# Leonel E Medina

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## Research Interests

Computational neuroscience, neural engineering, neuroprosthetics, brain-machine interfaces. Machine learning, computer vision.

## Education

- Duke University, Durham, NC, USA — PhD Biomedical Engineering, 2016
- Universidad de Chile, Santiago, Chile — MSc Biomedical Engineering, 2006
- Universidad de Chile, Santiago, Chile — Professional Title Electrical Engineering, 2006
- Universidad de Chile, Santiago, Chile — BSc Electrical Engineering, 2003

## Research Positions

**POSTDOCTORAL RESEARCHER, CINV, UNIVERSIDAD DE VALPARAISO; VALPARAISO, CHILE — 2017-**
Developing computational models of the neural circuits involved in motion direction selectivity in the retina. Advisor: Dr. Patricio Orio.

**RESEARCH ASSOCIATE, DUKE UNIVERSITY; DURHAM, NC, USA — 2016–2017**
Developed computational models of nerve fibers to quantify responses to kilohertz-frequency electrical signals.

**DOCTORAL STUDENT, GRILL LAB, DUKE UNIVERSITY; DURHAM, NC, USA — 2012–2016**
Developed models and quantified experimentally high-frequency electrical stimulation of nerve fibers. Advisor: Dr. Warren Grill.

**DOCTORAL STUDENT, NICOLELIS LAB, DUKE UNIVERISTY; DURHAM, NC, USA — 2010–2012**
Designed and tested novel patterns of intra-cortical micro-stimulation for brain-machine interface feedback in primates. Advisor: Dr. Miguel Nicolelis.

**RESEARCH ASSISTANT, PEREZ LAB, UNIVERSIDAD DE CHILE; SANTIAGO, CHILE — 2003–2006**
Designed and conducted psychophysical experiments to improve detection of weak tactile signals. Advisor: Dr. Claudio Pérez.

## Professional Experience

**R&D ENGINEER, DIE, UNIVERSIDAD DE CHILE; SANTIAGO, CHILE — 2006–2010**
Developed computational algorithms for face recognition and rock classification using video cameras. Implemented an access control system based on face biometrics. Carried out administrative tasks for FONDEF projects D04I-1256 and D08I-1060. Principal Investigator: Dr. Claudio Pérez.

## Teaching Experience

**GUEST LECTURER, SCHOOL OF MEDICINE, UNIVERSIDAD DE CHILE; SANTIAGO, CHILE**
RC circuits seminar and lab. Course: Physics (Fall 2016).

**GUEST LECTURER, DEPT OF BIOMEDICAL ENGINEERING, DUKE UNIVERSITY; DURHAM, NC, USA**
“Introduction to NEURON – Neural modelling software” and “Neural recording”. Course: Fundamentals of Electrical Stimulation of the Nervous System (Fall 2013 & Fall 2015).

**TEACHING ASSISTANT, DEPT OF BIOMEDICAL ENGINEERING, DUKE UNIVERSITY; DURHAM, NC, USA**
Bioelectric Engineering (Spring 2012), Fundamentals of Electrical Stimulation of the Nervous System (Fall 2013).

**TEACHING ASSISTANT, DEPT OF ELECTRICAL ENGINEERING, UNIVERSIDAD DE CHILE; SANTIAGO, CHILE**

Analysis of Signals (Fall 2004-2009), Introduction to Digital Image Processing (Spring 2003-2009), Electromagnetism (Fall 2001-2002).

**TEACHING ASSISTANT, SCHOOL OF ENGINEERING, UNIVERSIDAD DE CHILE; SANTIAGO, CHILE**

Mathematics summer course for high-school students (January 2000 & January 2001).

## Academic Service

*Ad hoc* reviewer for PLoS ONE, Medical & Biological Engineering & Computing, Journal of Bioinformatics and Biological Engineering.

