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Year 2021 closed with the announcement of a non-exclusive partnership between Solvias and Enzymicals. What is the aim of this collaboration?
Solvias has a proven track record in the efficient and successful development of metal catalyzed processes, while Enzymicals focuses on industrial biocatalysis. The combination of complementary methodologies aims to provide our customers the access to a full chemist's toolbox for the efficient introduction of chiral centers and solutions to challenging chemical transformations. While most of the time either the one or the other methodology is considered, we want to be able to select the most efficient, selective and economically favorable catalyst together with our customers rather than adapt to fitting one or the other. The combination of biocatalysis and chemocatalysis enables sustainable production of chemicals that would be impossible to access with the use of biocatalysis or chemocatalysis alone.

In the past decade both chemocatalysis and biocatalysis have become strategic assets widely applicable to asymmetric reactions. what can you both achieve with the use of these processes?
The smart implementation of these complementary methodologies in synthetic route design can result in novel synthetic strategies with the common objective of achieving more sustainable manufacturing. Solvias' expertise in chemocatalysis and Enzymicals' mastery of biotechnology will allow for cutting edge research & development to find the most suitable synthesis for a widening selection of products.

What is the future of the development chemist: a comprehensive tool of chemo- and bio-catalysts to cover all applications and achieve both more sustainable and cost-efficient production?
Catalysis plays a key role in gaining the economic as well as ecological advantages of modern sustainable chemistry. It is important to get the most out of a single resource by applying strategies with emphasis on reducing waste, achieving high selectivities, create structural complexity in a single step, avoiding auxiliaries, protecting groups and achieving a high atom-economy. However, for a truly sustainable production further requirements have to be met which are at first glance independent from catalysis but can be indirectly supported by the implementation of efficient catalytic transformations. For example, downstream processing, isolation or implementation of telescoped steps in the synthetic sequence is much simplified when initially high conversions and selectivities are achieved by use of a powerful catalyst. Well established technologies enable the reliable engineering of (bio)catalysts towards more traditional chemical process conditions with outstanding performance.
We're offering to bridge chemo- and bio-catalysis with the final goal to not only accomplish chemical transformations with minimized purification steps, low cost and improved stereo-chemical control, but also to enhance reactivity and outcome through the cooperative effect between different catalytic paths. In particular, the combination of both technologies within chemo-enzymatic cascades represents an innovative and highly promising path for cost-efficient production strategies. However, it would be presumptuous to claim that this combination is the solution to every synthetic question. The art of process development is significantly more diverse than the sole implementation of catalytic transformations.

Kilo lab facilities at Solvias for synthesis and chemocatalysis.

The huge variety of commercially available ligands and the opportunity to tailor enzymes to specific needs by evolution that Solvias and Enzymicals can now offer provides chemists with complementary technologies to tackle everyday challenges in organic chemistry. can you comment?
The usefulness of new catalytic methodologies for larger-scale production is closely associated not only with the streamlining of the process itself (catalyst loading, accessibility of key starting materials, temperature, safety, volume efficiency, etc.) but also with the commercial availability of biocatalysts or chemocatalysts. While the successful development of biocatalysts relies on enzyme evolution, chemocatalysts (consisting of metal precursor and ligand) rely on the availability of a large diversity of ligands that enables synthesis of the desired product. In turn, modularity in ligand design is an important key for a successful and fast lead finding and subsequent optimization. The resulting large variety of modular (chiral) catalysts has led to significant progress in substrate scope, reaction conditions as well as catalyst costs and availability. Providing these catalysts reliably on scale enables customers to implement new, more efficient synthetic pathways and benefit from sustained cost savings in the competitive fine chemical market. At the end, the most powerful catalytic transformation to e.g. efficiently introduce a stereocenter is of limited benefit if the specific transformation does not fit in an overall streamlined route design. Thus, it is very important to continuously expand the chemist's toolbox with new, powerful catalytic transformations. Therefore, we are convinced that providing services in both, bio- and chemocatalysis is an asset to generate solutions on most of the everyday challenges in organic chemistry and thus making a significant contribution to a more sustainable production environment.

The advent of digitalisation (big data analysis, data mining) and machine learning technologies combined to high-throughput, promises to revolutionise the rational design of catalysts. how does this influence your portfolio?
Computational approaches combined with big data and machine learning can be a very powerful tool to efficiently identify the "best" catalyst for a specific transformation, especially when applying this technology in combination with high-throughput experimentation in a closed loop. However, also on this topic the requirement on a catalyst/ligand portfolio is manifold and not solely based on performance of catalysts (which is very substrate dependent anyways). Storage stability, scalability, easy-to-handle, modularity and especially all aspects of supply chain security are key to use a catalysts/ligand portfolio successfully. Of course, computational and machine learning technologies may assist to identify key structural parameters and thus to efficiently design new ligand derivatives. Due to the generation of large libraries of mutants that can be quickly screened (with for instance microfluidics platforms), biocatalysis is a field that is excellently suited for AI.

Check our websites and get in touch with the respective experts from Solvias and Enzymicals. We'll gladly inform you about the current developments in catalysis and how we can support your goals.

Process research facility at Enzymicals for fermentation development.