

CURRICULUM VITAE

Name : **PATRICIO ORIO**
Nationality: Chile
Date of Birth: December 3, 1973
Address: Centro de Neurociencias de Valparaíso
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Universidad de Valparaíso
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Academic Position

2012 - Associate Professor. Department of Neuroscience, Faculty of Sciences, University of Valparaiso, Chile.
2007 - 2011 Auxiliary Professor. Department of Neuroscience, Faculty of Sciences, University of Valparaiso, Chile.

EDUCATION

1998-2004 Ph.D. in Biological Sciences. Facultad de Ciencias, Universidad de Chile, Santiago, Chile.
1992-1997 Biochemistry. Facultad de Ciencias Químicas y Farmacéuticas, Universidad de Chile, Santiago, Chile.

Titles and Degrees

2004 Ph.D. in Biological Sciences. Facultad de Ciencias, Universidad de Chile, Santiago, Chile.
2000 Biochemist. Facultad de Ciencias Químicas y Farmacéuticas, Universidad de Chile, Santiago, Chile.

RESEARCH

Research Experience

- 2007 - Modelling of stochastic and dynamical systems applied to neuroscience.
- 2005 - 2007 Electrophysiological Characterization and Quantitative Description of Cold-sensing Neurons. Sensory Transduction and Nociception Laboratory, Instituto de Neurociencias de Alicante (Universidad Miguel Hernández/CSIC), Alicante, Spain.
- 1999 – 2004 Function-Structure Relationships in the BK Potassium Channel and its Regulation by α -subunits. (PhD Thesis). Dr. Ramón Latorre, Laboratorio de Biofísica y Fisiología Molecular, Centro de Estudios Científicos (CECS), Valdivia, Chile.
- 1997 Functional and Molecular characterization of Gap Junctions in human circulating lymphocytes (Thesis for Biochemist title). Dr. Juan Carlos Sáez, P. Universidad Católica de Chile.

Scientific Grants (last 10 years)

- 2014 – 2019 Basal Grant “Advanced Center for Electronic and Electrical Engineering”. Researcher.
- 2013 – 2015 Fondecyt 1130862: Conductance-based modeling of the dynamic response of cold thermoreceptors. PI
- 2013 – 2015 Fondecyt 1131064: Cellular And Molecular Determinants of the Abnormal Cold Sensitivity of Primary Sensory Neurons in Response to Axonal Damage. Co-Inv
- 2013 – 2015 Anillo de Ciencia y Tecnología ACT-1113 “Estudio Del Papel Fisiológico De Los Canales TRP En La Termotransducción Y La Plasticidad Sináptica”. PI
- 2013 – 2015 Anillo de Ciencia y Tecnología ACT-1104 “Sensor de Voltage de Canales de Iones: Desde la Estructura a la Función”. Co-Inv.
- 2012 – 2013 ANR/CONICYT-47 “KEOpS: Algorithms for modelling the visual system: From natural vision to numerical applications.” Investigador Asociado.
- 2011 - 2013 INRIA Associated Team ‘Cortina’. (Chile-France).
- 2011 - Millenium Institute “Centro Interdisciplinario de Neurociencia de Valparaíso CINV”. Adjunt Researcher
- 2009 – 2011 Proyecto FONDECYT de Iniciación en Investigación. “Effect of stochastic channel gating and axonal geometry on sensory transduction and encoding in cold-sensitive nerve endings”. (PI)
- 2008 – 2009 DIPUV Grant (Dir. de Investigación Universidad de Valparaíso): “Modelos de respuesta dinámica en neuronas y terminaciones nerviosas sensibles a frío”. (PI)
- 2007 – 2009 Programa Bicentenario de Ciencia y Tecnología: Inserción de académicos en la Facultad de Ciencias de la Universidad de Valparaíso con perspectivas a la creación de un programa de Doctorado en Ciencias, mención Modelación Estocástica.

