The catalytic hydrogenation method and the silane method complement each other nicely. Both procedures will provide *N*-methylamide from the corresponding methylol in excellent yield, but show different selectivities toward other functional groups in the same molecule.[4,5] This selectivity is exemplified by the reduction of cinnamamide methylol and *p*-nitrobenzamide methylol to different sets of products as shown in Table I. Both of these reduction methods can be used for lactam methylation as exemplified by reduction of *N*-methylolpyrrolidone to *N*-methylpyrrolidone. Imide methylols, on the other hand, appear to be inert to reduction, and phthalimide methylol was recovered unchanged in both experiments. This lack of reactivity is probably due to the inability of phthalamide methylol to form the corresponding less stable acylimidinium ion in trifluoroacetic acid.[6] Ureas can also be successfully methylated in this fashion, and in the two cases attempted (Table I) satisfactory yields were obtained using both reduction procedures.

Experimental Section

All methylols used in this study were prepared from the amide, urea, or lactam and 40% aqueous formaldehyde solution usually in the presence of potassium carbonate or sodium hydroxide using standard procedures previously described in detail.[3] Pyrrolidone methylol was purchased from K and K Laboratories. Trifluoroacetic acid was distilled from concentrated sulfuric acid before use.

General Procedure for Reduction of Methylols with Triethylsilane–Trifluoroacetic Acid. A solution containing 1 mmol of methylol, 1.14 g (10 mmol) of trifluoroacetic acid, 0.174 (1.5 mmol) of triethylsilane, and 10 ml of reagent grade chloroform was stirred for 1–4 hr at room temperature.[7] The mixture was diluted with ethyl acetate and washed with sodium bicarbonate solution. The organic phase was dried ($MgSO_4$) and evaporated to dryness, giving a nearly pure product which could be recrystallized or distilled if desired.

General Procedure for the Reduction of Methylols with Hydrogen–Pd/C–Trifluoroacetic Acid. A solution of 2 mmol of methylol, 2.28 g (20 mmol) of trifluoroacetic acid, and 200 mg of 5% Pd/C in 30 ml of reagent grade chlorofrrm was hydrogenated at room temperature and atmospheric pressure until the theoretical amount of hydrogen was absorbed. The catalyst was removed by filtration and the organic phase was washed with saturated sodium chloride solution, washed with 15% sodium carbonate solution, dried ($MgSO_4$), and evaporated to afford an essentially pure product which could be purified further if desired.

Acknowledgment. We are indebted to the National Science Foundation (MPS 75-01558), National Institutes of Health (CA12568 and HL18450), and Eli Lilly & Co. for financial support.

Registry No.—Trifluoroacetic acid, 76-05-1; triethylsilane, 617-86-7; *N*-methylhexanamide, 3418-05-1; *N*-methylbenzamide, 613-93-4; 4-methoxy-*N*-methylbenzamide, 3400-22-4; *N*-methyl-3-pyridinecarboxamide, 114-33-0; *N*-methylhydrocinnamamide, 940-43-2; *N*-methyl-*N'*-phenylurea, 1007-36-9; *N,N*-diethyl-*N'*-methylurea, 39499-81-5; *N*-methylpyrrolidone, 872-50-4; *p*-amino-*N*-methylbenzamide, 6274-22-2.

References and Notes

(1) (a) Postdoctoral Research Associate. (b) Fellow of the Alfred P. Sloan Foundation 1975–1977; recipient of an NIH Research Career Development Award, 1975–1980.
(2) (a) I. T. Harrison and S. Harrison, "Compendium of Organic Synthetic Methods", Vol. I, Wiley-Interscience, New York, N.Y., 1971, pp 211–212; (b) L. Bernardi, R. DeCastiglione, and U. Scarponi, *J. Chem. Soc., Chem. Commun.*, 320 (1975); (c) H. E. Johnson and D. G. Crosby, *J. Org. Chem.*, **27**, 2205 (1962).
(3) H. E. Zaugg and W. B. Martin, *Org. React.*, **14**, 52 (1965).
(4) D. N. Kursanov, A. N. Parnes, and N. M. Loim, *Synthesis*, 633 (1974).
(5) R. L. Augustine, "Catalytic Hydrogenation", Marcel Dekker, New York, N.Y., 1965.
(6) It has been shown that imide methylols will undergo amidomethylation at carbon if concentrated sulfuric acid is used as catalyst.[3]
(7) In the case of nicotinamide methylol, it was found best to reflux the reaction mixture for 2 hr.

