Obituary

Eladio Viñuela (1937–99)

Pioneer of molecular biology in Spain

Eladio Viñuela, who died earlier this year in Madrid at the age of 62, was one of Spain's leading scientists. Beyond his own substantial research contributions, he was an inspiration to the Spanish scientific community, which has lost a key player in developing the country's strength in molecular biology.

Born in February 1937 in a small village in Extremadura, in southwestern Spain, Viñuela obtained his academic degrees at the University of Madrid before moving to the laboratory of Alberto Sols at the Spanish Research Council in Madrid. There he worked on carbohydrate metabolism, discovering the enzyme glucokinase, the synthesis of which depends on insulin and which is responsible for phosphorylation of glucose in the liver. He also demonstrated the allosteric properties of yeast phosphofructokinase, which has a regulatory binding site for ATP (the end-product of the pathway) that differs from the substrate site. The end-product inhibition of phosphofructokinase by ATP was proposed to act as a feedback control in the breakdown of glucose.

In 1964, Viñuela moved to New York University to work as a postdoctoral student in the laboratory of the Nobel prizewinner Severo Ochoa. At that time there was no molecular biology in Spain, so, to learn this relatively new area of biology, it was a must to move — preferably to the United States. This was a turning point in Viñuela's career. In New York he began collaborating with Charles Weissmann on research into the replication of bacteriophage MS2 RNA, especially the mechanism of parental-type 'plus strand' formation. This provided further insights into how MS2 RNA replicates. After this work he started to characterize the proteins induced after the infection of *Escherichia coli* with phage MS2, and to study translation of MS2 RNA. This was a time when the basic processes of the transfer of genetic information (replication, transcription and translation) started to be deciphered. The remarkable finding to emerge was that formyl methionine is the initiator of all the proteins encoded by the polycistronic MS2 RNA in *E. coli*, a result that quickly made its way into the textbooks.

But Viñuela's most influential work of this period was carried out independently,

This was the description that, in polyacrylamide gels in the presence of the detergent sodium dodecyl sulphate (SDS), there is a correlation between the electrophoretic mobility of a protein and its molecular mass. The technique was a revolutionary way of characterizing protein molecular mass, and much faster than the established method involving ultracentrifugation. The paper concerned was entitled "Molecular weight estimation of polypeptide chains by electrophoresis in SDS-polyacrylamide gels" and appeared in *Biochemical and Biophysical Research Communications* (28, 815–820; 1967). It became a *Current Contents* citation classic, and the technique is still widely used to determine the molecular mass of proteins and to separate them according to size.

At the age of 26 Viñuela had married Margarita Salas, herself a highly talented molecular biologist. They had met during their university studies in Madrid and they both worked in the laboratories of Sols and Ochoa (the picture here shows them together in the lab). In 1967 they moved back to Spain to develop molecular biology and to contribute to science in their home country. They brought to Spain a new mentality and a new way of doing science, and together they created the first department of molecular biology of the Spanish Research Council in Madrid, starting with seven PhD students with backgrounds in biology, chemistry and medicine.

As researchers, Viñuela and Salas complemented each other well — her systematic thinking and his wide-ranging and restless intellect led them to achieve defined goals. Their investigations into the morphogenesis of bacteriophage $\phi 29$ resulted in the identification of a protein,

covalently linked to the 5' ends of the viral DNA, that was later shown to act as a primer for $\phi 29$ DNA replication. Protein priming turned out to be a hitherto unknown way to initiate replication in both DNA- and RNA-containing viruses.

From 1970, Viñuela used this basic research background to move into the study of African swine fever virus, an especially serious animal pathogen in southern Europe. Major contributions here were the description of the virus genome structure and replication strategies, as well as identification of the virus attachment protein involved in the interaction with the animal-cell receptor, and the discovery of multigene families in the virus genome. The complete sequencing of the viral DNA, and identification of several genes involved in the regulation of the host's immune response and apoptosis, provided telling insights into the biology of African swine fever virus. Basic studies of this virus are leading to more specific diagnostic tests for the disease.

Viñuela set an example through his own fruitful research and international reputation (he was among the first Spanish members of the European Molecular Biology Organization). He was also a catalyst in Spanish science in general, and in molecular biology and virology in particular, through his creation of an influential school of students. Many disciples of his are now senior research scientists and university professors in Spain and elsewhere; the passion for the scientific life and for rigour in research that they inherited from their maestro and *amigo* are transparent in *Phage $\phi 29$ and the Origins of Molecular Biology in Spain*, a festschrift compiled to mark his 60th birthday. As a co-founder of the Centro de Biología Molecular 'Severo Ochoa' in 1975, together with Federico Mayor, D. Vazquez and A. Garcia-Bellido, it was his drive and vision that saw through the design and development of its technical department and core scientific facilities, a true innovation in Spanish research institutions at that time.

For current and future generations of Spanish researchers, Eladio Viñuela will remain a guiding light. His death on 9 March was untimely. Viñuela's erudition, capacity for organization and creativity together made him one of the best of scientists, and best of men.

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