

MANUEL OCHOA

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EDUCATION

- Doctor of Philosophy* 2012–2016 Purdue University—West Lafayette, IN
School of Electrical and Computer Engineering
Dissertation: *Laser-processed parchment paper for fabrication of chronic wound dressings with selective oxygenation*
Major Advisor: Prof. Babak ZIAIE
- Master of Science in Electrical and Computer Eng.* 2009–2012 Purdue University—West Lafayette, IN
School of Electrical and Computer Engineering
Thesis: *A piezoelectrically actuated titanium micropump for drug delivery*
Major Advisor: Prof. Babak ZIAIE
- Bachelor of Science* 2005–2009 California Institute of Technology—Pasadena, CA
Department of Electrical Engineering

RESEARCH EXPERIENCE

- SmartGait, LLC* 2017–Present Senior Scientist
- PI of an NSF SBIR project with SmartGait, LLC, a start-up company which develops wireless portable systems for gait monitoring and analysis in gait-compromised patients.
- Ziaie Biomedical Microdevices Laboratory (ZBML), Birck Nanotechnology Center, Purdue University* 2016–Present Post-Doctoral Research Assistant
- Developing a scalable, commercializable dressing for integrated sensing and delivery of oxygen in chronic wounds (funded by NextFlex PC 1.0.) in collaboration with IU School of Medicine, Western Michigan University, and Integra LifeSciences Corporation.
Advisor: Prof. Babak ZIAIE
- 2009–2016 Graduate Student Research Assistant
- Developed low-cost microsystem platforms for dermal wound monitoring and healing. This research is funded by the NSF as part of a multi-institution collaboration (Purdue, Tufts, Harvard Medical School, MIT, Brigham and Women’s Hospital).
 - Designed, fabricated, and characterized an all-titanium piezoelectrically actuated micropump for continuous transdermal delivery of liquid drugs (MS thesis).
 - Contributed ideas, figures, and writing for 17 research proposals (e.g., NIH SBIR, U01, R21; NSF IDBS, ERC, STC; CTSI; DOD), including writing a full NSF proposal.
 - Deployed online resources to centralize lab protocols, equipment guides, new user guides, research and writing tutorials, email lists, data collection and analysis software, and equipment and material management. Developed and maintained group website.
Advisor: Prof. Babak ZIAIE

- Caltech /
Jet Propulsion
Laboratory (JPL)* 2008–2009 Undergraduate Researcher
- Designed (in Verilog and VHDL), simulated, and implemented a hardware version of computation-intensive algorithms for a visual odometry system.
Advisors: Prof. Pietro PERONA (Caltech) & Dr. Larry MATTHIES (JPL)
- Jet Propulsion
Laboratory (JPL)* 2007 & 2008 Summer Intern
- Designed embedded system schematics and PCBs for a multi-channel, CPLD-controlled, microprocessor-equipped power isolation system for a rover testbed platform.
 - Programmed a Cirris cable testing machine in C++ to streamline the testing of custom-designed cables against their schematics.
 - Analyzed and documented a multi-module data acquisition system in Verilog.
Supervisors: Elihu H. McMAHON & Michael THIELMAN
- Caltech Gray
Group* Summer 2005 Undergraduate Researcher
- Assisted Dr. Stephen Contakes with organic chemistry research in Prof. Harry B. Gray's group as part of Caltech's Freshmen Summer Institute.
Advisor: Dr. Stephen CONTAKES

