

Curriculum Vitae
Paul D. Marasco Ph.D.

Address*Primary*

Cleveland Clinic
Lerner Research Institute
Department of Biomedical Engineering
9500 Euclid Avenue / ND20
Cleveland, Ohio 44195
marascp2@ccf.org
Office (216) 444-1217
Fax (216) 444-9198
<http://www.lerner.ccf.org/bme/marasco/>

Secondary

Advanced Platform Technology (APT) Center
Louis Stokes Cleveland VA Medical Center
10701 East Boulevard, 151 AW/APT
Cleveland, OH 44106
Ph: (216) 707-6421 x 5766
F: (216) 707-6420
pmarasco@aptcenter.org
<http://www.aptccenter.research.va.gov/index.asp>
<http://www.aptccenter.research.va.gov/staff/investigators/marasco/>

Positions*Primary*

Associate Professor/Staff, Department of Biomedical Engineering, Lerner Research Institute, Cleveland Clinic (07/2013-Current)

Secondary

Research Health Scientist/ Principal Investigator, Advanced Platform Technology (APT) Center
Louis Stokes Cleveland VA Medical Center (09/2010-Current)
Director of Amputee Research, Department of Physical Medicine and Rehabilitation
Louis Stokes Cleveland VA Medical Center (03/2011-Current)
University Graduate Faculty (Level 1), Cleveland State University (04/2015-Current)
Staff Professor, Department of Bioengineering and Chemical Engineering, Universidad de Ingeniería y Tecnología (UTEC), Lima Perú (01/2019-Current)

Adjunct

Adjunct Associate Professor, Department of Biomedical Engineering, Case Western Reserve University (10/2016-Current)
Adjunct Assistant Professor of Molecular Medicine, Case Western Reserve University (08/2016-Current)
Adjunct Professor, Department of Cognitive Science, Case Western Reserve University (06/2012-06/2016)

Research Interests

Sensory Integration with Prosthetic devices, Amputee Research, Cognitive Embodiment, Visual-Tactile Integration, Sensory Neurophysiology, Brain Organization, Neural Plasticity, Kinesthesia, Diabetic Sensory Neuropathy

Education

Post Doctoral Fellowship, Center for Bionic Medicine (CBM), Rehabilitation Institute of Chicago (now the Shirley Ryan Ability Lab), Chicago IL, 2006-2009

Ph.D. Neuroscience, Vanderbilt Brain Institute, Vanderbilt University, Nashville TN, 2006

B.A. Biology, University of Colorado, Colorado Springs CO, 1999

Grants/Awards

Current Funding:

Department of Defense, Congressionally Directed Medical Research Program (CDMRP) Clinical and Rehabilitative Medicine Research Program (CRM RP) Grant #MR140156 “Physiologically relevant prosthetic limb movement feedback for upper and lower extremity amputees”

Role: Principal Investigator (09/2015-10/2019: NCE) \$1.5M

VA Presidential Early Career Award for Scientists and Engineers (PECASE), 2016

Role: Awardee (02/2016-03/2020) \$125K

VA Department of Veterans Affairs, Merit Review, 1 I01 RX001833-01A2 “Advanced Materials to Improve Moisture Management for Prosthetic Socket Liners”

Role: Principal Investigator (01/2017-12/2020) \$915K

Defense Advanced Research Project Agency (DARPA), Department of Defense, Advance Study #N66001-15-C-4038. “Natural Sensation for Lower Limb Amputees”

Role: Co-Investigator (09/2015-10/2019) \$1.7M

Previous Funding:

Defense Advanced Research Project Agency (DARPA), Department of Defense, Contract # N66001-15-C-4015 “Functional Metrics for Humans with Bidirectionally Integrated Prosthetic Limbs”

Role: Principal Investigator (12/2015-01/2019) \$2.5M

Orthofix Inc. Sponsored Research Agreement, “Pulsed Electromagnetic Frequency (PEMF) Stimulation of mechanosensory nerves affecting bone”

Role: Co-Investigator (06/2016-02/2018) \$350K

National Institutes of Health (NIH) Director’s Transformative R01 Research Award, 1R01NS081710 - 01, “Restoring upper limb movement sense to amputees; a move towards natural control of prosthetic limbs”

Role: Principal Investigator (12/2013-11/2017) \$1.2M

Defense Advanced Research Project Agency (DARPA), Department of Defense, 61732-LS-DRP, Under P-1108-114403/DARPA-BAA-11-08 Reliable Peripheral Interfaces (RPI), “A touch feedback factor array system for long-term implementation of physiologically relevant cutaneous touch with prosthetic limbs.”

Role: Principal Investigator (02/2012-09/2017) \$1.3M

VA RR&D Merit Review Award “Peripheral Interfaces in Amputees to Restore Sensation”

Role: Co-Investigator (09/2014-10/2016) \$1.2M

Advanced Platform Technology Center of Excellence, Innovation Incentive II, “Advanced Materials for Water Managing Prosthetic Socket Liners”

Role: Principal Investigator (10/2013-11/2014) \$20k

VA RR&D Career Development Award, Level-2 No. A7253W. "Proprioception in Rat Cortex to Examine Sensory Feedback for Prosthetics."

Role: Principal Investigator (06/2010-07/2013) \$475K

VA RR&D Merit Review Award “Novel modalities for assessing the cortical tissue-electrode interface”

Role: Co-Investigator (09/2010-10/2013)

National Institute on Disability and Rehabilitation Research (NIDRR), Mary E. Switzer Merit Fellowship “An investigation of percepts to touch following integration of physiologically relevant sensory feedback with artificial limbs.”

