A Palladium-Catalyzed Three-Component-Coupling Strategy for the Differential Vicinal Diarylation of Terminal 1,3-Dienes

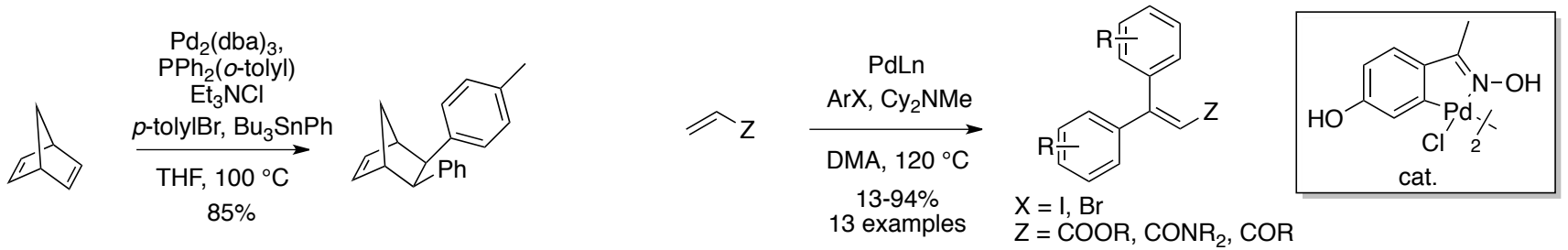
Stokes, B. J.; Liao, L.; Mendes de Andrade, A.; Wang, Q.; Sigman, M. S.

