RITU RAMAN

Curriculum Vitae

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EDUCATION

University of Illinois at Urbana Champaign, Urbana-Champaign, IL
Ph.D. Candidate, Mechanical Engineering — Expected December 2016
M.S. Mechanical Engineering — 2013
GPA: 3.9/4.0, NSF Graduate Research Fellow (2014-Present), NSF IGERT Fellow (2012-2014)

Cornell University, Ithaca, NY
B.S. Mechanical Engineering, Minor Biomedical Engineering, *magna cum laude* — 2012
GPA: 3.9/4.0, Dean's List, Kessler Fellow, Tau Beta Pi Engineering Honor Society

PUBLICATIONS

PEER REVIEWED JOURNAL ARTICLES

[7] **Raman, R.,** Cvetkovic, C., and Bashir, R., 2016. A Modular Approach to Design, Fabrication, and Characterization of Muscle-Powered Biological Machines. *Nature Protocols. (In Press)*

[6] **Raman, R.,** Mitchell, M., Perez-Pinera, P., Bashir, R., and Destefano, L., 2016. Design and Integration of a Problem-Based Biofabrication Course into an Undergraduate Biomedical Engineering Curriculum. *Journal of Biological Engineering.*

[5] **Raman, R.**, Cvetkovic, C., Uzel, S.G.M., Platt, R.J., Sengupta, P., Kamm, R.D., and Bashir, R., 2016. Optogenetic skeletal muscle-powered adaptive biological machines. *Proceedings of the National Academy of Sciences.*

[4] **Raman, R.*,** Clay, N.E.*, Sen, S., Melhem, M., Qin, E., Kong, H., and Bashir, R., 2016. 3D Printing Enables Separation of Orthogonal Functions within a Hydrogel Particle. *Biomedical Microdevices. ***co-first author***

[3] **Raman, R.**, Bhaduri, B., Mir, M., Shkumatov, A., Lee, M.K., Popescu, G., Kong, H. and Bashir, R., 2015. High‐Resolution Projection Microstereolithography for Patterning of Neovasculature. *Advanced Healthcare Materials*. ***Back Cover***

[2] Neiman, J.A.S., **Raman, R**., Chan, V., Rhoads, M.G., Raredon, M.S.B., Velazquez, J.J., Dyer, R.L., Bashir, R., Hammond, P.T. and Griffith, L.G., 2015. Photopatterning of hydrogel scaffolds coupled to filter materials using stereolithography for perfused 3D culture of hepatocytes. *Biotechnology and Bioengineering*, *112*(4), pp.777-787.

[1] Cvetkovic, C.*, **Raman, R.***, Chan, V., Williams, B.J., Tolish, M., Bajaj, P., Sakar, M.S., Asada, H.H., Saif, M.T.A. and Bashir, R., 2014. Three-dimensionally printed biological machines powered by skeletal muscle. *Proceedings of the National Academy of Sciences*, *111*(28), pp.10125-10130. ****co-first author**.*

PEER REVIEWED JOURNAL ARTICLES IN PREPARATION

[2] Cvetkovic, C., Rich, M.H., **Raman, R.**, Kong, H., and Bashir, R., 2016. A 3D Printed Platform for Modular Neuromuscular Motor Units. *Microsystems & Nanoengineering. (In review)*

[1] **Raman, R.,** Grant, L., Seo, Y., Gapinske, M., Palasz, A., Dabbous, H., Perez-Pinera, P., and Bashir, R., 2016. Damage, Healing and Remodeling in Optogenetic Skeletal Muscle Bioactuators. (*In preparation*)

PUBLICATIONS (Continued)

JOURNAL REVIEW ARTICLES

[2] Chan, V., **Raman, R.**, Cvetkovic, C. and Bashir, R., 2013. Enabling microscale and nanoscale approaches for bioengineered cardiac tissue. *ACS Nano*, *7*(3), pp.1830-1837.

[1] Dorvel, B., Damhorst, G., Chan, V., Shim, J., Banerjee, S., Cvetkovic, C., **Raman, R**. and Bashir, R., 2013. Research Highlights: Highlights from the last year in nanomedicine. *Nanomedicine*, *8*(1), pp.13-15.

BOOK CHAPTERS

[1] **Raman, R**., Bashir, R. "Stereolithographic 3D Bioprinting for Biomedical Applications", 3D Biofabrication for Biomedical and Translational Research, 2015.