Role: Principal Investigator (2010) \$65K

Advanced Platform Technology Center research support award

Role: Award Recipient (07/2009) \$25K
NICHD NO1-HD-5-3402 HHSN27500503402C "Hyper-Reinnervation to Improve Myoelectric Prosthesis Control in Shoulder Disarticulation".
Role: Co-Investigator (09/2006-10/2009)

Awards:

Paper of the Year, Canadian Association of Physical Medicine and Rehabilitation 67th Annual Scientific Meeting; Coauthor (May 2019)
Nomination for the Cleveland Clinic Sones Innovation Award (2018) [top 3 finalist]
Presidential Early Career Award for Scientists and Engineers (PECASE) (February 2016)
Cleveland Clinic Caregiver Celebrations Appreciation Award (July 2015)
International Functional Stimulation Society Travel Award sponsored by: Project SMART (September 2012)
Globe Foundation Fellowship (September 2006-September 2007)
Fine Science Tools Travel Award (November 2004)
Fundamental Neuroscience Training Grant (August 2002-June 2004)
Zaebst Memorial Fellowship (December 1998-December 1999)
Colorado Scholars Award (August 1997-June 1998), (August 1998-June 1999)
Most Promising Biology Student (March 1994)
President's List (March 1997, March 1999)
Dean's List (March 1996, November 1998)
President, Tri Beta Biology Honor Society (August 1998-June 1999)

Publications (*Corresponding Author)

George JA, Kluger DT, Davis TS, Wendelken SM, Okorokova EV, He Q, Duncan CC, Hutchinson DT, Thumser ZC, Beckler DT, **Marasco PD**, Bensmaia SJ, Clark GA. (2019) Biomimetic sensory feedback through peripheral nerve stimulation improves dexterous use of a bionic hand. *Sci. Robot.* 4, eaax2352.
Christie BP, Charkhkar H, Shell CE, **Marasco PD**, Tyler DJ, Triolo RJ. (2019) Visual inputs and postural manipulations affect the location of somatosensory percepts elicited by electrical stimulation. *Nat Sci Rep.* Aug 12;9(1):11699.
Shehata AW, Keri MI, Gomez M, **Marasco PD**, Vette AH, Hebert JS. (2019) Skin Stretch Enhances Illusory Movement in Persons with Lower-Limb Amputation. *IEEE Int Conf Rehabil Robot.* Jun;2019:1233-1238.
Beckler DT, Thumser ZC, Schofield JS, **Marasco PD***. (2019) Using sensory discrimination in a foraging-style task to evaluate human upper-limb sensorimotor performance. *Nat Sci Rep.* Apr 9;9(1):5806.
Schofield JS, Schoepp KR, Stobbe M, **Marasco PD**, Hebert JS. (2019) Fabrication and application of an Adjustable myoelectric transhumeral prosthetic socket. *Prosthet Orthot Int.* Mar 29:309364619836353.
Schofield JS, Shell CE, Thumser ZC, Beckler DT, Nataraj R, **Marasco PD***. (2019) Characterization of the Sense of Agency over the Actions of Neural-machine Interface-operated Prostheses. *J Vis Exp.* Jan 7;(143)
Beckler DT, Thumser ZC, Schofield JS, **Marasco PD***. (2018) Reliability in evaluator-based tests: using simulation constructed models to determine contextually relevant agreement thresholds. *BMC Med Res Methodol.* Nov 19;18(1):141. <https://rdcu.be/bbLIN>
Downey JE, Weiss JM, Flesher SN, Thumser ZC, **Marasco PD**, Boninger ML, Gaunt RA, Collinger JL. (2018) Implicit Grasp Force Representation in Human Motor Cortical Recordings. *Front Neurosci.* Oct 31;12:801.
Schoepp KR, Schofield JS, Home D, Dawson MR, Lou E, Keri M, **Marasco PD**, Hebert JS. (2018) Real time monitoring of transtibial elevated vacuum prostheses: A case series on socket air pressure. *PLoS One.* Oct 22;13(10)
Huaroto JJ, Suarez EL, Hermano Krebs I, **Marasco PD**, Vela EA. (2018) A Soft Pneumatic Actuator as a Haptic Wearable Device for Upper Limb Amputees: Towards a Soft Robotic Liner. *IEEE Robotics and Automation Letters* (Online ISSN: 2377-3766; Digital Object Identifier: 10.1109/LRA.2018.2874379)
Charkhkar H, Shell CE, **Marasco PD**, Pinault GJ, Tyler DJ, Triolo RJ. (2018) High-density peripheral nerve cuffs restore natural sensation to individuals with lower-limb amputations. *J Neural Eng.* Jun 1;15(5):056002.

