Yves Chauvin

(1930–2015)

Nobel-prizewinning chemist who rearranged carbon–carbon bonds.


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The impact of Yves Chauvin's work across the chemical industries is mind-boggling. By dissecting how carbon–carbon bonds shift in reactions of petroleum compounds, Chauvin revealed the steps in one of organic chemistry's most important reactions: metathesis. This Nobel-prizewinning work laid the path for chemical processes that are now used to make everything from pesticides to drugs. His proudest achievement, however, was developing crucial processes in the oil and plastics industries, now used to produce millions of tonnes of compounds each year.

Chauvin, who died on 27 January, was born in 1930 in Belgium, close to the border with France. His French parents sent him across the border daily to primary school; when his family returned to France, Chauvin finished his education in Paris. His summers were spent in a large family house in Tours, in France's Loire Valley, where he lived out the end of his life.

After finishing his undergraduate degree in chemical engineering in 1954 at Lyon's college of industrial chemistry (École Supérieure de Chimie Industrielle de Lyon), he began working at the French chemical company Progil (now part of Sanofi), where he met his wife, Huguette Labarre.

Chauvin said that he regretted that military service and other circumstances kept him from pursuing a PhD. But he also felt that not having one freed his mind to consider a broad range of topics. He resigned from Progil after two years because managers demanded that he simply copy procedures without exploring ideas from other fields.

In 1960, he moved to his scientific home for the next 40 years, the French Institute of Petroleum (IFP) near Paris. Here, Chauvin devoted himself to accelerating the production of chemicals by a process known as homogeneous catalysis. In this procedure, all components are dissolved in a solution, enabling fine control and the ability to work with large volumes of chemicals at relatively low temperatures. He bucked the trend in petrochemistry that then favoured catalysis on solid substrates, a technique that requires higher temperatures and often produces toxic by-products.

The work led to the invention of processes that are now central to the petrochemical industry. The dimersol and difasol processes pair smaller hydrocarbons to 'octane boosters' added to petrol or, in a modified version, to the starting material for plasticizers, additives that increase the plasticity or fluidity of a material. The alphabutol process combines carbon molecules to make feedstocks and additives for everything from lubricants to plastics.

Chauvin continued to develop homogeneous catalysis. He solved a major problem: the separation of the catalyst from the reaction medium, drawing on his knowledge of batteries to develop ionic liquids as new solvents.

Although Chauvin's name became synonymous with the process of homogeneous catalysis, he is best known for working out the steps of the intricate molecular dance known as olefin metathesis. Here, fragments of olefins — molecules containing double-bonded carbon atoms — swap places with each other, much as dancing couples swap partners. The genius of Chauvin was to co-opt ideas from a very different chemical process called ring-opening polymerization.

In a simple but ground-breaking experiment, he reacted two types of olefin (cyclic and non-cyclic) to show that the resulting products combined fragments of both. He deduced that the molecular swaps were not symmetrical, as was commonly assumed, but were orchestrated by the formation of a temporary hydrocarbon ring containing the metal catalyst. Other chemists, notably Robert Grubbs and Richard Schrock, with whom Chauvin shared the 2005 Nobel Prize in Chemistry, used this insight to improve and develop industrial reactions that underpin much of 'green' chemistry — efficient industrial processes that produce little waste.

When Chauvin retired from the IFP in 1995, he came to work in my surface organometallic chemistry laboratory at the University of Lyon. He would regularly catch the 5 a.m. train from his home in Tours to be at the bench by 8 a.m.

Chauvin's later collaborations adapted homogeneous catalysis to ionic liquids, which can be effectively applied to a variety of reactions, and their products — used for many industrial purposes — are readily isolated from the catalyst.

Yves's scientific virtuosity was tempered with humility. He was reluctant to go to Stockholm in 2005 because he felt that his contribution was less than that of Grubbs and Schrock, who made metathesis reactions broadly practical. He balanced fundamental and applied research, producing more than 100 papers and 130 patents.

Yves was always young at heart. He never missed his 16-kilometre weekly hike or failed to read the weekly edition of *Chemical Abstracts*. His deep curiosity was equalled by a knowledge and intuition that made him a fantastic inventor. Yves is deeply missed, both as a friend and as a great scientist. ■

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