AWARDS & HONORS

FELLOWSHIPS & SCHOLARSHIPS

Baxter Young Investigator Award	2015
National Science Foundation Graduate Research Fellowship	2014
Society of Women Engineers Chrysler Foundation Scholarship	2014
National Science Foundation IGERT Fellowship	2012
McManus Senior Design Award	2012
Engineering Learning Initiatives Research Funding Award	2010

RESEARCH PRESENTATIONS

Most Published Graduate Student in MechSE Illinois Graduate Program	2016
BMES CMBE Student/Fellow Award	2016
MechSE Department Research Forum Best Poster Award	2015
Society of Women Engineers National Poster Competition Top 10 Finalist	2015
Center for Nanoscale Science and Technology Poster Award	2015
National Science Foundation IGERT Symposium Poster Award	2014
Illinois-Tsinghua Nanotechnology Symposium Best Poster Award	2014
Center for Nanoscale Science and Technology Best Poster Award	2013
Bionanotechnology Symposium Poster Award	2012

INNOVATION & ENTREPRENEURSHIP

ThinkChicago: Lollapalooza Civic Tech Challenge – 1st Place	2016
Illinois Innovation $15k Prize	2015
National Science Foundation EBICS STC Product Conceptualization Prize	2015
Kessler Fellowship for Entrepreneurial Engineers	2011
Mechanical Engineering Innovation Award	2011

OUTREACH

Society of Women Engineers Outstanding Collegiate Member Award	2014
Society of Women Engineers Student Leader Award	2013

TEACHING EXPERIENCE

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Lecturer, BIOE 306 Biofabrication Lab — Fall 2015, 2016

Designed and co-lectured course focused on teaching the fundamental design rules and principles of building biological machines, "bio-bots". Disseminated novel course curriculum and core philosophy of "building with biology" to instructors at partner institutions around the nation.

TEACHING EXPERIENCE (Continued)

Camp Coordinator, GAMES Engineering Girls Summer Camp 2013-2016

Served as lead coordinator (2016) for camp focused on teaching mechanical engineering design principles to high school students. Designed and led week-long project teaching students how to build a stereolithographic 3D printer targeted for use in rural classrooms in Kenya.

CORNELL UNIVERSITY

Camp Coordinator, CURIE Engineering Girls Summer Camp 2012

Teaching Assistant 2011-2012

Taught discussion sections, held office hours, helped write quizzes, graded assignments and exams, and developed new classroom demonstrations for three core mechanical engineering courses (MAE 3260 System Dynamics – Spring 2011, MAE 3230 Fluid Mechanics – Fall 2011, MAE 2120 Mechanical Properties – Spring 2012)

Engineering Tutor, Tau Beta Pi Engineering Honors Society 2011-2012

Engineering Tutor, Cornell Engineering Learning Initiatives 2010-2012

MENTORING EXPERIENCE

Undergraduate Research Mentor 2013-2016

[9] Lauren Grant (2015-2016), Current: Graduate Student at UIUC
[8] Michael Gapinske (2015-2016), Current: Graduate Student at UIUC
[7] Ashley Williams (2014-2016), Current: Dean's Graduate Fellow at Duke
[6] Alexandra Palasz (2015-2016), Current: Research Technician at UIUC
[5] Howard Dabbous (2015-2016), Current: Medical Student at American University of Beirut
[4] Aaron Jankelow (2015), Current: Graduate Student at UIUC
[3] Samir Mishra (2013-2014), Current: Medical Student at Rush Medical College
[2] Madeline Tolish (2013), Current: Consultant at Capgemini
[1] Stephanie Nemec (2013), Current: Device Engineer and Project Manager at AbbVie

UNIVERSITY SERVICE & OUTREACH

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Graduate Society of Women Engineers, *Publicity Chair & Speaker Coordinator* 2012-2016
Mechanical Engineering Graduate Women, *President, Treasurer, & Secretary* 2013-2016
GAMES Engineering Girls Camp, *Camp Coordinator* 2013-2016
NSF EBICS STC Student Leadership Council, *Elected Member* 2013-2016
Dean's Engineering Graduate Student Advisory Council, *Elected Member* 2014-2016
Cornell University Alumni Network, *Admissions Ambassador* 2014-2016
Bionanotechnology Lab Operations and Safety Committee, *Elected Member* 2015-2016
Young Engineers Initiative in Kenya, *Co-Founder* 2016
BOLD: Women in Innovation at Illinois, *Co-Founder* 2016
NSF EBICS STC Design Principles Task Force, *Elected Member* 2016
Department Diversity Advocates Program, *Co-Founder* 2016
nanoSTRuCT Outreach Organization, *Board Member* 2013-2015
NSF IGERT Student Leadership Council, *Elected Member* 2013-2014

