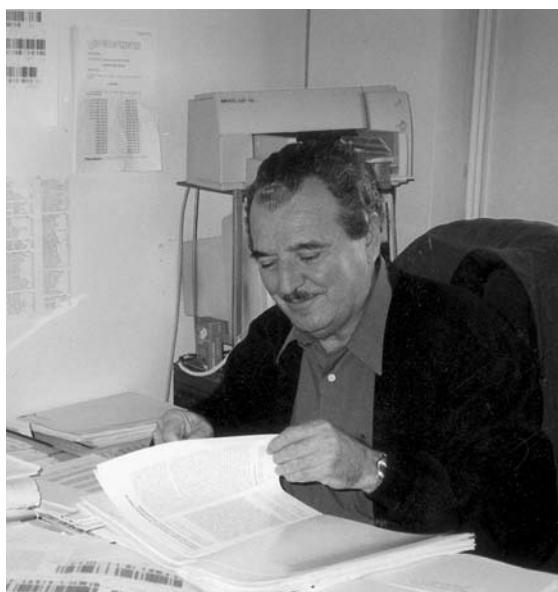


*Obituary***A tribute to Julio López-Gorgé (1935–2004): the music in science***

Julio López-Gorgé, photograph taken in 2003

Julio López-Gorgé died of a stroke unexpectedly on June 7, 2004. On his desk waiting for him were the tickets to attend the 53rd International Festival of Music and Dance of Granada to begin on June 18. He was always proud of having attended all the seasons of this renowned festival ever since its beginning. Music was his big passion. Julio was born in 1935 in Melilla, a Spanish city in the north of Africa, where he proudly received the Special Award for his secondary-school degree, for him the most humanistic period of his life. Very young, he moved to the city of Granada to pursue his undergraduate studies in Pharmacy at the University of Granada.

In 1961, he began his scientific career in the Department of Parasitology in the Institute López Neyra and finished his PhD under the direction of Professor Miguel Monteoliva, on 'Some aspects, nature and content in protids, glucids and lipids of *Moniezia expansa* (Rudolphi,

1.805)'. In this work, he demonstrated the presence of ascarilic alcohol in different worms, selectively localized in the reproductive organs of the females (López-Gorgé et al. 1965). A short stay in the Laboratoire de Chimie des Substances Naturelles (at Centre National de Recherche Scientifique, CNRS, at Gif-sur-Yvette, France) in 1962 helped to improve his research on 'unsaponifiable' intestinal parasites. After completing his doctorate, he and his colleagues made an important discovery on L-glutamate-I-carboxylase in intestinal parasites, published in *Nature* (Monteoliva et al. 1965; also see Ibañez et al. 1969), where they demonstrated that the metabolism of intestinal parasites is predominantly anaerobic, making the investigation of a Krebs cycle by-pass system seem worthwhile.

In 1967, Julio was granted a fellowship for 1 year from the Ramsey Memorial Fellowships Trust to work at King's College, London (UK), where he studied the metabolism of guanidines of intestinal parasites. Back in Spain, a contin-

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uous allergy to ascaroids forced him to abandon his research in parasitology, and in 1968 he became one of the members of the recently created Plant Biochemistry Section led by Federico Mayor Zaragoza (UNESCO Director 1987–1999), in the Estación Experimental del Zaidín (CSIC) in Granada. With the help of the Director, Professor Luis Recalde, he initiated the study of *plant biology*. These years were the most difficult due to the lack of grants. However, the economic and material difficulties did not dampen his enthusiasm for research. For all the young, talented people, this formative period was stimulating and unforgettable, and he shared these first hard years with close companions and dear friends.

The experience acquired by Julio in parasite phosphatases and pyrophosphatases during his stay in the Lopez Neyra Parasitology Institute prompted his brilliant idea of directing the research of the recently created group towards the study of the carbon metabolism pathways in plants through the study of hexose-biphosphatase. This was his debut in photosynthesis, working with fructose-1,6-bisphosphatase (FBPase), a highly regulated enzyme in the chloroplast which has a cytosolic counterpart involved in gluconeogenesis. The results of this research confirmed that Julio's choice had been correct, and finally this topic became the main research subject of the group led by him. When the group was first formed, Julio married Ana Chueca Sancho, Doctor in Pharmacy and working at Madrid University. They made their home in Granada and became an inseparable team; Ana was his best support for his research and personal life.

Always interested in new topics, he was involved in the study of the acid phosphatase in prostatic tissue (López-Gorgé and Villanueva 1968) and in the identification of commercial varieties of potato in collaboration with the Commerce Ministry (Ruiz Nieto 1990). He is the author of a patent entitled 'Methods to Preserve Mushrooms by lyophilization'. He helped J.P. Donaire in the biochemical and physiological aspects of olive trees (Donaire et al. 1975), an important crop in the economy of southern Spain. With L.A. del Río he was involved in the characterization of reactive oxygen species (ROS)-related enzymatic systems in pea plants (del Río et al. 1978). He supervised the PhD theses of M.A. Díaz

and M. Barón on the effect of some heterocyclic herbicides on CO₂ assimilation and the Photosystem II machinery (Díaz et al. 1980; Barón et al. 1986).

