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Lewis acid-catalyzed asymmetric radical additions of trialkylboranes to (1*R*,2*S*,5*R*)-2-(1-methyl-1-phenylethyl)-5-methylcyclohexyl-2*H*-azirine-3-carboxylate

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Abstract—The asymmetric addition of alkyl radicals to (1*R*,2*S*,5*R*)-2-(1-methyl-1-phenylethyl)-5-methylcyclohexyl-2*H*-azirine-3-carboxylate (**1**) yielding the corresponding 2-alkylaziridine-2-carboxylates has been investigated. High diastereoselectivities and good yields were obtained in the addition of primary alkyl radicals to azirine **1**, while secondary radicals gave a lower dr. The influence of Lewis acids was also investigated; 10 mol% of CuCl were found to increase the dr.

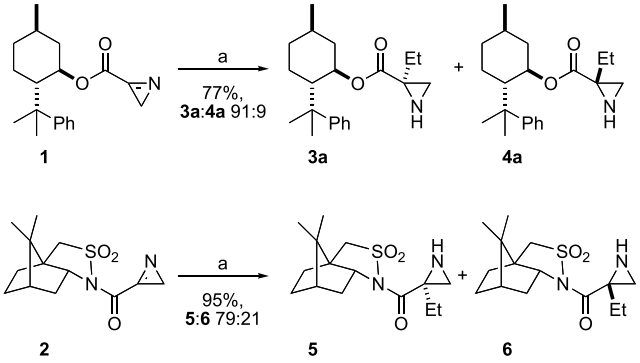
1. Introduction

The asymmetric addition of carbon nucleophiles to imines is an important route to chiral amines and has been employed in the synthesis of various amino acids and alkaloids.[1] In the search for new, efficient and general methods to generate enantiopure amines, radical addition to imine derivatives, particularly oxime ethers and hydrazones, has become an interesting alternative.[2,3] In this respect, it has recently been shown that 2*H*-azirines are promising alternative alkyl radical acceptors,[4] yielding aziridines, a class of compounds that has received much recent attention.[5]

There are two common methods to induce stereoselectivity in intermolecular alkyl radical additions to imines, either by use of a chiral Lewis acid or by a chiral auxiliary.[2,3,6] A large number of Lewis acids have previously been investigated in order to increase selectivities and reactivities in radical reactions.[6,7] However, difficulties experienced when studying the asymmetric addition of organolithiums[8] and the hetero Diels–Alder reaction using azirines as substrates and various chiral Lewis acids to mediate the reactions indicated the difficulties associated with this approach.[9] In contrast, it was shown that 8-phenylmenthyl-2*H*-azirine-3-carboxylate undergoes highly diastereoselective aza-Diels–Alder reactions under Lewis acid activation.[9,10] Prompted by these results we decided to investigate the use of chiral auxiliaries in the asymmetric addition of alkyl radical addition to azirines, and herein detail our results.[11]

2. Results and discussion

Azirine carboxylates **1** and **2**, having as auxiliaries 8-phenylmenthyl and Oppolzers sultam, respectively, were selected as substrates for initial screening in the radical addition reaction (Scheme 1). Initial studies were conducted using Et_3B/O_2 as radical initiator; in this reaction Et_3B is believed to function as an initiator and Lewis acid.[12,13] Using these reaction conditions azirine **1** gave **3a**:**4a** in excellent dr (91:9) and good yield (77%), while **2** afforded **5**:**6** in only modest dr (79:21) but high yield (95%).



Scheme 1. (a) Et_3B (5 equiv), EtI (10 equiv) O_2, CH_2Cl_2, −105 °C.

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Consequently azirine **1** was chosen as substrate for further investigations.

Optimization of the reaction conditions showed that the highest diastereoselectivity was obtained in CH_2Cl_2 or Et_2O, dr 91:9 in both solvents, and CH_2Cl_2 was chosen for further studies. The dependence of the temperature on the dr was then evaluated (Table 1).

Table 1. Influence of temperature on diastereoselectivity[a]

Entry	Temperature (°C)	Yield[b] (%)	dr[c] **3a**:**4a**
1	−105	77	91:9
2	−78	76	88:12
3	−40	72	85:15
4	−20	80	72:28
5	0	70	66:34
6	rt	65	55:45

[a] Reaction conditions: azirine **1** (1 equiv), EtI (10 equiv), Et_3B (5 equiv), O_2 (5 mL), CH_2Cl_2, 5 min.
[b] Isolated yield.
[c] Determined by HPLC.

As expected the highest dr was obtained at −105 °C (entry 1), but the selectivity decreased only slightly for temperatures up to −40 °C (entries 2, 3). With temperatures at and above −20 °C the dr fell dramatically, giving almost a 1:1 mixture at rt (entries 4–6).

The addition of other alkyl radicals was then attempted. This could potentially be realized by an iodine atom-transfer process in which the desired radical ($R^{\cdot}$) is generated from an initiator, such as Et_3B/O_2, and R–I to give EtI and the corresponding alkyl radical ($R^{\cdot}$).[14] A requirement in this process is that the generated radical ($R^{\cdot}$) is more stable then $Et^{\cdot}$, shifting the equilibrium towards addition of the desired radical ($R^{\cdot}$). To test the feasability of this protocol, three secondary and tertiary alkyl iodides were selected for an initial screening (Table 2).

Table 2. Effect of alkyl iodides on the addition of ethyl radical to **1**[a]

Entry	RI	Yield[b] (%)	dr[c] **3a**:**4a**
1	*i*-PrI	58	94:6
2	*t*-BuI	62	93:7
3	*c*-$C_6H_{11}I$	71	94:6
4	*c*-$C_6H_{11}I$[d]	82	89:11

[a] Reaction conditions: azirine **1** (1 equiv), RI (10 equiv), Et_3B (5 equiv), O_2 (5 mL), CH_2Cl_2, −105 °C, 5 min.
[b] Isolated yield of **3a**:**4a**.
[c] Determined by HPLC.
[d] Freshly distilled *c*-$C_6H_{11}I$ was used.

