

Professor Jean Montreuil

This issue of *Carbohydrate Research*, consisting of a collection of papers describing recent advances in the field of glycoconjugates, is dedicated to Professor Jean Montreuil in recognition of his outstanding contribution to a wide range of areas in the field of Glycoconjugates and on the occasion of his retirement from the Chair of Biochemistry at the Université des Sciences et Technologies de Lille.

Jean Montreuil was born on October 11th, 1920, in Lille, North France. He was living in a small village, Trith-Saint Leger, close to Valenciennes, 40 km east of Lille, in an industrial area. He likes to recall that, at Secondary School, he majored in French literature, history, and philosophy, rather than in mathematics and sciences. In 1939, he joined the French Army as a volunteer, and participated in the Campagne de France from October 1939 to November 1940.

At the Faculty of Pharmacy of Lille, he studied pharmaceutical sciences and obtained the “Diploma of Pharmacist” in 1945, together with degrees in the Life Sciences that he prepared during the same period at the Faculty of Sciences. He was eager to be engaged in research, but, since no position was available, he began as a local pharmacist in St. Quentin, Northern France. I guess he was already more interested in concocting some special preparations in the back of the shop rather than selling pills.

As he often says, the chance of his life came in 1948, when he was offered the position of assistant at the School of Medicine, and the opportunity to prepare a Ph.D. thesis under the direction of Professor Paul Boulanger, at the Cancer Research Institute of Lille (Director: Jules Driessens). He was asked to investigate three projects. The first one, the composition, structure, and metabolism of ribonucleic acid in normal and cancer tissue (a real promising program!). The second one (in case the first one would have been too short!), was the structure of gastric mucins and its modification in stomach diseases. The last one (just to keep busy!), concerned the evolution of the carbohydrate content of barley during germination in the beer fermentation process. This program was going to influence his whole life. He kept working on nucleic acids up to 1971 but, more importantly, he started his work on carbohydrates, and it is well known how he developed and influenced the field. He had made up his mind that research should always go back and forth from fundamental investigations to applied developments. Consequently, he always encouraged his collaborators engaged in fundamental research but also to never forget to look for industrial or medical applications. Like his “benchmate” and friend, Gérard Biserte, had done in the field of proteins and amino acids, he took advantage of the new technique of paper chromatography to develop analytical procedures. He always emphasized how important it is to lay any scientific hypothesis on solid analytical and structural bases. In July 1952, he defended his thesis titled “Studies of pentose nucleic acids”.

In 1952, Jean Montreuil was asked to create ex-nihilo the teaching of Biological Chemistry at the Faculty of Sciences of Lille. At that time, it was a real novelty and no more than a dozen students attended his lectures (today more than 300 students study biochemistry each year). In 1956, he started his own laboratory in a rather small building of the old Faculty of Sciences of Lille with half a dozen collaborators. As pioneers, they were setting up the laboratory like a camp, fixing apparatus with nails and pieces of wood, investigating research problems systematically and patiently. In 1965, the Faculty of Sciences moved to a new campus outside of Lille, at Villeneuve d'Ascq. There, in a 1500-m² new laboratory, Jean Montreuil could widely develop his teaching in biochemistry and research in the field of carbohydrates and glycoconjugates. He attracted many investigators and developed his field of research so well that the laboratory became overcrowded and one of his last successes, as Chairman of the Institute, was to obtain the funding for a new building doubling the area of the Institute.

A list of all the contributions made by Jean Montreuil to the research on carbohydrates and glycoconjugates would exceed the space available, so just a few striking accomplishments will be noted. First of all, his immediate objective was to determine the structure of glycans and glycoproteins, as other investigations on metabolism and biological roles had to rely on a perfect knowledge of the structures. Thus, over more than a decade, his laboratory patiently developed precise colorimetric methods, screened many chromatographic procedures, and investigated specific chemical reactions to determine the structures of oligosaccharides. These techniques were applied to the isolation and characterization of new oligosaccharides from milk and urine, a long list that is still growing 25 years later. A further development of these studies was the characterisation of milk glycoproteins which led to the discovery of lactotransferrin in 1959 and milk IgA in 1960. New procedures were described and with the skill and expertise of his first collaborators, A. Adam-Chosson, B. Bayard, S. Bouquelet, B. Fournet, M. Mon-signy, E. Segard, G. Spik, and G. Strecker, the structure of a complex-type glycan component of a glycoprotein (transferrin) was elucidated in 1973. Rapidly, new structures were elucidated, and Jean Montreuil proposed that all N-glycans have the same core, to which are attached various branches that he named "antennae" to better suggest their mobility and potential recognition roles. A few years later, as a result of a fruitful collaboration with Professor Hans Vliegthart in Utrecht, the procedure for the determination of oligosaccharide structures using ¹H NMR spectroscopy was developed, a noticeable improvement since it permitted the reduction by a factor of ten, and now at least by a hundred, the amount of material and time required to elucidate the structure of oligosaccharides.

