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DISPLACEMENT OF ACTIVATED AMINO GROUPS.
THE REACTION OF ORGANOCUPRATES WITH N,N-DITRIFLUOROMETHANESULFONIMIDES.

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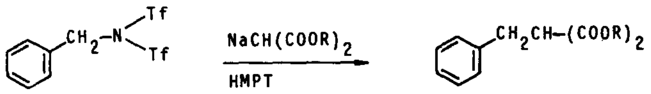
Replacement of amino substituents by other functional groups *via* substitution or elimination represents an old, yet still unresolved synthetic problem. The classical methods such as diazotation, Hofmann elimination, etc. usually do not give satisfaction because they often lead to side products and are not generally applicable.

Recently, Baumgarten,[1-4] Hendrickson,[5] Glass[6-7] and Andersen[8] achieved transformation of primary amino groups into reactive leaving groups by replacing the nitrogen-bound hydrogen by strongly electron-withdrawing sulfonyl substituents, thus making them amenable to nucleophilic substitution. By this approach certain

$$R\text{-}CH_2\text{-}NH_2 \rightarrow RCH_2\text{-}N(SO_2R')_2 \xrightarrow{X^-} RCH_2\text{-}X + \bar{N}(SO_2R')$$

N,N-ditosyl or dinosylimides have been converted into halides,[1-4,8] tosylates and carboxylates[9] or reduced to alcanes.[10] In some cases, displacement of the sulfonimide moiety has also been achieved by carbanion nucleophiles with concurrent C-C bond formation, for example in the reaction of benzyl- or hexyl-N,N-ditrifluoromethanesulfonimide (1) or (2) with sodium cyanide or sodium malonate in HMPT[6] which leads to substitution in 57-80% yield, *i.e.*

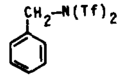
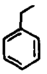
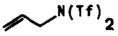
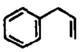
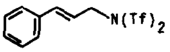
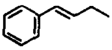
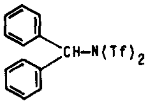
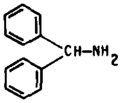
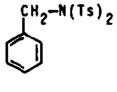


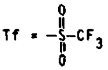
1

57%

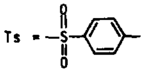
We have found that lithium dimethyl or diphenyl cuprates[11] couple with N,N-ditrifluoromethanesulfonimides of benzylic or allylic primary amines[12] to give substitution products in *ca.* 70% yield. The main results of our study are summarized in the Table. Reactions were carried out with 5 eq. of cuprate with ether or ether/THF as solvent under the conditions indicated. The reaction appears to be specific for benzylic and allylic NTf_2 groups.

Table. Reaction of Sulfonimides RCH_2-$N(SO_2R')_2$ with Organocuprates

Sulfonimide	No.	Cuprate	Product	Yield
	1	Me_2CuLi -25°/2 hrs to 3 days		60-70 %
$H_3C(CH_2)_5$-$N(Tf)_2$	2	Me_2CuLi -30°/48 hrs	$H_3C(CH_2)_5NHTf$ 7	ca 70%
	3	ϕ_2CuLi -25°/30 min	 8	73%
	4	Me_2CuLi -70°C/22 h	 9	12%
	5	Me_2CuLi -78 to 25	starting cpd(5)	
//	5	$Me_3CuLi_2(LiI)$ -78 to 0°	 10	78%
	6	Me_2CuLi		max 30%



$$Tf = -\overset{O}{\underset{O}{\overset{\|}{\underset{\|}{S}}}}-CF_3$$



$$Ts = -\overset{O}{\underset{O}{\overset{\|}{\underset{\|}{S}}}}-C_6H_4-CH_3$$

With *n*-hexylsulfonimide (2) no substitution product was obtained, but rather the sulfonamide 7, which must be formed by attack of the cuprate on sulfur. Amide formation was found to increase with increasing the reaction time and, consequently, cannot be caused by hydrolysis during work-up. The sulfonimide of benzhydrylamine (5) was unreactive towards lithium dimethylcuprate; the more reactive Me_3CuLi_2 gave hydrolysis to the amine 10. This result demonstrates that the reacting carbon, in addition to being allylic or benzylic, must be primary. The reaction of benzyl-N,N-ditosylimide (6) with lithiumdimethylcuprate was investigated under a variety of conditions. However, yields were generally low, and even in the most favorable case only 30% of ethylbenzene was formed. Either the starting compound 6 was recovered unchanged or partial S-N cleavage to benzyltosylamide occurred.

Substitution of the allyl derivative 3 could in principle proceed by direct displacement at the allylic position (S_N2 type) or at the terminal vinylic carbon with concurrent rearrangement of the double bond (S_N2' type). In order to distinguish between these two pathways, the cinnamylimide 4 was also subjected to reaction with a cuprate. Unfortunately, 4 turned out to be very difficult to manipulate owing to its tendency toward decomposition, so that yields of the reaction were low (12%). The only product isolated was 1-phenyl-1-butene (9), derived from the S_N2-pathway. The behaviour of 4 is analoguous to that of cinnamyltosylate which upon treatment with lithium dimethylcuprate affords mainly 1-phenyl-1-butene (S_N2 product, 45%) and little 3-phenyl-1-butene (S_N2' product, 1%).[16] In 4 the S_N2' pathway is obviously disfavoured for both steric and electronic reasons, so that its absence does not definitely rule out the S_N2' reaction in the case of the allylimide 3. However, in view of the high reactivity of the benzylic position in 1 and the allylic position in 4 in direct displacement there appears to be no need to invoke a S_N2' pathway for the allylic derivative 3.

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