CORNELL UNIVERSITY

CURIE Engineering Girls Camp, *Camp Coordinator* 2012
Tau Beta Pi Engineering Honor Society, *Engineering Tutor* 2011-2012
American Society of Mechanical Engineers, *Newsletter Committee* 2011-2012
Cornell Engineering Learning Initiatives, *Engineering Tutor* 2010-2012
Cornell Piano Society, *Publicity Director* 2010-2012
Society of Women Engineers, *Corporate Liaison* 2010-2011
Society of Asian Scientists and Engineers, *Director of Club Affairs* 2009-2011

PROFESSIONAL SERVICE

Advanced Healthcare Materials, *Peer Reviewer*	2015-Present
ThinkChicago, *Judge*	2016
Society of Women Engineers Emerging Leader Awards, *Judge*	2016
CNST Nanotechnology Workshop, *Session Chair*	2016
Illinois Innovation Prize, *Judge*	2016
Illinois MechSE Biointerest Group, *Seminar Host*	2016
NSF EBICS Retreat Ethics Workshop, *Organization Committee*	2013-2016
Women Empowered in STEM Conference, *Organization Committee*	2012-2016
TERMIS World Congress Meeting, *Session Co-Chair*	2015
NSF IGERT Bionanotechnology Symposium, *Poster Judge*	2015

PATENTS

[4] Patent Application: Chan, V., **Raman, R.**, Cvetkovic, C., Bashir, R. Locomotive biological machines.

[3] Provisional Filing: **Raman, R.,** Cvetkovic, C., Bashir, R. Modular tissue engineered rings.

[2] Provisional Filing: **Raman, R.,** Bhaduri, B., Mir, M., Popescu, G., Kong, H.J., Bashir, R. Projection stereolithography system for high-resolution patterning of cells in 3D.

[1] Provisional Filing: Bajaj, P., **Raman, R.**, Bashir, R. Patterned three dimensional encapsulation of biological entities in hydrogels.

CONFERENCE ACTIVITY

ORAL PRESENTATIONS

Raman, R., et al. (2016, July). *Civic Technology Challenge Pitch.* Think Chicago | Lollapalooza. Chicago, IL. ***1st Place Prize**

Raman, R., et al. (2016, January). *Optogenetic Skeletal Muscle-Powered 3D Printed Adaptive Biological Machines*. BMES CMBE Annual Meeting. New Orleans, LA. ***Designated Student Fellow Awardee**

Raman, R., et al. (2015, December). *Building with Biology*. EBICS NSF Site Visit. Boston, MA.

Raman, R., et al. (2015, October). *Optogenetic Skeletal Muscle Powered 3D Printed Biological Machines*. BMES Annual Meeting. Tampa, FL. ***Designated "Dream Team & Center"**

Raman, R., et al. (2015, October). *High-Resolution 3D Bio-Printing Apparatus for Applications in Patterning of Microvasculature.* BMES Annual Meeting. Tampa, FL. ***Designated "Dream Team & Center"**

Raman, R., et al. (2015, September). *Optogenetic Skeletal Muscle Powered 3D Printed Biological Machines.* TERMIS World Congress. Boston, MA.

Raman, R., et al. (2015, June). *BioBlocks: Building with Biology*. EBICS Annual Retreat: Product Conceptualization Competition. Atlanta, GA. ***1st Place Prize**

Raman, R., et al. (2015, June). *Student Leadership Council Annual Update*. EBICS Annual Retreat. Atlanta, GA.

Raman, R., et al. (2014, October). *3D Printed Optogenetic Skeletal Muscle-Powered Biological Machines.* BMES Annual Meeting. San Antonio, TX.

Raman, R., et al. (2014, June). *Student Leadership Council Annual Update*. EBICS Annual Retreat. Atlanta, GA.

Raman, R., et al. (2013, October). *Building with Biology: Using 3D Printing to Forward-Engineer the Future*. SWE National Conference. Baltimore, MD.

POSTER PRESENTATIONS

Raman, R., et al. (2016, July). *Damage, Healing, and Environmental Adaptation in Optogenetic Skeletal Muscle Bioactuators*. EBICS Annual Retreat. St. Charles, IL.

Raman, R., et al. (2016, February). *Optogenetic Skeletal Muscle-Powered 3D Printed Biological Machines.* Purdue Future Faculty Workshop. West Lafayette, IN.

