU
Zaver Bhujwala, Radiology, JHU Medicine
Rosselle Abraham, Cardiology, JHU Medicine
Nitish Thakor, Biomedical Engineering and JHU Medicine
Howard Fairbrother, Chemistry, JHU
Marek Mirski (JHU Anesthesiology / Neuroscience)
Peter Devreotes (JHU Cell Biology)

Outside Johns Hopkins University

Stergios Papadakis (Staff Scientist, Applied Physics Laboratory)
Robert Osiander (Staff Scientist, Applied Physics Laboratory)
Daniel Choi (Associate Professor, Department of Materials Science, University of Idaho)
Ritesh Agarwal (Assistant Professor, Department of Materials Science, UPenn)