Synthetic Applications of Phenylthio[(α-diethoxymethyl)vinyl]cuprate and (α-Diethoxymethyl)vinylcopper

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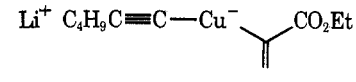
The utility of alkyl, alkenyl, and aryl organocuprate(I) reagents for the formation of carbon–carbon σ bonds via conjugate addition to α,β-unsaturated carbonyl compounds[2] and homoconjugate addition to cyclopropyl carbonyl compounds[3] has been demonstrated. Organocuprate (I) reagents have also been effectively used for selective substitution reactions with a wide variety of substrates[4]. Recently Marino[5] reported the preparation of α-carbethoxyvinylcuprate **1**, which is specific for allyl halides. Alkyl



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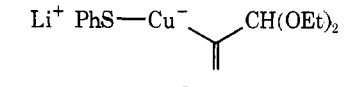

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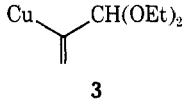
iodides, iodobenzene, 2-bromopropene, and benzyl bromide were unaffected under the reaction conditions employed with allyl halides. Furthermore, in direct contrast with lithium divinylcuprate, dialkylcuprates,[2] and mixed cuprate reagents,[6] the reaction of **1** with a series of α,β-unsaturated carbonyl compounds resulted in 1,2 addition to the carbonyl with the exception of methyl vinyl ketone.[7,8] In conjunction with our interest in functionalized nonterminal vinylcopper reagents,[9,10] we wish to communicate our results involving the mixed cuprate phenylthio[(α-diethoxymethyl)vinyl]cuprate (**2**) and (α-diethoxymethyl)vinylcopper (**3**).



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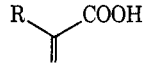

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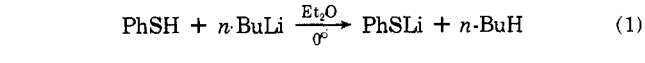
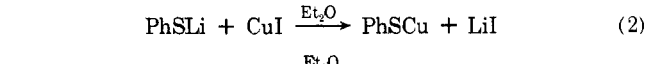
Our interest in reagents of type **2** stemmed from a need to construct a three-carbon unit fused to a carbon framework which would be equivalent to a 2-substituted propenoic acid derivative (e.g., **4**). In this regard we wish to report the generation of the mixed organocuprate reagent **2**, its reactivity toward allylic halides and α,β-unsaturated ketones, and its application to the synthesis of α-methylene lactones. In addition generation of the vinylcopper reagent **3** and its reactivity toward allylic halides is reported.

The mixed cuprate **2** was prepared according to eq 1–3. Thiophenol in anhydrous ether was treated with 1 equiv of



(1)



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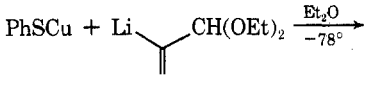

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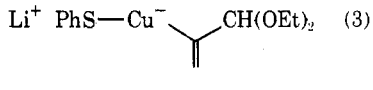
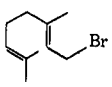
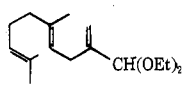
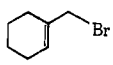
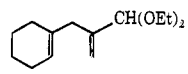
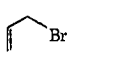
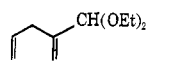
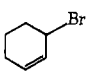
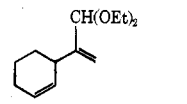
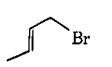
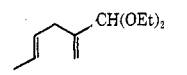
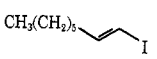


(3)

n-butyllithium. Addition of the lithium thiophenoxide to a suspension of cuprous iodide at room temperature in anhy-