- Thumser ZC, Slifkin AB, Beckler DT, **Marasco PD***. (2018) Fitts' Law in the Control of Isometric Grip Force With Naturalistic Targets. *Front Psychol.* Apr 26;9:560.
- Marasco PD***, Hebert JS, Sensinger JW, Shell CE, Schofield JS, Thumser ZC, Nataraj R, Beckler DT, Dawson MR, Blustein DH, Gill S, Mensh BD, Granja-Vazquez R, Newcomb MD, Carey JP, Orzell BM. (2018) Illusory movement perception improves motor control for prosthetic hands. *Sci Transl Med.* Mar 14;10(432)
- Marasco PD***. (2018) Using proprioception to get a better grasp on embodiment. *J Physiol.* Jan 15;596(2):133-134. (*Editor's Choice Recognition*)
- McDaniel J, Lombardo LM, Foglyano KM, **Marasco PD**, J Triolo R. (2017) Cycle Training Using Implanted Neural Prostheses: Team Cleveland. *Eur J Transl Myol.* Dec 6;27(4):7087.
- Marasco PD***, Bourbeau DJ, Shell CE, Granja-Vazquez R, Ina JG. (2017) The neural response properties and cortical organization of a rapidly adapting muscle sensory group response that overlaps with the frequencies that elicit the kinesthetic illusion. *PLoS One.* Nov 28;12(11):e0188559.
- McDaniel J, Lombardo L, Foglyano K, **Marasco PD**, Triolo RJ. (2017) Setting the pace: insights and advancements gained while preparing for an FES bike race. *J NeuroEng and Rehabil.* 17;14(1):118
- Schofield JS, Schoepp KR, Williams HE, Carey JP, **Marasco PD**, Hebert JS. (2017) Characterization of interfacial socket pressure in transhumeral prostheses: A case series. *PLoS One.* Jun 2;12(6):e0178517. doi: 10.1371/journal.pone.0178517. eCollection 2017.
- Schofield JS, Evans KR, Hebert JS, **Marasco PD**, Carey JP. (2016) The Effect of Biomechanical Variables on Force Sensitive Resistor Error: Implications for Calibration and Improved Accuracy. *J Am Chem Soc.* Apr 3;135(13):5167-74.
- Hebert JS, Olson JL, Morhart MJ, Dawson MR, **Marasco PD**, Kuiken TA, Chan KM. (2014) Novel targeted sensory reinnervation technique to restore functional hand sensation after transhumeral amputation. *IEEE Trans Neural Syst Rehabil Eng.* Jul;22(4):765-73.
- Fox JD, Capadona JR, **Marasco PD**, Rowan SJ. (2013) Bioinspired Water-Enhanced Mechanical Gradient Nanocomposite Films That Mimic the Architecture and Properties of the Squid Beak. *J Am Chem Soc.*
- Marasco PD***, Kim K, Colgate JE, Peshkin MA, Kuiken TA. (2011) Robotic touch shifts perception of embodiment to a prosthesis in Targeted Reinnervation amputees. *Brain.* 134: 747-58
- Marasco PD***, and Kuiken TA. (2010) Amputation with median nerve redirection (Targeted Reinnervation) reactivates forepaw barrel subfield in rats. *Journal of Neuroscience* 30:16008-16014.
- Marasco PD***, Schultz AE, Kuiken TA. (2009) Sensory capacity of reinnervated skin after redirection of amputated upper limb nerves to the chest. *Brain.* 132(pt 6): 1441-8.
- Schultz AE, **Marasco PD**, Kuiken TA. (2009) Vibrotactile detection thresholds for chest skin of amputees following targeted reinnervation surgery. *Brain Research.* 1251:121-9.
- Kuiken TA[†], **Marasco PD**[†], Lock BA, Harden RN, Dewald JP. (2007) Redirection of cutaneous sensation from the hand to the chest skin of human amputees with targeted reinnervation. *Proceedings of the National Academy of Sciences U S A.* 104: 20061-6. ([†]these authors contributed equally to this work)
- Marasco PD**, Tsuruda PR, Bautista DM, Catania KC. (2007) The fine structure of Eimer's organ in the coast mole (*Scapanus orarius*). *Anatomical Record.* 290: 437-448.
- Marasco PD**, and Catania KC. (2007) Response properties of primary afferents supplying Eimer's organ. *Journal of Experimental Biology.* 210: 765-780
- Kuiken TA, Miller LA, Lipschutz RD, Lock BA, Stubblefield K, **Marasco PD**, Zhou P, Dumanian GA. (2007) Targeted reinnervation for enhanced prosthetic arm function in a woman with proximal amputation. *The Lancet* 369: 371-380
- Marasco PD**, Tsuruda PR, Bautista DM, Julius D, Catania KC. (2006) Neuroanatomical evidence for segregation of nerve fibers conveying light touch and pain sensation in Eimer's organ of the mole. *Proceedings of the National Academy of Sciences U S A.* 103: 9339-9344
- Henry EC, **Marasco PD**, Catania KC. (2005) Plasticity of the cortical dentition representation after tooth extraction in naked mole-rats. *Journal of Comparative Neurology* 485: 64-74
- Appel, B., **P. Marasco**, L. McClung and A.J. Latimer (2003) lunatic fringe Regulates delta-notch induction of hypochord in zebrafish. *Developmental Dynamics* 228: 281-286
- Crish SD, Comer CM, **Marasco PD**, Catania KC. Somatosensation in the superior colliculus of the star-nosed

mole. J Comp Neurol. 2003 Sep 29;464(4):415-25.

Submitted for Review/In Preparation

Shell CE, Schofield JS, Thumser ZC, Nataraj R, Beckler DT, **Marasco PD**. Functional tests to evaluate contributions of kinesthetic feedback to bionic prosthetic usability (Submitted)

Schofield JS, Hebert JS, **Marasco PD**, Carey JP. Advances in the quantification and prediction of prosthetic socket interface mechanics: a fifteen year review (In Review)

Evon S. Ereifej, Courtney E. Shell, Jonathon S. Schofield, Hamid Charkhkar, Ivana Cuberovic, Chuck A. Dorval, Emily L. Graczyk, Takashi D.Y. Kozai, Kevin J. Otto, Erik J. Peterson, Dustin J. Tyler, Cristin G. Welle, Alik S. Widge, José Zariffa, Chet T. Moritz, Dennis J. Bourbeau, **Paul D. Marasco** Neural engineering: process, applications, and role in the future of medicine (In Process)

Book Chapters

Marasco PD., “Targeted Sensory Reinnervation”, chapter 8, in: *Targeted Muscle Reinnervation*, Kuiken and Schultz, Eds. CRC Press Taylor & Francis Group, Boca Raton, 2014 ISBN 978-1-4398-6080-9

Capadona, JR and **PD Marasco** “Brain Response to Neural Prostheses”, chapter 6, in: *The Textbook of Neural Repair*, Volume 1, Seltzer et al. Eds, 2nd Edition. Cambridge University Press, Cambridge, 2014 ISBN 978-1-1398-9832-4

Marasco, PD, JS Hebert and BM Orzell “Artificial limbs for upper extremity amputation”, chapter 49, in: *Technological Advances in Surgery, Trauma, and Critical Care*, Latifi, Rhee and Gruessner Eds, Springer Science + Business Media, 2015 ISBN 978-1-4939-2670-1

Abstracts

Ahmed W. Shehata, McNeil Keri, Mellissa Gomez, **Paul D. Marasco**, Albert Vette, Jacqueline S. Hebert (2019) Skin Stretch Enhances Illusory Movement in Persons with Lower-Limb Amputation. 2019 IEEE-RAS-EMBS International Conference on Rehabilitation Robotics (ICORR)

Shell CE, Schofield JS, **Marasco PD**, (2018) Do skin and muscle contribute to movement perception conflict? Movement: Brain, Body, Cognition 2018, Harvard Medical School, Boston, USA, (platform presentation)

Schofield JS, Thumser ZC, Newcomb MD, Shell CE, **Marasco PD**, (2018) Illusory drift in the visual field as a method for understanding proprioception. Movement: Brain, Body, Cognition 2018, Harvard Medical School, Boston, USA, (platform presentation)

Marasco PD, Shell CE, Beckler DT, Thumser ZC, Nataraj R, (2018) Engineered illusory movement percepts of complex grip conformations improves motor control for bionic prosthetic hands. International Symposium on Innovations in Amputation Surgery and Prosthetic Technologies (IASPT), Vienna, Austria (platform presentation)

Courtney E. Shell, **Paul D. Marasco**, (2017) Interrogating the functional interpretation of joint movement illusions using intentional binding (MEC 17). (platform presentation)

Courtney E. Shell, Rafael Granja-Vazquez, Zachary C. Thumser, Dylan T. Beckler, **Paul D. Marasco**, (2017) Embodiment of bi-directionally integrated prosthetic limbs (MEC 17). (platform presentation)

Zachary C. Thumser, Andrew B. Slifkin, Dylan T. Beckler, **Paul D. Marasco**, (2017) Control of isometric grip force, visual information processes, and fitts’ law (MEC 17).