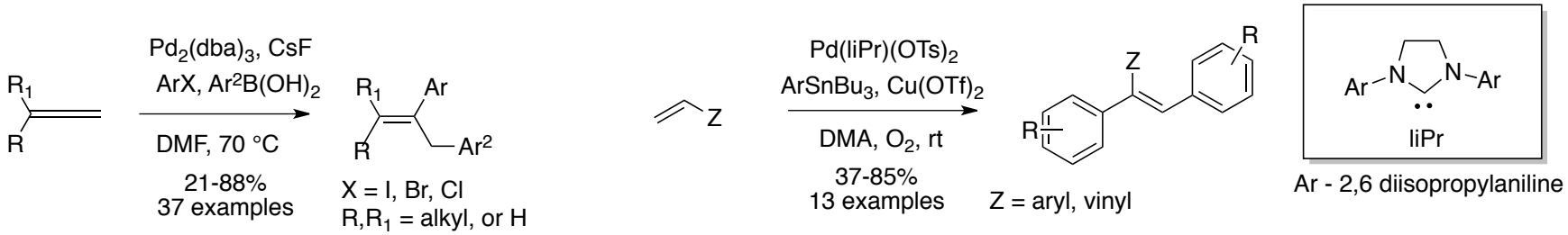
Org. Lett. 2014, DOI: 10.1021/ol502279u

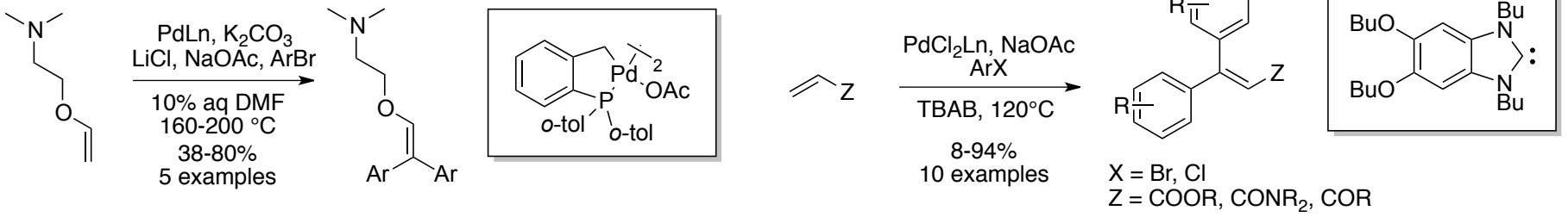
Wipf Group Current Literature 9/6/14

James Johnson

Previous Multicomponent Diarylations

