UNIVERSITY of HOUSTON
DEPARTMENT OF CHEMISTRY

Ir(III)-Catalyzed Reductive Amination of Carbonyl Compounds with High Selectivity

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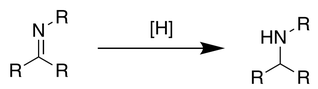
Background

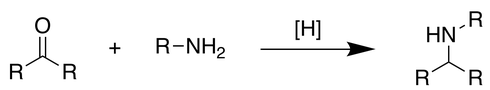
- Amines are a nitrogenous class of organic molecules that are commonly found in pharmaceuticals, agrochemicals, and many biologically relevant compounds.
- Common synthetic methods for producing amines includes the reduction of imines and the reductive amination of carbonyl compounds.

Imine Reduction



- Synthesis of imines can be difficult.
- Imines are unstable compounds.

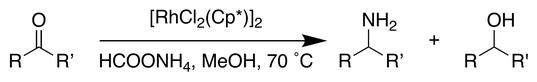
Reductive Amination



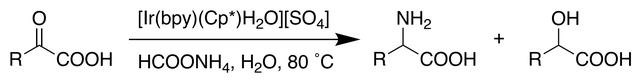
- Boron hydrides are toxic in stoichiometric amounts.
- These reactions display poor chemoselectivity.

Previous Works

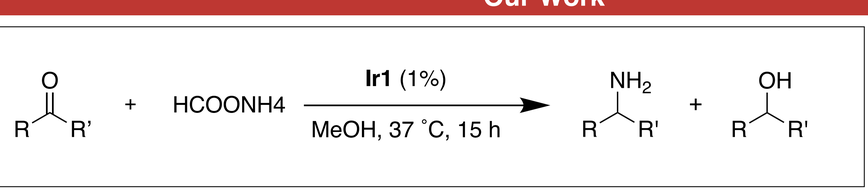
Yoshimura (2002)

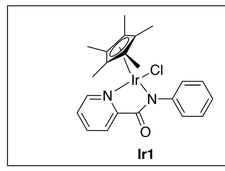


Fukuzumi (2004)



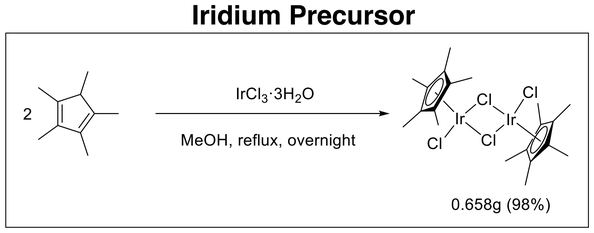
Our Work





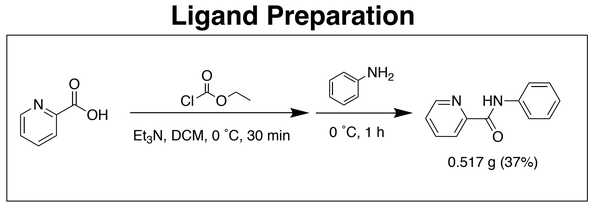
Synthetic Pathway

Iridium Precursor



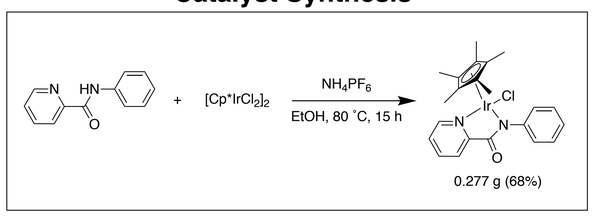
0.658g (98%)

Ligand Preparation

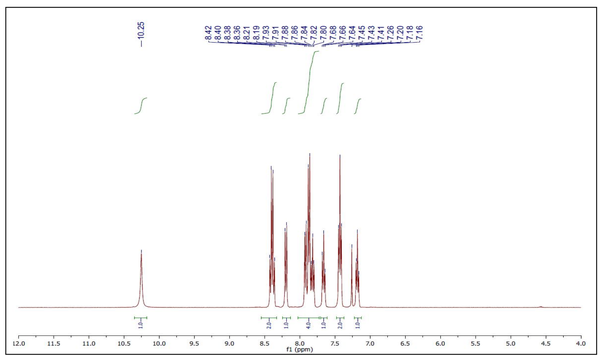


0.517 g (37%)

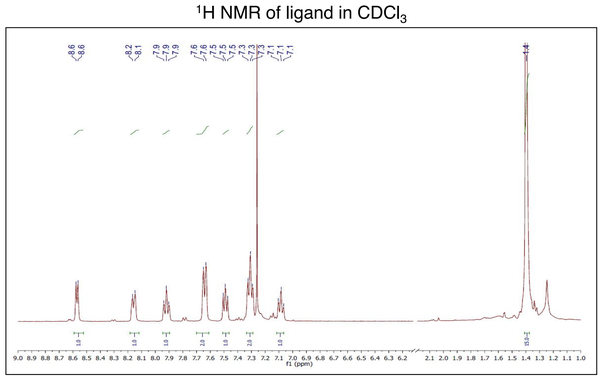
Catalyst Synthesis



0.277 g (68%)