The reaction of azirine **1** with *i*-PrI, *t*-BuI and *c*-$C_6H_{11}I$ in the presence of Et_3B/O_2 gave selective addition of only the ethyl radical, furnishing **3a**,**4a** in moderate to good yields and high diastereoselectivity (entries 1–3). Considering that the radical transfer rate can be slow at low temperatures and that all starting material was consumed after 5 min at −105 °C, these observations are understandable.[4,15] Interestingly, the dr obtained in these reactions were somewhat higher compared to a reaction without an added alkyl iodide (compare Table 2, entries 1–3 with Table 1, entry 1). Commercially available alkyl iodides are stabilized with metallic copper, the salts of which are well known to act as Lewis acids.[16] When the reaction was repeated with freshly distilled *c*-$C_6H_{11}I$ the dr dropped, supporting the notion of Cu-salts acting as Lewis acids (entry 4).

Consequently, it was decided to investigate the influence of Lewis acids on the radical addition reaction (Table 3). Strong Lewis acids such as $BF_3\cdot OEt_2$ and $SnCl_4$ were found to cause instant decomposition of azirine **1**. Weaker Lewis acids were therefore, selected; initially five different Lewis acids were investigated (entries 2–6). Catalytic amounts of AgOTf and CuCl increased the dr, giving aziridine **2a** in moderate yields (entries 2 and 3), while treatment with $Cu(OTf)_2$ significantly decreased the dr (entry 4). Neither $In(OTf)_3$ nor $YbCl_3$ altered the diastereoselectivity, but caused dramatically lowered yields (entries 5 and 6). The use of Lewis acids lowered the yield in all reactions and unreacted **1** was present in all reaction mixtures, as judged by TLC. As a result the reaction time was increased to 60 min in the subsequent experiments. Three Cu(I) salts were evaluated to investigate the importance of the counter ion (entries 7–9). Lower yields were obtained in all cases, compared to the uncatalyzed reaction. The selectivities for the $(CuOTf)_2\cdot$ PhMe and CuI catalyzed reactions were lower compared to the uncatalyzed one, while the dr in the reaction promoted by CuCl was higher. This suggests that the Lewis acid not only influences the dr but also decreases the reactivity of **1** to various extents. We have previously shown that $MgBr_2\cdot OEt_2$ and $ZnCl_2\cdot OEt_2$ are excellent catalysts for the hetero Diels–Alder reaction with **1**.[9,10] In the present reaction, however, they gave inferior results.

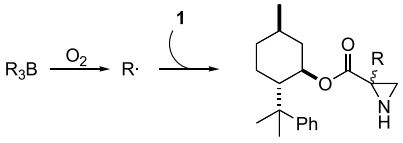
Table 3. Influence of Lewis acids on the radical addition to azirine **1**[a]

Entry	Reaction time (min)	Lewis acid/ equiv	Yield[b] (%)	dr[c] **3a**:**4a**
1	5	—	81	91:9
2	5	AgOTf/0.1	52	96:4
3	5	CuCl/0.1	53	96:4
4	5	$Cu(OTf)_2$/0.1	54	75:25
5	5	$In(OTf)_3$/0.1	16	90:10
6	5	$YbCl_3$/0.1	28	90:10
7	60	CuCl/0.1	69	96:4
8	60	CuI/0.1	58	91:9
9	60	$(CuOTf)_2\cdot$ ⊜ PhMe/0.1	61	92:8

[a] Reaction conditions: azirine **1** (1 equiv), Et_3B (3 equiv), Lewis acid, O_2 (5 mL), CH_2Cl_2, −105 °C.
[b] Isolated yield.
[c] Determined by HPLC.

From the results in Table 2 it is evident that the atom-transfer technique is not applicable to the addition of alkyl moieties, other than ethyl, to **1**. To circumvent this drawback it was decided to investigate the use of other boranes in the addition reaction (Scheme 2).[17]

A requirement in the alkyl radical addition to **1** is the use of 3 equiv of Et_3B. Attempts with 0.5 and 2 equiv of Et_3B gave only trace amounts of aziridines **3a**:**4a**. Trialkylboranes coordinated to a donor atom such as oxygen or nitrogen, as is the case in the present reaction, might be less inclined to react with O_2 to generate alkyl radicals, and consequently the formation of radicals from such species might be retarded. The necessity for excessive amounts of Et_3B is consistent with a mechanism in which the trialkylborane



Scheme 2. Addition of trialkylboranes to azirine **1**.

plays multiple roles: as Lewis acid, radical initiator, and terminator.[4,18] Consequently, it would be valuable if a radical initiator carrying less than three R-groups could be applied. B-Alkyl catecholboranes have been used as radical sources in reactions with enones, vinyl sulfones and in direct allylations.[19] Disappointingly, attempts with B-propyl catecholborane as a radical initiator only gave decomposition of azirine **1**, which might be due to the increased Lewis activity of the borane compared to Et_3B. By the same reasoning boranes with N- or S- ligands can be expected to give similar results. As a result, it was decided to investigate the use of various trialkylboranes in the radical addition to azirine **1** and the reults are summarized in Table 4.[20]

In order to further evaluate the influence of Lewis acid activation, all reactions were run in the presence and the absence of catalytic amounts of CuCl. As shown previously, addition of CuCl to azirine **1** prior to addition of Et_3B increased the dr, but lowered the yield (entries 1, 2). Addition of *n*-Bu_3B, gave **3b**:**4b** in good dr that remained unchanged upon addition of CuCl, while the yield increased significantly (entries 3, 4). With the more stable radicals formed from triallylborane, *i*-Pr_3B and *s*-Bu_3B the corresponding aziridines **3c**:**4c**, **3d**:**4d**, and **3e**:**4e** (4 diastereomers) were obtained in modest to good yields, but poor selectivities (entries 5–10). Finally, $(C_6H_{11}CH_2CH_2)_3B$ and (2-methylallyl)$_3B$ were employed to find out if primary radicals generally give higher selectivities than secondary ones in this reaction. This gave aziridines **3f**:**4f** and **3g**:**4g**, respectively, in moderate to good yield and dr (entries 11, 13). In both cases the addition of CuCl increased the dr, but resulted in lower yields with $(C_6H_{11}CH_2CH_2)_3B$ (entries 12, 14).