Paul D. Marasco, Jacqueline S. Hebert, Jon W. Sensinger, Courtney E. Shell, Jonathon S. Schofield, Zachary C. Thumser, Raviraj Nataraj, Dylan T. Beckler, Michael R. Dawson, Dan H. Blustein, Satinder Gill, Rafael Granja-Vazquez, Jason P. Carey, Beth M. Orzell, (2017) Functional kinesthetic perception of complex bionic hand movements (MEC 17). (platform presentation)

Dylan T. Beckler, Zachary C. Thumser, **Paul D. Marasco**, (2017) Descriptive outcome metrics of sensorized upper limb performance using optimal foraging theory (MEC 17).

Dylan T. Beckler, Zachary C. Thumser, **Paul D. Marasco** (2017) Reliability in evaluator-based tests: a modelling approach for interpreting indices of reliability and determining agreement thresholds (MEC 17). (platform presentation)

Courtney Shell, Hamid Charkhkar, Dustin Tyler, **Paul Marasco**, Ron Triolo (2017) Standing balance responses

- to projected sensory stimuli in below-knee amputees (MEC 17).
- Hebert JS and **Marasco PD**, (2016) Prosthetic limbs that feel: Advances in clinical translation through bi-directional multi-modality perceptual integration. First International Symposium on Innovations in Amputation Surgery and Prosthetic Technologies (IASPT). (platform presentation).
- Marasco PD**, Hebert JS, Schofield JS, Thumser ZC, Dawson MR, Carey JP, Orzell BM (2015) Engineering perceptual illusions of hand movement to sense the activity of bi-directionally integrated bionic limbs Society for Neuroscience 45th annual meeting. (platform presentation).
- Marasco, PD**, JS Hebert and JS Schofield (2014) Vibration of reinnervated muscle induces perceptual illusion of joint movement in upper limb amputees with targeted sensory reinnervation. 79th Cold Spring Harbor Laboratories Symposium: Cognition
- Marasco PD**, DJ Bourbeau, J Ina. (2014) Kinesthesia: neural substrates, cortical organization and mechanistic insight into the kinesthetic illusion. 79th Cold Spring Harbor Laboratories Symposium: Cognition
- Santos-Munné, J., **P.D. Marasco** (2014) A multi-digit tactor array system for physiologically relevant sensory feedback for prosthetic limbs. MEC'14: Myelectric Controls Symposium
- Thumser, Z.C., R. Lim, **P.D. Marasco** (2014) Applying a fitts' law inspired approach to quantifying performance improvement in a touch-feedback equipped prosthesis. MEC'14: Myelectric Controls Symposium
- Lim, R., Z.C. Thumser, **P.D. Marasco** (2014) The application of optimal foraging theory to the quantitative evaluation of somatosensory feedback systems in prosthetic Limbs. MEC'14: Myelectric Controls Symposium
- Marasco, P.D.**, J.S. Hebert (2013) Vibration of reinnervated muscle induces perceptual illusion of joint movement in an upper limb amputee with targeted sensory reinnervation. 2013 NIH Common Fund High Risk-High Reward Research Program Symposium
- Marasco, P.D.**, (2012) An electrophysiological investigation of the neural substrates of limb movement feedback. International Functional Electrical Stimulation Society 2012; "Smart Machines-Neural Evolution"
- Marasco, P.D.**, A.S. Ianni (2011) Electrophysiological examination of peripheral response properties and cortical organizational characteristics of kinesthesia in a rat model: Steps towards providing limb position feedback for prosthetic limbs. Society for Neuroscience 39th annual meeting
- Harris, J.P., **P.D. Marasco**, D.J. Tyler (2011) Lipopolysaccharide-induced response degrades intracortical Recordings. Society for Neuroscience 39th annual meeting
- Koppaka, S.S., A.E. Hess, **P.D. Marasco**, D.J. Tyler (2011) Insertion mechanics of the perineurium and epineurium. Biomedical Engineering Society annual meeting
- Marasco, P.D.**, A.E. Schultz, K. Kim, J.E. Colgate, M.A. Peshkin, T.A. Kuiken. (2010) Direct sensory feedback prosthetics: neural mechanisms of function, plasticity, and ownership. Biomedical Engineering Society annual meeting October 2010 (platform presentation)
- Ko, J.H., M. de la Garza, **P.D. Marasco**, G.A. Dumanian, T.A. Kuiken (2010) The effects of targeted reinnervation on neuroma formation in a novel rat hindlimb model. Plastic Surgery Research Council 55th annual meeting (platform presentation)
- Marasco, P.D.**, K. Kim, J.E. Colgate, M.A. Peshkin, and T.A. Kuiken (2009) Mechanical touch interface applied redirected sensory nerves drives perceptual shift towards embodiment of a prosthetic arm in a Targeted Reinnervation amputee. Society for Neuroscience 38th annual meeting (platform presentation)
- Marasco, P.D** and T.A. Kuiken (2008) Median nerve redirection (Targeted Reinnervation) following forelimb amputation reactivates the forepaw barrel subfield in the somatosensory cortex of adult rats; with correlations to Targeted Reinnervation in human amputees to provide physiologically relevant sensory feedback for prosthetic limbs. Society for Neuroscience 38th annual meeting (platform presentation)
- Marasco, P.D.**, A.E. Schultz, J.S. Sensinger, and T.A. Kuiken (2008) Investigation of sensation in amputees who have undergone Targeted Reinnervation. 38th Neural Interfaces Conference (platform presentation)
- Marasco, P.D.**, A.E. Schultz and T.A. Kuiken (2008) Tactile and spatial acuity in amputees with Targeted Reinnervation. Society for Neuroscience, Chicago chapter annual meeting
- Marasco, P.D.**, B.A. Lock and T.A. Kuiken (2007) Restoring somatic sensation of the hand in human amputees Society for Neuroscience 37th annual meeting
- Marasco, P.D.**, and K.C. Catania (2005) An investigation of the mechanosensory Eimer's organ in the