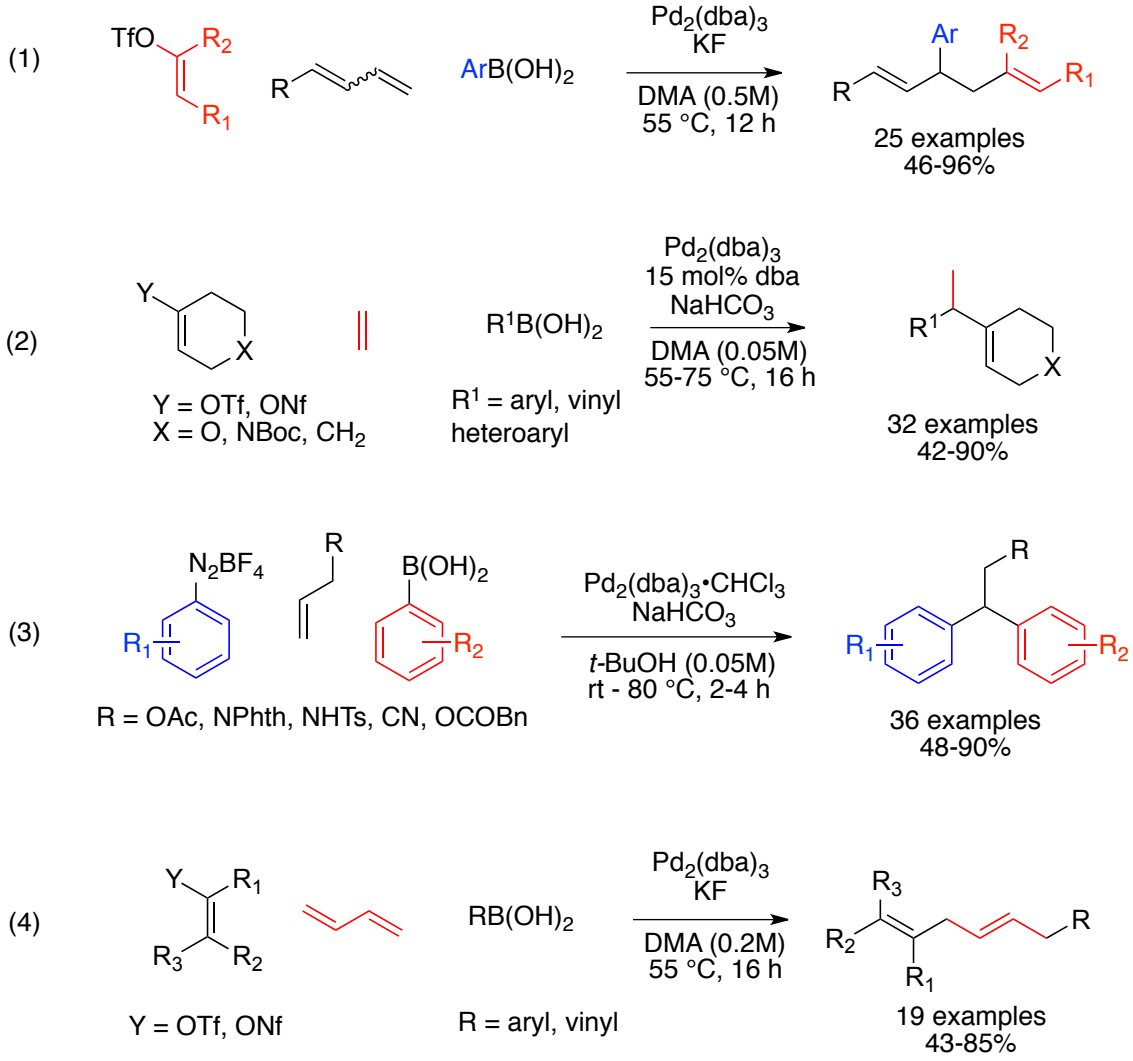






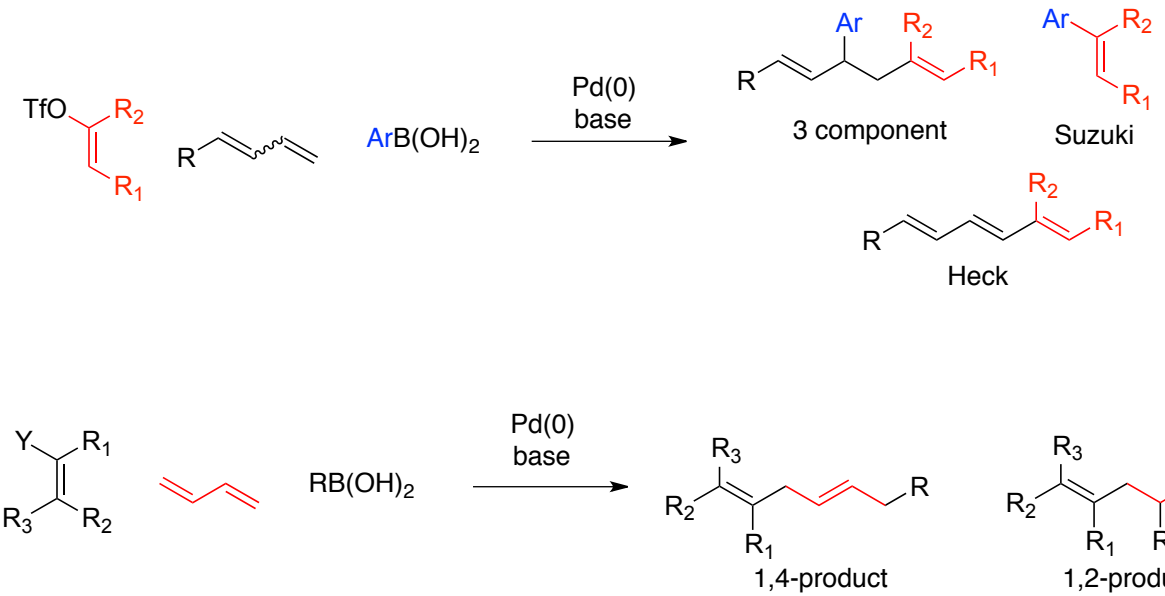
JACS 2001, 123, 8217; JOC 2004, 69, 3345; JOC 2005, 70, 4360.
ACIE 2009, 48, 3146; New J. Chem. 2006, 30, 803.