The relative stereochemistry of the newly formed stereocenter in the addition reactions was analyzed as follows. Compound **3a** and **5**, the major diastereomers from the addition of Et_3B to **1** and **2**, respectively, were separated. Compound **5** was then recrystallized and the absolute configuration of the quaternary aziridine carbon was determined to be (*S*) by X-ray measurements (Fig. 1).[11]

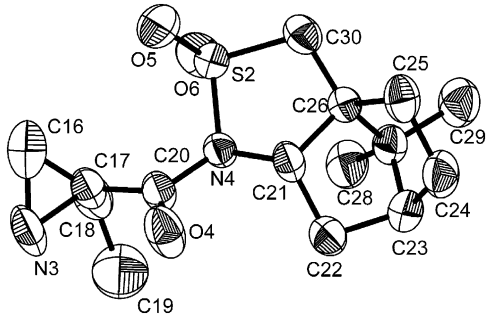
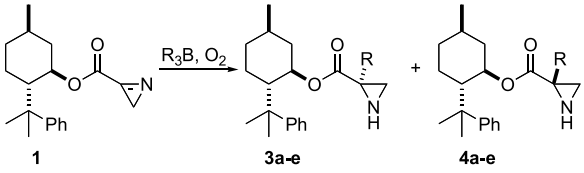


Figure 1. One of the four molecules of **5** in the asymmetric unit. Thermal ellipsoids are drawn at a 50% probability level.

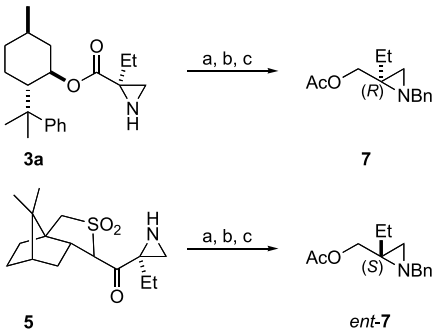
The absolute stereochemistry of **3a** was then deduced as follows. Reduction of aziridine **3a** with $LiAlH_4$ followed by benzylation and acetylation gave compound **7** (Scheme 3).

Table 4. Addition of various alkyl radicals to azirine **1**[a]



Entry	Reaction time (min)	R_3B	Lewis acid/equiv	Products	Yield[b] (%)	Ratio[c]
1	5	Et_3B	—	**3a**:**4a**	81	91:9
2	60	Et_3B	CuCl/0.1	**3a**:**4a**	69	96:4
3	5	*n*-Bu_3B	—	**3b**:**4b**	69	87:13
4	60	*n*-Bu_3B	CuCl/0.1	**3b**,**4b**	81	88:12
5	5	(allyl)$_3B$[d]	—	**3c**:**4c**	72	59:41
6	60	(allyl)$_3B$[d]	CuCl/0.1	**3c**:**4c**	85	66:34
7	5	*i*-Pr_3B[d]	—	**3d**:**4d**	51	49:51
8	60	*i*-Pr_3B[d]	CuCl/0.1	**3d**:**4d**	63	61:39
9	5	*s*-Bu_3B	—	**3e**:**4e**[e]	43	50:50
10	60	*s*-Bu_3B	CuCl/0.1	**3e**:**4e**[e]	63	55:45
11	5	$(C_6H_5CH_2CH_2)_3B$[d]	—	**3f**:**4f**	56	72:28
12	60	$(C_6H_5CH_2CH_2)_3B$[d]	CuCl/0.1	**3f**:**4f**	28	83:17
13	5	(2-methylallyl)$_3B$[d]	—	**3g**:**4g**	71	78:22
14	60	(2-methylallyl)$_3B$[d]	CuCl/0.1	**3g**:**4g**	71	83:17

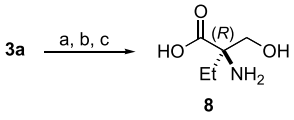
[a] Reaction conditions: azirine **1** (1 equiv), R_3B (3 equiv), Lewis acid, O_2 (5 mL), CH_2Cl_2, −105 °C.
[b] Isolated yield.
[c] Determined by HPLC.
[d] R_3B not isolated and >3 equiv were used.
[e] Four stereoisomers formed.



Scheme 3. (a) $LiAlH_4$, Et_2O, −78 °C→rt, 2 h; (b) BnBr, K_2CO_3, MeCN, reflux; (c) Ac_2O, DMAP, CH_2Cl_2, 0 °C→rt, 3 h, yield over three steps: **7**: 63%, *ent*-**7**: 86%.

Treatment of **5** under identical reaction conditions resulted in a compound that upon comparison with **7** by chiral HPLC and optical rotation proved to be *ent*-**7**. Thus, the absolute configuration of the quaternary carbon in aziridine **3a** is (*R*).

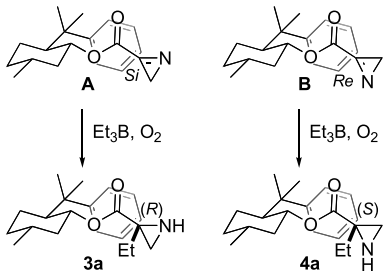
This assignment was also confirmed by chemical correlation (Scheme 4). Hydrolysis[21] of the aziridine moiety in **3a** gave the corresponding amino alcohol, which was benzoylated followed by hydrolysis of the ester moiety to give (*R*)-(+)-C^{α}-ethyl serine (**8**), the analytical data of which was in good agreement with literature data.[22]



Scheme 4. (a) $HClO_4$, THF/H_2O, 80 °C, 10 h; (b) BzCl, Et_3N, DMAP, CH_2Cl_2, rt, 3 h; (c) KOH, hydroquinone, $EtOH/H_2O$, 80 °C, 14 h, yield over three steps: 51%.