Table I
Reaction of RX with Phenylthio[(α-diethoxymethyl)vinyl]cuprate (2) and (α-Diethoxymethyl)vinylcopper (3)

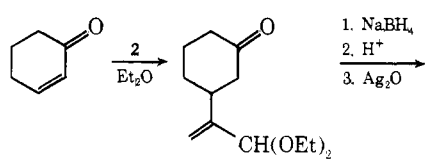
RX	Registry no.	Product	Registry no.	% yield[a] based on 2	% yield[a] based on 3
	25996-10-5		57428-07-6	85	90
	37677-17-1		57428-08-7	70	75
	106-95-6		57428-09-8	80	70
	1521-51-3		57428-10-1	76[b]	50[c]
	29576-14-5		57428-11-2	74	65
	42599-17-7			No reaction	
$PhCH_2Br$	100-39-0			No reaction	

[a] All yields are based on starting halide and on isolated chromatographically pure substances. In all experiments 2.0 equiv of reagent was employed and reactions were conducted at −78° (1 h) followed by warming to −40° (1 h) except where noted. [b] Reaction was carried out at −40° for 3 h. [c] Reaction was carried out at −40° for 2 h.

drous ether produced phenylthiocopper which was cooled to −78° and treated with the α-lithio derivative (5)[11] of the ethyl acetal of α-bromoacrolein. The reactivity of 2 at or below −40° with various halides revealed, as was the case with 1, that mixed cuprate 2 allows for the economical selective transfer of a latent three-carbon propenoic acid chain and is highly specific for allylic halides. The results are summarized in Table I. As indicated in Table I, benzyl bromide[12] and 1-iodo-*trans*-oct-1-ene failed to undergo reaction under the conditions reported. Cyclohexene epoxide failed to react under similar conditions.

Recently new mixed cuprate(I) reagents for the selective transfer of vinyl[6] have been developed for 1,4-conjugate vinylation of cyclopentenones and cyclohexenones. The inability of the α-carbethoxyvinylcuprate reagent (1) to undergo conjugate addition is surprising and suggests that the ester moiety and the acetylenic ligand reduce the reagent's nucleophilicity. We have observed that the functionalized nonterminal mixed cuprate 2 undergoes smooth conjugate 1,4 addition to cyclohexenone, cyclopentenone, and methyl vinyl ketone in *diethyl ether*[13] at temperatures below −40° in 88, 50, and 50% yields, respectively.[14]

To illustrate the potential of this new reagent we have developed a route to an unreported class of δ-valerolactones[15] which employs the 1,4 addition of 2 to enones. The product 6 from addition to cyclohexenone was reduced



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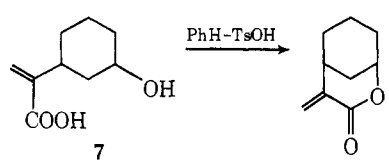

7 8

with sodium borohydride and smoothly converted to the hydroxypropenoic acid derivative 7 (82% overall yield). The unsaturated acid 7 was lactonized to the α-methylene-δ-valerolactone 8 in 60% yield.

During the course of this investigation we observed that the corresponding (α-diethoxymethyl)vinylcopper reagent 3 (generated from 5 and cuprous iodide in equimolar ratio) is highly specific for allylic halides and provides a stereospecific route to functionalized 1,4-dienes.[16] In contrast to the facile and efficient reactions with allylic halides, 3 did not react with benzyl bromide or 1-iodo-*trans*-oct-1-ene. Addition of cyclohexenone to 3 in diethyl ether resulted in a 90% isolated yield of only the 1,2-addition product.

The ability of phenylthio[(α-diethoxymethyl)vinyl]cuprate (2) to selectively transfer the nonterminal vinyl moiety to α,β-unsaturated enones and allylic halides provides a useful method for synthesizing a wide variety of 2-substituted propenoic acid derivatives.