Coast Mole using the fluorescent cationic styryl dye AM1-43. Society for Neuroscience 35th annual meeting
Marasco, P.D., and K.C. Catania (2004) The response properties of primary afferents innervating mechanosensory Eimer's organs; clues to the functional organization of a putative texture detecting array. Society for Neuroscience 34th annual meeting
Marasco, P.D., and K.C. Catania (2003) The anatomical organization of the brainstem trigeminal complex in the star-nosed mole. Society for Neuroscience 33rd annual meeting
Henry, E.C., **P.D. Marasco** and K.C. Catania (2003) Plasticity of the oral-facial cortical representation after tooth extraction in the naked mole-rat: a possible mechanism for phantom tooth pain? Society for Neuroscience 33rd annual meeting

Other Publications

Marasco, PD, JS Hebert, J Sensinger. (2015) Developing a New Generation of Objective Functional Metrics for Advanced Upper Limb Prosthetics. Frontiers in Rehabilitation, A Newsletter for Physicians, Cleveland Clinic Department of Physical Medicine and Rehabilitation.
Marasco, P.D. (2012) The Turn (haiku poetry and photo project). The Great Lakes Courier, Volume 1 Issues 1 (March, 2012), 4 (August 2012), Volume 2 Issue 1 (May 2013), Volume 2 Issue 1 (May 2013), Volume 2 Issue 5 (September 2013)
<http://greatlakescourier.com/read/2012/03/13/the-turn>
<http://www.greatlakescourier.com/read/2012/08/17/the-turn>
<http://www.greatlakescourier.com/read/2013/05/03/the-turn>
<http://greatlakescourier.com/read/2013/07/30/the-turn>
<http://greatlakescourier.com/read/2013/09/04/the-turn>

Invited Lectures

Invited Speaker: Workshop; Transplantation: Update and Future Projection; 2019 American Society for Surgery of the Hand Annual Meeting, Las Vegas, NV, September 2019
Invited Speaker: Workshop; Advanced outcome metrics for upper limb sensory-motor function; Rehab Week 2019, Toronto, CA, June 2019
Invited Speaker: Orthotic and Prosthetic Innovative Technologies Conference (OPTech), Ann Arbor, MI, May 2019
Featured Speaker: Arm Dynamics 2019 Symposium, Redondo Beach, CA, April 2019
Session Chair: "Sensory Feedback" International Symposium on Innovations in Amputation Surgery and Prosthetic Technologies (IASPT), Vienna, Austria, May 2018
Invited Speaker: Vascular Grand Rounds, Cleveland Clinic, March 2018
Guest Lecturer: Biomechanics and Prosthetics, EBME 307, Bolu Ajiboye, Ph.D., Dept. of Biomedical Engineering, Case Western Reserve University, April 2017
Invited Speaker: Cleveland City Wide PM&R Grand Rounds, December 2016
Invited Speaker: University of Akron Fall Biomedical Engineering Seminar Series, Akron OH, November 2016
Invited Speaker: Cleveland State University, Operation STEM Scholars Cohort Meeting, November 2016
Invited Speaker: Department of Veterans Affairs, Extremity Trauma and Amputation Center of Excellence (EACE) / Amputee System of Care (ASoC), National Grand Rounds, August 2016
Invited Speaker: Universidad de Ingeniería y Tecnología (UTEC), Lima Peru, June 2016
Featured Speaker: Presidential Early Career Research Award, Department of Veterans Affairs Office of Research and Development, Washington DC, February 2016
Featured Speaker: NIH Common Fund 2015 High-Risk, High-Reward Research Symposium, National Institutes of Health, Bethesda, MD, December 2015
Invited Speaker: Association of Medical Illustrators (AMI), July 2015
Featured Speaker: Cleveland Clinic Partners in Philanthropy annual meeting, June 2015
Featured Speaker: Cleveland Clinic Alumni Association Board of Directors annual meeting, April 2015
Guest Lecturer: University Heights senior adult network, University Heights Public Library, April 2015
Invited Speaker to General Assembly: Ohio Chapter of the American Academy of Orthotists & Prosthetists

(AAOP) March 2015

Keynote Speaker: MEC Symposium, Institute of Biomedical Engineering, University of New Brunswick, Engineered Perception: “Sensation, Cognition and Prosthetics”, August 2014

Guest Lecturer: Biomechanics and Prosthetics, EBME 307, Bolu Ajiboye, Ph.D., Dept. of Biomedical Engineering, Case Western Reserve University, April 2014

Invited Speaker: Integrated Bioscience Seminar Series, “Kinesthesia, embodiment and artificial limbs: A neuro-cognitive perspective on biomimicry”, University of Akron, April 2014

Invited Speaker: Defense Advanced Research Projects Agency (DARPA) Sensorimotor Prosthetics Workshop, Doug Weber Ph.D., Program Officer. “Sensory Neurophysiology, Embodiment and Prosthetics”, February 2014.

Guest Lecturer: Basic Cellular and Molecular Neuroscience, MMED 415, Dawn Taylor Ph.D. Neuroscience, Lerner Research Institute, Cleveland Clinic, October 2013

Guest Lecturer: Biomechanics and Prosthetics, EBME 307, Bolu Ajiboye, Ph.D., Dept. of Biomedical Engineering, Case Western Reserve University, April 2013

Invited Speaker: Case Western Reserve University Biology Department Seminar, “An electrophysiological investigation of the neural substrates of limb movement feedback”, March 2013

Invited Speaker: Case Western Reserve University Department of Biomedical Engineering Seminar Series “An Electrophysiological investigation of the neural substrates of limb movement feedback”, February 2013

Invited Speaker: International Functional Electrical Stimulation Society (IFESS) Somatosensory Prostheses, September 2012

Invited Speaker: International Functional Electrical Stimulation Society (IFESS) Using a Novel Targeted Sensory Reinnervation Technique and Machine Learning Algorithms to Enhance Control and Improve Function of Myoelectric Prostheses after Upper Limb Amputation, September 2012

Invited Speaker/Contributor: TATRC LEGS Integrated Research Team Summit, August 2012

Invited Speaker: Dept of Cognitive Science Colloquium Series, Case Western Reserve University, April 2012

Invited Speaker: Targeted Muscle Reinnervation – Current Approaches and Future Directions, October 2011

Guest Lecturer: Performance and the Embodied Mind, Cogs 329, Yanna Popova D.Phil. Dept of Cognitive Science Case Western Reserve University, September 2011