It is likely that trialkylborane plays an important role for the stereoselectivity obtained in radical addition to azirine **1**. In contrast to the hetero Diels–Alder reaction with azirine **1**, requiring stoichiometric amounts of a chelating Lewis acid to obtain high diastereoselectivity,[10] good selectivity was observed in the present study in the absence of with Et_3B. Spectroscopic investigations of conjugate radical additions to α,β-unsaturated carbonyl compounds suggest a complexation of the organoborane to the C=O oxygen prior to addition of the radical.[23] It has also been shown that Lewis acids such as $BF_3{\cdot}OEt_2$ can catalyze reactions with 2*H*-azirines, indicating the possibility of coordination to the azirine nitrogen.[24] Thus, the mode of complexation of the trialkylborane to azirine **1** is not obvious.

8-Phenylmenthyl derivatives similar to azirine **1** adopt s-*cis* (**A**) or s-*trans* (**B**) conformations as depicted in Scheme 5.[25] Assuming that these structures are relevant for the present study, then a monodentate Lewis acid is expected, for steric and electronic reasons, to favor s-*trans* conformer (**B**). Addition to this conformer would preferentially take place to the *Re* face of the C=N bond, affording the (*S*) stereochemistry at the newly formed stereocenter. Similarly, a chelating Lewis acid would be expected to preferentially react through structure **A**, thus, affording an adduct having (*R*) stereochemistry. As has been shown (vide supra), the (*R*) aziridine is obtained as the major diastereomer in Et_3B/O_2



Scheme 5.

initiated ethyl radical additions to azirine **1**, indicating that these simple models are not applicable to the present study. The stereochemical outcome in the addition to azirine **2** can be rationalised in analogy to similar reactions with glyoxylic oxime ethers.[13]

3. Conclusion

We have shown that radical addition to azirine **1** afford the corresponding aziridine in modest to excellent dr. The use of catalytic amounts of CuCl was found to increase the dr, although the effect on the yield varied. The scope of the reaction, in terms of varying the trialkylborane used in the additions, has been investigated.

4. Experimental.[26]

4.1. General methods

4.1.1. General procedure for alkyl radical additions to azirine 1 in the presence of an alkyliodide. *Method A*. To **1** (17 mg, 0.058 mmol) in CH_2Cl_2 (2 mL) at −105 °C was added EtI (46 μL, 0.58 mmol) and Et_3B (288 μL, 0.29 mmol, 1 M solution in hexanes) followed by O_2 (5 mL). After 5 min the reaction was quenched by addition of $NaHCO_3$ (1 mL aqueous satd). The resultant mixture was filtered through an Extrelute® NT3 tube and eluted with CH_2Cl_2 (15 mL), EtOAc (15 mL) and CH_2Cl_2 (15 mL), The combined organic phases were concentrated and flash chromatographed (pentane/EtOAc 1:0→4:1) to give **3a**:**4a** (15 mg, 77%, 91:9) as an oil.

4.1.2. General procedure for alkyl radical additions to azirine 1 without an alkyliodide. *Method B*. To **1** (17 mg, 0.058 mmol) in CH_2Cl_2 (2 mL) at −105 °C was added Et_3B (172 μL, 0.17 mmol, 1 M solution in hexanes) and O_2 (5 mL). After 5 min the reaction was quenched by addition of $NaHCO_3$ (1 mL aqueous satd). The resultant mixture was filtered through an Extrelute® NT3 tube eluted with CH_2Cl_2 (15 mL), EtOAc (15 mL) and CH_2Cl_2 (15 mL). The combined organic phases were concentrated and flash chromatographed (pentane/EtOAc 1:0→4:1) to give **3a**:**4a** (15.2 mg, 81%, 91:9) as an oil.

4.1.3. General procedure for alkyl radical additions to azirine 1 in the presence of Lewis acid. *Method C*. To **1** (17 mg, 58 μmol) in CH_2Cl_2 at −105 °C was added CuCl (0.61 mg, 6 μmol). The resultant mixture was stirred for 10 min before Et_3B (172 μL, 172 μM, 1 M in hexanes) was

added followed by O_2 (5 mL). After stirring for 60 min at −105 °C the reaction was quenched by addition of $NaHCO_3$ (1 mL aqueous satd). This mixture was filtered through an Extrelut® NT3 tube eluting with CH_2Cl_2 (15 mL), EtOAc (15 mL) and CH_2Cl_2 (15 mL). The combined organic phases were and concentrated and flash chromatographed (pentane/EtOAc 1:0→4:1) to give **3a**:**4a** (12.9 mg, 69%, 96:4) as a pale oil.

4.2. Data for compounds

4.2.1. (2*S*)-(1*R*,2*S*,5*R*)-5-Methyl-2-(2-phenylpropan-2-yl) cyclohexyl 2-ethylaziridine-2-carboxylate (3a). Prepared according to method A, B or C to give **3a**:**4a** as a colorless oil; dr was determined by HPLC: (Zorbax Rx-SIL, hexane/*i*-PrOH 99.5:0.5, 1.1 mL/min) R_t **4a** = 19.5 min, R_t **3a** = 23.0 min.

Analytical data for **3a**: R_f 0.38 (pentane/EtOAc 4:1); $[\alpha]_D^{25}$ + 7.4 (*c* 1.0, CH_2Cl_2); δ_H ($CDCl_3$, 400 MHz) 7.37–7.24 (4H, m, Ph), 7.23–7.14 (1H, m, Ph), 4.80 (1H, dt, *J* = 12.1, 3.5 Hz, C*H*O), 2.10 (1H, m, C*H*CMe$_2$Ph) 1.87–1.77 (3H, m, C*H*$_2$N, C*H*HCHMe), 1.73–1.57 (3H, m, C*H*HMe, CHMeC*H*H, C*H*HCHCMe$_2$Ph) 1.52–1.41 (2H, m, CH*H*Me, C*H*Me), 1.29 (3H, s, Me), 1.18 (3H, s, Me), 1.13 (1H, dt, *J* = 12.9, 3.3 Hz, CH*H*CHMe), 1.01–0.79 (9H, m, CH$_2$*Me*, CH*Me*, CH*H*CHCMe$_2$Ph, CHMeCH*H*, N*H*); δ_C ($CDCl_3$, 100 MHz) 172.7, 151.8, 128.1, 125.2, 125.1, 75.6, 50.3, 41.5, 39.4, 39.1, 34.5, 33.9, 31.3, 29.1, 26.4, 24.5, 23.7, 21.7, 9.9; IR (neat) 2964, 2926, 1714, 1193, 1093 cm^{-1}; HRMS (FAB+) calcd for $C_{21}H_{32}NO_2$ (M+H) 330.2433, found 330.2432.

