# Biocompatible nitroaromatic reduction using biogenic Pd nanoparticles and $H_2$ generated *in situ* by *Escherichia coli*

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The fusion of synthetic chemistry and metabolic engineering represents a significant area of research, offering new possibilities for enhanced reactivity and selectivity. Despite the challenges associated with integrating these systems, recent works have shown that several chemical reactions can proceed under biocompatible conditions.[1][2] Nitro group reduction is amongst the most vital chemical reactions for the production of pharmaceuticals and commodity chemicals. However, common methods often require specialist precious metal catalysts and petro-derived $H_2$ gas at high temperature and/or pressure.[3] Whilst there are greener alternative approaches such as the use of nitroreductases, these enzymes typically have limited scopes and require additional cocatalysts for complete conversion to amines.[4]

Here we present biocompatible nitro reduction using palladium nanoparticles (Pd NPs) synthesised by *Escherichia coli* (*E. coli*) *in situ*, and demonstrate the synthetic utility of these biogenic catalysts in aqueous media at 37 ºC. The process leverages *E. coli*'s ability to produce $H_2$ from glucose, facilitating *in situ* catalyst formation whilst also supplying hydrogen for the catalysis. Moreover, we show this nitro reduction can be interfaced with whole cell biocatalysis, enabling the one-pot synthesis of a variety of amines and amides including pharmaceuticals and their building blocks from nitroaromatics. This study highlights the unique features of biocompatible chemistry with bacterial metal catalyst and its use for sustainable chemical synthesis.

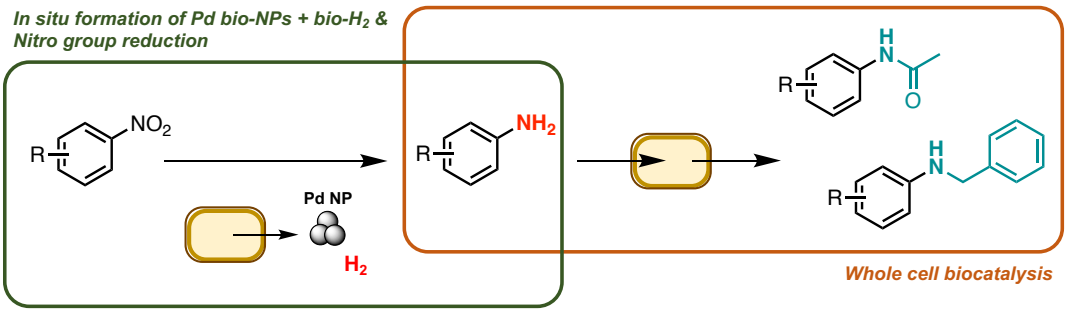


Figure 1. Biocompatible nitro reduction by biogenic Pd nanoparticles and bio-$H_2$ generated by *E. coli in situ* and its combination with whole cell biocatalysis.

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[3] H. K. Kadam, S. G. Silve, *RSC Adv.* **2015**, *5*, 83391-83407.

[4] S. Bisagni, A. Bornadel, A. H. Cherney, S. J. Hedley, J. LePaih, S. M. Mennen, A. Pushpanath, I. Slabu, J. Tedrow, B. Dominguez, *Curr. Res. Chem. Biol.* **2022**, *2*, 100026.