Invited Speaker: Biomedical Engineering Society annual meeting, October 2010

Featured Speaker: American Orthotic and Prosthetic Association National Assembly, September 2008

Invited Speaker: Dupage Area Engineer’s Week public outreach event, February 2007

Service

VA Program Lead: Prosthetics and Orthotics Program of the Advanced Platform Technology Center of Excellence 2014-Ongoing

VA Member: Advanced Platform Technology Center of Excellence Leadership Committee. 2012-Ongoing

Scientist Reviewer: NIH SBIR/STTR, Small Business: Clinical Neurophysiology, Devices, Neuroprosthetics, and Biosensors 2018

Scientist Reviewer: Department of Defense, U.S. Army Medical Research and Materiel Command, Congressionally Directed Medical Research Programs (CDMRP), 2016-2017 Peer Reviewed Orthopaedic Research Program (PRORP) Clinical Trials in Rehabilitation (CT-Rehab)

Scientist Reviewer: Department of Defense, U.S. Army Medical Research and Materiel Command, Congressionally Directed Medical Research Programs (CDMRP), 2015-2016 Orthotics and Prosthetics Outcomes Research Program (OPORP)

Scientific Review Group: Peer Reviewed Medical Research Program (PRMRP), Congressionally Directed Medical Research Program (CDMRP)

VA Scientific Review Group: VA Rehabilitation Research and Development (RR&D) Merit Review

VA Scientific Review Group: VA Rehabilitation Research and Development (RR&D) SPiRE.

Scientific Review Group: US Army Medical Research and Materiel Command (USAMRMC), American Institute of Biological Sciences (AIBS).

Scientist Reviewer: Cleveland Clinic Research Program, Section 313, Biomedical Engineering/Transplant

VA Scientific Member: Louis Stokes Cleveland Department of Veterans Affairs Medical Center Institutional Animal Care and Use Committee. 2010-2013

VA IACUC Representative: Subcommittee on Research Safety (SRS), Louis Stokes Cleveland Department of Veterans Affairs Medical Center. 2009-2013

Scientific Journals with an impact factor of 10 and above:

- Scientific Reviewer for: The Lancet (IF: 53.254)
- Scientific Reviewer for: The Lancet Neurology (IF: 27.138)
- Scientific Reviewer for: Science Translational Medicine, Ongoing (IF: 16.71)
- Scientific Reviewer for: Science Advances (IF: 11.51)

General Scientific Journals

- Editorial Board: Scientific Reports (Nature Journal), Neuroscience section, June 2019-Ongoing
- Scientific Reviewer for: Biomedical Physics and Engineering Express (BPEX)
- Scientific Reviewer for: Arts
- Scientific Reviewer for: IEEE Transactions on Biomedical Engineering
- Scientific Reviewer for: PLoS One
- Scientific Reviewer for: Experimental Brain Research
- Scientific Reviewer for: Advances in Systems Science and Applications
- Scientific Reviewer for: Journal of Neural Engineering, Ongoing
- Scientific Reviewer for: Transactions on Neural Systems & Rehabilitation Engineering, Ongoing
- Scientific Reviewer for: Journal of NeuroEngineering and Rehabilitation, Ongoing
- Scientific Reviewer for: IEEE Transactions on Human-Machine Systems, Ongoing
- Scientific Reviewer for: Journal of Orthotics and Prosthetics, Ongoing
- Scientific Reviewer for: Journal of Morphology
- Scientific Reviewer for: Neurorehabilitation and Neural Repair, Ongoing
- Scientific Reviewer for: IEEE Transactions on Neural Systems & Rehabilitation Engineering, Ongoing
- Scientific Reviewer for: Biomedical Signal Processing and Control, Ongoing
- Scientific Reviewer for: Disability and Rehabilitation: Assistive Technology, Ongoing
- Scientific Reviewer for: Transactions on Biomedical Engineering, Ongoing
- Scientific Reviewer for: Expert Reviews of Medical Devices, Ongoing
- Scientific Reviewer for: Restorative Neurology and Neuroscience
- Scientific Reviewer for: International Conference on Robotics and Automation

Invited as the host editor for a *Frontiers in Neuroscience* Research Topic: The current state of embodied prosthetic limbs

Chair: Neurological Institute and Department of Biomedical Engineering Professional Staff Search Committee, Lerner Research Institute, Cleveland Clinic (2018)

Member: Department of Biomedical Engineering Professional Staff Search Committee, Lerner Research Institute, Cleveland Clinic (2017)

Community Outreach: Business Professional Panel. Westlake High School Career Development Program in cooperation with the West Shore Chamber of Commerce Education Committee (November 2017)

Community Outreach: Interview with Middle School Science Students: Tenafly Middle School, Tenafly NJ (January 2016)

Community Outreach: Lab Interview with Middle School Science and Robotics Team: The BeachBots, Hope Chapel Academy, Hermosa Beach CA (February 2017)

Community Outreach: Science Fair Judge, 5th and 6th grades, Menlo Park Academy, Cleveland Metropolitan School District, January 2015

Community Outreach: Guest Lecturer: University Heights senior adult network, University Heights Public Library, April 2015

Community Outreach: Science Fair Judge, 3rd grade, Menlo Park Academy, Cleveland Metropolitan School District, January 2014

Community Outreach: "From the Earliest Human Technology to the Latest" Demonstration of flintknapping

and advanced prosthetic limbs to the 3rd grade Discovery Classroom, Emerson Elementary, Lakewood Ohio, January 2013

Other Service

Race Mechanic and Neurophysiologist, Team Cleveland, Spinal Cord Injury Functional Electrical Stimulation Bicycle Racing Team, Ron Triolo PhD (Lead), Gold Medal Winning Team, Cybathlon Cybernetic Olympics, Zurich/Kloten Switzerland (October 2016).