4.2.2. (2*S*)-(1*R*,2*S*,5*R*)-5-Methyl-2-(2-phenylpropan-2-yl) cyclohexyl 2-butylaziridine-2-carboxylate (3b). Prepared according to method B or C to give **3b**:**4b** as a colorless oil; dr was determined by HPLC: (Zorbax Rx-SIL, hexane/*i*-PrOH 99.5:0.5, 1.1 mL/min) R_t **4b** = 15.6 min, R_t **3b** = 17.6 min.

Analytical data for **3b**: R_f 0.38 (pentane/EtOAc 4:1); $[\alpha]_D^{25}$ + 9.2 (*c* 0.39, CH_2Cl_2); δ_H ($CDCl_3$, 400 MHz) 7.32–7.24 (4H, m, Ph), 7.20–7.15 (1H, m, Ph), 4.85 (1H, dt, *J* = 10.6, 4.3 Hz, C*H*O), 2.10 (1H, dt, *J* = 11.9, 3.3 Hz, C*H*HCHCMe$_2$Ph), 1.86–1.77 (3H, m, C*H*$_2$N, C*H*HCHMe), 1.73–1.66 (1H, m, CC*H*H), 1.62–1.41 (4H, m, CCH*H*, CHMeC*H*H, C*H*HCHCMe$_2$Ph, C*H*Me), 1.28 (3H, s, Me), 1.18 (3H, s, Me), 1.33–1.10 (5H, m, CH*H*CHMe, CHMeCH*H*, CH*H*CMe$_2$Ph, CCH$_2$C*H*$_2$), 0.98–0.76 (9H, m, CH*Me*, C*H*$_2$Me, CH$_2$*Me*, N*H*); δ_C ($CDCl_3$, 125 MHz) 172.8, 151.9, 128.1, 125.2, 125.0, 75.7, 50.2, 41.4, 39.4, 38.3, 34.5, 33.9, 31.3, 31.1, 29.2, 27.8, 26.4, 23.6, 22.7, 21.7, 14.0; IR (neat) 2954, 2927, 1715, 1094 cm^{-1}; HRMS (FAB+) calcd for $C_{23}H_{36}NO_2$ (M+H) 358.2746, found 358.2747.

4.2.3. (2*S*)-(1*R*,2*S*,5*R*)-5-Methyl-2-(2-phenylpropan-2-yl) cyclohexyl 2-allylaziridine-2-carboxylate (3c) and (2*R*)-(1*R*,2*S*,5*R*)-5-methyl-2-(2-phenylpropan-2-yl)cyclohexyl 2-allylaziridine-2-carboxylate (4c). Prepared according to method B or C to give **3c**:**4c** as a colorless oil; dr was determined by HPLC: (Zorbax Rx-SIL, hexane/*i*-PrOH 99.5:0.5, 1.1 mL/min) R_t **4c** = 15.3 min, R_t **3c** = 18.7 min.

Analytical data for **3c**: R_f 0.34 (pentane/EtOAc 4:1); $[\alpha]_D^{25}$ + 5.1 (*c* 0.49, CH_2Cl_2); δ_H ($CDCl_3$, 500 MHz) 7.31–7.25 (4H, m, Ph), 7.19–7.15 (1H, m, Ph), 5.71–5.62 (1H, m, C*H*CH$_2$), 5.03–4.97 (2H, m, CHC*H*$_2$), 4.86 (1H, dt, *J* = 10.6, 4.4 Hz, C*H*O), 2.18 (1H, dd, *J* = 14.7, 6.6 Hz, C*H*HCH=CH$_2$), 2.11 (1H, m, C*H*CMe$_2$Ph), 1.87–1.76 (3H, m, C*H*HCHMe, CHMeC*H*H, C*H*HN), 1.70 (1H, br d, *J* = 12.8 Hz, CH*H*N), 1.64 (1H, dd, *J* = 14.7, 6.6 Hz, CH*H*CH=CH$_2$), 1.52–1.43 (2H, m, C*H*Me, C*H*HCHCMe$_2$Ph), 1.28 (3H, s, Me), 1.20–1.11 (1H, m, CH*H*CHMe), 1.18 (3H, s, Me), 0.97–0.85 (3H, m, CHMeCH*H*, CH*H*CHCMe$_2$Ph, N*H*), 0.88 (3H, d, *J* = 7.1 Hz, CH*Me*); δ_C ($CDCl_3$, 125 MHz) 172.5, 151.9, 133.8, 128.1, 125.2, 125.1, 117.2, 75.9, 50.3, 41.5, 39.4, 37.5, 35.2, 34.5, 33.2, 31.3, 29.5, 26.4, 23.3, 21.7; IR (neat) 2957, 2924, 1714, 1094 cm^{-1}; HRMS (FAB+) calcd for $C_{22}H_{32}NO_2$ (M+H) 342.2433, found 342.2432.