Previous Work from the Sigman Lab

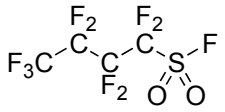


(1) JACS 2011, 133, 5784–5787; (2) JACS. 2012, 134, 11372−11375; (3) JACS 2013, 135, 4167−4170; (4) OL 2013, 15, 5008.

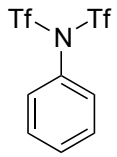
Common Problems with Multicomponent Pd Diarylations



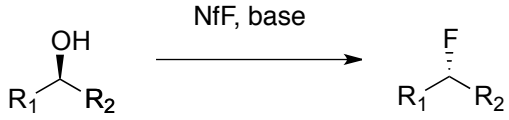
Nonaflates

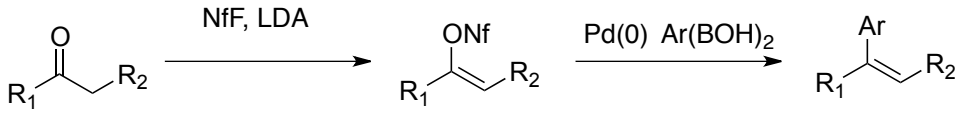


NfF $40/25g



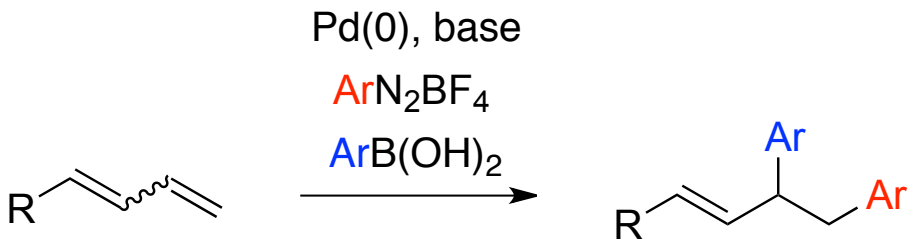
$55/25g

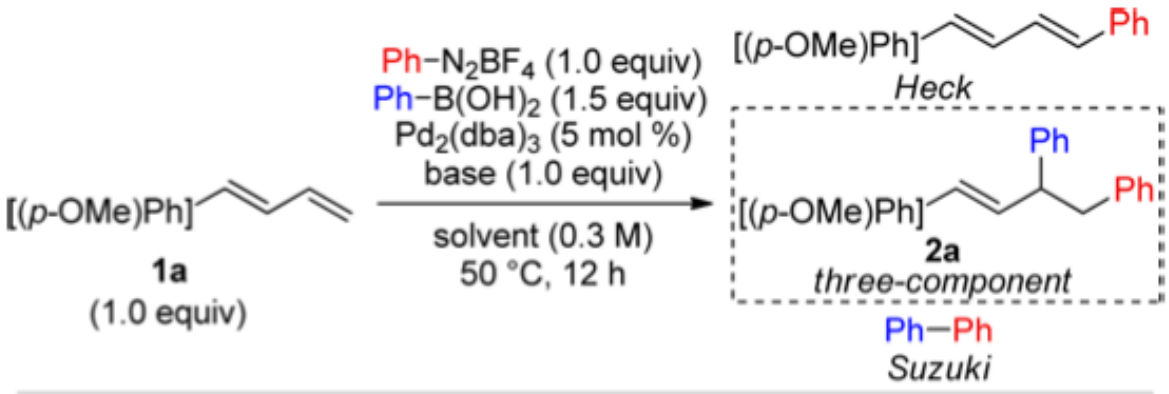




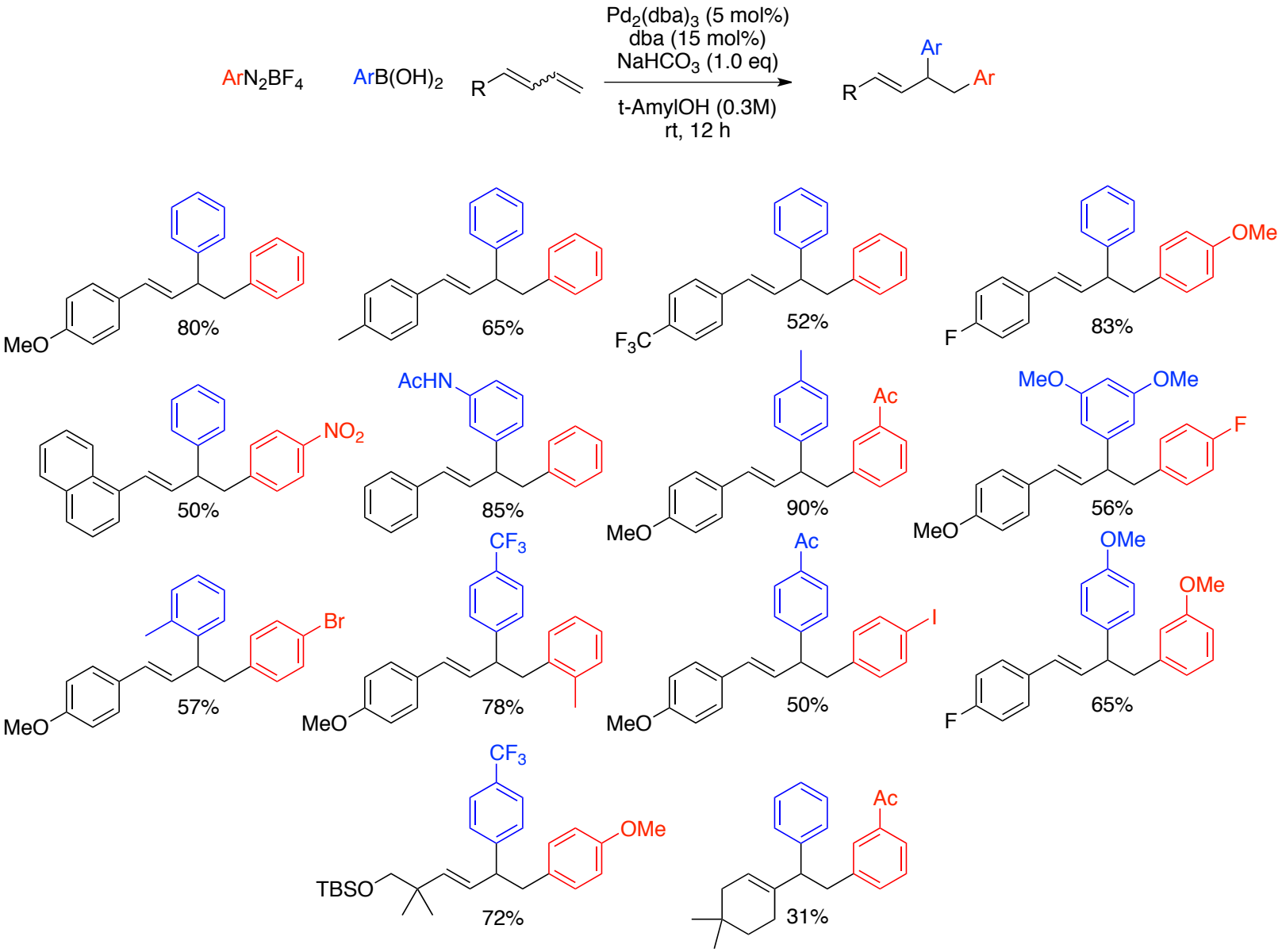
Adv. Synth. Catal. 2009, 351, 2747 – 2763

