José A. Rodríguez-Martínez: Interrogating Proteins [1]

Submitted by Lorraine Doralys Rodriguez-River... [2] on 1 December 2020 - 8:58pm

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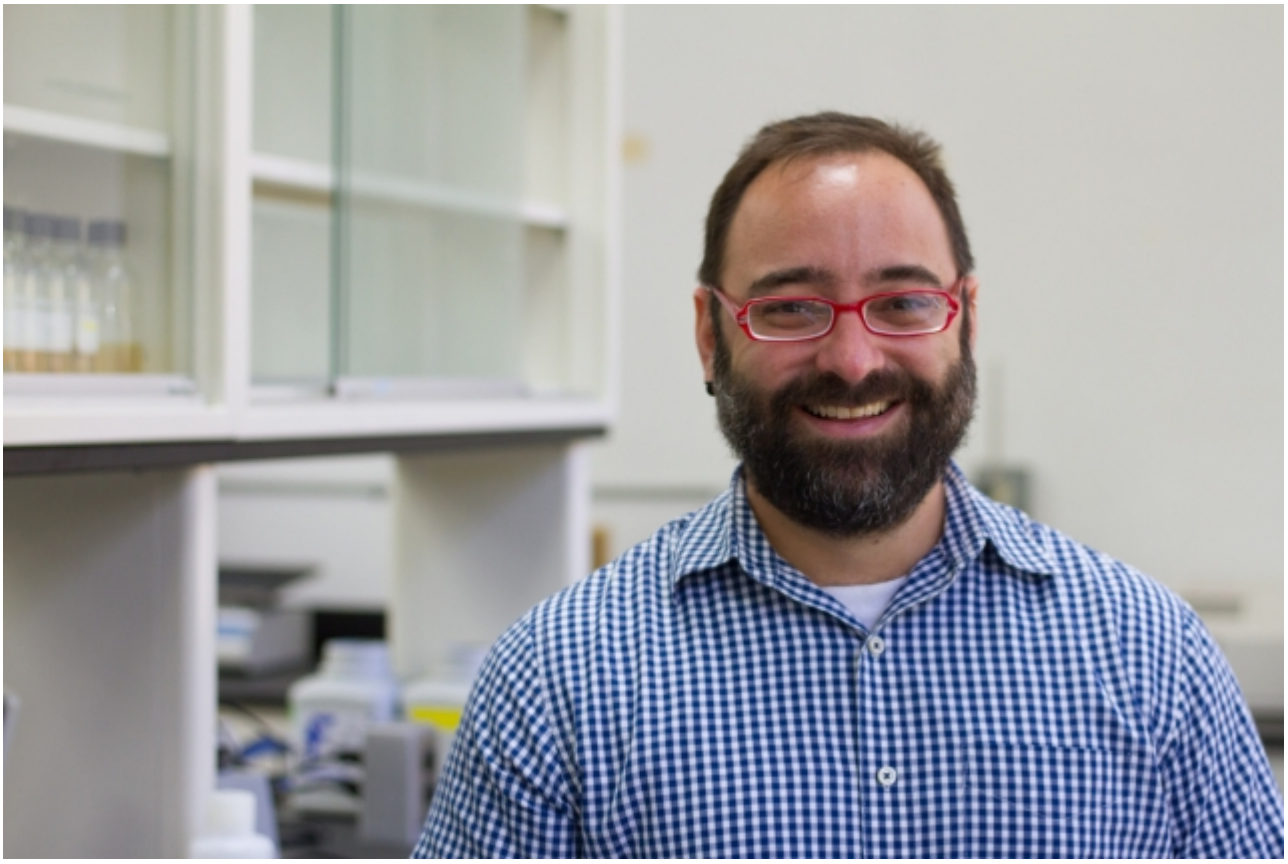

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Translated by Charlene Rivera-Bonet

Did you know that the colors of butterflies, the development of the heart and the resistance of certain bacteria to peroxide have something in common? They are all a result of the interaction between proteins and nucleic acids (such as DNA). Discovering and understanding the interactions between these two molecules essential for life is important to explain different

biological processes, which is the goal of Dr. José A. Rodríguez Martínez [4]. As a principal investigator and assistant professor at the University of Puerto Rico at Río Piedras (UPR-RP), he developed a technique to interrogate any protein and ask, which nucleic acid sequence do you interact with?

What does this method consist of? The method consists on using nucleic acid sequences (called aptamers) that interact with proteins to detect or identify something. For example, Dr. Rodríguez-Martínez, in collaboration with Dr. Eduardo Nicolau [5] from the Department of Chemistry at UPR-RP, recently received funds from the Puerto Rico Public Health Trust [6] to develop a test to detect the coronavirus SARS-CoV-2, which causes COVID-19, using this method. The team will use aptamers that interact with proteins on the surface of the virus and translate this interaction to a detectable signal to identify the presence of the virus in patient samples. This represents a potential diagnostic test for COVID-19 that is more economic and efficient than tests that use antibodies to detect antigens or parts of the coronavirus.

In addition to using the interaction between aptamers and proteins to detect SARS-CoV-2, Dr. Rodríguez-Martínez's lab (also known as the JARM lab [7]), uses this method on other research projects. Currently, over a dozen graduate and undergraduate students work arduously on three projects.