Analytical data for **4c**: R_f 0.41 (pentane/EtOAc 4:1); $[\alpha]_D^{25}$ + 29.9 (*c* 0.38, CH_2Cl_2); δ_H ($CDCl_3$, 500 MHz) 7.33–7.25 (4H, m, Ph), 7.18–7.14 (1H, m, Ph), 5.73–5.63 (1H, m, C*H*CH$_2$), 5.06–4.97 (2H, m, CHC*H*$_2$), 4.94 (1H, dt, *J* = 10.6, 4.4 Hz, C*H*O), 2.24–2.16 (1H, m, C*H*HCH=CH$_2$), 2.07 (1H, m, C*H*HN), 1.93 (1H, br dd, *J* = 14.3, 6.6 Hz, CH*H*N), 1.79 (1H, m, CH*H*CH=CH$_2$), 1.74–1.68 (2H, m, C*H*HCHCMe$_2$Ph, C*H*HCHMe), 1.64 (1H, app dt, *J* = 12.8, 2.9 Hz, C*H*CMe$_2$Ph), 1.50–1.41 (1H, m, N*H*), 1.32 (3H, s, Me), 1.20 (3H, s, Me), 1.10 (1H, m, CHMeC*H*H), 1.05–0.96 (1H, m, C*H*Me), 0.99 (1H, m, CH*H*CHMe), 0.92–0.82 (2H, m, CHMeCH*H*, CH*H*CHCMe$_2$Ph), 0.87 (3H, d, *J* = 6.6 Hz, CH*Me*); δ_C ($CDCl_3$, 125 MHz) 172.8, 151.4, 134.0, 128.2, 125.4, 125.3, 117.2, 76.1, 50.1, 41.8, 39.7, 37.4, 35.0, 34.4, 31.9, 31.3, 28.2, 26.7, 25.3, 21.7; IR (neat) 2959, 2924, 1716, 1093 cm^{-1}; HRMS (FAB+) calcd for $C_{22}H_{32}NO_2$ (M+H) 342.2433, found 342.2444.

4.2.4. (2*S*)-(1*R*,2*S*,5*R*)-5-Methyl-2-(2-phenylpropan-2-yl) cyclohexyl 2-isopropylaziridine-2-carboxylate (3d) and (2*R*)-(1*R*,2*S*,5*R*)-5-methyl-2-(2-phenylpropan-2-yl)cyclohexyl 2-isopropylaziridine-2-carboxylate (4d). Prepared according to method B or C to give **3d**:**4d** as a colorless oil; dr was determined by HPLC: (Zorbax Rx-SIL, hexane/*i*-PrOH 99.5:0.5, 1.1 mL/min) R_t **4d** = 10.1 min, R_t **3d** = 12.3 min.

Analytical data for **3d**: R_f 0.48 (pentane/EtOAc 4:1); $[\alpha]_D^{25}$ + 26.6 (*c* 0.55, CH_2Cl_2); δ_H ($CDCl_3$, 500 MHz) 7.31–7.24 (4H, m, Ph), 7.20–7.16 (1H, m, Ph), 4.88 (1H, dt, *J* = 11.0, 4.4 Hz, C*H*O), 2.10 (1H, m, C*H*CMe$_2$Ph), 1.85–1.77 (2H, m, C*H*HN, C*H*Me), 1.72–1.61 (3H, m, CH*H*N, CHMeC*H*H, C*H*HCHCMe$_2$Ph), 1.54–1.44 (2H, m, C*H*Me$_2$, C*H*HCHMe), 1.28 (3H, s, Me), 1.18 (3H, s, Me), 1.15 (1H, m, N*H*), 0.95 (1H, m, CH*H*CHMe), 0.95–0.85 (1H, m, CHMeCH*H*), 0.88 (6H, d, *J* = 7.0 Hz, CH*Me*$_2$), 0.76 (1H, m, CH*H*CHCMe$_2$Ph), 0.67 (3H, d, *J* = 7.0 Hz, CH*Me*); δ_C ($CDCl_3$, 125 MHz) 172.8, 151.8, 128.1, 125.2, 125.1, 75.6, 50.2, 42.2, 41.5, 39.4, 34.5, 31.9, 31.3, 29.0, 27.4, 26.5, 23.8, 21.7, 19.4, 16.8; IR (neat) 2962, 2925, 1715, 1185, 1091 cm^{-1}; HRMS (FAB+) calcd for $C_{22}H_{34}NO_2$ (M+H) 344.2590, found 344.2588.

Analytical data for **4d**: R_f 0.57 (pentane/EtOAc 4:1); $[\alpha]_D^{25}$ + 24.3 (*c* 0.35, CH_2Cl_2); δ_H ($CDCl_3$, 500 MHz)

7.32–7.26 (4H, m, Ph), 7.19–7.15 (1H, m, Ph), 4.92 (1H, dt, $J=10.6$, 4.4 Hz, C*H*O), 2.09 (1H, m, C*H*CMe$_2$Ph), 1.85–1.75 (2H, m, C*H*HN, C*H*Me), 1.70 (1H, m, CHMeC*H*H), 1.65 (1H, m, CH*H*N), 1.52–1.42 (1H, m, C*H*HCHCMe$_2$Ph), 1.45 (1H, m, C*H*Me$_2$), 1.38 (1H, m, C*H*HCHMe), 1.31 (3H, s, Me), 1.19 (3H, s, Me), 1.11 (1H, m, N*H*), 0.99 (1H, m, CH*H*CHMe), 0.92–0.82 (1H, m, CH*H*CHCMe$_2$Ph), 0.88 (3H, d, $J=6.6$ Hz, Me), 0.84 (3H, d, $J=7.0$ Hz, Me), 0.82 (3H, d, $J=7.0$ Hz, CH*Me*), 0.76 (1H, m, CHMeCH*H*); δ_C ($CDCl_3$, 125 MHz) 172.6, 151.5, 128.2, 125.3, 125.2, 75.9, 49.9, 42.4, 41.8, 39.7, 34.5, 31.3, 29.9, 28.3, 27.8, 26.7, 25.1, 21.7, 18.7, 18.2; IR (neat) 2961, 2925, 1718, 1183, 1094 cm^{-1}; HRMS (FAB+) calcd for $C_{22}H_{34}NO_2$ (M+H) 344.2590, found 344.2593.