Experimental Section

NMR spectra were obtained on Varian A-60 and T-60 spectrometers in CCl_4 or $CDCl_3$ solutions with Me_4Si as an internal standard. Infrared spectra (ir) were obtained on a Perkin-Elmer Model 247 infrared spectrophotometer as a liquid film or in $CHCl_3$ solution. Mass spectra (MS) were recorded on an LKB-9000 and a Varian MAT CH5-DF. Boiling points are uncorrected. Analyses were performed by Galbraith Laboratories, Inc., Knoxville, Tenn. Anhydrous cuprous iodide was purchased from Alfa Inorganics, Inc., and used directly without further drying or purification. Diethyl ether was dried and kept over sodium prior to use. *n*-Butyllithium obtained from MCB was about 1.55 M in hexane solution.

General Procedure for Reaction for α,β-Unsaturated Ketones with Lithium Phenylthio[(α-diethoxymethyl)vinyl]cuprate. To a suspension of 381 mg (2.0 mmol) of cuprous iodide in 2.0 ml of anhydrous ether under nitrogen was added lithium thiophenoxide (2.0 mmol) [prepared by reaction of 1.29 ml (2.0 mmol) of *n*-butyllithium and 220 mg (2.0 mmol) of thiophenol at 0° under nitrogen in 2.0 ml of anhydrous ether] in ether at room temperature. A yellow heterogeneous mixture was formed. After 5 min the mixture was cooled to −78° and a precooled (−78°) solution of 2-lithio-1,1-diethoxy-2-propene in ether [prepared[11] by reaction of 418 mg (2.0 mmol) of 1,1-diethoxy-2-bromo-2-propene with 1.29 ml (2.0 mmol) of *n*-butyllithium at −78° in 4.0 ml of anhydrous

ether (1 h)] was added. After 1 h at −78°, 96 mg (1.0 mmol) of cyclohexenone in 2.0 ml of dry ether was added. The reaction mixture was stirred at −78° for 1 h followed by warming to −40°. After 2 h at −40°, the reaction was quenched by the addition of 2.0 ml of saturated ammonium chloride solution. The yellow precipitate was removed by filtration through Celite and washed with ether. The combined ether layers were washed with saturated ammonium chloride and 5% sodium hydroxide and dried over anhydrous sodium sulfate. Removal of the solvent under reduced pressure gave 312 mg of crude product. Purification on 10.0 g of silica gel [elution with ether–hexanes (1:12)] gave 200 mg (88%) of pure 1,4-addition product **6**: ir ($CHCl_3$) 5.85 μ; NMR (CCl_4) δ 5.18 (s, 1 H), 4.98 (s, 1 H), 4.70 (s, 1 H), 3.40 (m, 4 H), 1.17 (t, 6 H); MS *m/e* 226. An analytical sample was prepared by distillation [45° (bath temperature) (0.25 mmHg)].

Anal. Calcd for $C_{13}H_{22}O_3$: 226.1569. Found: 226.1572.

2-(*cis*-3-Hydroxycyclohexyl)propenoic Acid Lactone (8). To a solution of sodium borohydride (46 mg, 0.92 mmol) in 10 ml of absolute ethanol was added a solution of ketone **6** (175 mg, 0.77 mmol) in 2 ml of absolute ethanol. After 1 h at room temperature, the solvent was removed under reduced pressure. The residue was taken up in ether and washed with saturated brine. The ether layer was dried (Na_2SO_4) and the solvent removed in vacuo to afford 171 mg (97%) of alcohol which was used directly in the next reaction.

A solution of the above alcohol (170 mg, 0.75 mmol) in 5 ml of tetrahydrofuran was added to 5 ml of 5% hydrochloric acid. The reaction mixture was stirred for 8 h at room temperature. Usual work-up with ether gave 113 mg (99%) of essentially pure aldehyde: ir (film) 2.95, 3.71, 5.95, 6.17 μ; NMR (CCl_4) δ 9.38 (s, 1 H), 6.22 (s, 1 H), 5.96 (s, 1 H).

