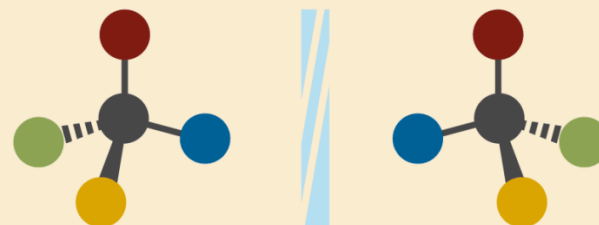


2021 NOBEL PRIZE IN CHEMISTRY



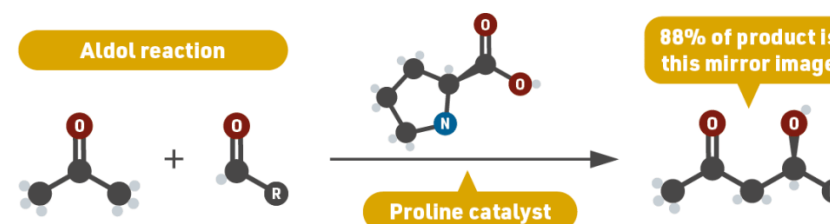
Awarded jointly to **Benjamin List** and **David W.C. MacMillan** for their development of a new type of catalysis, asymmetric organocatalysis, a precise new tool for molecular construction.



Mirror image molecules (enantiomers)

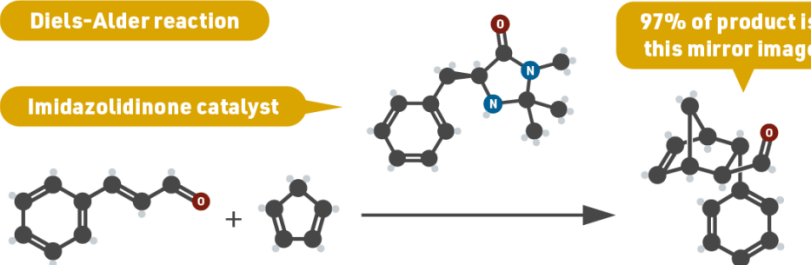
Molecules can exist in mirror image forms with different properties. To make medicines and other compounds we often want just one of these forms. Catalysts, substances that speed up reactions, can help. Nature's catalysts, enzymes, build specific mirror image molecules all the time, but have complicated structures. Metal catalysts can do the job but are sensitive to air and moisture, and sometimes harmful to the environment.

Benjamin List wondered if the single amino acids which build up enzymes could catalyse a reaction on their own. Knowing of previous research on the amino acid proline acting as a catalyst, he used it to catalyse an aldol reaction and found it was efficient – and also formed one mirror image of the product much more often than the other.



Diels-Alder reaction

Imidazolidinone catalyst



David MacMillan tried to develop alternatives to metal catalysts using organic molecules. He identified an imidazolidinone molecule which could catalyse a carbon-carbon bond forming reaction and produced mainly one mirror image of the product. He coined the term 'organocatalysis' for the concept of catalysing reactions using small organic molecules.



Cheaper to use

Environmentally friendly

More efficient

WHY DOES THIS RESEARCH MATTER?

The winners, along with other researchers, have since designed many more organic molecule catalysts. They are cheap, environmentally friendly, and can make specific mirror images of molecules. They can be used one after another for different reaction steps, improving the efficiency of molecule-making.

Nobel Prize in Chemistry press release: <https://www.nobelprize.org/prizes/chemistry/2021/press-release/>



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