Raman, R., et al. (2015, December). *Optogenetic Skeletal Muscle-Powered 3D Printed Biological Machines.* EBICS Annual Site Visit. Boston, MA.

Raman, R., et al. (2015, November). *Optogenetic Skeletal Muscle-Powered 3D Printed Biological Machines.* MechSE Graduate Research Forum. Urbana, IL. ***Best Poster Award**

Raman. R., et al. (2015, October). *3D Printed Light-Controlled Muscle-Powered Biological Machines.* SWE National Conference. Nashville, TN. ***National Top 10 Finalist**

Raman, R., et al. (2015, June). *3D Printed Optogenetic Muscle-Powered Biological Machines.* EBICS Annual Retreat. Atlanta, GA.

Raman, R., et al. (2015, May). *3D Printed Optogenetic Muscle-Powered Biological Machines.* CNST Annual Symposium. Urbana, IL. ***Poster Award**

Raman, R., et al. (2014, December). *A Projection Stereolithography System for High-resolution Patterning of Cells in 3D: Applications in Tissue Engineering of Vasculature.* IEEE EMBS MNM Conference. Oahu, HI.

Raman, R., et al. (2014, December). *3D Printed Optogenetic Skeletal Muscle-Powered Biological Machines.* EBICS Annual Site Visit. Boston, MA.

Raman, R., et al. (2014, October). *A Projection Stereolithography System for High-resolution Patterning of Cells in 3D: Applications in Tissue Engineering of Vasculature.* BMES Annual Meeting. San Antonio, TX.

Raman, R., et al. (2014, June). *3D Printed Optogenetic Skeletal Muscle-Powered Biological Machines.* EBICS Annual Retreat. Urbana, IL.

Raman, R., et al. (2014, May). *3D Printed Optogenetic Skeletal Muscle-Powered Biological Machines.* National Science Foundation IGERT Symposium Poster Award. Urbana, IL. ***Poster Award**

Raman, R., et al. (2014, April). *A Projection Stereolithography System for High-resolution Patterning of Cells in 3D.* Illinois-Tsinghua Nanotechnology Symposium. Urbana, IL. ***Best Poster Award**

Raman, R., et al. (2013, November). *A Projection Stereolithography System for High-resolution Patterning of Cells in 3D.* Bioengineering 10th Anniversary Symposium. Urbana, IL.

Raman, R., et al. (2013, September). *A Projection Stereolithography System for High-resolution Patterning of Cells in 3D.* BMES Annual Meeting. Seattle, WA.

Raman, R., et al. (2013, June). *A Projection Stereolithography System for High-resolution Patterning of Cells in 3D.* EBICS Annual Retreat. Atlanta, GA.

Raman, R., et al. (2013, May). *A Projection Stereolithography System for High-resolution Patterning of Cells in 3D.* CNST Annual Symposium. Urbana, IL. ***Best Poster Award**

Raman, R., et al. (2012, August). *Bioreactor Design: Dynamic Compressive Loading of Tissue Engineered Knee Menisci.* NSF IGERT Bionanotechnology Symposium. Urbana, IL. ***Poster Award**

OTHER CONFERENCES ATTENDED

Women Empowered in STEM (2013-2016). Urbana, IL.
Tech Transfer Summit North America (2015, July). Chicago, IL.
3D Printing for Medical Procedures (2014, May). Singapore.
Society of Women Engineers Regional Conference (2013, February). Minneapolis, MN.

INVITED TALKS

Raman. R., et al. (2016, September). *Bio-Bots: Building Beyond Biology.* Discovery Center, NSF Building with Biology Public Engagement Grant, and Boston Museum of Science. Murfreesboro, TN.

Raman. R., et al. (2016, May). *Stereolithographic 3D Printing for Biomedical Applications.* United States Patent and Trademark Office. Washington D.C.

Raman. R., et al. (2016, April). *BioBots: Building with Biology*. Presentation to Congressman Randy Hultgren. Urbana, IL.

Raman, R., et al. (2015, April). *3D Printed Muscle Powered Biological Machines*. BUGSS (Baltimore Under Group Science Space) Bioprinting Breakout. Baltimore, MD (Virtual).

Raman. R., et al. (2015, October). *BioBots: Building with Biology*. Presentation to NSF Director, France Cordova. Urbana, IL.

Raman, R., et al. (2015, April). *BioBlocks: Building with Biology*. Entrepreneurship Forum. Urbana, IL.