Supervision of Thesis works

- Erick Olivares, PhD thesis in Neuroscience, Universidad de Valparaíso. Graduated March, 2014. “Estudio a través de modelación matemática del rol de TRPM8 en el patrón de disparo de terminales nerviosos sensibles a frío.”
- Miguel Piñero, PhD thesis in Neuroscience, Universidad de Valparaíso. (*currently in development*). “Estudio de las propiedades del circuito asociado a las neuronas CCAP AN1 – AN4 y motoneuronas durante la ecdisis a pupa en *Drosophila Melanogaster*”.
- Gaspar Herrera, PhD thesis in Neuroscience, Universidad de Valparaíso (*in development*). “Injury- associated changes in the expression of KCNA genes in cold-sensitive DRG neurons and their impact on the detection threshold to cold of free nerve endings.”

Undergraduate students.

- Jean Paul Maidana, Mathematical Engineering, Universidad Técnica Federico Santa María. *In development*.
- “Efecto del ruido multiplicativo en sistemas de ecuaciones diferenciales estocásticas aplicadas a la neurociencia”. Marilyn Gatica, Mathematical Engineering, Universidad de Santiago de Chile. *Finished November 2014*
- “Análisis Geométrico de un modelo de excitabilidad neuronal”. Mauricio Caviedes, program in Physics, Universidad de Valparaíso. *Finished August 2014*.

Publications

- Victor Leiva, Mauricio Tejo, Pierre Guiraud, Oliver Schmachtenberg, Patricio Orio and Fernando Marmolejo-Ramos (2014). Modeling neural activity with cumulative damage distributions. *Biol Cybern*, [Epub ahead of print]. <http://dx.doi.org/10.1007/s00422-015-0651-9>
- Danilo Pezo, Daniel Soudry and Patricio Orio (2014). Diffusion approximation-based simulation of stochastic ion channels: which method to use?. *Front. Comput. Neurosci.* **8**:139. doi: 10.3389/fncom.2014.00139
- María-José Escobar, Danilo Pezo, Patricio Orio (2013) Mathematical Analysis and Modeling of Motion Direction Selectivity in the Retina. *J Physiol Paris*, **107**(5):349-359
- Katica Boric, Patricio Orio, Thierry Vieville, Kathleen Whitlock (2013). Quantitative analysis of cell migration using optical flow. *PLoS ONE* **8**(7): e69574.
- Orio P., Parra A., Madrid R., González O., Belmonte C., Viana F. (2012) Role of Ih in the Firing Pattern of Mammalian Cold Thermoreceptors. *J Neurophysiol* **108**:3009-3023
- Orio P. and Soudry D. (2012) Simple and Fast Implementation of the Diffusion Approximation Algorithm for Stochastic Ion Channels with Multiple States. *PLoS ONE* **7**(5): e36670.