TEACHING AND MENTORING EXPERIENCE

- Purdue
Department of
Mathematics* 2013–Present Mathematics Instructor/Lecturer
- Instructor for Applied Calculus I (Fall 2013, Fall 2014, Fall 2015) and Applied Calculus II [online] (Summer 2014). Experience with lecturing and writing exams.
Supervisor: Prof. Dominic NAUGHTON
- Ziaie Biomedical
Microdevices
Laboratory
(ZBML)* 2011–Present Mentoring
- Designed and supervised appropriate research projects for 8 undergraduate researchers (e.g., summer reserachers) and mentored incoming graduate students.
- ZBML / Birck
Nanotechnology
Center, Purdue
University* 2013–2015 Public Outreach
- Hosted interactive scientific research presentations (March 2013 & April 2014) for middle school students who visited Purdue; created and distributed educational pamphlets.
 - Organized and ran an interactive "mock cleanroom" educational activity (April 2013, 2014, 2015) as part of Purdue's *NanoDays* 3-day event (open to the public) to elucidate key concepts in nanotechnology and microfabrication. Recruited and coordinated 28 volunteers in April 2015.
- Purdue
Department of
Mathematics* 2010–2012 Mathematics Recitation Teaching Assistant
- Held recitation sessions once per week and wrote quizzes for Calculus I (Fall 2012), Calculus II (Fall 2010), Calculus III (Spring 2011), and Differential Equations and Linear Algebra (Fall 2011).
Supervisor: Prof. Rita SAERENS

2008–2009 Mathematics and Science Tutor

ASOSAL,
Los Angeles

Tutored K-12 students in mathematics and science as a volunteer tutor at the Association of Salvadorians (ASOSAL) enrichment center in Los Angeles, CA.

MICRO-FABRICATION SKILLS

(Bio)MEMS
Micromachining

Class 1-10-100 cleanroom and bio-cleanroom experience · wet etching · DRIE · photolithography · PECVD · surface profilometry · MEMS packaging · FE-SEM · Bio Safety Level II (BSL-II) certification · oxygen measurements · wireless device characterization

Rapid prototyping

Soft lithography (e.g., for microfluidic and lab-on-a-chip applications) · CAD for 3D printing (for stereo-lithography and extrusion systems) · cutter-plotting · screen printing · process development using commercial films · Laser machining using CO₂ and fiber lasers (system super-user/trainer)

COMPUTER SKILLS

Operating Systems

Windows 98/ME/XP/7, Mac OS X, Linux (Ubuntu)

Languages

L^AT_EX, HTML/CSS, PHP, C, 80188 Assembly, Verilog

Software
Packages

Adobe Bridge	Mathworks MATLAB	Altium Designer
Adobe Illustrator	Wolfram Mathematica	Tanner L-Edit
Adobe Photoshop	Origin Pro	Xilinx ISE WebPack
CorelDRAW	Microsoft Office	ModelSim
Maxon Cinema 4D	Mendeley	Subversion/Mercurial
SolidWorks (modeling)	Apache Server	NeoFox Viewer

PROFESSIONAL INVOLVEMENT

Societies

IEEE (EMBS & Education Society) · Student Member · 2009–Present
Mellon Mays Fellows Professional Network (MMFPN) · 2012–Present
BMES · Student Member · 2014–Present
AAAS · Student Member · 2014–Present
Mexican American Engineers & Scientists (MAES) · 2014–Present
Materials Research Society (MRS) · Student Member · 2012–2013

Committees

Purdue Nanomanufacturing Committee · Member · 2012–Present
Purdue Nanotechnology Student Advisory Council · Vice President (2013–Present);
President (2012–2013) · Social Committee Chair (2011–2012)

Editorial

Reviewer for: IEEE TBME · IEEE IoT · Materials Research Society · BioCAS Conference

Other

Ziaie Group (ZBML) · Webmaster & Photographer · 2011–Present
Mendeley Advisor (local liaison to Mendeley Ltd.) · 2011–Present

HONORS AND ACHIEVEMENTS

Awards 2008 · Mellon-Mays Undergraduate Fellowship Recipient
 2005 · Caltech President's Scholarship Recipient
 2005 · High School Valedictorian

ADDITIONAL INFORMATION

Spoken Languages ENGLISH · Native speaker
 SPANISH
Other interests Biomedical microsystems · Consumer electronics and gadgets · Science communication
 Macrophotography & photomicroscopy · Science of cooking · Coffee

CAMPUS TALKS AND WORKSHOPS

“Laser-enabled technologies for low-cost, disposable wearable medical devices”, in *1st Annual Conference on Micro & Nanoscale Science for Addressing Grand Challenges*, Purdue University, April **2016**.