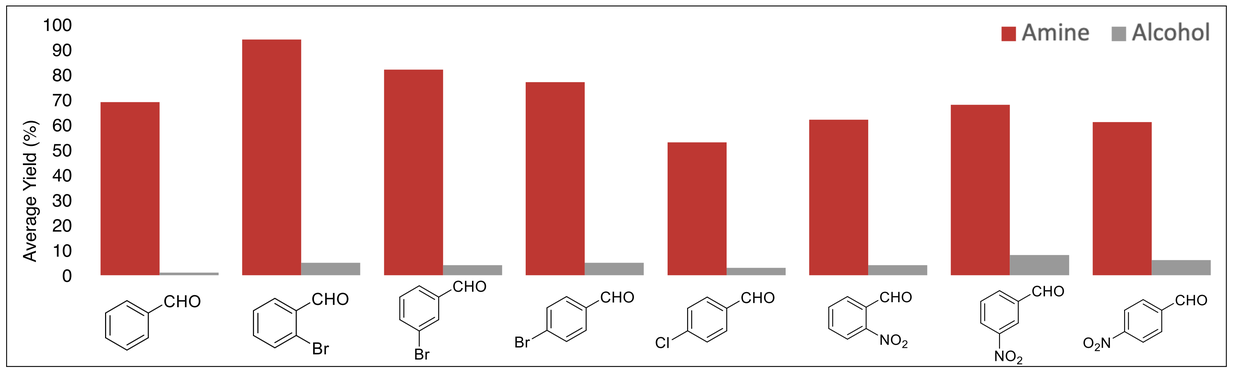


¹H NMR of ligand in $CDCl_3$

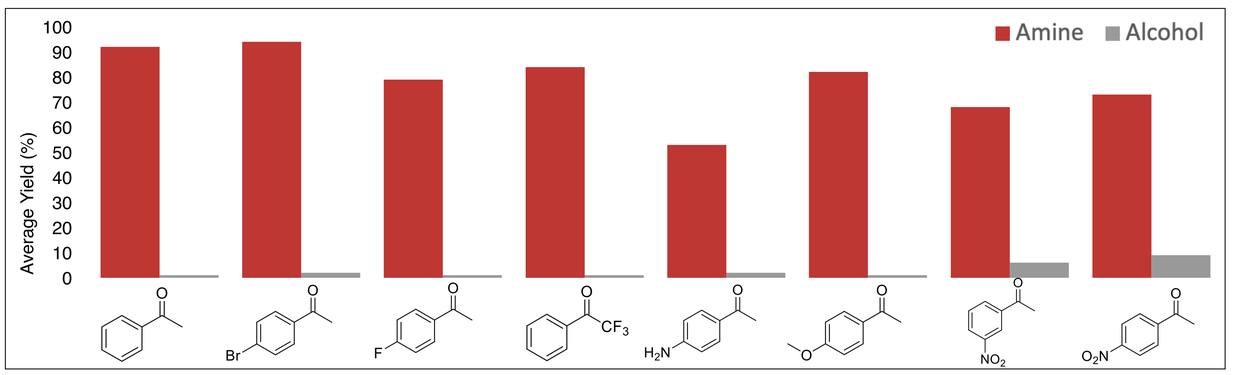


¹H NMR of Ir1 in $CDCl_3$

Average NMR Yields of Aromatic Aldehydes

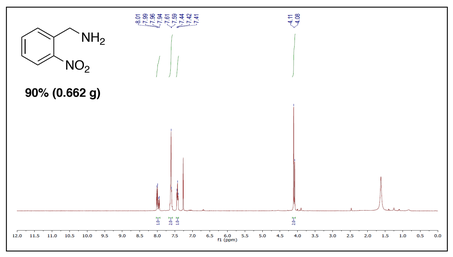


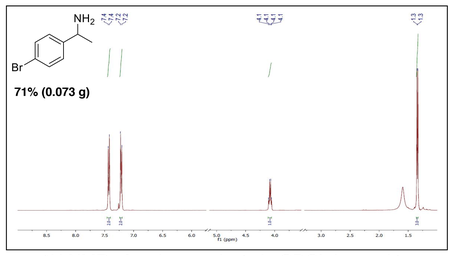
Average NMR Yields of Aromatic Ketones



All ^1H NMR yield samples were run in MeOD using 1,3,5-trimethoxybenzene as internal standard.

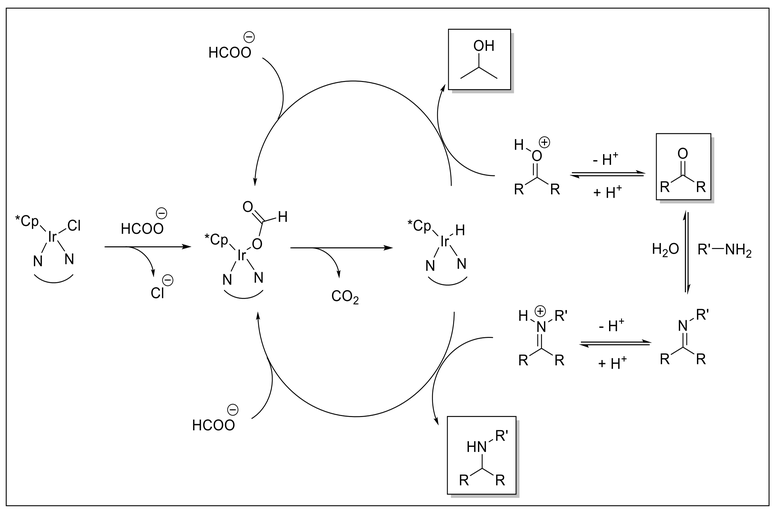
Isolated Yields





¹H NMR of amine products in $CDCl_3$ is used to confirm the synthesis of expected product.

Proposed Mechanism



Conclusion

In this work, we demonstrate the reductive amination of carbonyl compounds at 37 ˚C in methanol catalyzed by a Cp*Ir(III) complex ligated by *N*-phenyl-2-pyridinecarboxamidate using ammonium formate as a nitrogen and hydride source. This reaction was run for various aromatic ketone and aldehyde substrates for 15 h with a catalytic loading of 1 mol % to give excellent chemoselectivity of primary amines.

References

1) M. Kitamura, D. Lee, S. Hayashi, S. Tanaka, M. Yoshimura, *J. Org. Chem.* **2002**, *67*, 8685 – 8687.
2) S. Ogo, K. Uehara, T. Abura, S. Fukuzumi, *J. Am. Chem. Soc.* **2004**, *126*, 3020 –3021.

Acknowledgements

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