SELECTED CAMPUS TALKS

Raman. R., et al. (2016, October). *BOLD: Women in Innovation at Illinois.* Inaugural Meeting Panel. ***Invited**

Raman. R., et al. (2016, September). *Writing a Winning Fellowship Proposal.* Bioengineering Department Panel. ***Invited**

Raman. R., et al. (2016, September). *Writing a Winning NSF Graduate Research Fellowship Proposal.* NSF GRFP Annual Workshop. ***Invited**

Raman. R., et al. (2016, July). *Stereolithographic 3D Printing.* GAMES Camp. Urbana, IL

Raman. R., et al. (2016, July). *Choosing a Graduate School.* NSF REU Program Panel. Urbana, IL. ***Invited**

Raman, R., et al. (2016, March). *Damage and Healing in Tissue Engineered Skeletal Muscle*. NSF EBICS Research Meeting. Urbana, IL.

Raman, R., et al. (2016, March). *Choosing a Graduate Advisor*. Transition from Undergraduate to Doctoral Programs Workshop Panel. Urbana, IL. ***Invited**

Raman, R., et al. (2015, September). *Road Map to Graduate School*. Morrill Engineering Program Panel. Urbana, IL. ***Invited**

Raman, R., et al. (2015, September). *NSF Graduate Research Fellowship Q&A*. MechSE Department Panel. Urbana, IL. ***Invited**

Raman, R., et al. (2015, September). *NanoSTRuCT: Integrating Outreach, Communication, and Leadership Experiences for Graduate Students.* Bionanotechnology Seminar. Urbana, IL.

Raman. R, et al. (2015, July). *3D Printed Biological Robots.* GAMES Camp. Urbana, IL.

Raman, R., et al. (2014, September). *3D Microfabrication of Biological Machines*. MechSE Bio-Interest Group Seminar. Urbana, IL. ***Invited**

Raman. R., et al. (2014, September). *Writing a Winning NSF Graduate Research Fellowship Proposal.* NSF GRFP Annual Workshop. ***Invited**

Raman, R., et al. (2013, December). *Microfabricated Biological Machines for Sensing and Locomotion*. Bionanotechnology Seminar. Urbana, IL.

Raman, R., et al. (2013, April). *A Projection Stereolithography System for High-resolution Patterning of Cells in 3D.* EBICS Symposium. Urbana, IL.

RESEARCH EXPERIENCE

NSF Graduate Research Fellow & IGERT Fellow, Bashir Lab, UIUC 2012-Present
Project: Skeletal Muscle Bioactuators for Bio-integrated Machines
Project: High-Resolution 3D Bio-Printing
Visiting Research Scholar, Mechanobiology Institute, National University of Singapore 2014
Project: Mechanical Properties of Tissue Engineered Skeletal Muscle
Undergraduate Researcher, Bonassar Lab, Cornell University
Project: Bioreactor Design for Cartilage Tissue Engineering 2011-2012
Undergraduate Researcher, Gao Lab, Cornell University
Project: Skeletal Muscle Characterization 2010-2011

PROFESSIONAL EXPERIENCE

Cornell Kessler Entrepreneurial Fellow, Rheonix Inc. 2011
Project: DNA Microarray Manufacturing
Sub-Team Leader, Cornell AguaClara LLC. 2010
Project: Chemical Dose Controller for Small-Scale Water Purification Plant
Education Intern, Cornell University Laboratory of Ornithology 2010
Project: Ornithology Research Dissemination

PROFESSIONAL TRAINING

Society of Women Engineers Academic Leadership for Women Program 2016
Illinois Female Engineers in Academia Program 2016

PROFESSIONAL AFFILIATIONS

Biomedical Engineering Society
Society of Women Engineers

MEDIA COVERAGE

BioBots research has been featured on NSF Science Nation, NPR Science Friday, MIT Technology Review, Popular Science, Forbes, TechCrunch, and many other news outlets. For links to international media coverage on research and outreach, as well as personal profiles and videos, please visit RituRaman.com/Publicity

REFERENCES

Rashid Bashir, Abel Bliss Professor and Department Head, rbashir@illinois.edu
Department of Bioengineering, University of Illinois at Urbana-Champaign

Roger D. Kamm, Cecil and Ida Green Distinguished Professor, rdkamm@mit.edu
Department of Mechanical Engineering, Massachusetts Institute of Technology

M. Taher A. Saif, Gutgsell Professor, saif@illinois.edu
Department of Mechanical Science and Engineering, University of Illinois at Urbana-Champaign