Sixteenth Lecture in the Series

James P. Holland Memorial Lecture

Monday, October 5, 2015, at 4:00 p.m.

Myers Hall 130 (915 East Third Street)
Indiana University Bloomington campus

Extreme muscle plasticity in electric fish: cellular and molecular insights

Graciela A. Unguez, Ph.D.

Professor of Biology
New Mexico State University, Las Cruces

Animals perform a remarkable diversity of movements through the coordinated mechanical contraction of skeletal muscle. This capacity for a wide range of movements is due to the presence of muscle cells with a very plastic phenotype that display many different biochemical, physiological, and morphological properties. What factors influence the maintenance, plasticity, and regeneration of differentiated muscle fibers is a fundamental question in muscle biology.

We have exploited the remarkable potential of skeletal muscle cells of the gymnotiform electric fish *Sternopygus macrurus* to trans-differentiate into electrocytes, the non-contractile electrogenic cells of the electric organ (EO), to investigate the mechanisms that regulate differentiation and regeneration of skeletal muscle.

In *S. macrurus*, mature electrocytes possess a phenotype that is intermediate between muscle and non-muscle cells. How some genes coding for muscle-specific proteins are down-regulated while others are maintained, and novel genes are upregulated, is an intriguing problem in the control of skeletal muscle and EO phenotype.

To date, the intracellular and extracellular factors that generate and maintain distinct patterns of gene expression in muscle and EO have not been defined. For example, physiological and molecular studies in *S. macrurus* have begun to shed light on the role that the nervous system plays on transcriptional and post-transcriptional events in the regulation of specific muscle protein systems of the EO. These findings are currently informing experimentation using cell culture approaches and application of engineering solutions to carry out long-term studies with fish in their aquatic environments.

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About Graciela A. Unguez

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Professional Experience

Professor, Department of Biology, New Mexico State University, Las Cruces, 2012–present
Associate Professor, Department of Biology, New Mexico State University, Las Cruces, 2006–2012
Assistant Professor, Department of Biology, New Mexico State University, Las Cruces, 1999–2006
Research Associate, Department of Zoology, University of Texas at Austin, 1999

Education

University of Texas, Austin, Postdoctoral Fellow, Neuroscience, 1999
University of California, Los Angeles, Ph.D., Physiology, 1994
University of California, Los Angeles, B.S., Kinesiology, 1987

Honors

Provosts Award for Excellence in Academic Advising, New Mexico State University, 2015
Member, American Society of Cell Biology (ASCB) Minorities Affairs Committee, 2010–present
Executive Planning Committee Member, National Academies Summer Institutes, National Academies Summer Institute on Undergraduate Education in Biology, University of Wisconsin-Madison, 2011–2013
Distinguished Member, Teaching Academy, New Mexico State University, 2008
Excellence in Mentoring, New Mexico AMP (Alliance for Minority Participation) Undergraduate Research Program, 2002–2004