Iridium-Catalyzed Borylation of Secondary Benzylic C-H Bonds Directed by a Hydrosilane

Cho, S. H.; Hartwig, J.F., *J. Am. Chem. Soc.,* **2013**, 135, 8157-8160
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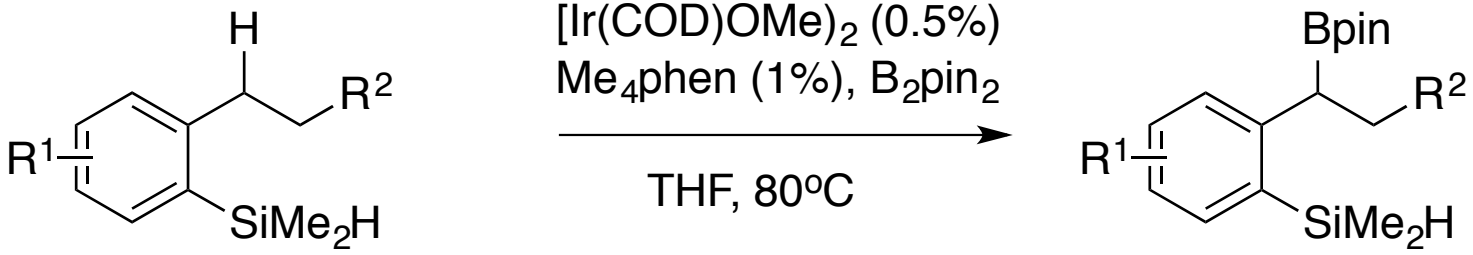
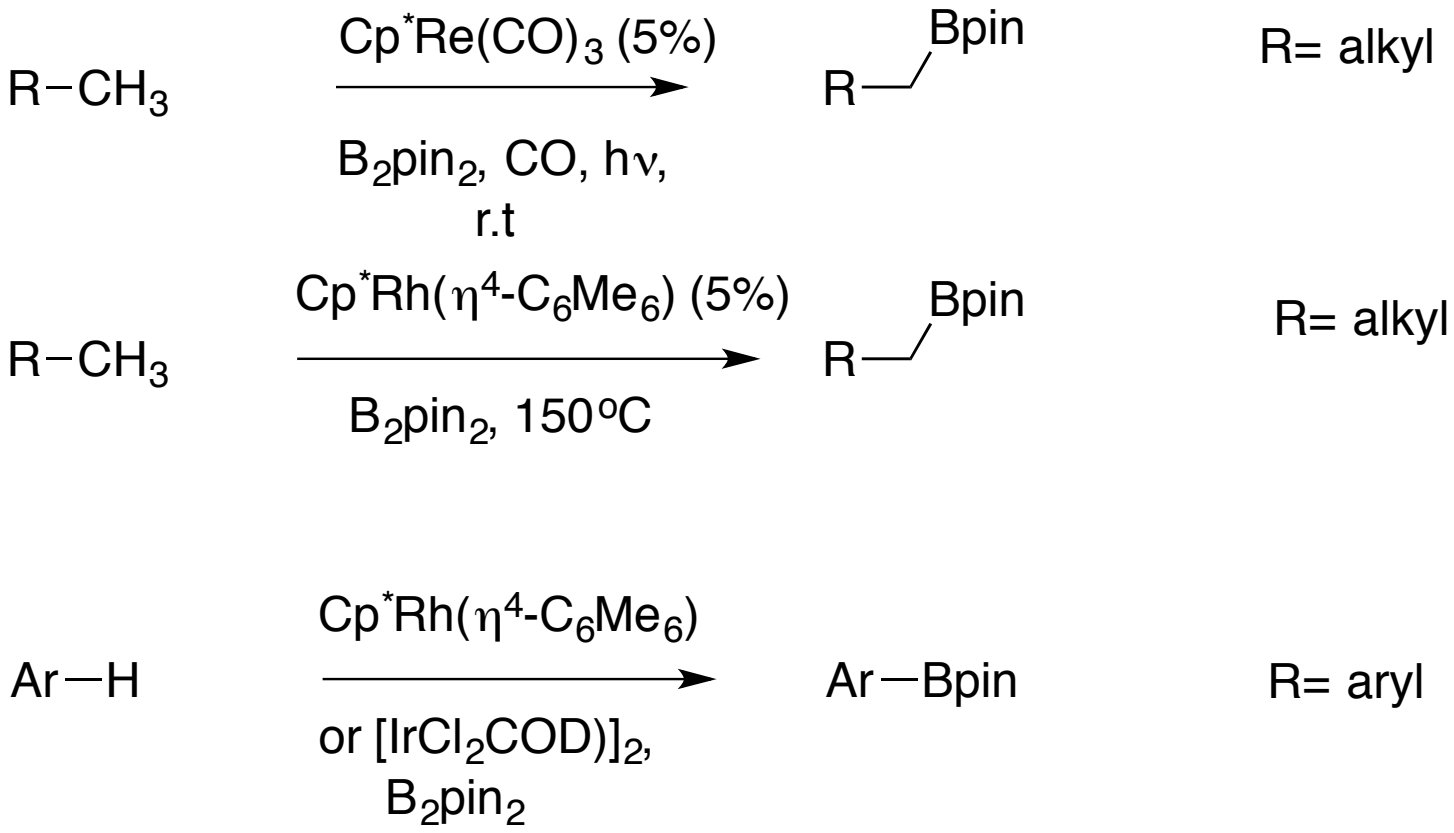


