

# Decarboxylative *ipso*-Amination of Benzoic Acids

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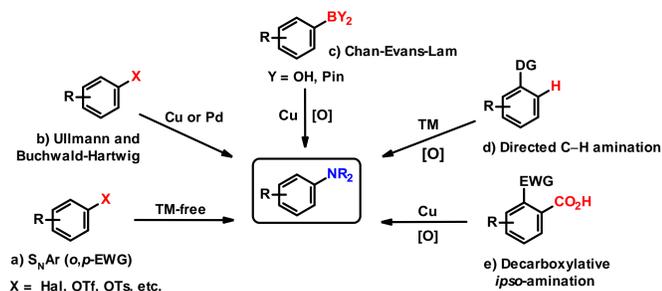
## Abstract



Using a bimetallic Pd/Cu-system with 1,10-phenanthroline as ligand and air or NMO as oxidants, electron-poor benzoic acids undergo oxidative decarboxylative coupling with free amines. This operationally simple aniline synthesis is widely applicable with regard to the amine and gives good yields even on multi-gram scale. Multisubstituted arenes are accessed via orthogonal C–C, C–Cl and C–N functionalizations. Preliminary mechanistic investigations suggest that arylamine formation occurs via reductive elimination from Pd<sup>IV</sup> intermediates.

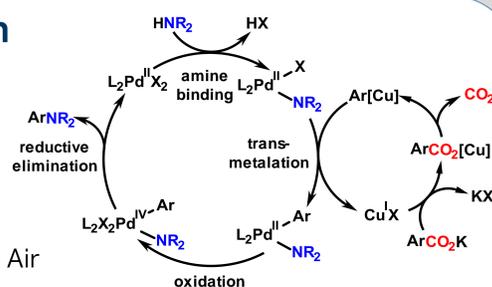
## N-Alkylanilines via Decarboxylative Couplings

Substituted anilines<sup>[1,2]</sup> are ubiquitous in pharmaceuticals<sup>[3]</sup> and material science.<sup>[4]</sup> The forcing conditions of aniline synthesis<sup>[5-6]</sup> imply the possibility of many side reactions of the basic amines, such as thermal condensation of ammonium benzoates, oxidative dimerization of anilines, oxidative decomposition of aliphatic amines and protodecarboxylation.

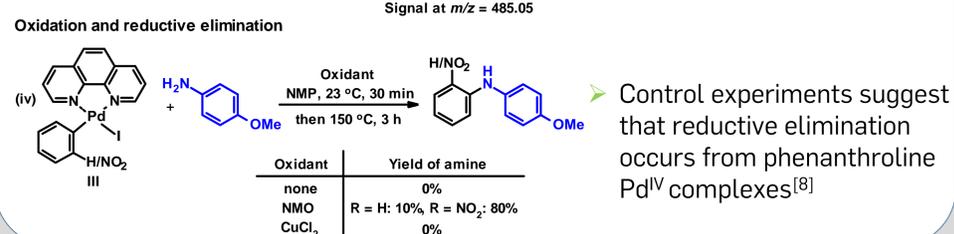
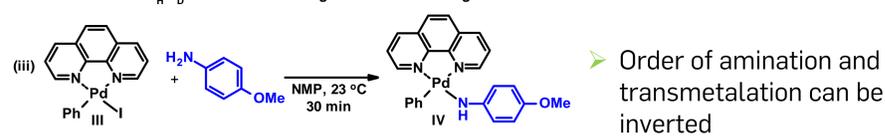
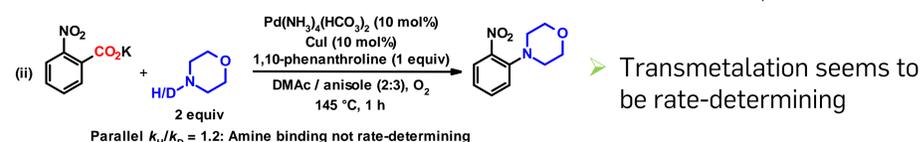
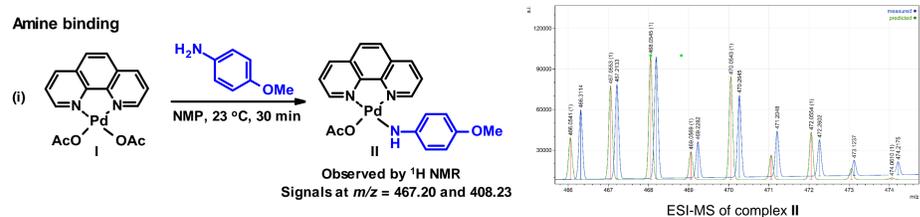


