Expanding Caenorhabditis elegans research: First Latin American Worm Meeting

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ABSTRACT

From February 22nd to 24th, 2017, in Montevideo, Uruguay, Latin American scientists working with C. elegans gathered to share their research at the First Latin American Worm Meeting. This event was supported by the International Worm Community and included the presence of 17 speakers from North America, Europe and Israel. Martin Chalffie, who supported the initiative from the beginning, gave a keynote talk. This meeting greatly helped consolidate the Latin American Worm Community. The next meeting will take place in Rosario, Argentina in 2020.

The First Latin American Worm Meeting took place in Montevideo, Uruguay, at the Institut Pasteur de Montevideo with the participation of students, post-doctoral fellows and principal investigators from Argentina, Brazil, Chile, Colombia, Mexico and Uruguay (Fig. 1). C. elegans research slowly started in Latin America around 15 years ago with a few independent efforts mainly in Argentina, Mexico and Brazil. First laboratories using C. elegans as a model organism originated from the Cold Spring Harbor Course while others were started by returning post-doctoral trainees. International collaborations, a regional meeting in Argentina, along with the consolidation of the “Small Brains, Big Ideas” biennial course held in Chile (smallbrains.org), set up the framework for C. elegans research to develop in Latin America. As a powerful model not only for basic research but also as a tool for biotechnological approaches, C. elegans is an ideal model organism to work with in Latin America. Its ease of manipulation, inexpensive maintenance, and short life cycle are just a few of the advantages that make the model perfectly suited for a region where funding for basic research is very limited. Equally important is the existence of an International Community that freely shares reagents, knowledge (Wormbase, Wormbook, Wormatlas) and opens their laboratories for collaborations. Independent efforts along with the help of international colleagues generated the conditions for the First Latin American Worm Meeting to take place.

The meeting

The Meeting was fast paced and dynamic, with very enriching discussions. The program contained 3 Technical Updates and 10 short sessions. In total there were 41 oral presentations from Latin American and international speakers, including talks selected from students’ abstracts. 30 posters were presented in 2 sessions and were kept up for discussions for the entire length of the meeting. The program also included 3 longer presentations: an Opening Keynote talk by Martin Chalffie (Columbia University, NY, USA), a First Day Closing Talk by Hannes Bülow (Albert Einstein College of Medicine, NY, USA) and a Meeting Closing talk by Benjamin Podbilewicz (Technion, Haifa, Israel).

Martin Chalffie opened the meeting by videoconference talking about how to secure neuronal type decisions in the touch receptor neurons by “guarantors,” “protectors” and “terminal selectors.” The first day of the meeting was closed with a presentation from

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Hannes Bülow on the assembly of the PVD neuron dendritic arbors and the role of non-autonomous signals from the skin, muscle and axon to achieve this complex process.

The meeting included 3 short Technical Updates. Luisa Cochella from the Research Institute of Molecular Pathology (IMP), Austria, gave a clear and detailed protocol on using the CRISPR/Cas system for genome editing. Manuel Zimmer, also from the IMP, presented a Technical Update on calcium imaging and how his laboratory uses this tool to assess the activity of \textit{C. elegans} using a luciferase system to measure oscillations in gene expression. Using this system he showed how light and temperature cycles can train the worm’s clock. Arantza Barrios (UCL) talked about 2 pairs of newly identified neurons in the \textit{C. elegans} male arising at sexual maturation from differentiated glial cells, and how one of them, MCMs, is involved in sexual conditioning. Meital Oren (Weizmann Institute of Science, Israel) showed how sex-shared circuits are remodeled at sexual maturation by pruning synapses in only one sex through a mechanism that involves the proteasome and the Doublesex family of transcription factors. Sexual maturation can also bring about changes in neuronal neurotransmitter identity as Laura Pereira (Hobert Lab, Columbia University, USA) showed for the AIM interneuron. A complex cis-regulatory code read by 6 transcription factors define the HSN serotonergic identity as demonstrated by Nuria Flames (Instituto de Biomedicina de Valencia, Spain), and suggested a conservation of this HSN code in serotonergic mouse neurons. Richard Poole described neurogenesis in the C-lineage and the identification of several mutants affecting the left/right asymmetric neurogenesis, including the Mediator complex and \textit{hlh-14}. Claire Bénard (University of Quebec at Montreal, Canada/University of Massachusetts, USA) showed the role of heparan sulfate elongating enzymes \textit{rib-1} and \textit{rib-2} in axon navigation and the role of the heparan sulfate proteoglycan \textit{lon-2} in UNC-40 mediated axon guidance.