4.2.5. (2*R*)-(1*R*,2*S*,5*R*)-5-Methyl-2-(2-phenylpropan-2-yl) cyclohexyl 2-sec-butylaziridine-2-carboxylate (3e) and (2*R*)-(1*R*,2*S*,5*R*)-5-methyl-2-(2-phenylpropan-2-yl)cyclohexyl 2-sec-butylaziridine-2-carboxylate (4e). Prepared according to method B or C to give **3d**:**4d** as a colorless oil; dr was determined by HPLC: (Zorbax Rx-SIL, hexane/*i*-PrOH 99.5:0.5, 1.1 mL/min) R_t **4e**=9.6 min and 10.0, R_t **3e**=12.6 min.

Analytical data for **3e**, mixture of the two diastereomers, not separable by preparative HPLC: R_f 0.53 (pentane/EtOAc 4:1); δ_H ($CDCl_3$, 500 MHz) 7.31–7.24 (4H, m), 7.21–7.17 (1H, m), 4.88 (1H, m), 2.08 (1H, m), 1.85–1.73 (2H, m), 1.71–1.64 (2H, m), 1.53 (1H, m), 1.51–1.44 (1H, m), 1.44–1.36 (1H, m), 1.35–1.20 (2H, m), 1.28 (3H, br s), 1.18 (3H, br s), 1.16–1.10 (1H, m), 0.96–0.82 (9H, m), 0.77–0.71 (3H, m); δ_C ($CDCl_3$, 125 MHz) 172.7, 172.6, 151.74, 151.68, 128.1, 125.2, 125.1, 75.63, 75.57, 50.19, 50.16, 42.3, 41.8, 41.5, 41.4, 39.46, 39.50, 36.0, 35.3, 34.51, 34.50, 32.0, 31.9, 31.3, 28.8, 28.6, 26.8, 26.54, 26.51, 24.35, 24.29, 24.1, 21.7, 16.2, 14.2, 12.4, 12.0; IR (neat) 2961, 2926, 1716, 1185, 1094 cm^{-1}; HRMS (FAB+) calcd for $C_{23}H_{36}NO_2$ (M+H) 358.2746, found 358.2741.

Analytical data for **4e**, two minor diastereomers still containing small amounts of the other isomer after preparative HPLC, first peak: R_f 0.64 (pentane/EtOAc 4:1); δ_H ($CDCl_3$, 500 MHz) 7.32–7.25 (4H, m), 7.19–7.15 (1H, m), 4.91 (1H, m), 2.07 (1H, m), 1.82 (1H, m), 1.65 (1H, m), 1.52–1.33 (5H, m), 1.30 (3H, br s), 1.19 (3H, br s), 1.17–1.04 (2H, m), 0.98 (1H, app q, $J=11.8$ Hz), 0.92–0.83 (10H, m), 0.77 (1H, m); δ_C ($CDCl_3$, 125 MHz) 172.3, 151.4, 128.2, 125.4, 125.2, 75.9, 49.8, 42.1, 41.8, 39.7, 36.1, 34.4, 31.3, 31.0, 28.0, 26.8, 25.7, 25.5, 21.7, 15.6, 12.2; IR (neat) 2962, 2926, 1714, 1181, 1094 cm^{-1}; HRMS (FAB+) calcd for $C_{23}H_{36}NO_2$ (M+H) 358.2746, found 358.2758.

Analytical data **4e**, second peak: R_f 0.64 (pentane/EtOAc 4:1); δ_H ($CDCl_3$, 500 MHz) 7.32–7.25 (4H, m), 7.20–7.15 (1H, m), 4.91 (1H, m), 2.07 (1H, m), 1.82 (1H, m), 1.74–1.60 (2H, m), 1.52–1.33 (5H, m), 1.30 (3H, br s), 1.19 (3H, br s), 1.17–1.05 (2H, m), 0.98 (1H, app q, $J=11.6$ Hz), 0.92–0.82 (10H, m,), 0.77 (1H, m); δ_H ($CDCl_3$, 125 MHz) 172.3, 151.4, 128.2, 125.4, 125.2, 75.9, 49.8, 42.1, 41.8, 39.7, 36.1, 34.4, 31.3, 31.0, 28.0, 26.8, 25.7, 25.5, 21.7, 15.6, 12.2; IR (neat) 2962, 2927, 1178, 1093 cm^{-1}; HRMS (FAB+) calcd for $C_{23}H_{36}NO_2$ (M+H) 358.2746, found 358.2742.

4.2.6. (2*S*)-(1*R*,2*S*,5*R*)-5-Methyl-2-(2-phenylpropan-2-yl) cyclohexyl 2-(2-cyclohexylethyl) aziridine-2-carboxylate (3f) and (2*R*)-(1*R*,2*S*,5*R*)-5-methyl-2-(2-phenylpropan-2-yl)cyclohexyl 2-(2-cyclohexylethyl)aziridine-2-carboxylate (4f). Prepared according to method B or C to give **3f**:**4f** as a colorless oil; dr was determined by HPLC: (Zorbax Rx-SIL, hexane/*i*-PrOH 99.5:0.5, 1.1 mL/min) R_t **4f**=12.0 min, R_t **3f**=13.6 min.

Analytical data for **3f**: R_f 0.48 (pentane/EtOAc 4:1); $[\alpha]_D^{25}+$ 10.3 (*c* 0.73, CH_2Cl_2); δ_H ($CDCl_3$, 500 MHz) 7.30–7.24 (4H, m), 7.19–7.15 (1H, m), 4.84 (1H, dt, $J=10.7$, 4.1 Hz), 2.12 (1H, m), 1.87–1.79 (3H, m), 1.75–1.62 (6H, m), 1.59–1.41 (3H, m), 1.31 (s, 3H), 1.23–1.06 (7H, m), 1.21 (3H, s), 0.99–0.80 (6H, m), 0.91 (3H, d, $J=6.6$ Hz); δ_C ($CDCl_3$, 125 MHz) 172.8, 151.8, 128.1, 125.2, 125.1, 75.7, 50.3, 41.5, 39.4, 38.4, 37.7, 34.5, 33.9, 33.3, 33.14, 33.07, 31.3, 29.2, 28.8, 26.7, 26.4, 26.34, 26.31, 23.6, 21.7; IR (neat) 2920, 2851, 1715, 1201, 1094 cm^{-1}; HRMS (FAB+) calcd for $C_{27}H_{42}NO_2$ (M+H) 412.3216, found 412.3216.