## Proposed Mechanism

- Pd/Cu bimetallic system
- 1, 10-phenanthroline as ligand for both metals
- Oxidation via NMO or even O<sub>2</sub> from Air
- Neither additional base nor phosphine ligands are required

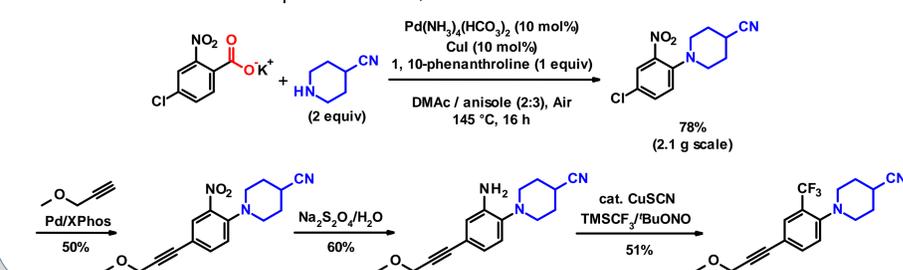


## Mechanistic Investigations

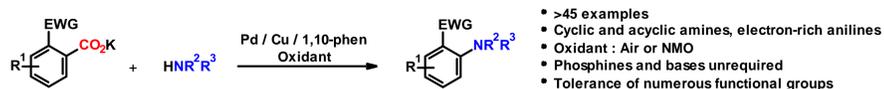


## Orthogonal Catalytic Arylations

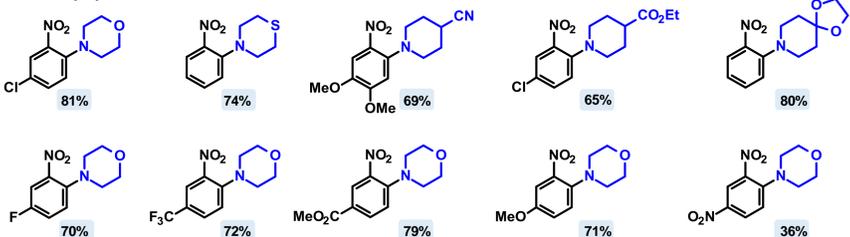
The synthetic opportunities opened up by the orthogonality of the decarboxylative *ipso*-amination to other Pd-catalyzed cross-coupling reactions are showcased by the following multistep synthesis. Multisubstituted arenes can be accessed via sequential C–C, C–Cl and C–N functionalizations.



## Substrate Scope<sup>[7]</sup>

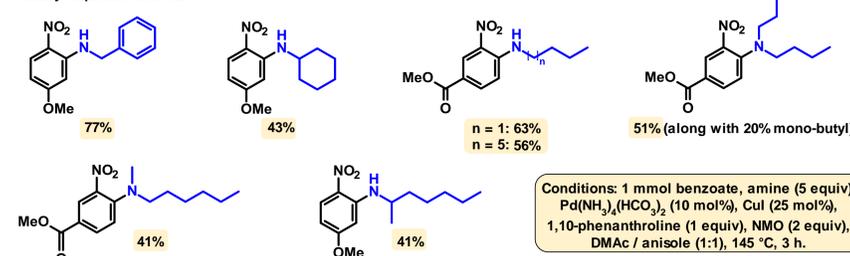


Secondary Cyclic Amines:



Conditions: 1 mmol benzoate, amine (2 equiv), Pd(NH<sub>3</sub>)<sub>4</sub>(HCO<sub>3</sub>)<sub>2</sub> (10 mol%), CuI (10 mol%), 1,10-phenanthroline (1 equiv), Air, DMAc / anisole (2:3), 145 °C, 16 h.

Primary Aliphatic Amines:



Anilines:



## References:

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We gratefully acknowledge financial support from:

