

To boldly go: new frontiers in the discovery of greener biocatalysts for consumer products.

The application of enzymes in chemical industrial processes is increasingly important to achieve the EU's sustainability goals and strengthen the bioeconomy, representing a greener alternative to oil-based chemistry. Society demands more environment-friendly, healthier products and cleaner energy. While enzymes have the potential to meet these demands, they still find several hurdles for their industrial application: low success rates of discovery and engineering; tedious and expensive methods to explore diversity and limited activity/stability in the final application.

Microorganisms represent an unfathomable source of enzymes for the bioeconomy, but only a small fraction of them can be cultivated in the laboratory. Moreover, sampling the natural microbial diversity, screening, identifying and isolating the relevant enzymes is cumbersome, expensive and results in a heavy environmental burden, low yields, high costs and long times to market.

Throughout the course of EU-funded projects CarbaZymes, MetaFluidics, RadicalZ and BlueTools, we have been developing (and will develop) technology to overcome the limitations both for the study of microbial communities and their "ecological use" and to tailor the discovered enzymes towards industrial applications. Our methods for enzyme discovery in the natural and artificial diversity make use of whole cells (*in vivo*) or cell-like compartments (*in vitro*) for recombinant expression, reducing the average time for enzyme discovery and evolution while increasing the amount of sampled sequence space, sometimes finding ourselves in uncharted territory.

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