Title Paper

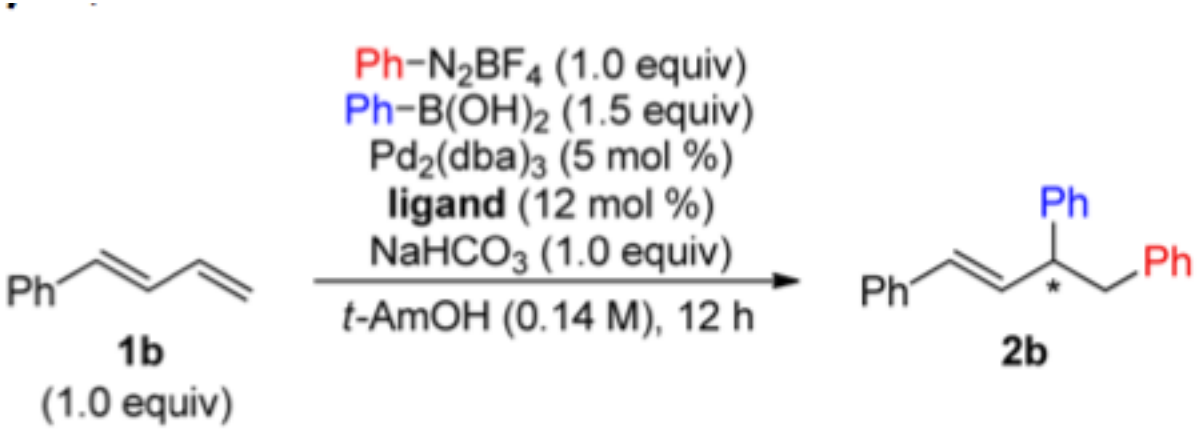




entry	base	solvent	conv (%)[a] of **1a**	yield (%)[a] of **2a**	selectivity[a] (**2a**/Suzuki/Heck)
1	KF	DMA	70	8	04:04:92
2	KF	1,4-dioxane	100	14	50:50:tr
3	KF	THF	100	tr	tr:50:50
4	KF	MeOH	100	tr	tr:08:92
5	KF	EtOH	100	4	05:19:76
6	KF	*i*-PrOH	100	11	14:14:72
7	KF	*t*-BuOH	100	33	62:13:25
8	KF	*t*-AmylOH	93	53	92:02:06
9[b]	KF	*t*-AmylOH	90	57	94:03:03
10[b]	$NaHCO_3$	*t*-AmylOH	96	58	96:02:02
11[b,c]	$NaHCO_3$	*t*-AmylOH	100	80	94:04:02

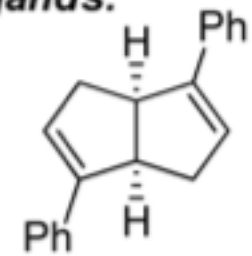

ArN2BF4
ArB(OH)2
R
Pd2(dba)3 (5 mol%)
dba (15 mol%)
NaHCO3 (1.0 eq)
t-AmylOH (0.3M)
rt, 12 h
Ar
R
Ar
MeO
80%
65%
F3C
52%
F
OMe
83%
NO2
50%
AcHN
85%
Ac
MeO
90%
MeO
OMe
F
MeO
56%
Br
MeO
57%
CF3
MeO
78%
Ac
I
MeO
50%
OMe
OMe
F
65%
CF3
TBSO
OMe
72%
Ac
31%

Asymmetric Diarylation

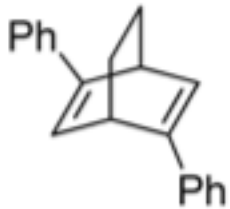


entry	temp. (°C)	ligand	yield (%)[a]	ee (%)[b]
1	rt	L1	n.d.	3
2	rt	L2	n.d.	29
3	rt	L3	n.d.	51
4	rt	L4	n.d.	65
5	–8	L4	10	83
6	0	L4	33	80
7	40	L4	51	55

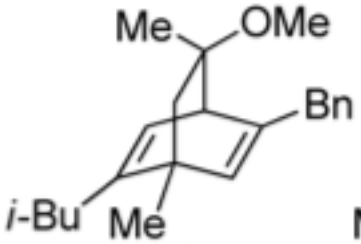
ligands:



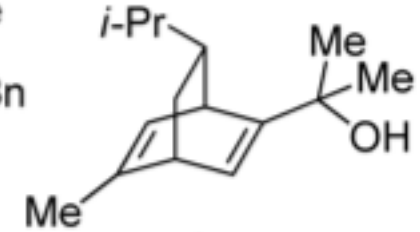
L1



L2

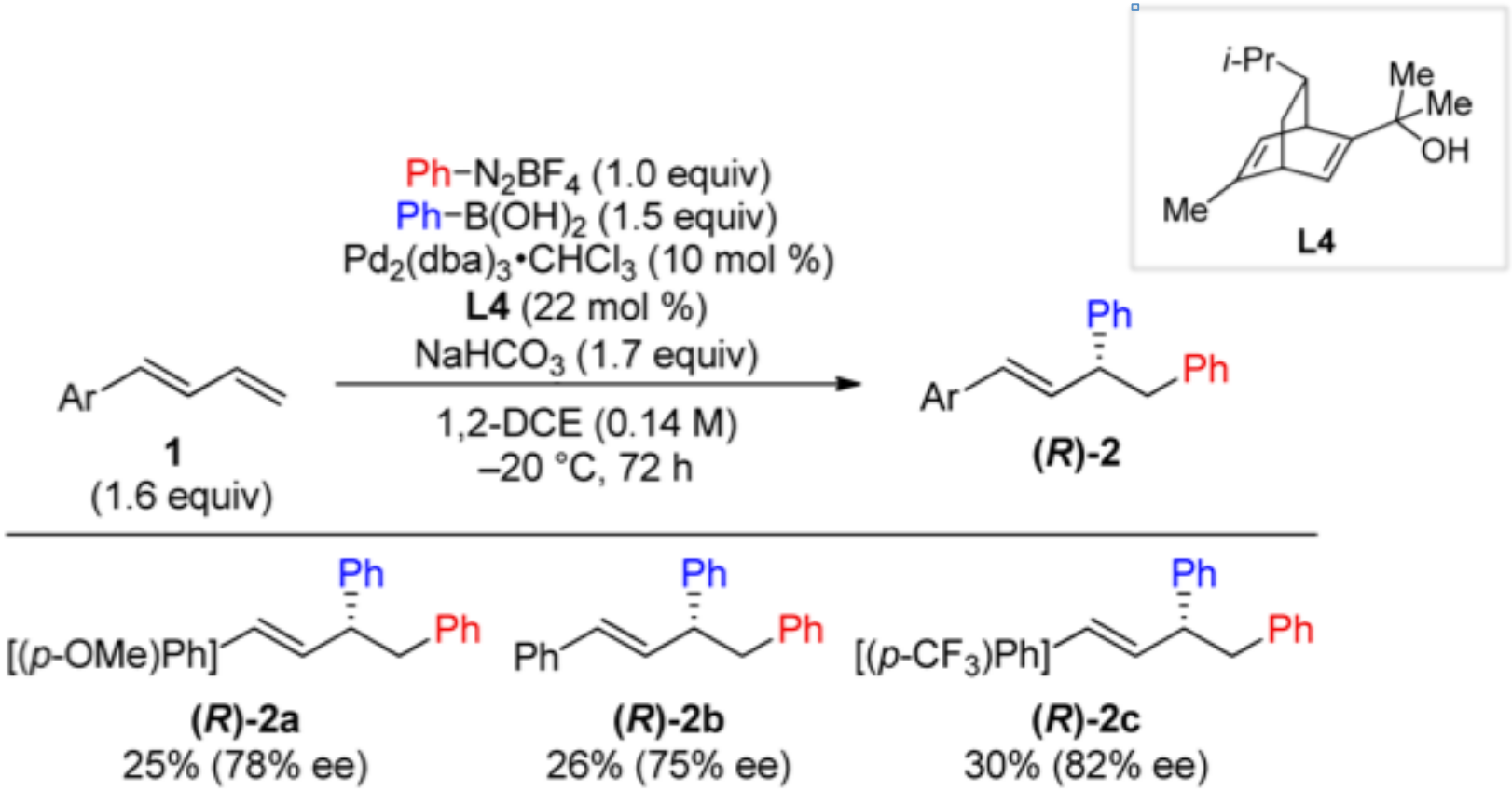


L3

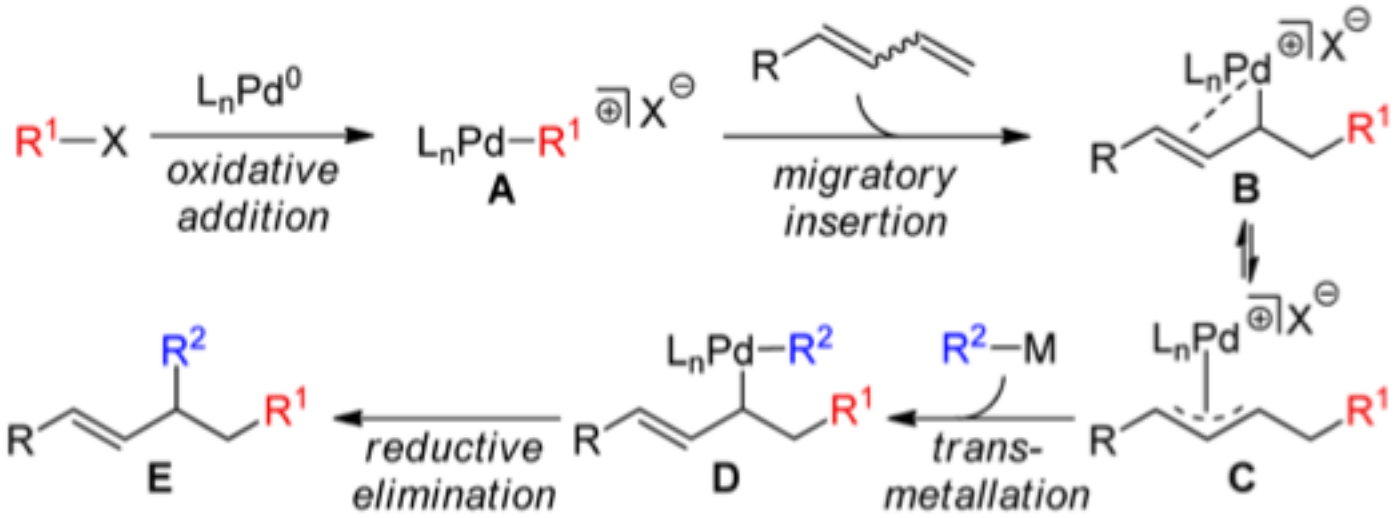


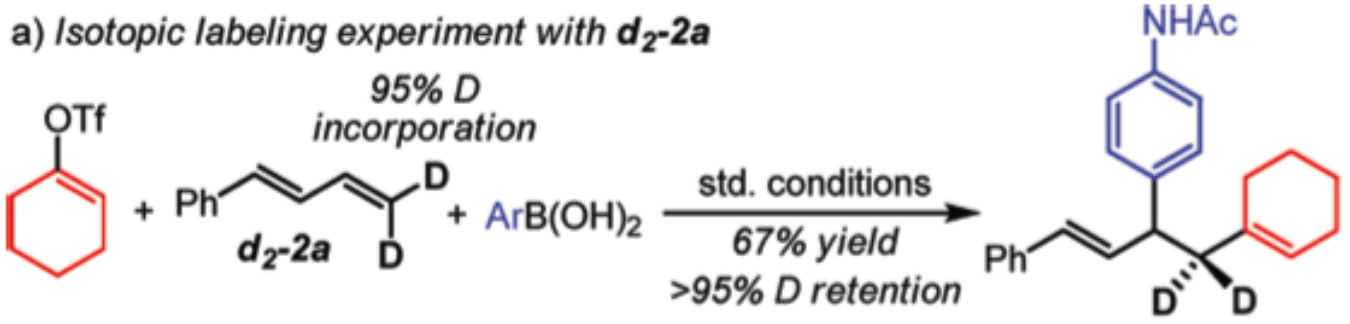
L4

Asymmetric Diarylation cont.



