

## Editorial

Biocatalysis – the application of Nature’s catalysts, the enzymes, to unnatural substrates – has become an important methodology in synthetic organic chemistry. Besides homo- and heterogenous catalysis, biocatalysis constitutes the third important group of catalytic methods available today. This technique enables extremely high selectivities to be achieved: excellent chemo-, regio-, enantio-, and stereoselectivities could be shown to be obtainable by using biocatalytic methods. In many cases, biocatalysis has proven to be the only approach to solve a given synthetic task. In addition, the use of enzymes, either isolated or as whole microorganism or plant cells, offer tremendous potential for ecologically clean production on an industrial scale.

For these reasons it is not surprising that, with respect to research and development, activity in this area is high on a world-wide scale. To give an overview on recent trends in biocatalysis, this issue of *Chemical Monthly* is devoted to this topic. Researchers in this active area have been invited to contribute. Consequently, the articles presented in this volume give a good summary on the current lines of development.

The finding that enzymes are not only active in water but also in organic solvents was one of the great breakthroughs in biocatalysis which opened a wealth of preparative possibilities. Synthetically, approaches employing these enzymatic transformations are well developed. This is in contrast to the level of understanding the influence of the type of solvent and the content of water on the performance of a given enzyme. In this respect, the review from the group in Milan (*Giacomo Carrea* and coworkers) on the modelling of enzyme properties in organic solvents is of particular importance.

Hydrolases are still the most frequently used enzymes for biocatalytic transformations. From the Delft group (*Fred van Rantwijk* and colleagues), recent examples of developments in the field of lipase catalyzed synthesis of amides are reviewed.

Two other invited reviews are devoted to the application of biocatalysis to organic synthesis: the article on chemoenzymatic synthesis of lipidated peptides by *Herbert Waldmann* and *Dieter Kadereit* from Karlsruhe and a contribution from the Oviedo group (*Vicente Gotor* and *Miguel Ferrero*) on the use of enzymes for synthetic work in the area of nucleoside chemistry.

Regarding the original scientific contributions, the fact that hydrolases are the most commonly applied enzymes in biocatalysis is reflected in the number of articles contained in this issue demonstrating the current trends in biocatalysis. The question of regio- and stereoselectivity in enzyme-catalyzed reactions is considered in an article from another group from Milan (*Enzo Santaniello* and coworkers)

dealing with the lipase catalyzed regio- and stereoselective acylation of hydroxy groups in steroidal side chains. The differentiation between substrates as well as the stereospecificity of transformations employing Penicillin G amidases is described by *Volker Kasche* and coworkers from Hamburg.

The preparation of enantiopure compounds is of tremendous importance in the area of chiral drugs and agrochemicals as well as in the flavour and fragrance fields. One approach still pursued is resolution of racemates employing hydrolytic enzymes. A representative example of this method is presented in the contribution by *Uwe T. Bornscheuer* and coworkers (Greifswald) concerning the resolution of the important drug ibuprofen using lipases. Another example is the article by *Kurt Faber* and coworkers (Graz) on the resolution of linalyl acetate. Here the question is raised how the difficulty of resolving tertiary alcohols might be overcome by novel esterase preparations. A further contribution by *Markus Pietzsch* and colleagues (Stuttgart, Zürich) is devoted to the deracemization of hydantoins.

Hydrolysis of nitriles is a biotransformation of tremendous industrial importance as the basis for the technical production of acrylamide. The question of manufacturing acrylic acid by using an immobilized biocatalyst is raised and discussed by *John Colby* and coworkers (Sunderland).

The introduction of hydroxyl groups onto unactivated carbon atoms in a regio- and enantioselective manner is only possible by using biohydroxylation. One of the most frequently used microorganisms for this purpose is *Beauveria bassiana* ATCC 7159. In the contribution from *Herbert Holland* (Canada) it is shown that also a *L*-specific  $\alpha$ -amino acid benzamidase is present in this microorganism.

The microbial hydroxylation of aromatic compounds leading to cyclohexadiene-1,2-diols is one of the great achievements in biocatalysis. In their contribution, *Derek Boyd* and coworkers (Belfast) investigate the question of how this methodology can also be applied to acyclic dienes.

Another area of recent progress in biocatalysis is the use of peroxidases. Important contributions to this field are the articles from Amsterdam (*Ron Wever* and colleagues) and Würzburg (*Waldemar Adam* and coworkers). It is shown how the outcome of biotransformations can be influenced by crucial choice of enzyme and conditions.

It is hoped that this issue of *Chemical Monthly* on biocatalysis will give a good impression on recent trends in this area. As the issue's guest editor I would like to thank all colleagues from the field of biocatalysis for their contributions. The help of Profs. *Falk* and *Kalchhauser* during the preparation of this special issue is gratefully acknowledged.

Herfried Griengl  
Issue Editor