Table 1. Preparation of N-Boc and N-Cbz Carbamates from Amines[a]

amine	N-Boc carbamate time, h	N-Boc carbamate yield, %	N-Cbz carbamate time, h	N-Cbz carbamate yield, %
$C_6H_5CH_2NH_2$	0.1	90	0.1	96
$CH_3NHCH_2CH_2OH$	0.1	96		
$CH_3(CH_2)_2NH_2$	0.1	97		
$(CH_3)_2CHNHCH(CH_3)_2$	30	92	2	88
$C_6H_5NH_2$	5.5	94	0.5	98
	84	72	3	86

[a]The reaction was carried out with equimolar amounts of an amine and the reagent in methylene chloride at room temperature.

Table 2. Preparation of N-Boc and N-Cbz Amino Acids[a]

amino acid	method[b]	N-Boc amino acid time, h	N-Boc amino acid yield, %[c]	N-Cbz amino acid time, h	N-Cbz amino acid yield, %[c]
Pro	A	0.5	76	0.2	96
	B	10	97		
Ala	A	0.5	66	0.2	97
	B	10	82		
Try	A	0.5	60	0.2	95
	B	10	93		
Val	A	0.5	62	0.2	97
	B	10	96		
Leu	A	0.5	64	0.2	86
	B	10	80		
Met	A	0.5	70	0.2	90
	B	10	80		
Phe	A			0.2	96
	B	10	85		

[a]The reaction was carried out with equimolar amounts of an amino acid, the reagent, and triethylamine. [b]Method A: in aqueous DMF at room temperature. Method B: in p-dioxane at 80°C. [c]Isolated yields.

though the reaction required 10 h at 80°C for completion of the reaction. Under the present conditions, several amino acids were cleanly converted into the corresponding N-Boc amino acids as shown in Table 2. However, benzyloxycarbonylation of amino acids occurred cleanly and rapidly in aqueous N,N'-dimethylformamide and the reaction was generally complete 10 min at room temperature. The identities of N-Boc and N-Cbz amino acids were confirmed by comparison NMR, mp, and $[\alpha]_D$ values with reported data.

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7. mp 104°C; NMR($CDCl_3$) δ 1.68 (s, 1H), 6.20-6.48 (m, 1H), 6.75-6.90 (m, 1H), 7.36-7.62 (m, 2H); IR(KBr) 1825, 1675 cm^{-1}. Calcd for $C_{10}H_{13}NO_4$: C, 56.89; H, 6.21; N, 6.63. Found: C, 56.8; H, 6.3; N, 6.6.
8. mp 99°C; NMR($CDCl_3$) δ 5.34 (s, 2H), 5.90-6.20 (m, 1H), 6.48-7.71 (m, 1H), 7.20-7.45 (m, 7H); IR(KBr) 1800, 1685 cm^{-1}. Calcd for $C_{13}H_{11}NO_4$: C, 63.71; H, 4.52; N, 5.76. Found: C, 63.5; H, 4.7; N, 5.7.

A Simple Approach to the Valerane Skeleton

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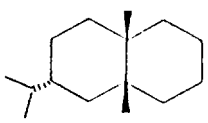
The carbon framework of the valerane sesquiterpenes provides stereochemically interesting *cis*-dimethyl substitution around the ring junction.[1] The parent compound is obtained by the reduction of 1-valeranone which isolated from *Valeriana officinalis*.[2] As a continuation of our studies using dianion methodology[3] we explored the stereospecific formation of the parent, valerane, (**1**).

Our approach is different from that recently reported by Garratt[4] in the timing of incorporation of the isopropyl group. Hydrogenolysis of the C-S bond of 12-thia[4.4.3]propell-3-



1

ene(**2**) by using Raney-nickel whose synthesis was reported in the previous article[5], provided the required *cis*-9, 10-dimethyl decalin-2-ene-(**3**) in 73% yield. The introduction of the isopropyl group was achieved according to the sequences shown in Figure 1. Hydroboration of the alkene bond of **3**

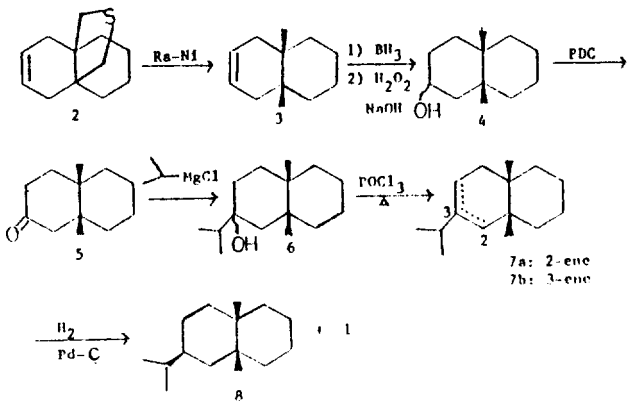


Figure 1. The synthesis of valerane.

