

Direct Displacement and Coupling of Prop-2-ynylic Acetates with Organocuprates

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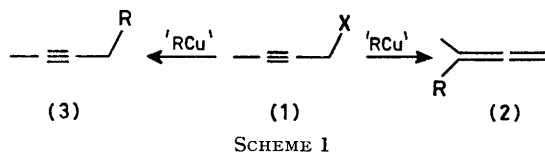
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Summary The direct displacement of the acetate in 1-trimethylsilyl-3-acetoxyoct-1-yne (**6**) by the alkyl substituent of dialkylorganocuprates, and the lithium dimethylcuprate-mediated coupling of 3-acetoxy-1-trimethylsilylpent-4-en-1-yne (**8b**) are reported.

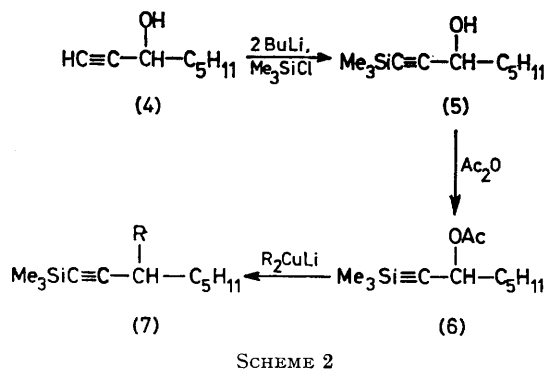
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THERE has been considerable interest in the reactions of organo-copper species (R_2CuLi , RCu) with prop-2-ynylic acetates, halides, tosylates, and ethers,¹ the major products of which are substituted allenes resulting from leaving group displacement *via* 1,3-substitution [Scheme 1, (1)→(2)].



We were interested in investigating the possible direct (S_N2 -type) displacement of prop-2-ynylic leaving groups with an alkyl or aryl unit [Scheme 1, (1)→(3)]. This extension of our previous work² with prop-2-ynylic alcohols would thus enhance the synthetic utility of such systems by providing an easy entry into substituted α -branched acetylenic systems.³

The position of nucleophilic attack in prop-2-ynylic substrates depends on a variety of factors.^{1a} However, the regioselectivity in the reactions of allyl systems with lithium dialkylcuprates has been shown to be influenced strongly by steric factors.⁴ Consequently, our approach to direct prop-2-ynylic displacement employed blocking the terminal position of the acetylene (4) (Scheme 2) with a



bulky group which was both compatible with organocuprates and labile to subsequent deblocking; we used the Me_3Si group. Thus oct-1-yn-3-ol was treated with 2.0 equiv. of *n*-butyl-lithium (Et_2O ; 0 °C) followed by 2.0 equiv. of trimethylsilyl chloride. Acidic workup (10% aq. HCl) gave the trimethylsilyl alcohol (5)§ in 92% yield after Kugelrohr distillation. Subsequent acetylation (Ac_2O ,

§ All new compounds showed acceptable analysis and spectral data in accordance with assigned structures.

¶ Assignment of the *Z*-configuration to the conjugated olefin part of the bis-enyne (11) rests on the n.m.r. coupling pattern of the methylene protons (observed multiplicity *t* of *d*; *J* 7.0 and 1.5 Hz).

