Professor Serge David

This issue of *Carbohydrate Research* is dedicated to Professor Serge David on the occasion of his 70th birthday, in recognition of his outstanding contributions in carbohydrate chemistry and biochemistry.

Serge David was born on November 6, 1921 in Grenoble in the heart of the French Alps. After finishing school in this town, he entered the well-known École Normale Supérieure, rue d'Ulm, Paris.

The keen interest of Serge David in experimental work began during his undergraduate studies by discovering, under the direction of Professor George Dupont, a new method for the preparation of cyclopentene by hemihydrogenation of cyclopentadiene. In 1945, he chose to complete his training at Magdalen College, Oxford, and joined the laboratory of Robert Robinson where he worked on the lipids of the tuberculosis bacillus. For this work, he was awarded his Ph.D. in 1947. He returned to Paris and investigated the structure of germanicol, a triterpene, which had just been isolated from *Euphorbia latex* by Marc Julia. Within fifteen months, without the modern techniques of analysis, he succeeded in elucidating the complete structure of this thirty-carbon pentacyclic alcohol. At the age of 27, he was appointed to the post of Lecturer in Biochemistry at the University of Nancy, just before he defended his French doctoral thesis. He achieved the status of Professor of Organic Chemistry in 1956 at the same University, and then in 1963 at the University of Paris-Sud in Orsay.

At Nancy, his first studies dealt with the components of hops in collaboration with the brewers of Lorraine, which resulted in him being named as their representative in the European Group of standardisation of brewery analysis. At the same time, he began his interest in the study of metabolism, and was a pioneer in France for the use of radioactive tracers. He then embarked on the difficult problem of the biosynthesis of thiamine, only present in small amounts in microorganisms. It took him 30 years to determine the origin of all carbon atoms of thiamine. It was particularly satisfying for him to discover that carbohydrates were involved in the building of both heterocyclic components of thiamine. Among other contributions in biochemistry, he showed that the D-ribose unit of yeast RNA resulted from the elimination of C-1 from D-glucose. In 1966, he tackled a new project concerning the biosynthesis of the deoxyribose unit of DNA, which still remains a challenging problem. He unambigously demonstrated that the reduction of the hydroxyl group of cytidine by bacterial or rat tumor enzyme takes place with retention of configuration.

In the fifties, labelled, complex molecules were not commercially available. The interest of Serge David in carbohydrate chemistry was initially motivated by a need to synthesize specifically labelled monosaccharides. His wide scientific knowledge led him to embrace all the aspects of that discipline. A first major question concerned the conformation of sugars and the origin of the anomeric effect. He experimentally probed

the interaction between the oxygen atom p-type lone pair and the adjacent, antibonding carbon–halogen orbital by nuclear-quadrupole-resonance measurements on seventeen pyranosyl chlorides and bromides.

As an organic chemist, Serge David introduced new methods into carbohydrate chemistry, such as the use of organotin derivatives and the extension of the hetero Diels–Adler reaction in the total synthesis of monosaccharide units. As soon as 1974, he discovered a new reaction, namely the conversion of diols into hydroxyketones via stannylenes, which turned out to be an efficient and regioselective reaction in carbohydrate chemistry. The structure of carbohydrate stannylenes was investigated by X-ray crystallography and ^{119}Sn-n.m.r. spectroscopy; Serge David suggested that the dimeric structure of stannylene was responsible for their regioselectivity towards electrophiles. Of great interest was the highly regioselective allylation or benzylation of one specific hydroxyl group. The most spectacular result from his laboratory was the straightforward synthesis of the 3'-allyl ether of methyl β-lactoside in 70% yield.

Alongside the oxidation of stannylene by bromine, Serge David discovered that triphenylbismuth diacetate converted sugar-derived diols to monophenyl ethers under mild conditions, with a preference for axial substitution. Regarding the cycloaddition, Serge David suggested in 1973 the construction of a new sugar unit on a dienyl ether of monosaccharides. This was apparently the first investigation of chiral induction in cycloadditions, which led to the first synthesis of chiral dienes. He developed this method to build the D-galacto unit of the nonreducing end of the antigenic blood groups. Thus, half a gram of the A trisaccharide was synthesized. In fact, Serge David became interested in the synthesis of oligosaccharides as soon as the structures of blood group epitopes were determined. His work in this area started with the synthesis of a branched pentasaccharide isolated by Kabat from ovarian cyst mucins; it was, at that time, the most complex oligosaccharide isolated from blood group substances. This synthesis, reported in 1977, was probably the first synthesis of a pentasaccharide. From this work, a vast program of oligosaccharide synthesis was initiated and developed in close collaboration with Ten Feizi at Harrow Hospital, England. This is a good example of a fruitful collaboration between immunologists and chemists which, through an unequivocal chemical synthesis, led to the exact determinations of Ii blood group epitopes.

In the eighties, Serge David showed great vision by realizing the potential of enzymes in synthesis, and started a new project on the use of immobilized enzymes in preparative sugar chemistry. With the help of the immobilized sialylaldolase, he described the preparation of *N*-acetylneuraminic acid, the most common sialic acid, on a ten-gram scale and subsequently of a large number of other natural sialic acids. In parallel with this work, he succeeded with a five-enzyme reactor in preparing four glycolipids and two glycoproteins sequences by enzymic galactosylation of chemically synthesized precursors. The door was opened for the enzymic synthesis of oligosaccharides as a valuable alternative to the chemical one.

Throughout his career, Serge David showed a continous interest for the interplay of chemistry and the life sciences. In 1965, he instigated a joint effort with the immunol-

ogist Pierre Grabar for the preparation of antinucleoside antibodies involving the synthesis of several nucleoside conjugates, at the very time when the occurrence of antinucleic acid antibodies was being debated. He also achieved the synthesis of several natural compounds, such as pseudocytidine, kasuganobiosamine, and a glycoside of purpurosamine.

Serge David is the author of more than 200 publications. In autumn 1990, he retired from his teaching responsabilities at the University, but his departure does not signify an end to his involvement in chemistry. He has just been named Professor Emeritus at the University of Paris-Sud and has set out an ambitious program on the synthesis of macrolides.

A quiet and reserved person, Serge David, over the years, has been greatly appreciated by people who have worked with him for his sense of humor, his great subtlety, and his cultural qualities. He still has a love for the mountains and is a keen hiker and skier. He is very active physically and intellectually, and walks ten kilometers per day between his house in Orsay and the laboratory.

We wish him a very happy retirement and every success in his continuing research.

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