An RNA biology session focused on the role of small RNAs and RNAi in physiology and cellular communication. Luisa Cochella talked about the \textit{in vivo} role of miRNAs whose expression have high cellular specificity. One example is \textit{mir-791} that is expressed in only 3 pairs of neurons and regulates \textit{CO₂} sensing. Marcelo Mori (University of Campinas, Brazil) shared a cautionary tale on the use of the L4440 Fire vector for RNAi experiments. His laboratory is also studying the effect of the systemic RNAi pathway in worm physiology. Andrea Calixto (Universidad Mayor, Chile) talked about the role of

![Figure 1. Meeting poster: GFP worm flowers for Latin America, made with worms expressing GFP under the \textit{mec-17} promoter (Zhang et al., 2002). Typography: MontevideoJTG (Alejandro Sequeira), based on Uruguayan painter Joaquin Torres Garcia (1874–1949) characters. Poster © Calixto/Carrera. Reproduced by permission of Calixto/Carrera. Permission to reuse must be obtained from the rightholder.](image-url)
bacterial and worm sRNAs in interkingdom crosstalk to trigger defensive transgenerational responses to pathogenesis in *C. elegans*. Alejandro Vasquez (Ambros Lab, University of Massachusetts, USA) introduced a novel topic: the use of *C. elegans* susceptibility to infection by *Pseudomonas aeruginosa* strains in the study of evolution of virulence gene by comparative genomics.

Another session discussed the use of *C. elegans* as a model for toxicological studies. Michael Aschner (Albert Einstein College of Medicine, USA) gave an overview on his work on manganese (Mn) neurotoxicity and how the worm has helped elucidate some of the mechanisms of Mn transport and toxicity. Felix Soares (Universidade Federal de Santa Maria, Brazil) described the effect of Mn in lipid metabolism and vitellogenesis. Daiana Silva-Ávila (Universidade Federal do Pampa, Brazil) is using *C. elegans* to address the toxicity of pesticide formulations in Brazil and South America finding that “inert” components seem to have also detrimental effects. Eliana Munarriz (Universidade de Buenos Aires, Argentina) showed that *C. elegans* could be used to assess water quality and pollution. Importantly, a study analyzing water samples from 2 different areas in Argentina had an impact on environmental policies.

Alicia Meléndez (City University of New York, USA) started out the Cell Biology session giving an overview of the role of autophagy in dauer formation and lipid metabolism and showed a new role for autophagy genes in cell cycle progression of germline stem cells. Daniel Shaye (University of Illinois-Chicago, USA) showed results from RNAi screens using the excretory cell as a paradigm of tubule formation to find conserved genes that will also shed light into human kidney and vascular disease. To finish this session Dayse Da Cunha (Instituto Federal de Mato Grosso, Brazil) highlighted the role of heparan sulfate and heparan sulfate proteoglycans in the *C. elegans* germline.