¹ (a) P. Vermeer, H. Westmijze, H. Kleijn, and L. A. van Dijck, *Rec. Trav. chim.*, 1978, **97**, 56; G. Tadema, P. Vermeer, J. Meijer, and L. Brandsma, *ibid.*, 1976, **95**, 66; P. Vermeer, J. Meijer, and L. Brandsma, *ibid.*, 1975, **94**, 112; L. A. van Dijck, B. J. Lankwerde, J. G. C. M. Vermeer, and A. J. M. Weber, *ibid.*, 1971, **90**, 801; J.-L. Luche, E. Barreiro, J.-M. Dollat, and P. Crabbé, *Tetrahedron Letters*, 1975, 4615; C. Descoins, C. A. Henrick, and J. B. Siddall, *ibid.*, 1972, 3777; J. L. Moreau, and M. Gaudemar, *J. Organometallic Chem.*, 1976, **108**, 159; P. Crabbé, E. Barreiro, J.-M. Dollat, and J.-L. Luche, *J.C.S. Chem. Comm.*, 1976, 183; P. Crabbé and H. Carpio, *ibid.*, 1972, 904; M. Kalli, P. D. Landor, and S. R. Landor, *ibid.*, p. 593; *J.C.S. Perkin I*, 1973, 1347; P. Rona and P. Crabbé, *J. Amer. Chem. Soc.*, 1968, **90**, 4733; 1969, **91**, 3289; (b) for a review on the substitution reactions of organocopper species see G. H. Posner, *Org. Reactions*, 1975, **22**, 253.

² R. S. Brinkmeyer and V. M. Kapoor, *J. Amer. Chem. Soc.*, 1977, **99**, 8339.

³ It is of interest that the reaction of Grignard reagents with prop-2-ynylic halides does yield the substitution product (7) in some cases: cf. J. Gore and M. L. Roumestant, *Tetrahedron Letters*, 1970, 891; D. J. Pasto, R. H. Schults, J. A. McGrath, and A. Waterhouse, *J. Org. Chem.*, 1978, **43**, 1382, and references therein; C. N. Bush and D. E. Applequist, *ibid.*, 1976, **42**, 1076.

⁴ Cf. A. Kreft, *Tetrahedron Letters*, 1977, 1035.

⁵ C. Descoins, C. A. Henrick, and J. B. Siddall, *Tetrahedron Letters*, 1972, 3777.

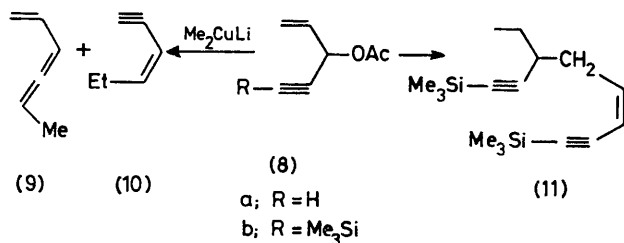
⁶ J.-M. Dollat, J.-L. Luche, and P. Crabbé, *J.C.S. Chem. Comm.*, 1977, 761, and references therein.

TABLE. Displacement of acetate by an alkyl group, (6)→(7) (Scheme 2).

R	Cu source, °C	Isolated yield, %
Me	CuI	0
Bu ⁿ	CuBr·Me ₂ S	-30
CH=CH ₂	CuBr·Me ₂ S	-30
Ph	CuBr·Me ₂ S	-30
		79
		86
		78
		65

pyridine) provided the acetate (6)§ in 91% yield after chromatography (basic alumina, activity grade III). The acetate (6) was then treated with organocuprates (Table) to provide the desired acetylenes (7) (R=Me, Buⁿ, CH=CH₂, or Ph)§ in good yields. The principal side product was the starting alcohol (4), 5–10% yield, resulting from acetate removal by cuprate. No allene products were detected by g.l.c. or n.m.r. spectroscopy.

The trimethylsilyl unit has a profound influence upon the course of reaction between these prop-2-ynylic substrates and lithium dialkylcuprates. The extent of perturbation caused by the trimethylsilyl group is illustrated by the striking difference in reactivity patterns for the analogous enyne acetates (8a) and (8b) (Scheme 3). Thus, Siddall



*et al.*⁵ have shown that the reaction of lithium dimethylcuprate and the enyne acetate (8a) produced the allene (9) (39%) and the enyne (10) (3%). However the trimethylsilyl enyne acetate (8b) generated principally dimeric enyne materials (>90% by g.l.c.) with the major product being (11)¶ (62% of starting material) under the reported conditions.⁵ This coupling reaction implies the existence of a highly reactive allylic copper(III) intermediate⁴ analogous to the previously known prop-2-ynylic organometallic copper(III) species,⁶ and we are currently examining this coupling process.

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