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In memory of David A.A. Mossel (1918-2004)

On August 30, 2004, Professor David A.A. Mossel passed away suddenly, after a normal working day. Despite his age, he had maintained his energy, vitality, and wide range of activities. He died working, as he would have probably desired. David Alexander Antonius Mossel was born in 1918 in Amsterdam, where he attended secondary school until 1936. He studied Medicine at the University of Leiden (1936-1941) and Human Biology at the University of Utrecht (1945-1949), obtaining his Ph.D. in 1949 with the doctoral thesis "Water in food: its influence on microorganisms". He received a Masters Degree in Food Science at the University of Cambridge in 1948, working with Sir Graham Wilson and Maurice Ingram, and a Diploma in Water and Food Microbiology at the Pasteur Institute in Paris and Lille in 1961, under the guidance of Professor Jacques Monod (Paris) and Professor René Buttiaux (Lille).

Among his academic positions, those most outstanding were: Full Professor of Food and Water Microbiology at the Catholic University of Louvain, Louvain-la-Neuve, Belgium (1969-1974), and at the Veterinary Faculty of the University of Utrecht, the Netherlands (1974-1989). As a researcher, he held executive positions in organizations associated with the International Union of Microbiological Societies: President (1976-1989) and honorary president (since 1989) of the

International Committee on Food Microbiology and Hygiene, and member of the International Commission on Microbiological Specifications for Foods (1962-1975). After his retirement, as Emeritus Professor of the Universities of Louvain and Utrecht, he continued his work as President of the

Christiaan Eijkman Foundation for Medical Research, which is affiliated with the University of Utrecht. There he trained post-graduate students in the field of food microbiology. During this last period, he wrote a teaching module on "Public Health Microbiology of Food and Drinking Water" for the International Distance Learning, Medical Sciences Education for Public Health Science: Food and Drinking Water (University of Hertfordshire, UK).

His work received international recognition, as reflected by several doctorates *honoris causa* awarded to him in Medicine, Agronomic Sciences, and Veterinary Medicine (the latter from the University of



Fig. 1. David A. A. Mossel (1918-2004).

León), and he was an invited lecturer at the Office of Naval Research (Chicago), Massachusetts Institute of Technology (Cambridge, MA), Queen's University (Belfast, UK), and at the University of Wisconsin at River Falls. In Boston, he gave a guest lecture in memory of Samuel Cate Prescott and William L. Underwood. As a visiting professor, he lectured and taught in almost fifty universities around the world. In Spanish-speaking countries, he was Honorary Visiting

Professor at the University of San Marcos in Lima, Perú, and at the University of the Basque Country in Vitoria, Spain. He was also Honorary Member of the British Society for Applied Bacteriology, the Institute of Food Science and Technology of the United Kingdom, the Société Française de Microbiologie, the American Public Health Association, and the Hungarian Institute of Food Science and Technology. He also had a Diploma of the American Veterinary Epidemiological Society and of the American College of Veterinary Preventive Medicine, and was Foreign Corresponding Member of the Spanish Royal Academy of Veterinary Medicine.

Professor Mossel was Editor-in-Chief of the *International Journal of Food Microbiology* and of the *Acta Alimentaria* of the Academy of Sciences of Budapest. In 1990, he became a member of the Editorial Board of the journal of the Spanish Society of Microbiology (*Microbiología SEM* and *International Microbiology*). He received several Dutch and international awards, including Knight of the Netherlands' Lion, bestowed by the Queen of Holland, the Silver Medal of Utrecht University for academic merits, and the Commander of the Order of Saint Silvester (Rome).

Mossel also took part in the Second World War. During those years of enormous amounts of suffering and death, he developed an interest in food- and water-borne diarrheic diseases, a subject to which he devoted a great part of his professional life. His more than 350 research articles, published in the most prestigious scientific journals, cover most aspects of food microbiology: poisoning and human infections of alimentary origin, food microbial spoilage, public health, microbial taxonomy, analytical techniques in food microbiology, new culture media, etc. He was a pioneer in food microbiology and trained several generations of researchers. Along with other outstanding scientists, such as Haines, Wilson, Ingram, Hobbs and Buttiaux—among the Europeans—and Tanner, Dack and Frazier—among the Americans—, he contributed to developing the body of knowledge comprising food microbiology. Before the efforts of these microbiologists (i.e. prior to 1935), this field consisted of only a few routine laboratory analyses to monitor the presence of “coliforms” or coli-aerogenes bacteria and total plate counts of aerobes. Mossel's most outstanding contributions were in food microbial ecology, mainly the study of factors that influence the growth of microorganisms in food, and microbial associations. Ingram had initiated studies demonstrating that

growth depends on certain factors, intrinsic (or dependent on food itself, such as pH, a_w and E_n) and extrinsic (or imposed from the outside, such as temperature, humidity and atmosphere composition) and Mossel very efficiently continued them. Currently, food industries take all these factors into account in order to inhibit the growth of pathogens and of microorganisms causing food spoilage.

Mossel's activities in seeking to improve to food hygiene and public health also deserve to be mentioned. He proposed an active intervention system throughout the food chain, at every link, to prevent food-borne diseases, instead of the traditional retrospective system, which consists of analyzing samples of the final products. This new approach, or integral strategy, for which Mossel invented the sonorous acronym LISA (longitudinally integrated safety assurance), has been incorporated into European Union rules seeking to assure food safety “from the farm to the table”. Of great importance were Mossel's contributions to formulating new culture media, using *Enterobacteriaceae* as indicators and to the definition of microbiological reference values or microbiological limits. His studies on the latter were precursors of the current procedures of risk assessment and the determination of food safety objectives, which nowadays are issues of great interest.

I met David Mossel in 1977, on the occasion of the first scientific meeting on food microbiology of the Spanish Society for Microbiology, which took place in Madrid. That was the beginning of a close relationship both scientifically and personally. We coauthored a book on food microbiology, published in 1985, of which a second edition was released in 2003. I also spent a sabbatical at his laboratory in the Netherlands. He was a man with a strong personality—extroverted, good-natured, and easily accessible, especially to the most humble. These features, together with his near-perfect knowledge of several languages (apart from his native Dutch he spoke English, French, German and Spanish fluently) and his mastery in motivating his students, who followed him after his classes, won him many disciples and admirers. His energy, vitality and enormous capacity for work were an inspiration to all who knew him.

Mossel's qualities enabled him to become a great contributor to the birth, childhood and development, over more than fifty years, of food microbiology and to spread his message worldwide. It is up to other investigators to follow the path he paved.