Group picture of the JARM Lab at UPR-RP.

The first project focuses on proteins that are necessary for heart development. Sometimes these proteins do not work properly, resulting in congenital cardiopathies or heart defects at birth. This project consists of answering the following question: What happens to these proteins when they do not function properly? The answer could be found in how these proteins interact with DNA.

The second project consists of studying a protein that determines the coloring patterns of butterflies' wings. This protein interacts with DNA and controls the red colored areas of the wings. This project highlights the utility of these molecular methods to answer questions that have

remained a scientific mystery for many years.

Finally, the third project looks at bacteria called *Vibrio fischeri,* which colonize organs in the squid. The squid defends itself from these bacteria by producing peroxide. The bacteria in turn defend themselves from the peroxide by producing proteins (called transcription factors) that turn on or off genes that give them protection. The aim of this project is to understand how the interaction between the transcription factors and DNA results in the bacteria being resistant to peroxide. Understanding these processes has an impact on how we can use certain compounds to kill bacteria in our daily lives.

What Dr. Rodríguez-Martínez enjoys the most about his work is the time he spends in the lab doing experiments, and the process of discovery. “There is nothing better than an experiment that goes well for me or my students” he said smiling.

The importance of taking opportunities

Something that has defined Dr. Rodríguez-Martínez’s professional trajectory is that he has never missed an opportunity. Many years before wanting to study biology, he was interested in environmental science. He still remembers how much he enjoyed doing experiments in his backyard. As a freshman in high school, he co-founded an environmental club at the Santo Tomás de Aquino Academy in Bayamón, Puerto Rico. He was then accepted into the Environmental Science program at the UPR-RP with the goal of pursuing a career in law. What he didn’t know is that his trajectory through the Department of Natural Sciences would take an interesting turn.

After taking a few courses he realized that this major was different from what he thought. His Organic Chemistry professor, Dr. Rosa Betancourt, asked him if he was interested in undergraduate research. Dr. Rodríguez-Martínez, like many students, thought of scientific research as something that only occurred at NASA and movies. To his surprise, in his university there were (and still are) research opportunities for undergraduates.

Professor Osvaldo Rosario [8] then recruited him to work with a technique used to identify contaminants in air samples. For the first time, he experienced the relationship between what he learned in his chemistry courses and research. The experience was so incredible that a week later he decided that he wanted to dedicate the rest of his life to be a researcher. Dr. Rodríguez-Martínez still remembers that on each lab door there was a summary of the titles and institutions attended by every principal investigator or professor of each lab. He realized that he needed to get a doctorate followed by a post-doctorate in order to have his own lab in an academic institution.

Dr. Rodríguez-Martínez completed his bachelor’s in Chemistry at the UPR-RP, where he continued his doctorate in the same discipline. During that time, he lived multiple challenging experiences and learned many lessons. One valuable lesson was courtesy of Dr. Reginald Morales [9], who when José had to write a proposal told him “Research never ends, at the end of a good research article there are always more questions to answer.” His advice suggested that these questions are the first pieces of a puzzle no one had thought of building before. Dr. Rodríguez-Martínez still applies this advice when starting a new research project.

For his doctorate, Dr. Rodríguez-Martínez joined the lab of Dr. Kai Griebenow [10], who specializes in the study of protein stability in pharmaceutical products. While presenting at the American Society for Biochemistry and Molecular Biology conference, he met Dr. Aseem Z. Ansari [11], who would become his post-doctoral mentor. His presentation was about molecules that interact with nucleic acids. Dr. Rodríguez-Martínez invited Dr. Ansari to give a seminar at the UPR-RP. José prepared for Dr. Ansari's visit by reading about his research and thinking about potential new project ideas to propose. Dr. Ansari was very impressed with José's interest, and recruited him to work in his lab at the University of Wisconsin-Madison (UW-Madison).

Lack of role models

Once he arrived at Madison, he realized something very peculiar: there were Latinos in other departments, but none in Biochemistry. "It's hard to visualize yourself", he expressed. "I like finding role models, ideally that look like me, to be able to visualize myself". In search for role models, Dr. Rodríguez-Martínez joined the Society for the Advancement of Chicanos/Hispanics and Native Americans (SACNAS). This group had a positive impact in his career because there, he found people that looked and talked like him.

José is currently a professor, mentor and researcher, just like he dreamed when he was an undergraduate student in Natural Sciences many years ago. Dr. Rodríguez-Martínez's leadership, perseverance and the ability to be innovative, are without a doubt a source of inspiration to new generations of scientists. In addition to his research, being a role model is something very important to him. When José was a graduate student, he remembers that Dr. Daniel Colón-Ramos [12] (Yale professor and founder of CienciaPR) gave a seminar at the UPR-RP. "It was important to see a Puerto Rican my age publish his research on the cover of Science. You are a graduate student and see these "Boricuas" doing these things, that makes you say I can be there too" he added. Currently, his experience and trajectory allow many Puerto Ricans and Latinx visualize themselves and continue his example to achieve the goals they dream.

Tags:

- Ciencia Boricua [13]
- Cerebros boricuas [14]

Categorías de Contenido:

- Biological and health sciences [15]

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