ester hydrolysis

In the course of his studies on the oxidation of acetals, Dr. Deslongchamps made a startling experimental observation: in a certain chemical reaction, only one ester was formed although the tetrahedral intermediate present should have decayed into two different esters according to the classical rules of chemistry. To explain this result, Dr. Deslongchamps assumed that the oxidation of acetals by ozone led to an intermediate with a specific conformation. This species then tended to cleave in one direction only, producing exclusively one of the two possible esters. This preference was thought to be explained by the fact that the observed ester was much more likely to form since the process required less energy. This deviation from normal chemical rules led Dr. Deslongchamps to formulate his new theory on the stereoelectronic control of hydrolysis reactions.

Further experiments based in particular on the synthesis and the reactivity of orthoesters confirmed the new theory.

For the past few months, Dr. Deslongchamps has been using the technique of tagging an amide or an ester with an atom of oxygen-18, a rare isotope of the common kind of oxygen. In this way, he is able to determine the precise conformation of the intermediate in hydrolysis reactions and to predict from his stereoelectronic theory the final products of the hydrolysis reaction. Mass spectrometry is then used to analyze the reaction products.

Through the efforts of scientists like Dr. Deslongchamps and his coworkers, organic chemistry is shedding its former reputation as an imprecise branch of science in which chemists can only prepare "soups" containing, in addition to the desired compounds, various unwanted impurities. Dr. Deslongchamps has perfected well-controlled quantitative reactions that fully convert starting materials into the desired compounds. This is of considerable practical importance to the chemical and drug industries which need to tailor synthesis procedures for a good yield and fewer fabrication steps.

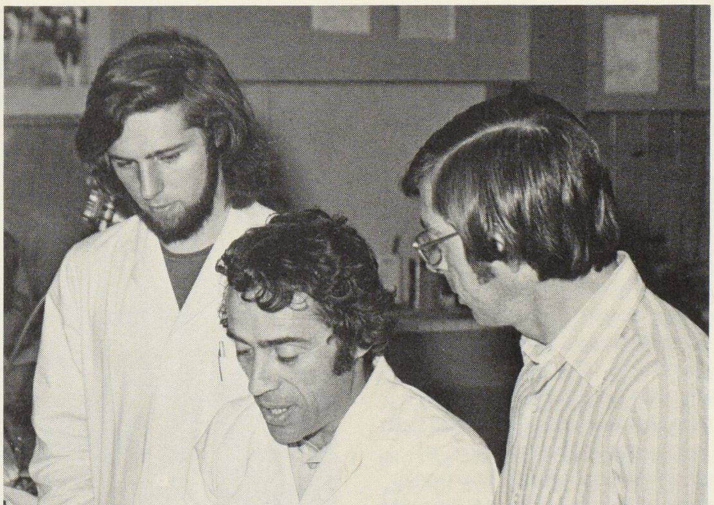
In living cells, for example, nucleic acids are linked together by ester and phosphoric acid bonds. Thus the transposition of Dr. Deslongchamps' ideas might eventually lead to the synthesis of DNA and of polynucleotides.

Understanding enzymatic action in hydrolysis reactions is also paramount in medicine. Each cell of a living being is a chemistry laboratory of great sophistication where many reagents are enzymes created for a specific purpose, under tight control. Taking account of the tri-dimensional nature of enzymes might be the key to understanding their reaction mechanisms. ☐

Michel Brochu

Two of Dr. Deslongchamps' collaborators are seen discussing scientific data with him: from left Roger St-Onge, Ph.D. student, Luc Ruest, research assistant and Dr. Deslongchamps.

Discussion scientifique entre le professeur Deslongchamps et deux de ses collaborateurs: dans l'ordre habituel, Roger St-Onge, étudiant au doctorat, Luc Ruest, assistant de recherche, le professeur Deslongchamps.



Centre de l'Audio Visuel, Université de Sherbrooke