

## In Memoriam

Marianne Grunberg-Manago 1921–2013

Marianne Grunberg-Manago discovered the enzyme polynucleotide phosphorylase (PNPase), which was essential for deciphering the genetic code at the beginning of the 1960s. She also had a distinguished international career at a time when there were few women working as scientists.

Marianne Grunberg-Manago was born into a family of artists on 6th January 1921 in Petrograd (St Petersburg) in Russia. She emigrated to France with her parents at the age of nine months. Later, she studied both Comparative Literature and Biology at the University of Paris, receiving her PhD in 1947. Marianne first worked on intermediary metabolism in bacteria at the Institut de Biologie Physico-Chimique (IBPC) in Paris. In 1953, she left for the USA, first to the University of Illinois at Urbana and later to New York University, where she joined the laboratory of Severo Ochoa in 1954. It was there that she discovered PNPase, an enzyme that catalysed the synthesis of polyribonucleotides. In 1959, Ochoa and Arthur Kornberg were awarded the Nobel prize 'for their discovery of the mechanisms in the biological synthesis of ribonucleic acid and deoxyribonucleic acid'. Later experiments showed that the major role of PNPase *in vivo* was RNA degradation rather than RNA synthesis. However, the capacity of PNPase to produce RNA played a key role in the experiments of Nirenberg and Matthaei in 1961, establishing that polyU (synthesized by PNPase) directed the synthesis of polyphenylalanine. Thus, the early steps in cracking the genetic code depended on the discovery of PNPase.

Marianne returned to the IBPC in 1956, where she studied the biochemical properties of PNPase and those of the various polynucleotides it synthesized. She also used these polynucleotides in cell-free systems to define new codons. The first area of work led her to investigate the biological role of PNPase and RNA degradation in model bacteria, while the second led her to study the mechanism of mRNA translation initiation in collaboration with François Gros, at the IBPC at that time. Later, she studied how translation was regulated, mainly in collaboration with Sylvain Blanquet and later with Jean-Pierre Ebel and Bernard and Chantal Ehresmann in Strasbourg.



Marianne Grunberg-Manago was the first woman to be President of the International Union of Biochemistry and Molecular Biology (1985–1988) and the only female President of the French Academy of Sciences (1995–1996). She was also a member of the American National Academy of Sciences and of numerous other Academies, won many French and international prizes and published more than 300 articles in peer-reviewed journals. Marianne was awarded the FEBS Diplôme d'Honneur in 1996.

In addition to being a prominent scientist, Marianne Grunberg-Manago was a wonderful person, greatly loved by all her collaborators, colleagues and friends. On 18th March 2000, she suffered a terrible brain haemorrhage that kept her in hospital until her death on 4th January 2013, two days before her 92nd birthday. Despite these 13 difficult years, Marianne will always be remembered as a vibrant person with a great sense of humour. After her election to the presidency of the French Academy of Sciences, many journalists came to interview her. One very admiring journalist confessed to her 'I always dreamed of becoming a scientist, but only managed to become a journalist' – to which Marianne replied 'that's funny, because I always wanted to be journalist, but only managed to become a scientist!'

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