Research on other nematodes species was also presented at the meeting, including work on parasitic as well as extremophile nematodes. Olga Castro’s laboratory (Universidad de Buenos Aires, Argentina) investigates how synthetic putative *C. elegans* DAF-12 modulators can affect the cycle and infection of tomato plants by nematodes of the genus *Meloidogyne*. Gustavo Salinas (Institut Pasteur Montevideo, Universidad de la República, Uruguay) showed the potential of *C. elegans* as a “parasite model” to understand key metabolic pathways present in parasites but absent in their hosts and to accelerate nematocidal drug discovery. Lastly in this session, Sergio Simonetta (Phyllumtech, Argentina) showed how *C. elegans* could be of use to find “green” pesticides to control plant parasitic nematodes using a rational design and genomic approach. In a different session, Mark Alkema (University of Massachusetts, USA) talked about recent work in his laboratory using *Turbatrix aceti*, to ask how organisms are capable of growing in extreme acidic environment using genome wide analysis.

Work on lipid metabolism was also presented. Celina Galles (Diego de Mendoza’s Lab, Instituto de Biología Molecular y Celular de Rosario, Argentina) showed that the endocannabinoid system could control cholesterol metabolism and dauer formation in *C. elegans*.

A session on stress in *C. elegans* showed both tissue specific as well as systemic ways that worms can coordinate stress responses. Rosa Navarro (Universidad Autónoma de Mexico, Mexico) talked about starvation stress in L4 larvae that increased germ cell apoptosis. Using an RNAi screen, her laboratory identified a group of RNA binding proteins required for this response. Diego Rayes (Instituto de Investigaciones Bioquímicas de Bahía Blanca, Argentina) examined the neuroendocrine regulation of stress by the RIM neuron at the organismal level.

Benjamin Podbilewicz closed the Meeting with a talk about cell fusion in *C. elegans* and the description of a superfamily of fusogens, the FUSEXINS. These proteins emerged from the analysis of HAP2/GCS1, a membrane glycoprotein required for gamete fusion in plants and protozoa. This protein is structurally similar to *C. elegans* EFF-1 suggesting that they have a common evolutionary origin.

Abstracts from all oral presentations and the 30 posters (covering topics in host-pathogen interactions, anthelmintic research, metabolism, natural product research, autophagy, stress response) can be accessed at: [http://pasteur.uy/en/last-news/first-latin-american-worm-meeting](http://pasteur.uy/en/last-news/first-latin-american-worm-meeting)

**Future plans**

Currently, there are more than 30 laboratories using *C. elegans* as a model organism in Latin America and this number is likely to grow. The meeting also served as a...
base for networking and fostered many new collaborations. Our next meeting will take place early in 2020 in Rosario, Argentina. We would like to truly thank all the international and Latin American speakers for making the meeting possible (many made a personal financial effort to attend). The First Latin American Worm Meeting was an exceptionally stimulating meeting that helped to consolidate our worm community (Fig. 2).

Disclosure of potential conflicts of interest

No potential conflicts of interest were disclosed.

Acknowledgments

We would like to thank all the sponsors that made this event possible: Institut Pasteur Montevideo, Fondo para la Convergencia Estructural del Mercosur (FOCEM), International Center For Genetic Engineering and Biotechnology (ICGEB), PEDECIBA (Uruguay), Universidad de la República (CSIC, Uruguay), Embassy of the United States of America (Uruguay), Embassy of Israel (Uruguay), B’nai B’rith Uruguay, The Company Of Biologists, Conicyt Chile (Conicyt-USA 2013–0041), PhylumTech, Ministerio de Turismo (Uruguay), COPA Airlines, Foro Viena-Montevideo. Inés Carrera wants to especially thank Luisa Cochella for agreeing back in early 2015 that doing this meeting was a great idea.

Reference

Zhang Y, Ma C, Delohery T, Nasipak B, Foat BC, Bounoutas A, Bussemaker HJ, Kim SK, Challie M. (2002). Identification of genes expressed in C. elegans touch receptor neurons. Nature 418(6895), 331–335.

Figure 2. First Latin American Worm Meeting held at the Institut Pasteur de Montevideo from February 22nd to 24th, 2017. 88 attendees from more than 10 countries helped consolidate the Latin American Worm Community.