Global Young Academy

Young Scientist Ambassador Programme

Country of Origin:
United States

County of Destination:
Costa Rica

Time of Visit:
29 July – 5 August 2017

Ambassador:
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Mission Report

YSAP Activities Overview

1) Engage scientists at Universidad de Costa Rica for collaborative project on evolution of muscle cell proliferation using frog models in Costa Rica

2) Meet coordinators at the US Embassy of Costa Rica to connect GYA outreach efforts with activities organized by Embassy for students in Costa Rica

3) Network with the director and staff of the National Academy of Sciences of Costa Rica to inform scientists about the Global Young Academy and to recruit new members from Central America

4) Coordinate with permitting officials to start permit application for fieldwork and data collection for collaborative research project

Background

Muscle proliferation in vertebrates is largely governed by *Myostatin*, a gene, that when normally expressed, inhibits muscle cell growth and development. Loss of function mutations in *Myostatin* are sufficient to promote muscle cell proliferation, leading to dramatic increases in muscle mass in mice, dogs, cows, horses, sheep, and humans. The ability to control muscle development by simple mutations, has led to interest in how *Myostatin* can be used to reverse muscle atrophy during aging, increase muscle mass during exercise, and create therapies to treat muscle disease.

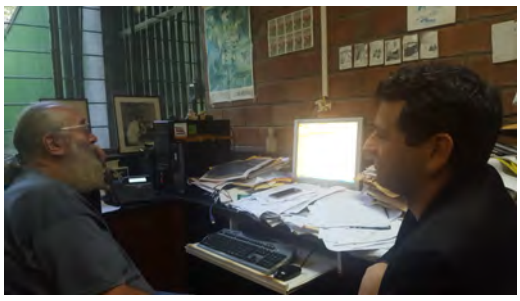
A major problem in applying knowledge of *Myostatin* to human disease is the inability to control where and when *Myostatin* can be expressed. Inhibiting the expression of *Myostatin* in targeted cells, would solve a major hurdle by creating a targeted pattern of gene manipulation.

Evolution may have solved this problem. In about 15 independent lineages of frogs, there are species in which males develop massive hypertrophied arms, coupled with spines on the chest and thumbs that serve as weapons during male-male combat. The muscle expansion that occurs in the forelimbs of males is unlike the traditional *Myostatin* mutant in which muscle proliferation occurs throughout the body. What factors promote increased muscle mass in forelimbs only? How is regulation of muscle proliferation prevented in other regions of the body? How does the expression of the spines used in combat link to regulation of muscle cells in the forelimbs? Are these genetic factors the same across 15 independent evolutionary events of forelimb muscle hypertrophy in frogs?

To start this work, I proposed to collaborate with researchers in Costa Rica, where several species of frogs with expanded forelimbs occur. The goal of this YSAP activity was to meet with herpetologists at Universidad de Costa Rica to recruit a team to work on this project. The initial plan is to recruit a graduate student to perform histology of forelimb muscle cells from hypertropid and non-hypertrophid individuals to measure cell volume and number and to develop a set of slides that can be used for subsequent staining to measure protein levels of *Myostain*. The student will then come to my laboratory at the University of Connecticut to measure transcriptomes levels in muscle tissue from hypertrophid and non-hypertrophid males.

YSAP Activities, Costa Rica

During the first week of August 2017, GYA member John Malone met with Federico Bolaños and other scientists at the Universidad de Costa Rica to discuss the proposed project on muscle cell proliferation using frog models, understand ways to recruit students, and discuss the overview goals and implementation of the project. Federico Bolaños communicated the call for new GYA members university-wide and productive discussions were had in planning for the upcoming field season and for recruiting students for an international exchange during summery 2018.


John with scientists at Universidad de Costa Rica, San Jose

On 3 August, John Malone met with Cultural Affairs Officers (Shirley Brenes, Carolina Quiros, Ligia Alpizar) at the US Embassy in Costa Rica to discuss opportunities for cultural exchange and student involvement in the proposed research activity. CAOs explained a variety of student exchange programmes available in Costa Rica and willingness to work with the proposed research to involve students and for outreach activities at local schools in the San Jose area. Additionally, CAOs circulated the call for new GYA members among their network of educators and scientists in Costa Rica.

John preparing to meet with cultural affairs officers at the US Embassy to talk about the Global Young Academy

John Malone gave an overview presentation of the Global Young Academy for Pedro León Azofeifa and Dayana Mora, president and executive director of the National Academy of Sciences of Costa Rica. León Azofeifa had just returned from a meeting with other National Academies in Europe and just learned about the Global Young Academy during his trip. After the presentation, it was discussed how to get young scientists from Costa Rica involved in the Global Young Academy and especially how to encourage young scientists to apply to the GYA. León Azofeifa and Dayana Mora showcased their database of Costa Rican researchers studying abroad and some of their initiatives to encourage young woman to pursue science as a career. In general, they were supportive of the idea of trying to encourage a Young Academy to be started in Costa Rica under the National Academy framework.

John meeting at the National Academy of Costa Rica

Finally, John Malone and David Laurencio met with conservation manager, Julio Bustamante at the MINAE field office in Puriscal, Costa Rica. Julio Bustamante is in charge of conservation efforts on the Pacific versant of Costa Rica where the proposed research would take place and permits would be needed to conduct the research. They discussed permitting needs, sample sizes required, and locations for the proposed work. Parque Nacional Carara is the desired location for proposed fieldwork and data collection.

John and Dave with Julio Bustamante in Puriscal, Costa Rica

John Malone
August 2017