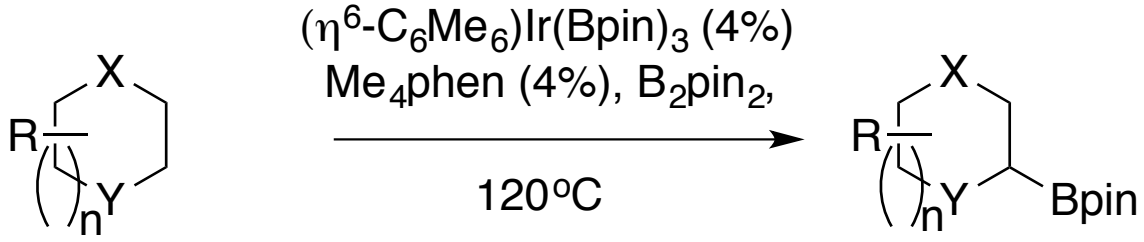
Michael Frasso
Current Literature
June 8, 2013

Previous C-H Borylations



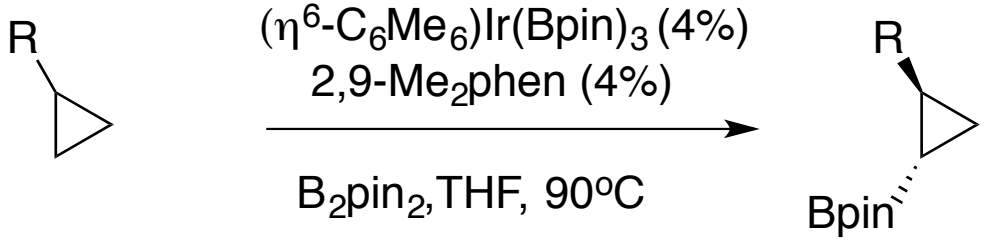
Angew. Chem. Intd. Ed., 38, 3391
Science, 287, 1995
Org. Lett. 3, 2831
J. Am. Chem. Soc., 124, 390