The above aldehyde (113 mg, 0.73 mmol) in 5 ml of dioxane was added to a solution of silver nitrate (240 mg, 1.46 mmol) in 10 ml of water. The resultant solution was treated dropwise with 5% sodium hydroxide until pH 10 was reached. The mixture was heated at 80° for 1 hr. Additional sodium hydroxide was added to maintain the pH at 10. The reaction mixture was cooled, filtered, and extracted with ether. Acidification of the aqueous layer with hydrochloric acid followed by extraction with ethyl acetate gave, after drying ($MgSO_4$) and removal of the solvent in vacuo, 105 mg (85%) of hydroxycarboxylic acid **7**: ir ($CHCl_3$) 2.65–4.50 (broad), 5.91, 6.17 μ.

A solution of carboxylic acid **7** (105 mg, 0.61 mmol) in benzene (25 ml) containing *p*-toluenesulfonic acid (10 mg) was refluxed for 12 h employing a Dean-Stark apparatus. The cooled reaction mixture was extracted with sodium bicarbonate solution and brine and dried over anhydrous magnesium sulfate. Removal of the solvent under reduced pressure gave 71 mg of crude lactone. Purification on silica gel (10 g) [elution with ether–hexanes (1:2)] gave 55 mg (60%) of pure α-methylene lactone **8**: ir ($CHCl_3$) 5.85, 6.15 μ; NMR (CCl_4) δ 6.18 (d, J = 2 Hz, 1 H), 5.38 (d, J = 2 Hz, 1 H), 4.60 (bs, 1 H), 2.88 (bs, 1 H); MS *m/e* 152. An analytical sample was prepared by distillation [45° (bath temperature) (0.25 mmHg)].

Anal. Calcd for $C_9H_{12}O_2$: C, 71.03; H, 7.95. Found: C, 70.95; H, 7.90.

General Procedure for Reaction of Phenylthio[(α-diethoxymethyl)vinyl]cuprate with Allylic Halides. To a suspension of phenylthiocopper (2.0 mmol) (prepared as described above) in anhydrous ether cooled to −78° was added a precooled (−78°) solution of 2-lithio-1,1-diethoxy-2-propene (2.0 mmol) in dry ether (prepared as described above). After 1 h at −78°, geranyl bromide (217 mg, 1.0 mmol) in 2.0 ml of ether was added. After stirring for 1 h at −78°, the temperature was warmed to −40° and stirring was continued for an additional 1 h. The reaction was quenched with saturated ammonium chloride solution (2.0 ml). The yellow precipitate was filtered and washed with ether. The combined ether layers were washed with saturated ammonium chloride, 5% aqueous sodium hydroxide, and brine. After drying over anhydrous sodium sulfate, the solvent was removed under reduced pressure, affording 320 mg of crude product. Purification by passage through a silica gel column [10.0 g, elution with ether–hexanes (1:40)] gave 229 mg (85%) of pure compound: NMR (CCl_4) δ 4.8–5.3 (m, 4 H), 4.61 (s, 1 H), 3.45 (m, 4 H), 2.58 (d, 2 H), 2.05 (m, 4 H), 1.55 (bs, 3 H), 1.58 (bs, 6 H), 1.18 (t, 6 H); MS *m/e* 266. An analytical sample was prepared by distillation [50° (bath temperature) (0.3 mmHg)].

Anal. Calcd for $C_{17}H_{30}O_2$: C, 76.64; H, 11.35. Found: C, 76.89; H, 11.50.

(α-Diethoxymethyl)vinylcopper. Preparation and Reaction with Allylic Halides. To a suspension of cuprous iodide (381 mg, 2.0 mmol) in 2.0 ml of anhydrous ether under nitrogen at −78° was added a precooled (−78°) solution of 2-lithio-1,1-diethoxy-2-propene (2.0 mmol) (prepared as described above) in anhydrous ether. After 1 h at −78°, a solution of cyclohexenyl bromide (161 mg, 1.0 mmol) in 2.0 ml of anhydrous ether was added. The reaction mixture was stirred at −40° for 2 h. The reaction was quenched with saturated ammonium chloride solution. The yellow precipitate was filtered through Celite and washed with ether. The combined ether fractions were washed with saturated ammonium chloride solution and brine and dried over anhydrous sodium sulfate. Evaporation of the solvent in vacuo afforded 339 mg of crude product. Purification on silica gel [10.0 g, elution with ether–hexanes (1:20)] gave 105 mg (50%) of pure product: NMR (CCl_4) δ 5.58 (m, 2 H), 5.20 (bs, 1 H), 4.98 (bs, 1 H), 4.71 (s, 1 H), 3.48 (m, 4 H); MS *m/e* 210. An analytical sample was prepared by distillation [40° (bath temperature (0.3 mmHg)].