“Laser Micromachining for Flexible Biomedical Microsystems”, in *Nanotechnology Student Advisory Council Technical Workshop Series*, Purdue University, December **2015**.

JOURNAL PUBLICATIONS (19)

- 2017 **M. Ochoa**, C. K. Yoon, and B. Ziaie, “Laser-fabricated, self-forming swimmers with catalytic propulsion and magnetic navigation,” *J Microelectromech S*, accepted.
- 2016 R. Rahimi, S. S. Htwe, **M. Ochoa**, A. Donaldson, M. Zieger, R. Sood, A. Tamayol, A. Khademhosseini, A. Ghaemmaghami, and B. Ziaie, “Paper-based in-vitro model for on-chip investigation of the human respiratory system,” *Lab Chip*, vol. 16, no. 22, **2016**, pp. 4319–4325.
- R. Rahimi, **M. Ochoa**, and B. Ziaie, “Direct laser writing of porous-carbon/silver nanocomposite for flexible electronics,” *ACS Appl. Mater. Interfaces*, **2016**.
- M. Ochoa**, H. Jiang, J. H. Park, A. Otte, R. Pinal, and B. Ziaie, “Nanoparticle-enabled wireless monitoring and characterization of physical degradation kinetics in pharmaceutical gelatin films,” *Sens. Actuators A: Phys.*, vol. 241, **2016**, pp. 238–244.
- R. Rahimi, **M. Ochoa**, T. Parupudi, X. Zhao, I. K. Yazdi, M. R. Dokmeci, A. Tamayol, A. Khademhosseini, and B. Ziaie, “A low-cost flexible pH sensor array for wound assessment,” *Sens. Actuators B: Chem.*, vol. 229, **2016**, pp. 609–617.
- 2015 W. Yu, R. Rahimi, **M. Ochoa**, R. Pinal, and B. Ziaie, “A smart capsule with GI-tract-location-specific payload release,” *IEEE Trans. Biomed. Eng.*, vol. 62, no. 9, **2015**, pp. 2289–2295

