

In memoriam Charles Noirot (1922–2010)

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Professor Charles Noirot died on 23 September 2010 at the age of 88. He was known throughout the scientific community as one of the greatest termite specialists of the twentieth century. He leaves an exceptional legacy of over 150 publications, including many that are seminal in the understanding of these social insects. The outstanding scientific contributions of Charles Noirot began in 1945 and continued until late in his life, concluding in 2003. His brilliant review articles will remain essential landmarks of science for many years to come. The news of his death has

produced many tributes and the unanimous feeling that an era in termite science has come to an end.

Charles Noirot was born in Paris on 16 July 1922 in a family with roots in the Jura. His enthusiasm for nature led him to study biology at the Sorbonne. There, he quickly attracted the notice of Professor P.-P. Grassé with whom he would come to co-author several publications and who suggested that he studies termites in the field. Appointed to the Office for Overseas Scientific and Technical Research (Office de la Recherche Scientifique et Technique d'Outre-Mer) he was first posted to Côte d'Ivoire (1946–1948) followed by a 6-month assignment (1948) in Algeria, Niger, Chad, Central African Republic, Cameroon and a 3-month (1958) foray in the Congo river basin (Cameroon, Congo and Gabon). These observations of termites in situ convinced him of their full potential as a model biological system and gave him a passion for the Isoptera that would never leave him. Employing his extraordinary capacity for work and exceptional memory, Charles Noirot would accumulate an unequalled knowledge of the diversity and biological complexity of these social insects. Returning to France to pursue an academic career and being strongly influenced by the work of V.B. Wigglesworth, he arrived in the University of Dijon in the sixties. There, he proceeded to gather a team of entomologists focusing on physiology, and specifically on the hormonal control of development and chemical communication. Admired for his clarity of mind and always abreast of the latest developments and issues in biology, he was often sought after by editors of the leading peer reviewed journals. For most of his academic career and beyond, he served in many scientific committees of the CNRS, both as an elected and as a nominated member. In his later years, he focussed on fewer projects, devoting himself to writing on the more essential concepts of termite science.

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The international reputation of Charles Noirot largely rests on his work on termites. While his research interests were extensive, the recurring theme was always the quest to understand the social organisation of Isoptera, and define its influence both on termite biology and on the evolutionary history of the order. No area of termite biology escaped his curiosity, but we recall here the two areas where he can be acknowledged as the pioneer. The first is social polymorphism and this made his reputation, as it led to an understanding of the structure of termite societies and their evolution. In particular, we owe to him the concepts of the pseudergate and of regressive molts, the specificity of the neotenic molt, the primary importance of sex-related factors in caste differentiation and the full details of temporal polymorphism in termites. The second area is the digestive tract and nutrition, a focus of his work throughout his career. His research in this field represents a major contribution to termite systematics and the understanding of the phylogeny of termites. His early observations on the intestinal flora of these insects inspired many later studies on the origin of the symbiosis and the phylogenetic position of termites within the Dictyoptera. His detailed description of the digestive tube led directly to the creation of the new subfamily Apicotermittinae and provided the means to recognise many new species. His work on the digestive tract is also the foundation for contemporary, phylogenists who can now link molecular data with precise morphological correlates. The cytological descriptions published with his wife Cécile Noirot-Timotheé also became the groundwork for later research which demonstrated the physiology of the termite fermentation chamber to be that of a bioreactor. To emphasise these two researches is not, however, to overlook his contribution in many other areas, amongst which one can cite the biology of fungus-growing termites and colony foundation, as well as the structure and evolution of nests. He can also be recognised for his descriptions of the structure and the role of endocrine and exocrine glands in polymorphism and chemical communication.

In addition to being a brilliant researcher, Charles Noirot was also a great teacher who inspired many to pursue studies in the natural sciences. Paris was the setting for his first teaching position. Later, he became involved again in Africa, being instrumental in creating in 1959, the Centre d'Enseignement Supérieur in Abidjan, Côte d'Ivoire. This centre, which he directed until 1963, would later become the nucleus of the University of Abidjan. In 1964, he was named to the chair of Zoology at the Faculty of Sciences in Dijon.

He taught there until 1987, passing on an expert knowledge of zoology to many generations of students. One highlight of his career in Dijon was the development of a curriculum specialising in insect physiology. Thinking ahead on the future of biological sciences, he also created a Masters programme in Cell and Molecular Biology to prepare the next generation of students and researchers. Former students still remember him for the quality of his lectures and his constant availability in spite of his heavy workload and professional responsibilities.

The character of Charles Noirot was one of natural authority in his laboratory, based as it was on his knowledge and intellectual vigour. Robust and objective interpretation was the cornerstones of his experiments and studies, and those of his young team. A true scientific mentor for many, he held individual researchers in the highest respect, ceaselessly trusting in and supporting their creative freedom. A man of humility and rare intellectual generosity, he will be remembered by all of us, students and colleagues, as a talented, passionate researcher who coupled an exceptional refinement with an exemplary scientific rigour.

Finally, we must recall the eminent role played by Charles Noirot in the international social insect community. Firstly, because he inspired several pathways of research beyond termite science. Secondly, because he attended each four yearly meeting of the IUSSI from the founding symposium in Paris in 1952 until the Paris congress in 1994, where he was made honorary president. Additionally, he played a major role in the rescue of the journal "Insectes Sociaux" in the 1970s and 1980s and in resurrecting the French section of the IUSSI. International tributes were paid to him in Dijon in September 2000 (Jacques Pasteels, 2001. Charles Noirot: an obligatory reference. *Insectes Sociaux* **48**: 185–186). The Golden Book he received on that occasion bears witness to his huge contribution and to the generous intellectual partnership he made with the scientific community all through his life.

Charles Noirot was more than a scientist of international renown. Deeply human, he felt a strong bond with Africa and its inhabitants. Our African colleagues have not forgotten the man who spent many years walking their savannas and forests and never failed to support the development of their educational system. The thought that arose at the news of his death is one that is reserved to the great: "a baobab has fallen".

Today, we all realise how much we owe to Charles Noirot.