However, his major contribution was made in elucidating the redox regulation of the carbon metabolism. With his associates J.J. Lázaro, A. de la Torre, A. Plá and N. Algaba, he reported on the structure, biosynthesis, phylogeny, action mechanism, molecular aspects, regulation, and kinetics of chloroplastic FBPase. The purification and characterization of the spinach FBPase was the first step in a series of studies on this enzyme in photosynthesis research. The protein is light modulated due to a change in pH and Mg²⁺ concentration in the chloroplast stroma, and because of the reduction of a disulphide bridge via a reductive interaction with thioredoxin *f*. The FBPase regulatory domain (loop 170) contains the cysteines involved in redox modulation (Carrasco et al. 1994; López-Jaramillo et al. 1997). This fragment displays negatively charged amino acids, which interact with a hydrophobic groove of thioredoxins (Hermoso et al. 1996; Wangenstein et al. 2001). The study of the cytosolic counterpart of the fructose-1,6-bisphosphatase shed light on the regulation in plant sucrose synthesis (Cazalis 2004). For these reasons, the admired Professor Bob Buchanan gave him the title of 'The king of fructose-1,6-bisphosphatase' at a conference. In 2002, an invited review on chloroplastic FBPase was published in *Photosynthesis Research* (Chueca et al. 2002), discussing all the discoveries made in relation to this enzyme in photosynthesis.

In collaboration with researchers from Europe (J.P. Jacquot and Y. Meyer of France) and the Americas (R. Wolosiuk of Argentina; and D. Knaff of the USA), Julio launched an interesting and new research topic seeking to characterize and define the specific function of each plant thioredoxin. These proteins, found in several copies and different locations, appear to have important functions related to different stages of the development and defence of the plants in response to environmental stress (Pagano et al. 2000).

Julio's group also became involved in plant biotechnology. In this field, in *Arabidopsis thaliana* plants, expressing antisense chloroplastic FBPase, an increase in the leaf-sugar content was found; this became a useful tool for a pos-

sible application in agriculture to improve the organoleptic qualities of different products, such as in strawberries (Sahrawy et al. 2004). Recent studies by the youngest members of the group, J.A. Traverso and J.D. Barajas, on cytosolic and chloroplastic Trxs promoters showed a valuable expression pattern defining new roles during plant development.

Two years ago, Professor López Gorgé, in collaboration with Dr J.L. Gonzalez Rebollar, had the privilege to set up one of his master projects, thought out for many years. This was a multidisciplinary project granted by the Ramon Areces Foundation, with the participation of scientists from different fields, assessing the potential technological uses of C₄ and CAM (Crasulacean acid metabolism) plant species in the south-eastern Spain adapted to an arid agrosystem. These autochthonous plants can help in revaluing regions where water is a limiting factor. Despite that, Julio could not see any of these projects completed, although he had the pleasure of seeing the first promising results.

Julio dedicated a significant part of his time and energy to the CSIC and the Institute, contributing greatly to its successful development. He served as Chairman of Biochemistry Department and Vice-Director of the Institute and served on several scientific committees. Dr López-Gorgé was a charismatic and active leader in his field and one of the most prestigious scientists in the Spanish Societies of Plant Physiology, Biochemistry and Plant Molecular Biology. He coordinated, in collaboration with other researchers, the CSIC thematic program 'Nutrient Fixation and Mobilization: Photosynthesis, Nitrogen Fixation and Mycorrhizas'.

The good relation with scientists of South American countries allowed the establishment of many links. Julio travelled over 30 years to these countries and received in his laboratory the visit of several researchers, some of them completing their PhD work. Special mention must be made of Ricardo Wolosiuk (Instituto Leloir of Buenos Aires), Eduardo Pagano (University of Buenos Aires) and Fernando Prado (University of Tucuman) from Argentina and C. Gonzalez's group, especially Olga Lastra from the University of Santiago of Chile.

Dr López-Gorgé was a very fine plant biochemist and talented in answering the questions

posed by the young scientists. But music was his other big passion. He was a music buff, a formal spectator in the summer Salzburg Festival, a staunch follower of the Orchestra of the City of Granada (OCG) ever since its creation. Recently named Chairman of the society 'Friends of the OCG', he had many projects in mind, unfortunately, without time to put them into practice. In his free time he wrote a book, '*Don Carlos*, a drama between the history and the legend' of Verdi.

Above all, Julio loved his family. He is survived by his wife, Ana, his son Ignacio, architect and film maker, and his daughter Amalia, teacher of music and cellist. He was a warm and gracious man and will be missed.

The sound of Bach played by Piotr, a violinist and friend of the OCG, was heard at his funeral.

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