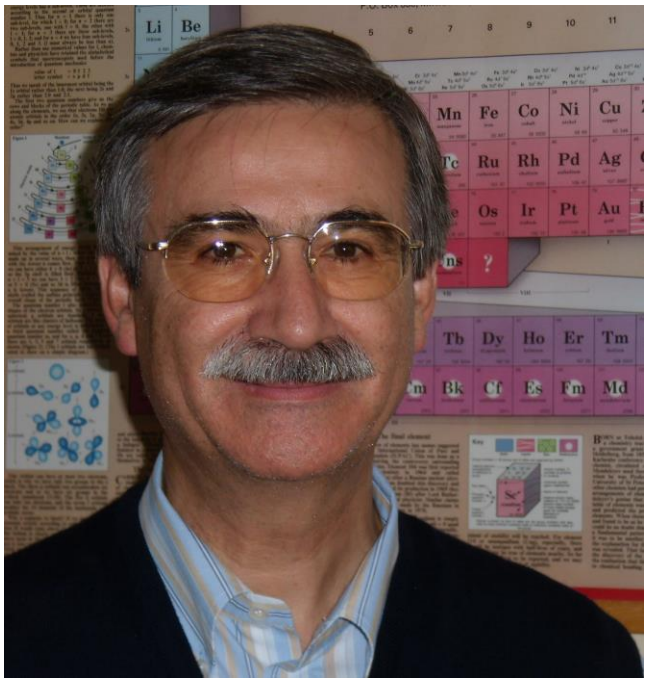
Professor Benito Alcaide

A Tribute



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It is a pleasure for me to write a tribute to introduce this Commemorative Issue of ARKIVOC dedicated to Professor Benito Alcaide on the occasion of his approaching 60th birthday and as acknowledgement of his contribution to the development of stereocontrolled organic synthesis. The research of Prof. Alcaide has certainly put him in a prominent position among synthetic chemists, particularly in the field of β-lactam chemistry.

Benito Alcaide was born in Aldea del Rey (Ciudad Real, La Mancha, Spain), on April 29, 1950. Professor Alcaide studied chemistry at the Universidad Complutense de Madrid (UCM). He graduated in 1972, being attracted to the field of organic chemistry by the stimulating classes of the late Prof. Manuel Lora-Tamayo (pioneer in the development of Spanish Organic Chemistry and former Spanish Education Minister). After a six-year period (interrupted for fifteen months because by compulsory, "Servicio Militar") he finished his Ph.D. in 1978 entitled, "Synthesis, optical resolution, and study of the chiroptical properties of polycyclic ketones" at UCM under the supervision of Prof. Franco Fernández. During this time he met a young lecturer, Carmen Pardo, who helped Benito to write up his dissertation in the absence of Franco Fernández (who had been appointed to a

chair at the Universidad de Santiago de Compostela). Carmen Pardo became his wife, on July 18, 1977.

Carrying out research in Spain at this time was not an easy task. However, Benito and others chemists of his generation contributed to the further development of organic chemistry in Spain. Younger organic chemists should be grateful to these people for this major restructuring of the scientific landscape in Spain, being fundamental in putting it into a competitive position in the field of organic chemistry.

The academic career of Benito Alcaide began in 1976 when he was appointed to the position of Assistant Professor in Organic Chemistry at the Faculty of Sciences of UCM. He became Associate Professor in 1984 and in 1990 was promoted to the position of Full Professor at UCM. Although Benito does not like to assume administrative responsibilities, he held the position of Head of the Department of Organic Chemistry from 1990 to 1992.