- Latorre R., Brauchi S., Madrid R., Orio P. (2011) A Cool Channel in Cold Transduction. *Physiology* **26**:273-285.
- Brauchi S., Orio P. (2011) Voltage Sensing in thermo-TRP channels. *Adv. Exp. Med. Biol.* **704**:517-530.
- Orio P., Madrid R., de la Peña E., Parra A., Meseguer V., Bayliss D.A., Belmonte C., Viana F. (2009) Characteristics and physiological role of hyperpolarization-activated current I_h in mouse cold thermoreceptors. *J Physiol* **587**:1961-1976.
- González-Pérez V., Neely A., Tapia C., González-Gutiérrez G., Contreras G., Orio P., Lagos V., Rojas G., Estévez T., Stack K., Naranjo D. (2008) Slow inactivation in Shaker K channels is delayed by intracellular tetraethylammonium. *J. Gen. Physiol.* **132**:633-50.
- Orio P., Torres Y., Rojas P., Carvacho I., Garcia M.L., Toro L., Valverde M.A., Latorre R. (2006). Structural Determinants for Functional Coupling Between the α and β Subunits in the Ca^{2+} -activated K^+ (BK) Channel. *J. Gen. Physiol.* **127**:191-204.
- Orio, P., Latorre, R. (2005) Differential effect of $\beta 1$ and $\beta 2$ subunits on BK Channel Activity. *J. Gen. Physiol.* **125**:395-411.
- Brauchi, S., Orio, P., Latorre, R. (2004) Clues to understanding cold sensation. Thermodynamics and electrophysiological analysis of the cold receptor TRPM8. *Proc Natl Acad Sci USA.* **101**:15494-15499
- Fernández-Fernández, J.M., Tomás, M., Vázquez, E., Orio, P., Latorre, R., Sentí, M., Marrugat, J., Valverde, M.A. (2004). Gain-of-function mutation in the KCNMB1 potassium channel subunit associated with low prevalence of diastolic hypertension. *J. Clin. Invest.* **113**:1032-1039.
- Orio, P; Rojas, P; Ferreira, G; Latorre, R. (2002) New disguises for an old channel: MaxiK channel β -subunits. *Physiology* **17**:156-161
- Bravo-Zehnder, M.; Orio, P.; Norambuena, A.; Wallner, M.; Meera, P.; Toro, L.; Latorre, R.; González, A. (2000) Apical sorting of a voltage-and Ca^{2+} -activated K^+ channel α -subunit in Madin-Darby canine kidney cells is independent of N-glycosylation. *Proc Natl Acad Sci USA* **97**(24):13114-13119.
- Valverde, MA; Rojas, P; Amigo, J; Cosmelli, D; Orio, P; Bahamonde, MI; Mann, GE; Vergara, C; Latorre, R (1999) Acute activation of Maxi-K channels (hSlo) by estradiol binding to the β subunit. *Science* **285**:1929-1931.
- Bitran, M; Tapia, W; Eugenn, E; Orio, P; Boric, MP (1999) Neuropeptide Y Induced inhibition of noradrenaline release in rat hypothalamus: role of receptor subtype and nitric oxide. *Brain Res* **851**:87-93

Book chapters

Olivares, E; Orio, Patricio. (2015) Mathematical Modeling of TRPM8 and the Cold Thermoreceptors. In: TRP Channels in Sensory Transduction. Madrid, R.; Bacigalupo, J., editors. Springer International Publishing.

Pertusa M, Moldenhauer H, Brauchi S, Latorre R, Madrid R, Orio P. (2015) Mutagenesis and Temperature-Sensitive Little Machines. In: Mutagenesis. Mishra R, editor. InTech.

Abstracts (last 5 years)

- Maidana, JP; Caviedes, M.; Gatica, M; Orio P. Unique effects of Channel Noise in a conductance-based model of slow wave parabolic bursting.. 1st International Conference on Mathematical Neuroscience. Antibes (France) June 2015.

- Caviedes M., Orio P. Caos en un modelo matemático de terminación nerviosa sensible a frío. XIX Simposio Chileno de Física. Concepción, November 2014

- Castro, S.; Salgado, S.; Escobar, MJ; Orio, P. BUILDING A MATHEMATICAL MODEL OF THE DIRECTION SELECTIVITY IN A STARBURST AMACRINE CELLS NETWORK. X Annual Meeting Sociedad Chilena de Neurociencia. Valdivia, October 2014

- Herrera-Pacheco, G.; Maidana, J.; Olivares, E.; Madrid, R.; Orio, P. Balance between TRPM8 and Kv1.1-1.2 conductances sets the threshold for cold detection. A modeling study on cold sensitive nerve endings. X Annual Meeting Sociedad Chilena de Neurociencia. Valdivia, October 2014.

- Orio, P.; Olivares, E.; Herrera, G.; Madrid, R. DIFFERENT ION CHANNELS INVOLVED IN COLD TRANSDUCTION: HOW DO WE PUT THEM TOGETHER? X Annual Meeting Sociedad Chilena de Neurociencia. Valdivia, October 2014.