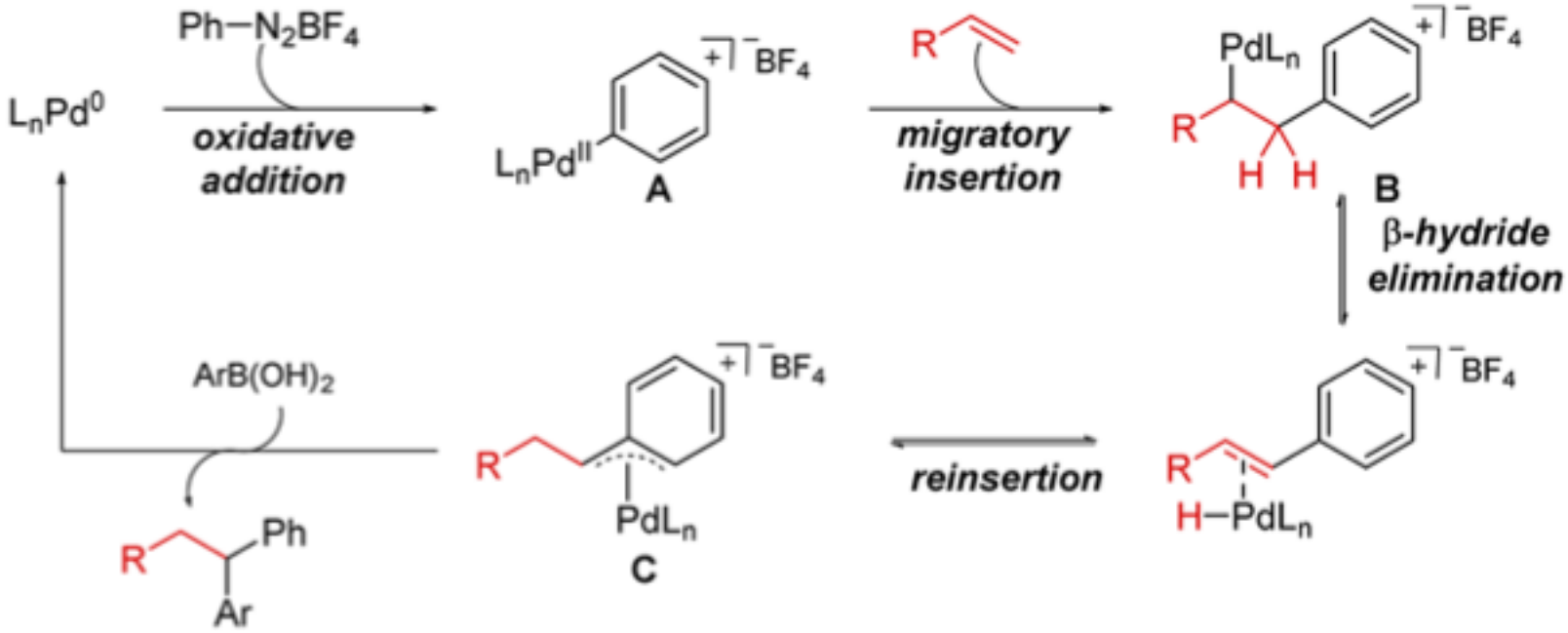
Mechanism for Diene Diarylation

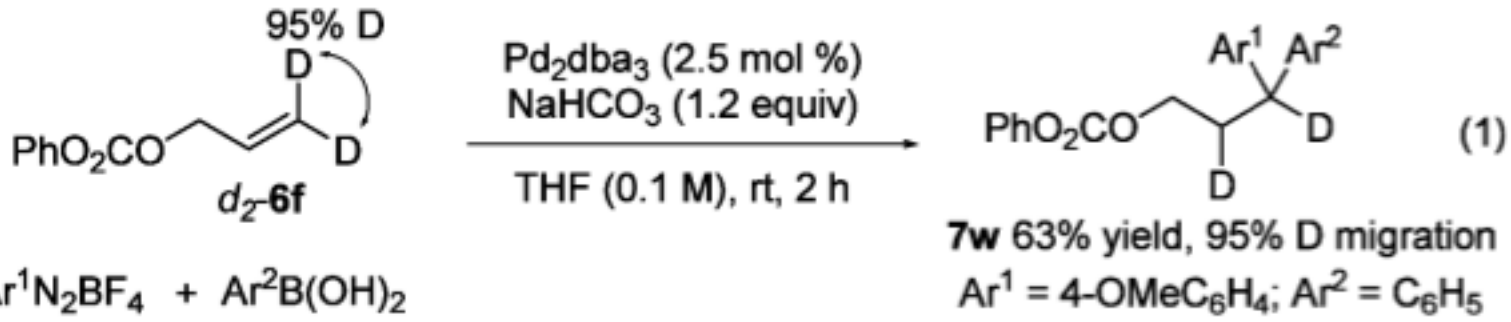




JACS 2011, 133, 5784–5787

Mechanism for Alkene Diarylation





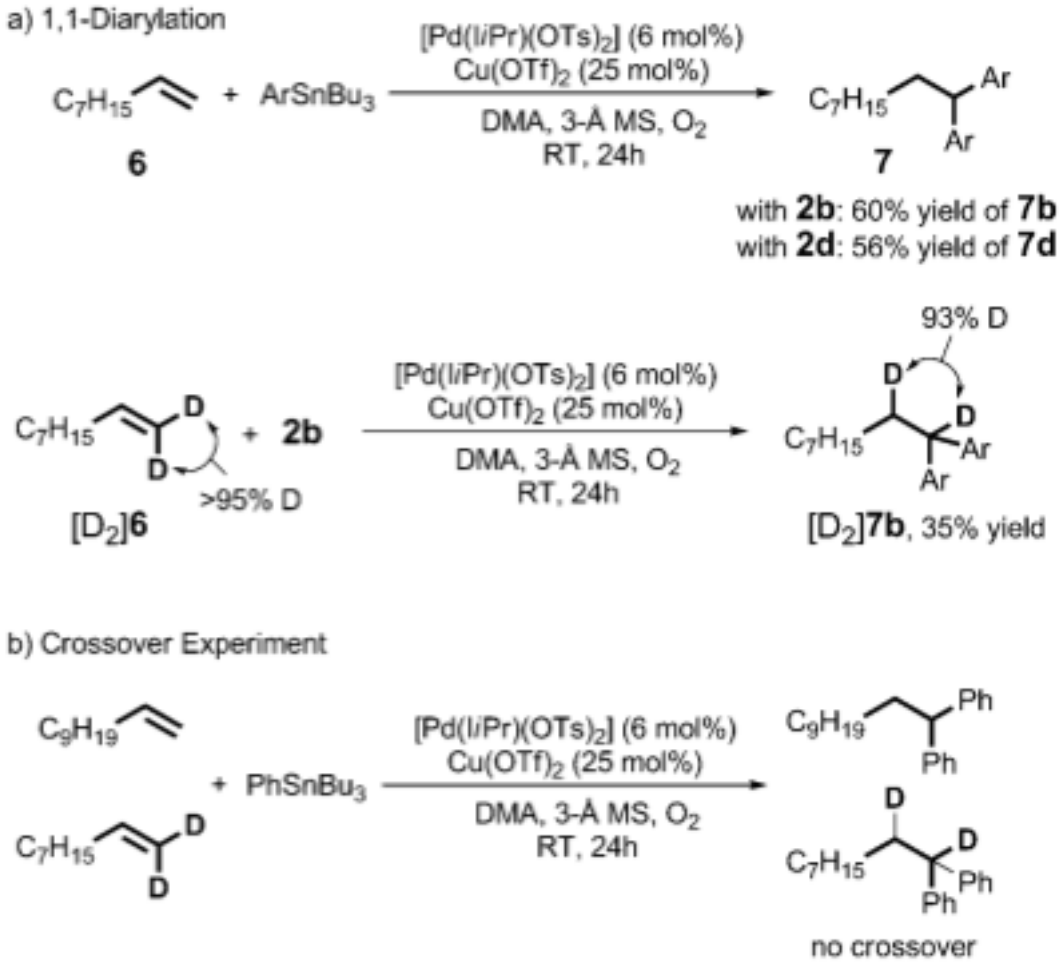
$Ar^1N_2BF_4$ + $Ar^2B(OH)_2$

9/6/14 OL 2013, 15, 5008. James Johnson @ Wipf Group

Conclusions

- Allows for rapid functionalization of terminal Alkenes or Dienes with selective addition of 2 different aryl or vinyl groups.
- Mild conditions that tolerate a number of functional groups
- Regioselective and Enantioselective

Thanks



ACIE 2009, 48, 3146 –3149