Previous C-H Borylations



R= alkyl, OBz, OPiv

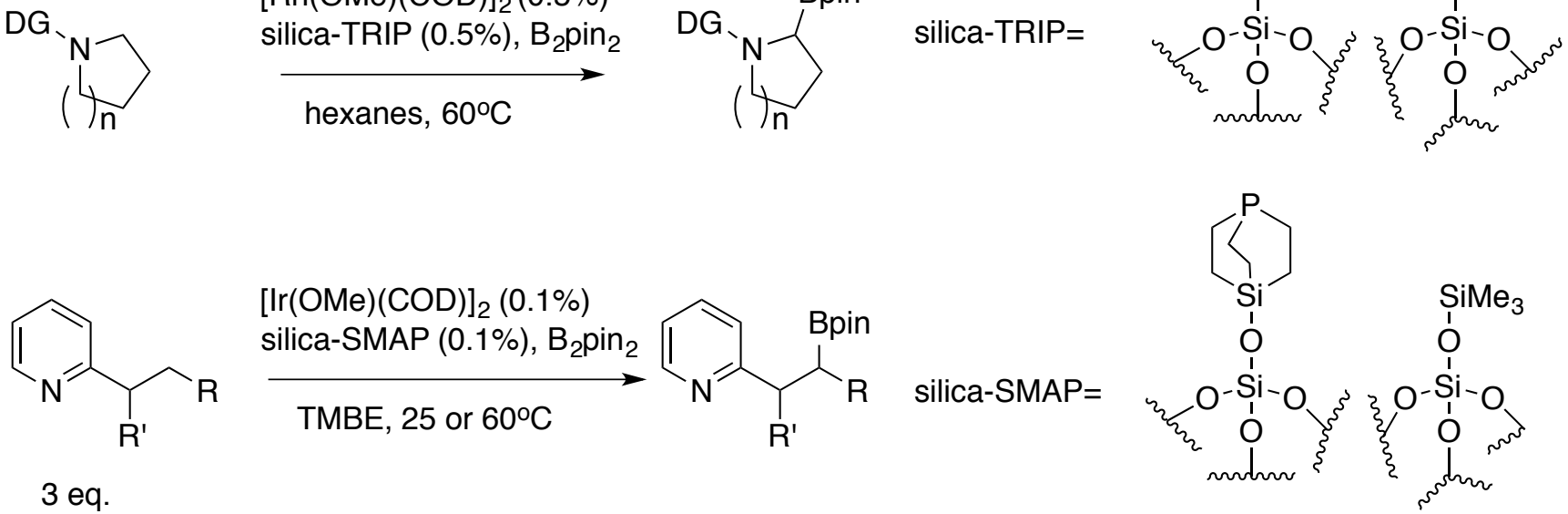
n = 0,1,2
X = O, CH_2
Y= CH_2, O, NPiv



R= Br, ester, ketone,
CN, alkyl, pinacole

J. Am. Chem. Soc., 134, 390
J. Am. Chem. Soc., 135, 12422

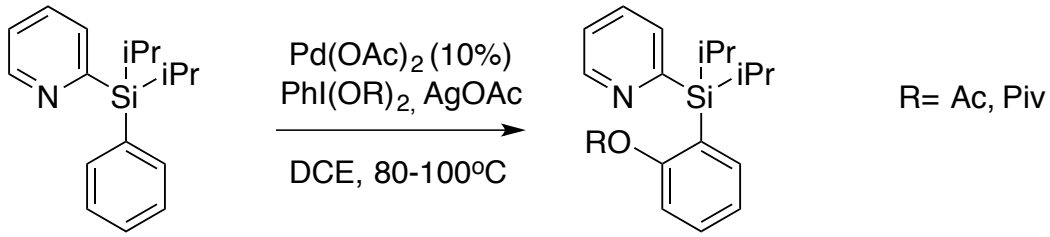
Previous C-H Borylations

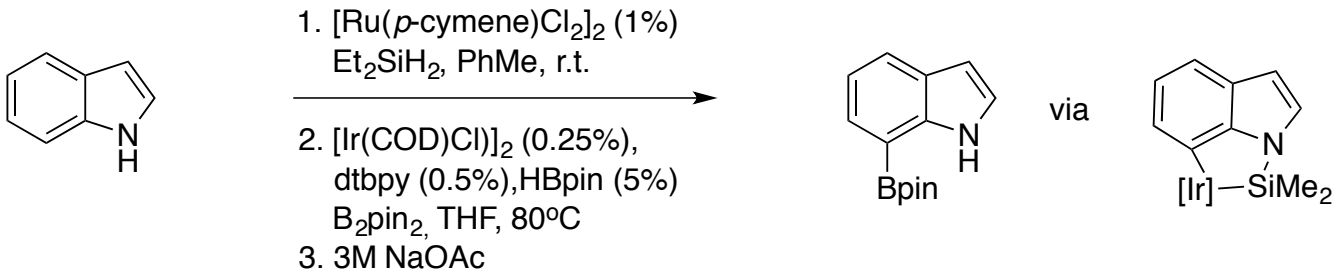


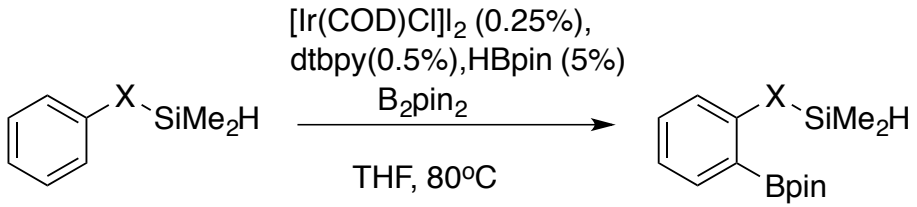
3 eq.

J. Am. Chem. Soc., 135, 13375
J. Am. Chem. Soc., 135, 2947

Silyl Directing Groups

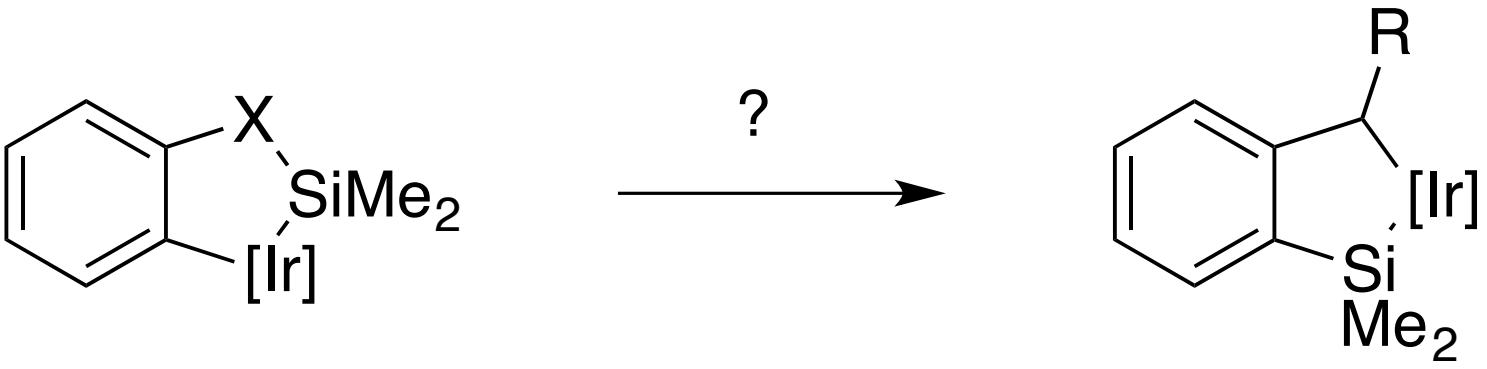




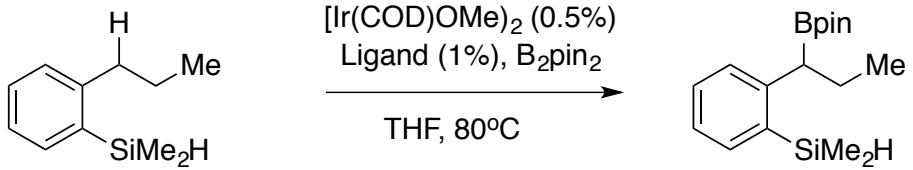


J. Am. Chem. Soc., 132, 8270
J. Am. Chem. Soc., 132, 4068
J. Am. Chem. Soc., 130, 7534

Redirection?

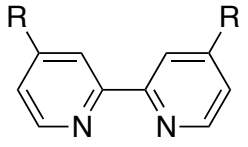


Ligand Screening

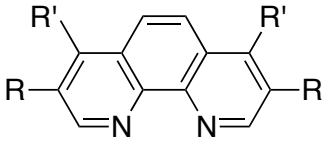


Ligand	Conv (%)	Yield (%)
L1	90	83
L2	80	61
L3	90	85
L4	94	89
L5	100	97 (93)
L5*	15	9

*HBpin as boron reagent



R= *t*-Bu, L1
R= H, L2



R= R'= H, L3
R= H, R'= Me, L4
R= R'= Me, L5

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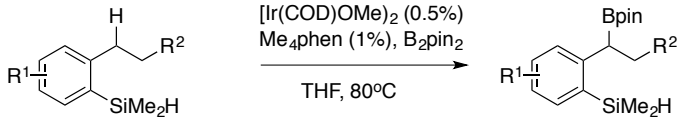
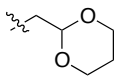
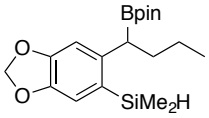
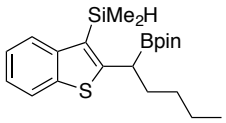
Scope of the Transformation