- R. Rahimi, **M. Ochoa**, A. Donaldson, T. Parupudi, M. R. Dokmeci, A. Khademhosseini, A. Ghaemmaghami, and B. Ziaie, "A Janus-paper PDMS platform for airliquid interface cell culture applications," *J. Micromech. Microeng.*, vol. 25, **2015**, 055015
- R. Rahimi, **M. Ochoa**, W. Yu, and B. Ziaie, "Highly stretchable and sensitive unidirectional strain sensor via laser carbonization," *ACS Appl. Mater. Interfaces*, vol. 7, no. 8, **2015**, pp. 4463–4470
- 2014 R. Rahimi, **M. Ochoa**, W. Yu, and B. Ziaie, "A sewing-enabled stitch-and-transfer method for robust, ultra-stretchable, conductive interconnects," *J. Micromech. Microeng.*, vol. 24, **2014**, 095018
- A. H. Najafabadi, A. Tamayol, N. Annabi, **M. Ochoa**, R. Rahimi, P. Mostafalu, M. Akbari, M. Nikkhah, M. R. Dokmeci, S. Sonkusale, B. Ziaie, A. Khademhosseini, "Biodegradable nanofibrous polymeric substrates for generating elastic and flexible electronics," *Adv. Mater.*, accepted.
- M. Ochoa**, R. Rahimi, and B. Ziaie, "Flexible Sensors for Chronic Wound Management," *IEEE Rev. Biomed. Eng.*, **2014**.
- P.-A. Vidi, T. Maleki, **M. Ochoa**, L. Wang, S. M. Clark, J. F. Leary, and S. A. Lelièvre, "Disease-on-a-Chip: Mimicry of Tumor Growth in Mammary Ducts," *Lab Chip*, **2014**.
- M. Ochoa**, R. Rahimi, Tiffany L. Huang, N. Alemdar, A. Khademhosseini, M. R. Dokmeci, and B. Ziaie, "A paper-based oxygen generating platform with spatially-defined catalytic regions for chronic wound treatment," *Sens. Actuators B: Chem*, **2014**.
- 2013 **M. Ochoa**, G. Chitnis, and B. Ziaie, "Laser-micromachined cellulose acetate adhesive tape as a low-cost smart material," *J. Polym. Sci. B Polym. Phys.*, vol. 51, no. 17, **2013**, pp. 1263–1267
- M. Ochoa**, P. Wei, A. J. Wolley, K. J. Otto, and B. Ziaie, "A hybrid PDMS-Parylene subdural multi-electrode array," *Biomed. Microdevices*, Jan. vol. 15, no. 3, **2013**, pp. 437–443
- 2012 **M. Ochoa**, C. Mousoulis, and B. Ziaie, "Polymeric microdevices for transdermal and subcutaneous drug delivery," *Adv. Drug Delivery Rev.*, vol. 64, no. 14, **2012**, pp. 1603–1616.
- M. Ochoa** and B. Ziaie, "A fermentation-powered thermopneumatic pump for biomedical applications," *Lab Chip*, vol. 12, no. 20, **2012**, pp. 4044–4048.
- 2011 **M. Ochoa** and B. Ziaie, "Analysis of novel methods to determine the accuracy of the OmniPod insulin pump: a key component of the artificial pancreas system.," *J. Diabetes Sci. Technol.*, vol. 5, no. 6, **2011**, pp. 1519–1520.
- C. Mousoulis, **M. Ochoa**, D. Papageorgiou, and B. Ziaie, "A skin-contact-actuated micropump for transdermal drug delivery," *IEEE Trans. Biomed. Eng.*, vol. 58, **2011**, pp. 1492–1498.

CONFERENCE PUBLICATIONS (32)

- 2016 V. Jain, **M. Ochoa**, and B. Ziaie, "A low-cost, paper-based visual indicator patch for monitoring dehydration rate due to sweating," in *Proceedings of MicroTAS '16*, **2016**.

