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RELATIVE CONFIGURATIONS OF PHENYLTRIPHENYLSILYLCARBINOL AND PHENYLTRIPHENYLMETHYLCARBINOL

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Our investigations on asymmetric reductions (1), required that the absolute configuration and maximum rotation of (+)-phenyltriphenylsilylcarbinol (IA) be determined. The racemate (2) was resolved by fractional crystallization from acetone of the brucine salt of its acid phthalate. Lithium aluminum hydride regeneration of the carbinol gave (+)-IA, $[\alpha]_D^{22} + 49.5 \pm 1.1°$ (c 1.775, $CHCl_3$) and (-)-IA, $[\alpha]_D^{21} -48.6 \pm 1.1°$ (c 1.915, $CHCl_3$).

The molecular rotations of (+)-phenyltriphenylsilylcarbinol, (+)-IA and (+)-phenyltriphenylmethylcarbinol, (+)-IIA, (3) and derivatives are compared according to the Freudenberg method (4) in Table I. In accord with the trend

TABLE I

Molecular Rotations, $[M]_D$, ($CHCl_3$) for (+)-Phenyltriphenylsilylcarbinol and (+)-Phenyltriphenylmethylcarbinol and their Derivatives [a]

No.	Compound	A H	B OAc	C Ph-COCO	D $R=C_8H_5O_3$ [b]
(+)-I	$Ph\overset{*}{C}H(OR)SiPh_3$	+181	+138	+209	+266
(+)-II	$Ph\overset{*}{C}H(OR)CPh_3$	+151	+132	+265	+256

(a) All new compounds gave elemental analyses and infrared spectra compatible with their assigned structures.
(b) The radical $C_8H_5O_3$ represents the <u>o</u>-phthalyl group.

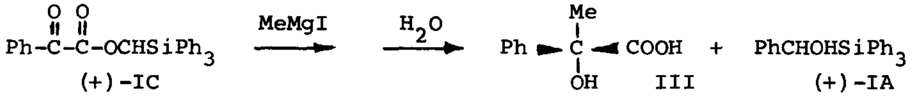
common to both series, these data support the assignment of the same relative configuration to both (+)-I and (+)-II. The ORD curves for (+)-IA and (+)-IIA show the following inflection points, [α] ($CHCl_3$):

λ mμ	589	290	280	275	272	270	268	265	263	243
(+)-IA	+181	+778	+400	+2350	+1950		+4030	+3650		+8350
(+)-IIA	+151		+1710	-357		+1000		-1210	-850	

Although both curves show an initial rise with lowering wavelength, the two curves deviate markedly at 290 mμ in a way which is difficult to use for the basis of a definitive assignment of relative configurations.

We therefore applied the quasi-racemate method of Fredga (4) to this system. The melting points of carefully prepared mixtures of (+)-IA (m.p. 104°) and (+)-IIA (m.p. 108°) were taken on a Kofler hot stage. The important inflection points, with corresponding mole per cent compositions, were as follows: 100° (30% (+)-IA), 109° (50%), 53° (70%). Similarly the values for the mixtures of (-)-IA and (+)-IIA were: 91° (40% (-)-IA), 96° (50%), 49° (60%). The melting points of the two (+)-I, (+)-II eutectic mixtures as well as the 50 mole per cent mixture, were consistently higher than the corresponding points for the (-)-IA, (+)-IIA mixtures. By direct comparison, the 50:50 mixture of (-)-IA and (+)-IIA melted thirteen degrees higher than the 50:50 mixture of (-)-IA and (+)-IIA, and one degree higher than pure (+)-IIA. According to Ricci (6), when in a quasi-racemate study both enantiomers exhibit compound formation in the solid state, as is apparently true in this case, then that combination with the higher melting point represents a mixture of compounds of opposite configuration. Based on this evidence therefore one concludes that (+)-IA and (+)-IIA have opposite configurations contrary to the conclusion drawn from the data in Table I.

