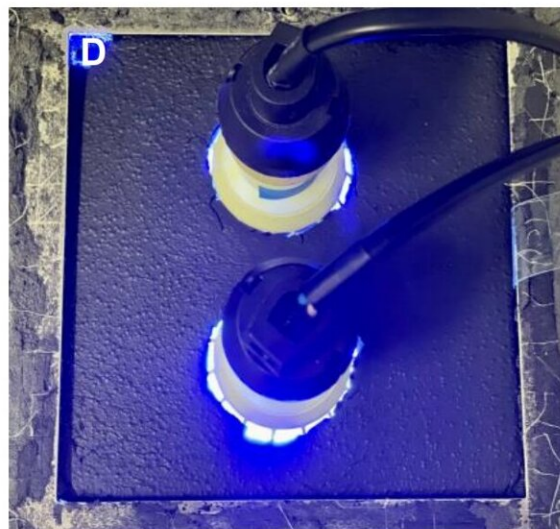
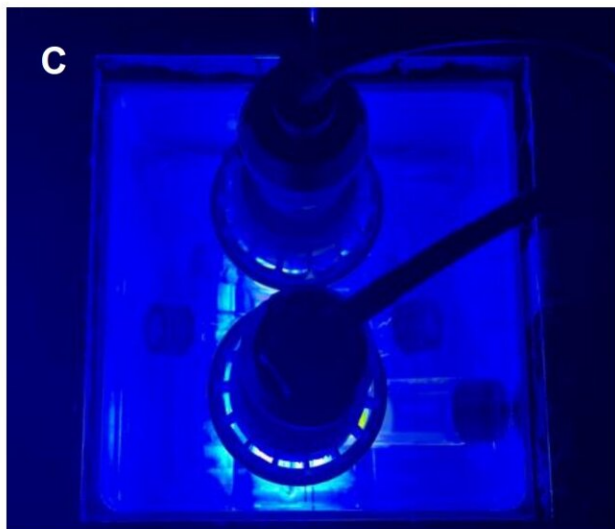


Advancing our mastery of stereoselective photoredox reactions to produce mirror-image molecules

January 24 2023, by Sarah-Lena Gombert



Optimization of the reaction conditions. Reactions conducted on 0.025 mmol scale. Conversions and yields were determined by ^1H NMR using benzyl methyl ether as internal standard. The er was determined by HPLC. N/A = not applicable. N/D = not determined. Below the reaction set up is shown in cryostat: (A) reaction vials in open book reactor, (B) with glass lid on, (C) with blue light on glass lid, (D) covered with insulating material. Credit: *Science* (2023). DOI: 10.1126/science.ade8190

Researchers of the Max-Planck-Institut für Kohlenforschung have expanded the molecular toolbox for efficient, targeted syntheses: To do so, they use a very special catalyst—and the energy of light. The result of their work has now been published in *Science*.

Typically, in a so-called photoredox reaction, [light](#) is absorbed by a photocatalyst. A single electron transfer then occurs between the catalyst and a substrate, creating a radical ion, which is highly reactive and can engage in various desirable transformations.

The problem with these "radicals," however, has been to control their selectivity. A second catalytic activation mode was often necessary to obtain a desired product in the required purity. This has previously limited stereoselective photoredox reactions to special substrates amenable to that second activation mode.

"Photocatalysis enables [chemical reactions](#) to take place with the help of light—for example, in the leaves of plants, but also in the production of drugs," explains Benjamin List, director at the Max-Planck-Institute. Photocatalytic reactions proceed via high-energy intermediates, and controlling the selectivity of their reactions has been difficult. "We now provide a general concept for carrying out these reactions with high stereoselectivity, in which we can produce mirror-image molecules," says Benjamin List.

This means that the photocatalyst absorbs light and takes up an electron from the substrate, i.e. a reaction partner. Since this electron is negatively charged, the [substrate](#) now automatically becomes positive and combines with a counteranion. This ion pair is now involved in another reaction step—the one that really interests the scientists. The original photocatalyst instead is no longer part of this step—and can be regenerated and used again to absorb light and pick up an electron.

With this new method, the researchers of the Kohlenforschung have succeeded in developing another molecular precision tool. "We haven't really thought about specific applications yet," says Dr. Sayantani Das, postdoctoral researcher with Benjamin List and involved in the project. But asymmetric photoredox catalysis could certainly be useful in the field of synthesis—for example, in the production of drugs or fragrances.

More information: Sayantani Das et al, Asymmetric counteranion-directed photoredox catalysis, *Science* (2023). [DOI: 10.1126/science.ade8190](https://doi.org/10.1126/science.ade8190)

Provided by Max-Planck-Institut für Kohlenforschung

Citation: Advancing our mastery of stereoselective photoredox reactions to produce mirror-image molecules (2023, January 24) retrieved 25 April 2024 from <https://phys.org/news/2023-01-advancing-mastery-stereoselective-photoredox-reactions.html>

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