<https://vimeo.com/183688652>

<https://www.youtube.com/watch?v=d4ruXKNVDyQ>

Popular Press

Article on collaborative project: **NPR**, Luisa Torres, “Improved Prosthetic Hand Has A Lighter Touch And Easy Grip.” July 24 2019

<https://www.npr.org/sections/health-shots/2019/07/24/744601440/improved-prosthetic-hand-gains-a-lighter-touch-and-easy-grip>

Article on collaborative project: **Scientific American**, Jeffery DelViscio, “A Robot Hand Helps Amputees ‘Feel’ Again.” July 24 2019

<https://www.scientificamerican.com/article/a-robot-hand-helps-amputees-feel-again/>

Article on collaborative project: **Gizmodo**, Ed Cara, “Scientists Have Created a Prosthetic Arm That Lets Patients Feel Touch Again.” July 24 2019

<https://gizmodo.com/scientists-have-created-a-prosthetic-arm-that-lets-pati-1836669048>

Comment in: **engadget**, Brian Mastroianni, “A mind-controlled robot arm doesn’t have to mean brain implants.” July 22 2019

<https://www.engadget.com/2019/07/22/mind-controlled-robot-arm-no-brain-implants/>

Comment in: **JHUEngineering**: The Johns Hopkins Whiting School of Engineering Magazine, David Glenn, “Sweet Sensation” Winter 2019

<https://engineering.jhu.edu/magazine/2018/11/sweet-sensation/>

Article on current work: **The Scientist**, Diana Kwon, “Vibrations Restore Sense of Movement in Prosthetics: Scientists recreate proprioception for people with artificial arms using a perceptual illusion.” September 1 2018

<https://www.the-scientist.com/notebook/vibrations-restore-sense-of-movement-in-prosthetics-64691>

Comment in: **Scientific American**, Simon Makin, “Prosthetic Limb Restores a Sense of Body Position” July 17 2018

<https://www.scientificamerican.com/article/prosthetic-limb-restores-a-sense-of-body-position/>

Comment in: **The Atlantic**, Sarah Zhang, “Why Would You Want a Prosthetic Hand That Feels Pain?” June 20 2018

<https://www.theatlantic.com/science/archive/2018/06/why-would-you-want-a-prosthetic-hand-that-feels-pain/563078/>

Comment in: **WIRED Magazine**, Matt Simon, “Pain Is Weird. Making Bionic Arms Feel Pain Is Even Weirder” June 22 2018

<https://www.wired.com/story/pain-is-weird-making-bionic-arms-feel-pain-is-even-weirder/>

Comment in: **Axios**, Alison Snyder, “New electronic skin gives prosthetics a sense of pain” June 20 2018

<https://www.axios.com/new-electronic-skin-gives-prosthetics-a-sense-of-pain-004d5a0d-4ab6-4639-8e3a-8ccd90f8c5d4.html>

Article on current work: **WNDU16 NBC**, Maureen McFadden (*Maureen’s Medical Moment*), “Bionic prosthesis restores sense of touch and movement for amputees” May 29, 2018

Article on current work: **Neurology Today**, Kurt Samson, “Neurotech Brief: Proximal Muscle Vibration Restores Sensory Feedback Loop in Prosthetic Hands” May 3 2018

https://journals.lww.com/neurotodayonline/Fulltext/2018/05030/Neurotech_Brief_Proximal_Muscle_Vibration.10.aspx

Article on current work: **SingularityHub**, Shelly Fan, “New Bionic Arm Blurs Line Between Self and Machine for Wearers” April 4 2018

<https://singularityhub.com/2018/04/04/new-bionic-arm-blurs-line-between-self-and-machine-for-wearers/>

Interview: **BBC World Service**, Oliver Conway, The Newsroom. March 17 2018

<https://www.bbc.co.uk/programmes/w172vspjyt3j028>

Article on current work: **National Geographic News**, Michael Greshko “Sensation of Movement Recreated in Amputees' Robotic Arms” March 2018
<https://news.nationalgeographic.com/2018/03/kinesthesia-prosthesisillusion-body-health-science-spd/>

Article on current work: **WIRED Magazine**, Robbie Gonzalez “Researchers Are Restoring Kinesthesia in Prosthetics Patients” March 2018
<https://www.wired.com/story/researchers-restore-feeling-to-lost-limbskinda/>

Article on current work: **NIH Research Matters** (March Top Story), Geri Piazza “Improving control of bionic prosthetic hands” March 2018
<https://www.nih.gov/news-events/nih-research-matters/improving-control-bionic-prosthetic-hands>

Article on current work: **U.S. News and World Report**, Robert Preidt “New Technology Gives 'Feeling' to Prosthetic Arms” March 2018
<https://health.usnews.com/health-care/articles/2018-03-14/new-technology-gives-feeling-to-prosthetic-arms>

Article on current work: **United Press International (UPI)**, Allen Cone “Prosthetic arm with realistic sensation makes 'life a better place'” March 2018
https://www.upi.com/Health_News/2018/03/14/Prosthetic-arm-with-realistic-sensation-makes-life-a-better-place/2001521051009/

Article on current work: **The Times of London**, Oliver Moody “Bionic hand motors make it feel just like your own” March 2018
<https://www.thetimes.co.uk/article/bionic-hand-motors-make-it-feel-just-like-your-own-sb22pxv60>

Article on current work: **Gizmodo**, Ed Cara “Scientists Create a Way for People With Amputations to Feel Their Prosthetic Hands” March 2018
<https://gizmodo.com/scientists-create-a-way-for-people-with-amputations-to-1823765634>

Article on current work: **Los Angeles Times**, Melissa Healy “By vibrating the muscles, engineers produce a better prosthetic hand” March 2018
<http://www.latimes.com/science/sciencenow/la-sci-sn-prosthetic-hand-vibration-20180315-story.html>

Article on current work: **IEEE Spectrum**, Eliza Strickland “Amputees ‘Feel’ the Movement of Their Prosthetic Hands” March 2018
<https://spectrum.ieee.org/the-human-os/biomedical/bionics/amputees-feel-the-movement-of-their-prosthetic-hands>

Article on current work: **Canadian Broadcasting Corporation (CBC)**, Nicole Ireland “Vibrating muscles help arm amputees 'feel' their prosthetic hand movements, study suggests” March 2018,
<http://www.cbc.ca/news/health/amputees-sense-movement-inprosthetic-hands-study-1.4576810>

Article on current work: **Daily Mail UK**, Jaleesa Baulkman “Woman who lost her arm in a car crash can FEEL her prosthetic arm” March 2018
<http://www.dailymail.co.uk/health/article-5497469/Woman-lost-arm-car-crash-FEEL-prosthetic-arm.html>

Article on current work: **STAT**, Megan Thielking “Scientists trick the brain into sensing the movement of a prosthetic” March 2018
<https://www.statnews.com/2018/03/15/prosthetics-movement/>