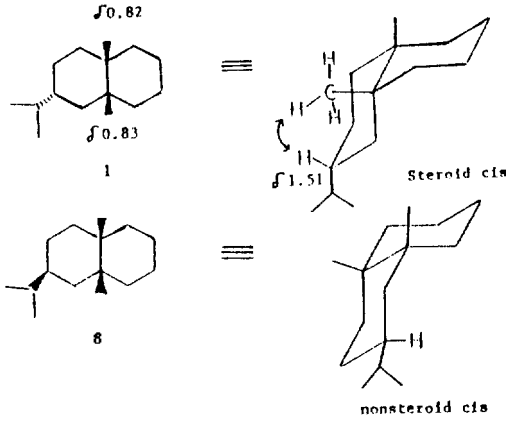


Figure 2. Conformational assignment for valerane.

gave the alcohol **4** in 95% yield. Oxidation of **4** with PDC in methylene chloride for 24 hours gave the corresponding ketone(**5**) in 93% conversion. Treatment of **5** with isopropylmagnesium chloride in ether gave an epimeric mixture of alcohol **6** in 88% yield. Dehydration of **6** with phosphorous oxychloride in pyridine at 90°C gave a 73% yield of a 45:55 mixture of **7a** and **7b** respectively. Catalytic reduction of these olefinic mixture by using hydrogenator at 60 psi for 12 hours with palladium on carbon in hexane gave a 45:55 mixture of the isomeric valeranes in 80% yield.

Rao[6] and Baldwin[7] synthesized **1** and **8** as a 40:60 ratio and the reported spectral data is identical with ours.[8]. In view of the flexible nature of the *cis* decalin, valerane could exist in at least two interchangeable all-chair conformations such as the steroid *cis* conformation or the nonsteroid *cis* conformation (Figure 2). Hartshorn[9] and Hikino[10] proved that valeranon exists in the steroid *cis* conformation from a study of its optical rotatory dispersion. Also, we proved the conformation of **1** and **8** by a NOE experiment as follows: Irradition of the 0.83ppm resonance in **1** gave a positive NOE effect at 1.51 ppm, but irradition of 0.84 and 0.79 ppm in **8** did not give any positive NOE effect, which indicates **1** is in the steroid *cis* conformation and **8** is in the nonsteroid *cis* conformation.

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8. **1** and **8** are separated by 10% OV-17 column(11' × 1/4") in GC. $CDCl_3$ is used as a solvent and the chemical shifts are reported in parts per million relative to TMS in ^1H and ^{13}C NMR. The absorption frequencies of IR are reported in reciprocal centimeters.
1: ^1H NMR, 1.86-1.03(16H, m), 0.84(6H,d,J=OHz), 0.83(3H,s), 0.82(3H,s); MS, 208(M^+), 193, 165, 149, 137, 123, 109, 95, 83(base), 69, 55, 41; HRMS, Calcd. for $C_{15}H_{28}$: 208.2191. Observed: 208.2180.
8: ^1H NMR, 1.95-1.04(16H,m), 0.84(3H,s), 0.83(6H,d, J=6Hz), 0.79(3H,s); MS, 208(M^+), 193(base), 165, 151, 137, 123, 109. 95, 83, 69, 55, 41; HRMS, Calcd. for $C_{15}H_{28}$: 208.2191. Observed: 208.2180.
3: ^1H NMR, 5.53(2H, s), 1.98-1.28(12H, m), 0.85(6H, s); ^{13}C NMR, 124.5(d), 35.1(s), 34.4(t), 34.1(t), 23.9(t), 21.7(q); MS, 164(M^+), 149(base), 135, 109, 93, 81, 67, 55, 41; IR, 2907, 1449, 1374, 909, 735.
4: ^1H NMR, 3.85(1H, br s), 2.0-1.0(15H, m), 0.87(3H, s), 0.85(3H, s); ^{13}C NMR, 67.9 and 66.9 for the isomers of the hydroxyl-bearing carbon. Several peaks were found at 37-31 and 25-21 ppm; MS, 182(M^+), 164, 149(base), 135, 121, 109, 95, 82, 67, 55, 42; IR, 3289, 2915, 1449, 1370, 1242, 1040.
5: ^1H NMR, 2.35(2H, br s), 1.7-1.2(12H, m), 1.02(3H, s), 0.89(3H, s); ^{13}C NMR, 199.8, 40.6, 38.0, 35.2, 34.8, 33.7, 23.4, 22.9, 21.7, 21.3; MS, 180(M^+), 165, 137, 123, 109(base), 95, 82, 67, 55, 42; IR, 2899, 1709, 1447, 705.
6: ^1H NMR, 2.0-1.3(16H, m), 1.01(3H, s), 0.88(3H,d,J=6Hz), 0.86(3H,d,J≈10Hz), 0.77(3H, s); ^{13}C NMR, 74.6 and 74.2 for the isomeric hydroxycarbon; MS, 206 (M^+-H_2O), 181(base), 163, 123, 107, 69, 55, 44; IR, 3390, 2933, 1449.
7a: ^1H NMR, 4.95(1H,t,J≈1.5Hz), 1.9-1.2 (14H, m), 0.96(6H,d,J=7Hz), 0.83(3H, s), 0.80(3H, s); ^{13}C NMR, 140.4 and 121.3 for sp^2 carbon; MS, 206(M^+), 191, 163, 150, 135, 107(base), 95, 81, 67, 55, 42; IR, 2907, 1449.
7b: ^1H NMR, 5.23(1H,t,J=2Hz), 1.9-1.2 (14H, m), 0.96(6H,d,J=7Hz), 0.83(6H, s); ^{13}C NMR, 140.4 and 115.5 for sp^2 carbon; MS, 206(M^+), 191, 163, 110(base), 95, 81, 67, 55, 42; IR, 2907, 1449.
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