# Advanced Tools for the Discovery and Engineering of Enzymes for Biocatalytic Applications

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This lecture will highlight principle strategies and current challenges in enzyme discovery and protein engineering aiming to enhance their usefulness in biocatalytic applications [1]. This also includes the combination of enzymes with chemocatalysts [2] and their incorporation into retrosynthetic concepts [3].
Examples will cover amine transaminases (ATA), Baeyer-Villiger- (BVMO) as well as P450-monooxygenases.
For the synthesis of chiral amines, we engineered (*S*)-selective ATA for the acceptance of bulky ketones in the asymmetric synthesis of chiral amines [4].
For BVMOs, we could recently engineer these enzymes to efficiently accept the cofactor NADH instead of NADPH [5]. Furthermore, we demonstrated how we could invert their regioselectivity exemplified for different enzymes and substrate types [6].
In BVMO- as well as P450-catalyzed reactions, uncoupling – the undesired formation of $H_2O_2$ – can represent a major issue. We have recently developed a sensitive assay to quantify $H_2O_2$-formation and hence to calculate desired product formation by following NAD(P)H consumption [7].
Finally, a new class of P450 monooxygenases from marine bacteria will be presented, which play a central role in the degradation of algal carbohydrates [8].

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