The research interests of Prof. Alcaide have mainly centered on stereocontrolled synthesis, in particular β-lactams and other biologically relevant heterocycles. Professor Alcaide's scientific career began with studies on the synthesis and chiroptical properties of model steroid ketones. He demonstrated that the synthesis, optical resolution, and circular dichroism of several *trans*-transoid-*trans*-perhydrophenanthrenones can be accomplished. Then, during his studies on α-iminoketones and related compounds, he discovered that the addition of methyl lithioisobutyrate to *N*-(α-methoxyphenacyl)anilines can proceed with total regiocontrol, and that the reduction of chiral α-iminoketones is stereocontrolled. After this initial period, Benito's chemical interest moved from ketones to 2-azetidinones. The fact that the β-lactam nucleus is the key structural feature of β-lactam antibiotics, particularly penicillins and cephalosporins, attracted Benito's attention to β-lactams. Initially, the four-membered heterocyclic ring was prepared using the metalloester enolate-imine condensation, and subsequently he built the functionalized β-lactam nucleus using the ketene-imine cycloaddition (Staudinger reaction). In this sense he was a pioneer since not many people in Spain were involved in β-lactam chemistry at that time. During these studies, he devised an original preparation of 4-oxoazetidine-2-carbaldehydes (or 4-formyl-β-lactams) by a one-pot method from glyoxal-derived diimines. These bifunctional compounds, which can be considered both as protected α-amino aldehydes and masked β-amino acids, exhibit a valuable dual reactivity which has been utilized by Professor Alcaide in a broad range of synthetic applications.

Benito Alcaide became involved in the development of nitrogen-containing molecules of biological relevance through 2-azetidinone-based methods. Proof of this can be found in the enantioselective preparation of amino acid derivatives, pyrrolidines, pyrroles, γ-lactams, succinimides, enaminones, morpholinones, tetrahydroazocinones, bis-γ-lactams, piperidines, indolizidines, pyrrolizidines, and quinolizidines, among others.

A very fruitful research area has been radical chemistry, leading to the development of diverse methodologies for the preparation of benzocarbapenems, benzocarbacephems,

unconventional polycyclic β-lactam bearing different-sized rings, and β-lactam-biaryl hybrids.

One of the major interests of Benito Alcaide over the years has been in the area of cycloaddition chemistry. The use of thermo or catalyzed ene reactions, Diels–Alder reactions, hetero Diels–Alder reactions, 1,3-dipolar cycloadditions of both nitrones and azomethine ylides, as well as [2+2] cycloaddition reactions gave rise to a variety of diversely functionalized 2-azetidinones. Benito also studied organocatalysis, which has emerged as a new and powerful tool in chemical synthesis.

During recent years the use of transition metals in organic synthesis has also been a focus of his research. One of the most important of all these achievements has been the discovery of a practical ruthenium-catalyzed cleavage of the allyl protecting group in amines, amides, lactams, imides, and related compounds. Particularly remarkable are the studies on the controlled chemo-, regio-, and stereoselective cyclizations of allenes. For example, he developed metal-catalyzed domino cyclizations of α-allenols followed by a coupling reaction leading to functionalized dihydrofuran derivatives.

Benito Alcaide has supervised 7 post-doctoral fellows and 18 PhD students. Almost all of them have gone on to positions of research in either industry or academia. The success of the students and post-docs is measured not only in their personal achievements in securing competitive employment but also by the excellent training they received.

Professor Alcaide is the author of over 200 scientific papers in prestigious international journals dealing with organic and multidisciplinary chemistry.

Apart from chemistry Benito enjoys sport. It is always interesting to discuss football with him because Benito is an enthusiastic supporter of the Real Madrid soccer team and I am not! He also enjoys walking in the countryside accompanied by his dog Mora, a black Labrador Retriever.

At home he is involved in a scientific atmosphere. His wife, Prof. Carmen Pardo, is an organic chemist specializing in supramolecular chemistry. Benito has two sons and a daughter, but neither of them followed their parents' chemistry career. His youngest son, Angel, is pursuing undergraduate studies on Electronic Engineering; his daughter, María, is carrying out doctoral research in the biocompatibility of materials in bone tissue, and his eldest son, Benito, is a medical doctor specialized in surgery. Prof. Alcaide recently became a grandfather with the birth of Martin, the son of Benito Alcaide, Jr.

Having had the privilege of doing research with Professor Benito Alcaide, it is a great pleasure to write these brief notes about the areas in which he has achieved distinction.

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