Anal. Calcd for $C_{13}H_{22}O_2$: C, 74.24; H, 10.54. Found: C, 73.98; H, 10.44.

Reaction of (α-Diethoxymethyl)vinylcopper with Cyclohexenone. To a suspension of cuprous idodide (381 mg, 2.0 mmol) in 2.0 ml of anhydrous ether under nitrogen at −78° was added a precooled (−78°) solution of 2-lithio-1,1-diethoxy-2-propene (2.0 mmol) (prepared as described above) in anhydrous ether. After 1 h at −78°, a solution of cyclohexenone (96 mg, 1.0 mmol) in 2.0 ml of anhydrous ether was added. The reaction mixture was stirred at −78° for 2 h. The reaction was quenched with saturated ammonium chloride solution. The yellow precipitate was filtered through Celite and washed with ether. The combined ether fractions were washed with saturated ammonium chloride solution and brine and dried over anhydrous sodium sulfate. Evaporation of the solvent in vacuo afforded 230 mg of crude product. Purification on silica gel [10.0 g, elution with ether–hexanes (1:4)] gave 203 mg (90%) of pure product [ir (neat) 2.89, 3.31, 6.13 μ; NMR (CCl_4) δ 5.7–5.5 (m, 2 H), 5.28 (bs, 1 H), 5.15 (bs, 1 H), 4.98 (s, 1 H), 3.7–3.2 (m, 4 H), 2.4–1.3 (m, 7 H), 1.18 (t, 6 H)] which was identical with a sample prepared by reaction of cyclohexenone with reagent **5**.

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Registry No.—**2**, 57428-24-7; **3**, 57428-12-3; **5**, 54780-30-2; **6**, 57428-13-4; **7**, 57428-14-5; **8**, 57428-15-6; cuprous iodide, 7681-65-4; lithium thiophenoxide, 2973-86-6; cyclohexenone, 930-68-7; 2-(*cis*-3-hydroxycyclohexyl)propenol diethyl acetal, 57428-16-7; 2-(*cis*-3-hydroxycyclohexyl)propenol, 57428-17-8.

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(11) The generation and use of 2-lithio-1,1-diethoxy-2-propene has been described by J. Ficini and J.-C. Depezay, *Tetrahedron Lett.*, 4797 (1969).
(12) Reaction of benzyl bromide with **2** at −40° for 4 h gave ca. 88% yield

of recovered benzyl bromide. At temperatures between −20 and 0° appreciable amounts of benzyl phenyl sulfide were isolated. At −40° <5% of benzyl phenyl sulfide could be detected.

(13) Posner[6c] has observed that lithium methyl(vinyl)cuprate in THF transfers the vinyl exclusively to C-3 of 2-cyclopentenone. When diethyl ether is employed instead of THF, the methyl and vinyl groups are both transferred to C-3 of 2-cyclopentenone. In our hands use of THF results in greatly diminished yields of 1,4-addition product.

(14) Yields are based on starting enone and on isolated chromatographically pure material. In general 2.0 equiv of **2** was employed and reactions were conducted at −78° (1 hr) followed by warming to −40° (2 hr).

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Synthesis of α-Substituted Selenonesters

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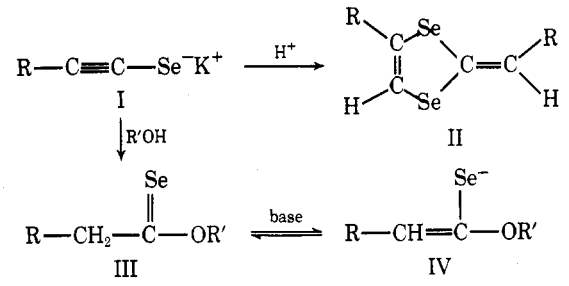
The syntheses of very few selenonesters have been reported[1]. We wish to report a new general synthesis of α-substituted selenonesters.