- H. Jiang, R. Rahimi, **M. Ochoa**, T. Parupudi, and B. Ziaie, "A pH-regulated drug delivery device for targeting infected regions in chronic dermal wounds," in *Proceedings of MicroTAS '16*, **2016**.
- W. Yu, J. Zhou, R. Rahimi, H. Jiang, **M. Ochoa**, and B. Ziaie, "Modular customizable 3d-printed batteries for wearable applications," in *Proceedings of MicroTAS '16*, **2016**.
- L. Yang, C. Compton, **M. Ochoa**, B. Ziaie, J. Sokol, and M. Boyce, "Early Experience with Medpor Nonporous Barrier Sheet In Orbital Fracture Repair," in *Invest. Ophthalmol. Vis. Sci.*, vol. 57; ARVO E-Abstract 710
- C. K. Yoon, **M. Ochoa**, A. Kim, R. Rahimi, and B. Ziaie, "An integrated low-cost radiation dosimeter utilizing microorganism as radiation-sensitive material," in *Hilton Head 2016: A Solid-State Sensors, Actuators and Microsystems Workshop*, **2016**.
- R. Rahimi **M. Ochoa**, S. S. Htwe, A. Donaldson, M. Zieger, M. R. Dokmeci, A. Khademhosseini, R. Sood, A. Ghaemmaghami, and B. Ziaie, "A low-cost paper-based model for on-chip human respiratory system studies," in *Hilton Head 2016: A Solid-State Sensors, Actuators and Microsystems Workshop*, **2016**.
- R. Rahimi , **M. Ochoa**, T. Parupudi, W. Yu, and B. Ziaie, "Facile fabrication of flexible electronics via direct laser writing of carbon-silver nanocomposite," in *Hilton Head 2016: A Solid-State Sensors, Actuators and Microsystems Workshop*, **2016**.
- J. Zhou, R. Rahimi, A. Kim, **M. Ochoa**, and B. Ziaie, "A PVDF-based flexible and shapeable acoustic power source for implantable biomedical devices," in *Hilton Head 2016: A Solid-State Sensors, Actuators and Microsystems Workshop*, **2016**.
- M. Ochoa**, C. K. Yoon, and B. Ziaie, "Flexible self-forming swimmers with catalytic propulsion and magnetic navigation," in *MEMS 2016, Shanghai, China*, **2016**, pp. 11611164.
- R. Rahimi, **M. Ochoa**, M. Zieger, R. Sood, and B. Ziaie, "A wireless strain sensor for wound monitoring with direct laser-defined patterning on a commercial dressing," in *MEMS 2016, Shanghai, China*, **2016**, pp. 481484.
- J. Zhou, A. Kim, **M. Ochoa**, H. Jiang, and B. Ziaie, "An ultrasonically powered micropump for on-demand in-situ drug delivery," in *MEMS 2016, Shanghai, China*, **2016**, pp. 349352.
- C. K. Yoon, A. Kim, **M. Ochoa**, T. Parupudi, and B. Ziaie, "A low-cost wearable radiation sensor based on dose response viability of yeast cells," in *MEMS 2016, Shanghai, China*, **2016**, pp. 10661069.
- 2015 **M. Ochoa**, J. Zhou, R. Rahimi, V. Badwaik, D. Thompson, and B. Ziaie, "Rapid 3D-print-and-shrink fabrication of biodegradable microneedles with complex geometries," in *Transducers 2015, Anchorage, AK*, **2015**.
- H. Jiang, **M. Ochoa**, J.H. Park, A. Otte, R. Pinal, and B. Ziaie, "Wireless screening of degradation kinetics in pharmaceutical gelatin films," in *Transducers 2015, Anchorage, AK*, **2015**.
- R. Rahimi, **M. Ochoa**, W. Yu, and B. Ziaie, "A highly stretchable pH sensor array using elastomer-embedded laser carbonized patterns," in *Transducers 2015, Anchorage, AK*, **2015**.