- González, A.; Ugarte, G.; Restrepo, C.; Herrera, G.; Piña, R.; Pertusa, M.; Orio, P.; Madrid, R. THE ROLE OF IKD CURRENT IN PAINFUL HYPERSENSITIVITY TO COLD INDUCED BY CHRONIC PERIPHERAL NERVE INJURY. X Annual Meeting Sociedad Chilena de Neurociencia. Valdivia, October 2014

- González, A.; Parra, A.; Acosta, MC; Ugarte, G.; Piña, R.; Pertusa, M.; Orio, P.; Viana, F.; Gallar, J.; Belmonte, C.; Madrid, R. Título (Idioma original) : INCIDENCE AND FUNCTIONAL CHARACTERISTICS OF TRIGEMINAL COLDSENSITIVE NEURONS WITH PARADOXICAL RESPONSE TO HEAT. X Annual Meeting Sociedad Chilena de Neurociencia. Valdivia, October 2014

- Building A Mathematical Model Of The Direction Selectivity In A Starburst Amacrine Cells Network. Castro S, Salgado S, Escobar MJ, Orio, P. Reunión Anual de la Sociedad Chilena de Neurociencia. Valdivia, Chile. (Octubre 2014)

- Different ion channels involved in cold transduction: how do we put them together? Orio P, Olivares E, Herrera G, Madrid R. Reunión Anual de la Sociedad Chilena de Neurociencia. Valdivia, Chile. (Octubre 2014)

- The Role Of IKD Current In Painful Hypersensitivity To Cold Induced By Chronic Peripheral Nerve Injury González A, Ugarte G, Restrepo C, Herrera G, Piña R, Pertusa M, Orio P, Madrid, R. Reunión Anual de la Sociedad Chilena de Neurociencia. Valdivia, Chile. (Octubre 2014)

- Balance between TRPM8 and Kv1.1-1.2 conductances sets the threshold for cold detection. A modeling study on cold sensitive nerve endings. Herrera-Pacheco G., Maidana J, Olivares E., Madrid R, Orio P. Reunión Anual de la Sociedad Chilena de Neurociencia. Valdivia, Chile. (Octubre 2014)

- Linking solutions via cluster methods for a conductance-based mathematical model of cold thermoreceptor. Maidana, J., Olivares, E., Orio, P. Reunión Anual de la Sociedad Chilena de Neurociencia. Valparaíso, Chile. (Octubre 2013)

- Tuning A Mathematical Model Of Dynamic Response In Cold-Sensitive Nerve Endings: Role Of Trpm8 And Other Conductances. Herrera, G., Maidana, J., Olivares, E., Flores, K., Madrid, R., Orio, P. Reunión Anual de la Sociedad Chilena de Neurociencia. Valparaíso, Chile. (Octubre 2013)

- Dynamic response to cold in a two-compartment conductance-based mathematical model of cold thermoreceptors. Erick Olivares, Rodolfo Madrid, Patricio Orio. I Congreso de la Federación de Asociaciones de Neurociencia de Latinoamérica y el Caribe FALAN. Cancún, México. (Noviembre 2012).

- Memory-like behavior arising from a memory-less kinetic mechanism: when and how. Jean Paul Maidana, Danilo Pezo, Patricio Orio. I Congreso de la Federación de Asociaciones de Neurociencia de Latinoamérica y el Caribe FALAN. Cancún, México. (Noviembre 2012).

- Parameters tuning of a conductance based cold receptor model through evolutionary strategy optimization algorithm. Erick Olivares, Rodolfo Madrid, Patricio Orio. 7^o Congreso Anual de la Sociedad Chilena de Neurociencia. Santa Cruz, Chile (Septiembre 2011).

- Role of thermoregulated conductances on the dynamic response of peripheral innocuous cold receptor terminals: A mathematical modeling approach. Erick Olivares, Rodolfo Madrid, Patricio Orio. 8th IBRO World Congress of Neuroscience. Florencia, Italia. (Julio 2011).

- Ethanol exposure disrupts cell migration and cilia structure in developing embryos. Katica Boric, Eduardo Couve, Patricio Orio, Fidel Vargas, Kathleen Whitlock. *Dev Biol* **356**:198 (abstract 317). (Julio 2011)
- Diffusion approximation algorithm for stochastic ion channel simulations with multiple states. Patricio Orio. Cosyne – Computational and Systems Neuroscience Meeting. Salt Lake City, USA. (Febrero 2011).
- Stochastic behavior of ion channels: numerical simulation and consequences for neuronal excitability. Patricio Orio, Andrés Canales, Erick Olivares. The Junior League of Ion Channels Scientists (Chile). Montegrande, Chile. (Marzo 2011)