During our previous work we had observed that arylethynylselenolate salts (I), prepared from 4-aryl-1,2,3-selenadiazoles, dimerized to form 1,3-diselenafulvenes (II).[2] Raap[3] has reported that aryl- or alkylethynylthiolates under certain conditions react with alcohols to form thionesters. It appeared possible that in very dilute solutions the rate of the bimolecular step leading to the fulvene II should slow down and reaction of I with protic solvents should predominate.



When I (R = Ph) is added to ethanol in low concentrations, besides the appearance of the characteristic absorbance at 340 nm for the fulvene a new peak at 275 nm is formed. Upon basification, this absorbance is shifted to 325 nm with an increase in absorbance. By using a technique of slow addition to a slightly acidified solution, such that the concentration of I at any time remains below 10^{-5} *M*, the formation of the fulvene is minimized; the product is essentially the 275-nm compound. Purified by column chromatography, the light yellow liquid was identified by its NMR, MS, and ir spectra as *O*-ethylphenyl selenonacetate (III).

The bathochromic shift in the uv spectrum on addition of base is attributed to the formation of the enolate ion (IV). A similar enolization of thionesters could be observed under more strongly basic conditions. Evidence for thione–enethiol equilibrium has been reported using polarographic techniques[4].

The NMR spectrum of all the selenonester derivatives formed (Table I) showed a shift of the methylene as well as the protons of the alkyl group of the ester to a lower field than the corresponding oxygen and even slightly lower than the sulfur analogues.

Besides the derivatives shown in Table I, selenonesters of acetic and propionic acids were also prepared. However, owing to their volatility, they could not be isolated in pure form and were identified only through their characteristic uv spectra.

Table I
Chemical Shifts and Ultraviolet Spectral Data of Selenoesters and Comparison with Thione and Oxygen Esters

Ester	Registry no.	NMR,[a] δ, ppm	λ_{max}, nm (ε)
PhCH$_2$C(=Se)OMe	57444-30-1	3.95 (2 H, s), 4.13 (3 H, s), 7.2 (5 H, br s)	275 (6.7×10^3)[b]
PhCH$_2$C(=S)OMe	5873-85-8	3.95 (2 H, s), 3.94 (3 H, s), 7.2 (5 H, br s)	240 (7.1×10^3)[b]
PhCH$_2$C(=O)OMe	101-41-7	3.50 (3 H, s), 3.54 (2 H, s), 7.2 (5 H, br s)	214 (6.0×10^3)[b]
PhCH$_2$C(=Se)OEt	57444-31-2	1.40 (3 H, t), 3.95 (2 H, s), 4.60 (2 H, q), 7.2 (5 H, br s)	277 (7.7×10^3)[c]
PhCH$_2$C(=Se)O-*i*-Pr	57444-32-3	1.30 (6 H, d), 3.90 (2 H, s), 5.60 (1 H, m), 7.2 (5 H, br s)	282 (8.3×10^3)[d]
p-MeOPhCH$_2$C(=Se)OMe	57444-33-4	3.89 (2 H, s), 3.95 (2 H, s), 4.18 (3 H, s), 6.75 (2 H, d), 7.20 (2 H, d)	275 (7.6×10^3)[b]
p-ClPhCH$_2$C(=Se)OMe	57444-34-5	3.98 (2 H, s), 4.18 (3 H, s), 7.25 (4 H, br s)	275 (7.0×10^3)[b]
p-O$_2$NPhCH$_2$C(=Se)OMe	57444-35-6	4.0 (2 H, s), 4.16 (3 H, s), 7.4 (2 H, d), 8.1 (2 H, d)	275 (1.68×10^4)[b]
β-Naph-CH$_2$C(=Se)OMe	57444-36-7	4.20 (5 H, s), 7.6 (7 H, m)	276 (1.3×10^4)[b]

[a] In carbon tetrachloride with Me_4Si as internal reference. [b] In methanol. [c] In ethanol. [d] In 2-propanol.