R^1	R^2	Yield (%)	R^1	R^2	Yield (%)
H	H	73			63
	Me	80			
	Et	70	*o*-Me	Et	81
	Ph	71	*o*-CF_3		73
	cyclopropyl	85	*o*-Cl		68
	OMe	95 (85)	*o*-F		70
	MOM	77	*p*-OMe		60
	OBn	70	*p*-OTBS		66
		74	*p*-Cl		64



50% yield



58% yield

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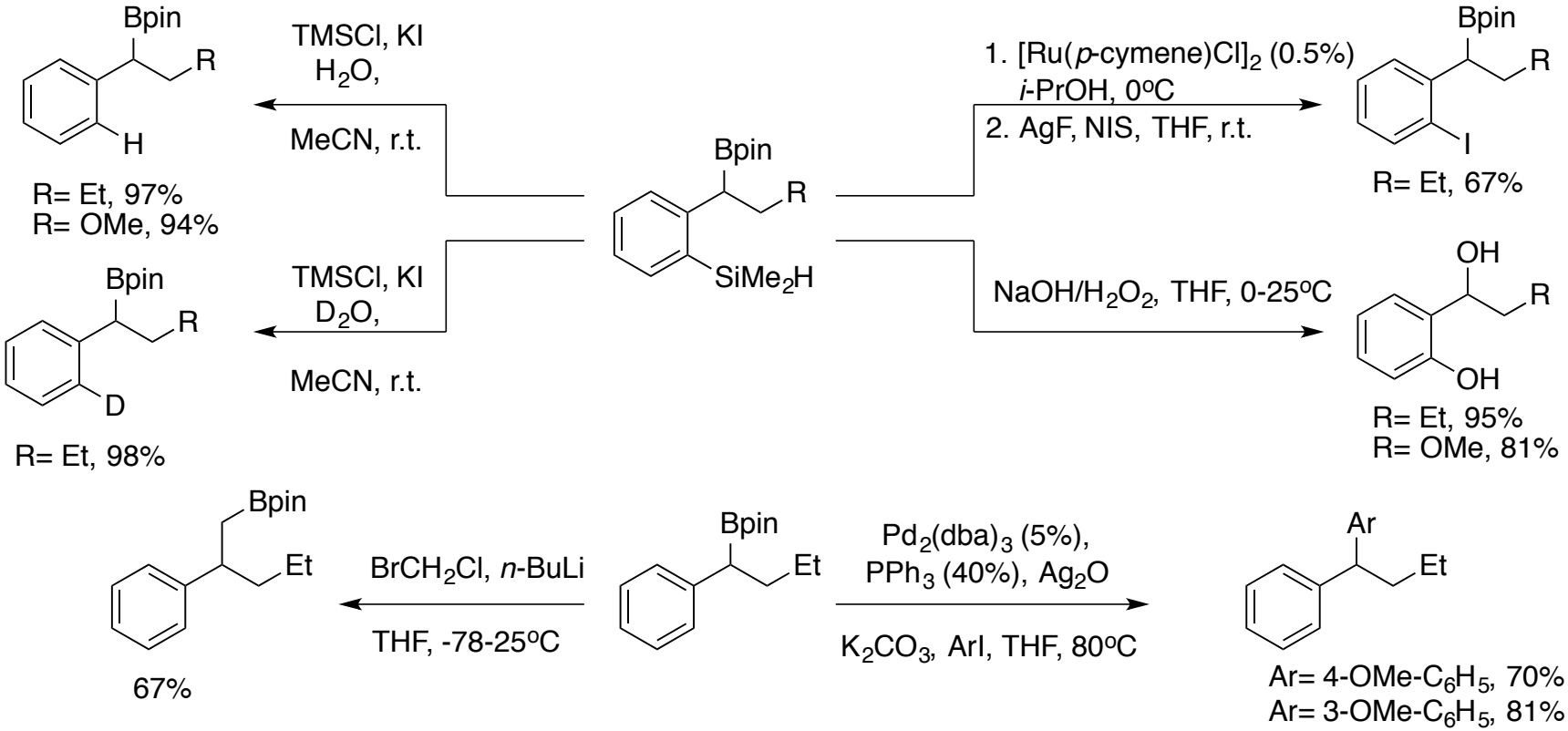
Further Transformations of the Product



