Margarita Salas (1938-2019)

(María Antonia Sánchez–Romero and Rocío Fernández–Fernández)

Margarita Salas

Claim to fame: pioneering DNA amplification

Background: description of the problem faced

DNA analysis has a wide range of applications, ranging from scientific research to diagnostics to forensic analysis. Often, it is the only technique applicable to a problem and, where other techniques are also available, it usually provides more information than the others. Traditionally, DNA techniques required substantial amounts of genetic material to produce reliable results. However, advances in molecular biology, such as the development of the polymerase chain reaction (PCR) in the 1980s, marked a significant breakthrough by enabling the amplification of specific DNA sequences from small samples. Despite this advance, DNA testing remained time-consuming and error-prone, restricting its usability to research laboratories and hindering its adoption in broader, real–world applications.

The Approach taken

Margarita Salas was the scientist who focused on basic research to understand fundamental biological processes, revolutionized DNA analysis techniques, making them more efficient, more reliable, and widely applicable to diverse disciplines. While studying the phi29 virus, she discovered and characterized an enzyme, called phi29 DNA polymerase, which was pivotal in advancing molecular biology.

The Breakthrough/Discovery solution to the problem

She discovered and characterized the phi29 DNA polymerase. This enzyme, derived from the bacteriophage phi29, is notable for its unique ability to amplify DNA with high fidelity and strand displacement activity, which allows it to replicate long DNA sequences efficiently without needing a thermal cycling process, as the case for PCR. The phi29 DNA polymerase could generate large amounts of DNA from minimal starting material much more quickly than existing alternatives. Her work on phi29 DNA polymerase revolutionized the field of molecular biology, particularly in the area of DNA amplification, leading to more efficient methods for whole genome amplification (WGA).

Its Application

The exceptional efficiency and fidelity of phi29 polymerase have established it as an indispensable tool in microbiological research and medical diagnostics. It has been particularly influential in situations where limited DNA samples need to be amplified for analysis, such as in identifying pathogens or detecting genetic mutations. The patents filed by Margarita facilitated the commercialization of user-friendly DNA amplification kits, revolutionizing genetic research. Her first patent, filed through the Spanish Consejo Superior de Investigaciones Científicas (CSIC), remains the most profitable patent ever registered by the institution.

Its Significance and how it changed microbiology, humanity

Discoveries of Margarita Salas have had a profound and lasting impact on the field of microbiology, genetics and molecular biology. Her work with the phi29 bacteriophage provided key insights into viral DNA replication, molecular genetics, and DNA amplification techniques that are now foundational in microbiological research and biotechnology. Margarita's work has not only advanced scientific understanding but has also had practical applications in genomic research, forensic science, disease diagnostics, and biotechnology.

The MicroDiscoverer Hero – the person

Margarita Salas was born in 1938 in a village called Canero (Asturias, Spain), but later moved to the city of Gijon (Asturias, Spain) where she spent most of her childhood and adolescence. At the age of 16, she moved to Madrid to study at the Faculty of Chemistry at the Complutense University. During her first years at the University, she discovered her great passion that would mark her scientific career: researching in the organic chemistry laboratory.

After completing her degree, Margarita Salas earned her PhD in the Alberto Sols laboratory. In 1964, she joined Severo Ochoa's laboratory at the New York University School of Medicine. Early in her career, she collaborated with her husband, Eladio Viñuela. However, Severo Ochoa, keenly aware of gender biases in the scientific community, recognized that female scientists were often overlooked, particularly when working alongside their husbands, as discoveries were typically credited to the male partner. To ensure Margarita's contributions received proper recognition, Ochoa professionally separated her work from her husband's. Upon returning to Spain, Margarita Salas became a leading figure in advancing research in biochemistry and molecular biology.

Margarita Salas passed away at the age of 80, after a remarkable career marked by success and widespread recognition. Nevertheless, her journey was far from easy; she faced numerous challenges simply because she was a woman. She remained resilient in the face of gender-based barriers, ensuring that her scientific contributions stood on their own merit, paving the way for future generations of researchers. Throughout her career, Margarita relentlessly fought to increase the visibility of women in science and to break down the barriers that hindered their progress in the field.