- R. Rahimi, **M. Ochoa**, W. Yu, and B. Ziaie, "A low-cost fabrication technique for direct sewing stretchable interconnections for wearable electronics," in *Transducers 2015, Anchorage, AK, 2015*.
- L. Ben-Yehoshua, **M. Ochoa**, and B. Ziaie, "Rapid fabrication of 3D elastomeric structures via laser-machining and vacuum deformation," in *Transducers 2015, Anchorage, AK, 2015*.
- Z.B. Hughes, R. Rahimi, **M. Ochoa**, and B. Ziaie, "Rapid prototyping of piezoresistive mems sensors via a single-step laser carbonization and micromachining process," in *Transducers 2015, Anchorage, AK, 2015*.
- M. Ochoa**, H. Jiang, R. Rahimi, and B. Ziaie, "Laser treated glass platform with rapid wicking-driven transport and particle separation capabilities," in *MEMS 2015, Estoril, Portugal, 2015*.
- R. Rahimi, **M. Ochoa**, W. Yu, and B. Ziaie, "A facile fabrication technique for stretchable interconnects and transducers via laser carbonization," in *MEMS 2015, Estoril, Portugal, 2015*.
- T.S. Zhang, A. Kim, **M. Ochoa**, and B. Ziaie, "Controllable 'somersault' magnetic soft robotics," in *MEMS 2015, Estoril, Portugal, 2015*.
- 2014 **M. Ochoa**, R. Rahimi, H. Jiang, and B. Ziaie, "Laser surface-treated glass with wicking capability for microfluidics," in *μ TAS 2015, San Antonio, TX, 2015*.
- R. Rahimi, **M. Ochoa**, J. Zhou, A. Tamayol, M.R. Dokmeci, A. Khademhosseini, A. Ghaemmaghami, and B. Ziaie, "A hybrid pdms/paper passive pump for slow-release/delivery of drugs in chronic dermal wounds," in *μ TAS 2015, San Antonio, TX, 2015*.
- R. Rahimi, **M. Ochoa**, M. R. Dokmeci, A. Khademhosseini, and B. Ziaie, "A janus-paper pdms platform for lab-on-a-chip applications," in *Hilton Head 2014: A Solid-State Sensors, Actuators and Microsystems Workshop, 2014*.
- R. Rahimi, **M. Ochoa**, X. Zhao, M. R. Dokmeci, A. Khademhosseini, and B. Ziaie, "A flexible ph sensor array on paper using laser pattern definition and self-aligned laminated encapsulation," in *Hilton Head 2014: A Solid-State Sensors, Actuators and Microsystems Workshop, 2014*.
- R. Rahimi, **M. Ochoa**, W. Yu, and B. Ziaie, "A sewing-enabled stitch-and-transfer method for robust, ultra-stretchable, conductive interconnects," in *Hilton Head 2014: A Solid-State Sensors, Actuators and Microsystems Workshop, 2014*.
- 2013 **M. Ochoa**, R. Rahimi, N. Alemdar, M. R. Dokmeci, A. Khademhosseini, and B. Ziaie, "A flexible, laser-defined, paper platform for localized oxygen generation and delivery, in *Proc. Transducers 2013, Actuators and Microsystems, 2013*.
- M. Ochoa**, R. Rahimi, R. Shi, and B. Ziaie, "An impact sensing platform for spinal cord injury experiments," in *Proc. Sensors '13, 2013*.
- R. Rahimi, **M. Ochoa**, and B. Ziaie, "A low-cost flexible electrochemical sensor for monitoring silver ion concentration in alginate wound dressings," in *Proc. Sensors 13, 2013*.

- R. Rahimi, G. Chitnis, P. Mostafalu, **M. Ochoa**, S. Sonkusale, and B. Ziaie, "A low-cost oxygen sensor on paper for monitoring wound oxygenation," in *The 7th International Conference on Microtechnologies in Medicine and Biology*, **2013**.
- 2011 **M. Ochoa**, C. Mousoulis, and B. Ziaie, "A sequential-dosage fluorocarbon-actuated micropump," in *Proceedings of MicroTAS '11*, **2011**, pp. 18071809.
- 2010 C. Mousoulis, **M. Ochoa**, and B. Ziaie, "A skin-contact-actuated dispenser/pump for transdermal drug delivery," in *Proceedings of MicroTAS '10*, **2010**, pp. 749751.

BOOK CHAPTERS

M. Ochoa, R. Rahimi, and B. Ziaie, "Laser-Enabled Fabrication Technologies for Low-Cost Flexible/Conformal Cutaneous Wound Interfaces," in *Stretchable Bioelectronics for Medical Devices and Systems*, J. A. Rogers, R. Ghaffari, and D.-H. Kim, Eds. Springer International Publishing, **2016**, pp. 207226.

PATENTS

- B. Ziaie, **M. Ochoa**, and C. Mousoulis, "Touch-actuated micropump for transdermal drug delivery and method of use," US Patent 2012/0046644 A12012.
- B. Ziaie, **M. Ochoa**, and R. Rahimi, "Platform for oxygen generation and delivery," US Patent Application 14/602,203.
- B. Ziaie and **M. Ochoa**, "Humidity sensors and methods of fabrication," Provisional US Patent.
- B. Ziaie, **M. Ochoa**, and V. Jain, "Skin-mounted sweat sensor," Provisional US Patent.

February 21, 2017