

Interview with Dr. Gabriela Olmedo



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ABSTRACT

Dr. Gabriela Olmedo works for the Center for Research and Advanced Studies of National Polytechnic Institute (CINVESTAV) Irapuato, Guanajuato where she is the chief of the Department of Genetic Engineering. She is an expert microbiologist, with her research focusing on RNA metabolism and bacterial comparative genomics. She is currently working on a research project studying the biodiversity of Cuatro Ciénegas, Coahuila, Mexico. This place is known for its 300 lakes that have a similar trophic chain to the Jurassic Period. She received her PhD at the University of Pennsylvania, Philadelphia.

Liliana Corona (LC): Today we are with Dr. Gabriela Olmedo (GO) to find out about her work as a research scientist.

LC: Well, let's start: How could you define 'evolution'?

GO: I can describe it as a number of changes in genetic material that result in alterations in the



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morphology and metabolism of organisms over many years, resulting in the diversity that we now see.

LC: Why has Cuatro Ciénegas (CC) become a place to study evolution?

GO: CC has a very special microbial population and the study of bacteria is a simple model that allows us to understand how changes occur in the genetic material in a short time. We analyze changes in the genomes at a molecular level, and study their relationship to specific genes that contribute to metabolic characteristics that we can monitor. It also demonstrates how the environment affects organisms to generate diversity.

LC: What makes CC so special?

GO: The geological origin of the lakes at CC makes it a very special place. Also, the isolation has helped it remain untainted and has kept the organisms that live there cut off which makes it an ideal system to study. Each of the lakes at CC has different organisms and it is very interesting to compare the bacteria between them. We also compare them with bacteria that live outside of CC, making it possible to ask questions about the biology and evolutionary

relationships of bacteria. These can be answered using microbiological and genomic tools.

LC: Which have been the most important discoveries in CC?

GO: For over 10 years, researchers from different countries have expressed interest in studying the valley of CC because they know the diversity and large number of endemic organisms that it has. The best known are the fish and snails studied by a group led by Dr. Minkley. Dr. Valeria Souza was a pioneer in microbiology research, and she found that many bacteria that live in the lakes have genetic characteristics indicative of a marine origin. Another feature of the lakes is the limited nutrients, especially phosphorus; it has been interesting trying to understand what mechanisms the bacteria use to survive there.

LC: Have any microorganisms with special characteristics been found in these pounds?

GO: Dr. Souza's group isolated heat-resistant bacteria of the genus *Bacillus* and then sequenced their DNA to see if this would reveal what metabolic characteristics made it possible for the bacteria to survive in a lake with such low phosphorus levels. *Bacillus coahuilensis* was the strain chosen for sequencing. One of the salient features that we found in its genome was the presence of two genes that give this bacterium the ability to synthesise sulpholipids. Most living organisms' membranes have a high content of phospholipids, so this is an important adaptation in an environment absent of phosphorus. The presence of the sulpholipids was later proved biochemically. The genes that give this property are very similar to the genes in cyanobacteria, so we speculate that they were acquired by horizontal transfer of genetic material from cyanobacteria (with which *Bacillus* coexists).

LC: Why has this microorganism been able to survive?

GO: Another feature of *B. coahuilensis* that has allowed it to survive at CC in the lake Churince is its ability to absorb nutrients using several transport proteins in the membrane. Therefore, despite

lacking several metabolic pathways and the ability to synthesise eight amino acids, it is able to obtain these nutrients from other bacteria.

LC: What expectations do you have about the future of this project?

GO: We have a large collection of bacteria of the genus *Bacillus* and we are planning to study them with genomic tools to understand their metabolism and ecology. A challenge for us is to analyze these bacteria and bacterial communities to learn about the exchange of genes, the metabolic characteristics which allow them to live in a community and other adaptations that allow them to grow and survive in this environment.

LC: What message would you give to young people thinking about a future in the study of evolution?

GO: Learning about the evolutionary process is fascinating, with new methods of DNA sequencing and analysis giving us the possibility to make comparisons at different levels and to explore how the microorganisms manage to be so diverse and to adapt to countless extreme environments. These range from those deficient in nutrients to those contaminated with metals to those with very high temperatures. It is interesting to find out about how there is a continuous exchange of genetic material in bacterial populations through plasmids and bacteriophages (viruses that infect bacteria). This DNA is a shared asset that belongs to no individual bacterium and is continuously exchanged. Therefore, bacteria have to use mechanisms to defend against the invasion of DNA and maintain a balance between defending their genetic identity and exploiting the adaptive opportunities that the DNA may bring.

LC: Finally, do you have any advice to readers?

GO: If anyone is thinking of engaging in research you must expect a fascinating world where there are surprises every day; science itself evolves continuously. It takes effort and perseverance to keep pace and not fall behind in research.

About the Author

Liliana Corona Martínez is currently studying at the University of Queretaro in Mexico.