By the end of 1980, a sufficient collection of structures had been obtained to compare their spatial conformation. After building molecular models, Jean Montreuil proposed interconvertible conformations; he coined first the terms "Y and T" conformations, and later "bird" or "umbrella" conformations as more suggestive. The knowledge of structures has always been for him a prerequisite to the

understanding of biological roles. He encouraged many of his associates to study the metabolism and roles of glycans and glyconjugates. Thus, the study of the catabolism of glycoproteins took its origin from the characterization of urinary oligosaccharides, and, for lactotransferrin ("his beloved child") the study of its interaction with receptors and gene cloning is now the subject of an entire group of investigators. This is also the case for the modification of cell surface glycans in transformed and cancer cells. The original studies on structures have stimulated developments of metabolic investigations and medical applications. This led to one of the first descriptions of normal and pathological catabolism of glycoproteins and the establishment of the molecular basis of glycoproteinosis. Since his first paper in 1949, concerning the intestinal absorption of carbohydrates the name of Jean Montreuil appears on almost 700 papers.

"Enthusiasm" is the key word that I would use to characterize Jean Montreuil with a single word. This enthusiasm gave him a constant spirit of enterprise, the capability to believe that any scientific adventure has to succeed; he is always persistent and never gives up. This enthusiasm led him to draw people to join him in the adventure of going from paper chromatography to NMR analysis, from colorimetric assay to mass spectrometry, from primary structure to 3D conformation, from sequencing to biological roles, and from metabolic studies to molecular biology of glyconjugates. His coworkers are all indebted to him for having been persistent enough to keep the whole laboratory in the field of "glycoscience", giving the opportunity to anyone to go and see "next door" when a problem is encountered outside one's own expertise. Many of us appreciated his talent to give stimulating lectures. No special secret, he just left his enthusiasm to do the job of transforming a long and dull list of metabolic reactions into a fascinating living story. This enthusiasm forces you to react, to enter into action... with him or against, and he never leaves you indifferent. Owing to his enthusiasm, he really created a "school", not only in his department but all over the world. Restlessly, he organized congresses, symposia, meetings, and summer schools, and hundreds of researchers are indebted to him. There is no need to recall the International Symposium on Glycoconjugates he organized on the Campus of Villeneuve d'Ascq in 1973, after the first meeting organized at Swampscott by Professor Roger Jeanloz in 1964. The "1973 Symposium" launched the now well-established series of two-year meetings of the World "glycomaniacs". Over the years, the number of participants has increased from one hundred to almost one thousand. Science has evolved tremendously, but the spirit of friendship and conviviality of 1973 is still alive at each meeting, wherever it is held. In this connection, since 1979, Jean Montreuil has been the French Representative on the Steering Committees of the "International Carbohydrate Organization", the "European Carbohydrate Organization", and the "International Glycoconjugate Symposia".

Jean Montreuil has received numerous awards, among them, the "Maurice Nicloux Award" in 1956, the "Foundation Jaffe Award" in 1982, the "Charles Leopold Mayer Award" of the French Academy of Sciences in 1985, and the

“Silver medal of the Royal University” of Utrecht. He is a permanent Associate Member of the French Academy of Medicine, the French Academy of Sciences, and the Belgian Royal Academy of Medicine. He is Doctor Honoris Gausa of the Free University of Brussels. Although Jean Montreuil has officially retired from the Chair of Biochemistry, this certainly does not mean the end of his involvement in science and teaching, and his interest in glycoconjugates. He is still active in the laboratory and in the French scientific community as Editor in Chief of “*Regard sur la Biochimie*”. His friends and colleagues all over the World wish him a long and happy retirement. I will finish by recalling what Jean Montreuil likes to say when someone claims that he is one of the “Masters” in science, teaching, or others... “Never forget that there are, for a Master, two ways to fail: to have no influence at all on his disciples, or to render them completely identical to him”. What a challenge for all of us!

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