RECENT DEVELOPMENTS IN BIOCATALYTIC REDOX REACTIONS

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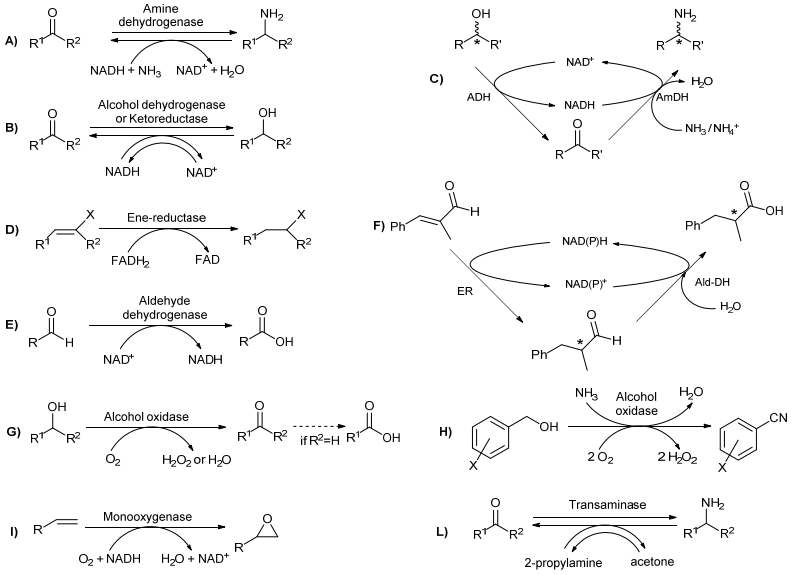
Oxidoreductase enzymes enable the selective manipulation of functional groups with unrivalled efficiency (Figure A-L).[1] For instance, my group is currently studying and engineering amine dehydrogenases (A), a new class of enzymes that performs the reductive amination of carbonyl compounds with high chemo- and stereo-selectivity.[2] The exquisite selectivity of amine dehydrogenases and alcohol dehydrogenases (B) enabled the development of a biocatalytic 'hydrogen-borrowing' amination (C), a reaction that converts racemic alcohols into enantiopure amines consuming only ammonia and producing water as the sole by-product.[3] The 'hydrogen-borrowing' concept was applied similarly in a combination of established ene-reductases (D) with our recently investigated aldehyde dehydrogenases (E).[4] The exquisite selectivity enabled the synthesis of pharmaceutically relevant optically active α-substituted carboxylic acids (F) starting from α,β unsaturated aldehydes.[5] Furthermore, during our studies on the biocatalytic alcohol oxidation (G), we discovered an unprecedented conversion of alcohols to nitriles—that is catalyzed by an alcohol oxidase variant (H)—at the sole expense of ammonia and dioxygen from air.[6] My group is also active in the field of asymmetric biocatalytic epoxidation (I). In this context, we engineered chimeric enzymes with improved efficiency.[7] Finally, scheme L depicts an alternative strategy for amination of carbonyl compounds that was implemented in flow microreactors in my group.[8]



[1] J. Dong et al. *Angew. Chem. Int. Ed.* **2018**, *57*, 9238.

[2] a) T. Knaus et al. *Green Chem.* **2017**, *19*, 453; b) V. Tseliou et al. *ChemBioChem* **2019**, *20*, 800; V. Tseliou et al. *Nat. Commun.* **2019**.

[3] a) F. G. Mutti et al. *Science* **2015**, *349*, 1525; b) W. Böhmer et al. *ChemCatChem* **2018**, *10*, 731; c) T. Knaus et al. *Org. Biomol. Chem.* **2017**, 15, 8313; c) J. Houwman et al. *Green Chem.* **2019**.

[4] T. Knaus et al. *Green Chem.* **2018**, *20*, 3931.

[5] T. Knaus et al. *Org. Biomol. Chem.* **2015**, *13*, 223.

[6] J. Vilím et al. *Angew. Chem. Int. Ed.* **2018**, *57*, 14240.

[7] M. L. Corrado et al. *ChemBioChem* **2018**, *19*, 679.

[8] W. Böhmer et al. *J. Biotechnol.* **2019**, *291*, 52.