## Publications

**1) PEER-REVIEWED JOURNAL ARTICLES (ISI).**

**Note**: Journal impact factor 2015 in brackets [].

- **Medina, L.E.**, Janik, J.J., Grill, W.M. Computational model of a dorsal column fiber and application to spinal cord stimulation using kilohertz-frequency signals. (*In preparation)*.
- **Medina, L.E.**, Grill, W.M., 2016. Nerve excitation using an amplitude-modulated signal with kilohertz-frequency carrier and non-zero offset. J NeuroEng Rehab 13, 63. [2.419]
- Howell, B.*, **Medina, L.E.***, Grill, W.M., 2015. Effects of frequency dependent membrane capacitance on neural excitation. J Neural Eng 12, 056015. *Both of these authors contributed equally to this work. [3.493]
- **Medina, L.E.**, Grill, W.M., 2014. Volume conductor model of transcutaneous electrical stimulation with kilohertz signals. J Neural Eng 11, 066012. [3.493]
- **Medina, L.E.**, Lebedev, M.A., O'Doherty, J.E., Nicolelis, M.A.L., 2012. Stochastic facilitation of artificial tactile sensation in primates. J Neurosci 32, 14271–14275. [5.924]
- Perez, C.A., Estévez, P.A., Vera, P.A., Castillo, L.E., Aravena, C.M., Schulz, D.A., **Medina, L.E.,** 2011. Ore grade estimation by feature selection and voting using boundary detection in digital image analysis. Int J Mineral Proc 101, 28–36. [1.617]
- Perez, C.A., Donoso, J.R., **Medina, L.E.**, 2010. A critical experimental study of the classical tactile threshold theory. BMC Neurosci 11, 76. [2.304]
- Perez, C.A., Cohn, T.E., **Medina, L.E.**, Donoso, J.R., 2007. Coincidence-enhanced stochastic resonance: experimental evidence challenges the psychophysical theory behind stochastic resonance. Neurosci Lett 424, 31–35. [2.107]
- Perez, C.A., Gonzalez, G.D., **Medina, L.E.**, Galdames, F.J., 2005. Linear versus nonlinear neural modeling for 2-D pattern recognition. IEEE Trans Sys Man & Cybern, Part A 35, 955–964. [1.598]

**2) BOOK CHAPTERS**

- **Medina, L.E**., Grill, W.M., 2015. Mammalian Motor Nerve Fibers, Models of. In: Jaeger, D., Jung R. (Ed.) Encyclopedia of Computational Neuroscience: SpringerReference, Springer-Verlag, Berlin. doi: 10.1007/978-1-4614-6675-8

**3) CONFERENCE PROCEEDINGS & POSTER PRESENTATIONS**

- **Medina, L.E.**, Crosby, N., Janik, J.J., Grill, W.M., 2016. Quantification of dorsal column fiber responses in a model of kilohertz-frequency spinal cord stimulation. NANS-NIC Joint Meeting, Baltimore, MD, USA.
- Pelot, N.A., **Medina, L.E.**, Grill, W.M., 2016. Computational model of the effects of kilohertz frequency waveform on small myelinated model axons. NANS-NIC Joint Meeting, Baltimore, MD, USA.

- **Medina, L.E.**, Howell, B., Janik, J.J., Grill, W.M., 2015. Computational model of kilohertz frequency spinal cord stimulation for the treatment of chronic pain. Duke Pain Symposium, Durham, NC, USA.
- **Medina, L.E.**, Grill, W.M., 2015. Phantom model of transcutaneous electrical stimulation with kilohertz signals. IEEE EMBS Conference on Neural Engineering, Montpellier, France. [SCOPUS]
- **Medina, L.E**., Grill, W.M., 2013. Circuit and volume conductor models of transcutaneous electrical stimulation. IEEE EMBS Conference on Neural Engineering, San Diego, CA, USA. [SCOPUS]
- **Medina, L.E.**, Lebedev, M.A., O'Doherty, J.E., Nicolelis, M.A.L., 2012. Noise-enhanced intracortical microstimulation for virtual touch. Annual Meeting of the Society for Neuroscience, New Orleans, LA, USA.

## Awards, Honors & Distinctions

- Student Travel Diversity Award, Neural Interfaces Conference, Baltimore, MD, USA, 2016.
- Student Travel Grant as finalist on student paper competition, IEEE Neural Engineering Conference, Montpellier, France, 2015.
- Conference Travel Fellowship, Duke University Graduate School, 2012 & 2013.
- **Fulbright-CONICYT Chile Fellowship** for doctoral studies in USA, 2009.
- "Partial Funding for Postgraduate Thesis" Fellowship, Vice-rectory of Academic Matters, Universidad de Chile, 2005.
- "Academic Excellence" Fellowship, Faculty of Physical and Mathematical Sciences, Universidad de Chile, granted to top 10 entering students, 1998.

## Skills

Matlab, Neuron, Python, C/C++. Plexon, PowerLab.
Languages: Spanish (native), English, French

## References

- Dr. Warren Grill
  Email: warren.grill@duke.edu
  Phone: +1 (919) 660 5276
  Duke University, Department of Biomedical Engineering
  Fitzpatrick CIEMAS, Room 1427, 101 Science Drive, Box 90281. Durham NC 27708-0281, USA.
- Dr. Claudio Pérez
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  Phone: +56 2 29784426
  Universidad de Chile, Department of Electrical Engineering
  Av Tupper 2007, 3er Piso, Room 303. Santiago, Chile.