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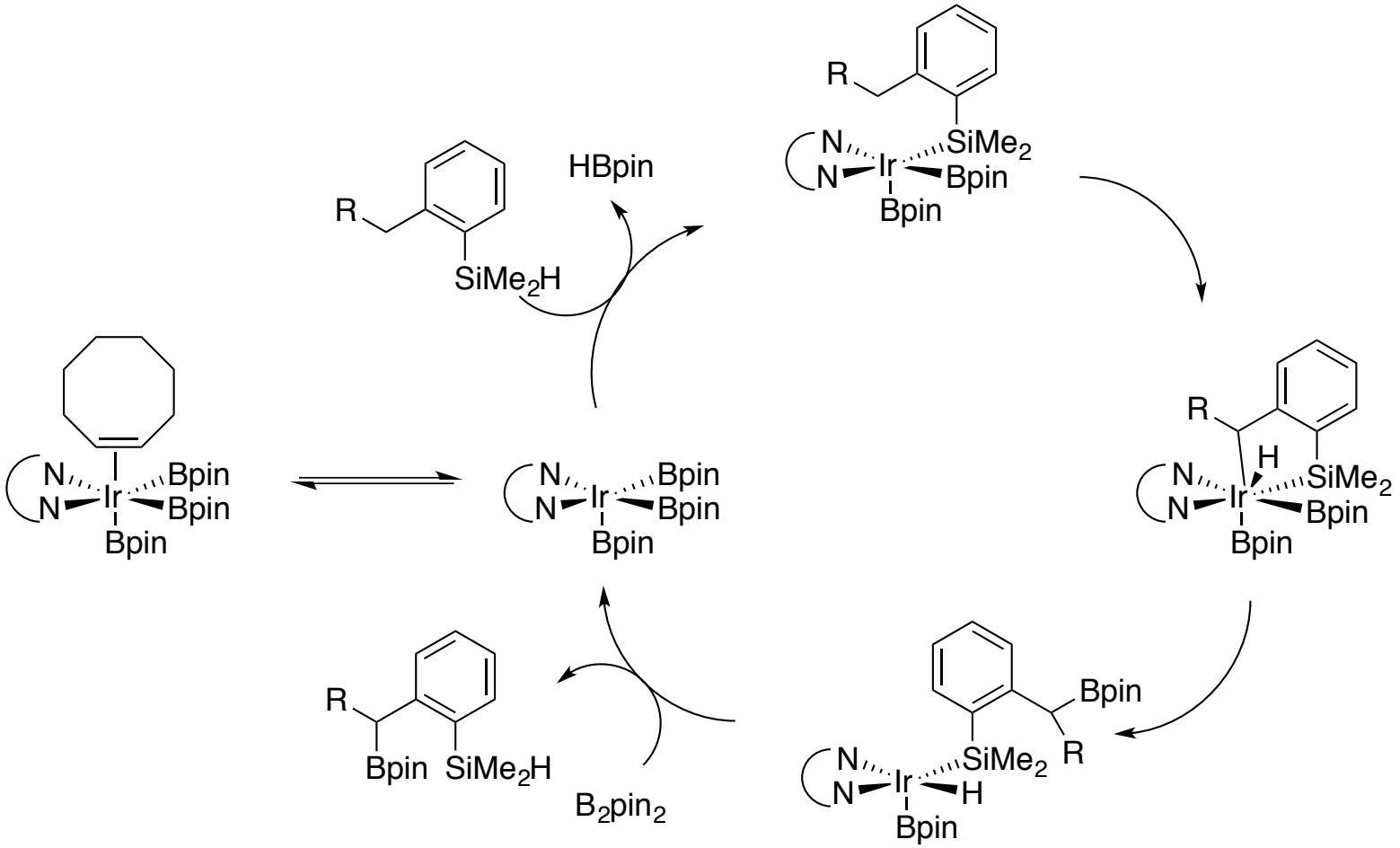
Proposed Mechanism



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J. Am. Chem. Soc., 127, 14263

Summary and Future Direction

- A benzylic borylation via a hyrdosilyl directed C-H activation was developed
- Modest functional group tolerance
- Development of an asymmetric variant