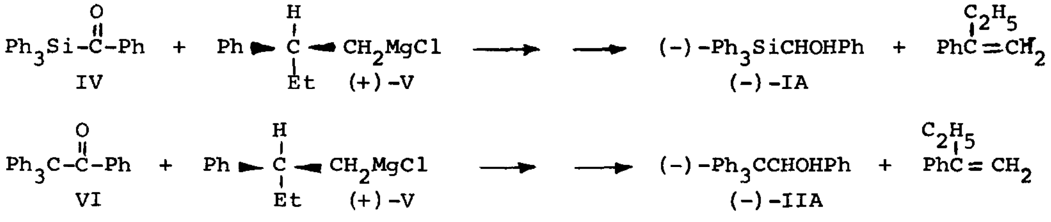
These conflicting data concerning the relative configurations to (+)-IA and (+)-IIA have been tested further by applying the Prelog atrolactic asymmetric synthesis method (3,7) directly to (+)-IA. (+)-Phenyltriphenylsilylcarbinyl phenylglyoxylate, (+)-IC, m.p. 166-168°, $[\alpha]_D^{22}+ 41.9 \pm 0.9°$ (c 2.245, $CHCl_3$), was prepared (65% yield) when (+)-IA, $[\alpha]_D^{25}$+ 48.4 ± -.-2° (c 11.0, $CHCl_3$) was stirred overnight at 20-25° with excess phenylglyoxalyl chloride (8). Upon treatment of (+)-IC with excess Grignard reagent from methyl iodide, followed by alkaline hydrolysis of the resulting atrolactic ester, (+)-atrolactic acid (III) (93° unrecrystallized yield), $[\alpha]_D$ + 9.6° (c 3.10, CH_3OH) corresponding to approximately 28% asymmetric synthesis, was obtained. Recrystallization



$$\underset{(+)\text{-IC}}{\mathrm{Ph{-}\overset{O}{\overset{\|}{C}}{-}\overset{O}{\overset{\|}{C}}{-}OCHSiPh_3}} \xrightarrow{\mathrm{MeMgI}} \xrightarrow{\mathrm{H_2O}} \mathrm{Ph}-\overset{\mathrm{Me}}{\underset{\mathrm{OH}}{\mathrm{C}}}-\underset{\mathrm{III}}{\mathrm{COOH}} + \underset{(+)\text{-IA}}{\mathrm{PhCHOHSiPh_3}}$$

gave atrolactic acid $[\alpha]_D^{15}$+ 14.6° (c 0.410, CH_3OH). Prelog's asymmetric synthesis starting with (+)-phenyltriphenylmethylcarbinol (3) gave (-)-atrolactic acid $[\alpha]_D$-10.3° (c 5.2, C_2H_5OH), corresponding to 27% asymmetric synthesis. Thus (+)-IA and (+)-IIA give atrolactic acids of opposite configurations with approximately the same extent of asymmetric synthesis. Accordingly, based on this evidence and Prelog's generalization, one concludes that (+)-IA and (+)-IIA have opposite configurations in accord with the conclusions from the quasi-racemate study, but in contrast to the conclusion drawn from the data in Table I.

The situation is further confused by the fact that asymmetric reduction of IV by the Grignard reagent from (+)-1-chloro-2-phenylbutane (V) gives (-)-IA ($[\alpha]_D^{21}$-5.09° (c 22.6, $CHCl_3$) while reduction of VI with the same Grignard reagent gives (-)-IIA $[\alpha]_D^{20}$-13.6° (c 2.1, $CHCl_3$) a result which leads to the conclusion that (-)-IA and (-)-IIA are configurationally related.



$$\underset{\mathrm{IV}}{\mathrm{Ph_3Si{-}\overset{O}{\overset{\|}{C}}{-}Ph}} + \mathrm{Ph}-\overset{\mathrm{H}}{\underset{\mathrm{Et}}{\mathrm{C}}}-\underset{(+)\text{-V}}{\mathrm{CH_2MgCl}} \longrightarrow \longrightarrow \underset{(-)\text{-IA}}{(-)\text{-}\mathrm{Ph_3SiCHOHPh}} + \mathrm{Ph\overset{C_2H_5}{C}{=}CH_2}$$

$$\underset{\mathrm{VI}}{\mathrm{Ph_3C{-}\overset{O}{\overset{\|}{C}}{-}Ph}} + \mathrm{Ph}-\overset{\mathrm{H}}{\underset{\mathrm{Et}}{\mathrm{C}}}-\underset{(+)\text{-V}}{\mathrm{CH_2MgCl}} \longrightarrow \longrightarrow \underset{(-)\text{-IIA}}{(-)\text{-}\mathrm{Ph_3CCHOHPh}} + \mathrm{Ph\overset{C_2H_5}{C}{=}CH_2}$$

Until further information is available it is apparent that reliable stereochemical conclusions cannot be made concerning the relative configurations of triphenylsilyl and triphenylmethyl analogs based upon asymmetric synthesis alone. Work is in progress to establish unequivocally the absolute configurations of these compounds and to extend the studies to the analogous trimethylsilyl-*t*-butyl system.

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