Article on current work: **New York Post**, Mike Wehner “New prosthetic hand moves and ‘feels’ like the real thing” March 2018
<https://nypost.com/2018/03/15/new-prosthetic-hand-moves-and-feelslike-the-real-thing/>

Article on current work: **Science Daily**, “Restoring movement sensation in upper limb amputation patients” March 2018
<https://www.sciencedaily.com/releases/2018/03/180314145024.htm>

Article on current work: **Galileo**, Anna Lisa Bonfranceschi “Protesi che “sentono” il movimento” March 2018
<https://www.galileonet.it/2018/03/protesi-movimento-vibrazioni/>

Article on current work: **Diario ABC**, “Descubren la forma de restaurar la sensación de movimiento en pacientes amputados” March 2018
http://www.abc.es/salud/enfermedades/abci-descubren-forma-restaurar-sensacion-movimiento-pacientes-amputados-201803141907_noticia.html

Article on current work: **El Correo**, “Crean un método para restaurar la sensación de movimiento en pacientes amputados” March 2018
<http://www.elcorreo.com/sociedad/ciencia/crean-metodo-restaurar-20180315231907-ntrc.html>

Article on current work: **Deutsches Ärzteblatt**, “Handprothese vermittelt Gespür für „innere“ Bewegungen”

Comment in: **New Scientist** (online), Ferris Jabr, "Monkeys 'feel' texture of virtual objects" October 5, 2011
<http://www.newscientist.com/article/dn21008-monkeys-feel-texture-of-virtual-objects.html>

News Highlight: **O&P Edge**, "Study: Amputees Who Undergo TMR Perceive Limb as Part of Their Body"
February 9, 2011 http://www.oandp.com/articles/NEWS_2011-02-09_02.asp

Article on recent work; Interview: **Science News**, Laura Sanders, "Prosthetics that feel: Amputees with rerouted 'sense of touch' view limbs as part of body." February 26, 2011; Vol. 179 #5 (p. 10)
http://www.sciencenews.org/view/generic/id/69296/title/Prosthetics_that_feel

Perspective: **O&P Business News**, Anthony Calabro, "DARPA Project Will Develop a System that Naturally Controls Prostheses", February 1, 2011
<http://www.oandpbusinessnews.com/view.aspx?rid=79641#perspective>

Interview: **The Economist** (Technology Quarterly), Duncan Graham-Rowe "How to rewire the nervous system" September 2, 2010
<http://www.economist.com/node/16909945>

Interview: **ABC Primetime "Medical Mysteries"**, September 9, 2008
<http://abcnews.go.com/Health/MedicalMysteries/story?id=5715902&page=1>

Interview: **ABC News, Good Morning America**, September 9, 2008

Interview: **NPR, Voice of America Radio**, Stephanie Lecci, Our World with Art Chimes, December 2007
<http://voanews.com/english/science/ourworld.cfm>

Interview: **Bloomberg News**, Tom Randall, December 2007

Interview: **Chicago Sun-Times**, Jim Ritter, "Artificial arm might feel like real thing," November 29, 2007

Interview: **The New Yorker**, Ben McGrath, A Reporter at Large, "Muscle Memory," July 30, 2007, p. 40
http://www.newyorker.com/reporting/2007/07/30/070730fa_fact_mcgrath

Appearance in: **Nature PBS**, The Beauty of Ugly, November 2007
<http://www.pbs.org/wnet/nature/beautyofugly/>

Postdoctoral Fellows

Current:

Courtney Shell PhD.

Previous:

Jonathan Schofield PhD. Assistant Professor University of California Davis (July 1 2019)

Students

Current:

Francesca Ferrari (PhD Student) Sant'Anna School of Advanced Studies, Pisa Italy.

Previous:

Hala Osman (MS) The effect of cognitive embodiment on vascular physiological perfusion. Applied Biomedical Engineering, Cleveland State University, Cleveland Ohio (04/2014-2018)

Morgan Gabbert (MS) Experimental Research (Psychology), Cleveland State University, Cleveland Ohio (10/2015-06/2017)

Neha Reddy (National Science Foundation *Research Experience for Undergraduates* Fellow) Cleveland Clinic, Cleveland Ohio (05/27/2015-8/1/2015) Accepted to Northwestern University MD/PhD program (Dec 2017)

Noble Jones (Medical Student) Lerner College of Medicine of Case Western Reserve University, Cleveland Clinic, Cleveland Ohio (12/2013-Current)

Briana Prager (Medical Student) Lerner College of Medicine of Case Western Reserve University, Cleveland Clinic, Cleveland Ohio (12/2013-02/2016)

Andrew Bowen (Medical Student) Lerner College of Medicine of Case Western Reserve University, Cleveland Clinic, Cleveland Ohio (12/2013-08/2014)

Megan Morisada (Medical Student) Lerner College of Medicine of Case Western Reserve University, Cleveland Clinic, Cleveland Ohio (12/2013-08/2014)

Eric Anderson (National Science Foundation *Research Experience for Undergraduates* Fellow) Cleveland Clinic, Cleveland Ohio (05/27/2014-08/01/2014)

Workshops and Continuing Education

Workshop through the Searle Center for Teaching Excellence, Northwestern University: “Setting Your Students Up to Succeed: Designing a Learner-Centered Course”. Completed: October 2008

Workshop through Office of Continuing Education, Northwestern University: “Grantsmanship for Research Professionals”. Completed: March 2008

Amputee Peer Visitor Training, Amputee Coalition, Voluntary Service US Department of Veterans Affairs, Louis Stokes Cleveland VA Medical Center. Audited/Completed: January 2012

Memberships/Professional Experience

Society for Neuroscience, Member

International Functional Electrical Stimulation Society, Member (2012)

Biomedical Engineering Society, Member (2010)

Research Assistant 1 (developmental molecular genetics), August 2000–August 2001

Vanderbilt University

Bruce Appel Ph.D.

Lab Instructor (Staff Position), Anatomy & Physiology, August 1998-May 2000.

University of Colorado, Colorado Springs

Jon Pigage Ph.D.

Science Learning Center Tutor, August 1998-December 1999.

University of Colorado, Colorado Springs

Barbara Gaddis Ph.D.

Lab Instructor, Biology 106, June 1998-August 1998.

University of Colorado, Colorado Springs

Jon Pigage Ph.D.