Analytical data for **4f**: R_f 0.53 (pentane/EtOAc 4:1); $[\alpha]_D^{25}+$ 15.3 (*c* 0.40, CH_2Cl_2); δ_H ($CDCl_3$, 500 MHz) 7.31–7.26 (4H, m), 7.19–7.15 (1H, m), 4.92 (1H, dt, $J=10.7$, 4.4 Hz), 2.05 (1H, m), 1.80 (1H, m), 1.74–1.59 (9H, m), 1.50–1.38 (3H, m), 1.32 (s, 3H), 1.35–1.05 (6H, m), 1.21 (3H, s), 1.02–0.79 (6H, m), 0.87 (3H, d, $J=6.6$ Hz); δ_H ($CDCl_3$, 125 MHz) 173.0, 151.3, 128.2, 125.4, 125.3, 75.6, 50.1, 41.8, 39.8, 38.5, 37.8, 34.4, 33.39, 33.36, 33.3, 33.2, 31.3, 27.6, 26.8, 26.7, 26.42, 26.35, 26.3, 25.9, 21.7; IR (neat) 2924, 2852, 1092 cm^{-1}; HRMS (FAB+) calcd for $C_{27}H_{42}NO_2$ (M+H) 412.3216, found 412.3216.

4.2.7. (2*S*)-(1*R*,2*S*,5*R*)-5-Methyl-2-(2-phenylpropan-2-yl) cyclohexyl 2-(2-methylallyl)aziridine-2-carboxylate (3g) and (2*R*)-(1*R*,2*S*,5*R*)-5-methyl-2-(2-phenylpropan-2-yl)cyclohexyl 2-(2-methylallyl)aziridine-2-carboxylate (4g). Prepared according to method B or C to give **3g**:**4g** as a colorless oil; dr was determined by HPLC: (Zorbax Rx-SIL, hexane/*i*-PrOH 99.5:0.5, 1.1 mL/min) R_t **4g**= 15.3 min, R_t **3g**=16.9 min.

Analytical data for **3g**: R_f 0.44 (pentane/EtOAc 4:1); $[\alpha]_D^{25}+$ 38.2 (*c* 0.92, CH_2Cl_2); δ_H ($CDCl_3$, 400 MHz) 7.32–7.27 (4H, m, Ar), 7.19–7.14 (1H, m, Ar), 4.81 (1H dt, $J=10.8$, 4.3 Hz, C*H*O), 4.72 (1H, s, =C*H*H), 4.62 (1H, s, =CH*H*), 2.15–2.04 (2H, m, C*H*CMe$_2$Ph, C*H*HC(Me)CH$_2$), 1.85–1.77 (3H, m, CH*H*C(Me)CH$_2$, C*H*HN, C*H*Me), 1.72–1.67 (1H, m, CH*H*N), 1.66 (3H, s, C(*Me*)CH$_2$), 1.55–1.40 (3H, m, CHMeC*H*H, C*H*HCHCMe$_2$Ph, C*H*HCHMe), 1.27 (3H, s, Me), 1.17 (3H, s, Me), 1.16–1.07 (2H, m, N*H*, CH*H*CHMe), 0.96–0.84 (2H, m, CHMeCH*H*, CH*H*CHCMe$_2$Ph), 0.87 (3H, d, $J=6.5$ Hz, CH*Me*); δ_C ($CDCl_3$, 125 MHz) 172.7, 152.0, 142.3, 128.1, 125.2, 125.1, 111.5, 76.2, 50.2, 41.1, 39.4, 38.4, 37.0, 34.5, 33.4, 31.2, 29.3, 26.4, 23.5, 23.5, 21.7; IR (neat) 2957, 2923, 1716, 1217, 1093 cm^{-1}; HRMS (FAB+) calcd for $C_{23}H_{34}NO_2$ (M+H) 356.2590, found 356.2592.

Analytical data for **4g**: R_f 0.52 (pentane/EtOAc 4:1); $[\alpha]_D^{25}+$ 23.5 (*c* 0.31, CH_2Cl_2); δ_H ($CDCl_3$, 500 MHz) 7.33–7.27 (4H, m, Ar), 7.20–7.14 (1H, m, Ar), 4.89 (1H, dt, $J=10.8$, 4.5 Hz, C*H*O), 4.76 (1H, s, =C*H*H), 4.66 (1H, s, =CH*H*),

2.15–1.97 (3H, m, $CHCMe_2Ph$, C*H*HC(Me)CH_2, CH*H*C(Me)CH_2), 1.83–1.77 (2H, m, C*H*HN, C*H*Me), 1.70–1.60 (2H, m, C*H*HN, C*H*HCHCMe_2Ph), 1.68 (3H, s, C(*Me*)CH_2), 1.53–1.40 (2H, m, C*H*HCHMe, m, CHMeC*H*H), 1.31 (3H, s, Me), 1.19 (3H, s, Me), 1.14–0.80 (4H, m, N*H*, CHMeC*H*H, CH*H*CHCMe_2Ph, CH*H*CHMe), 0.87 (3H, d, $J=6.5$ Hz, CH*Me*); δ_C ($CDCl_3$, 125 MHz) 172.7, 151.4, 142.3, 128.2, 125.4, 125.3, 111.5, 76.3, 50.0, 41.5, 39.7, 38.7, 36.9, 34.4, 32.7, 31.3, 27.9, 26.7, 25.5, 23.6, 21.7; IR (neat) 2960, 2924, 1174 cm^{-1}; HRMS (FAB+) calcd for $C_{23}H_{34}NO_2$ (M+H) 356.2590, found 356.2591.

4.2.8. Aziridine 5. Prepared according to method A to give **5**:**6** as crystals; dr was determined by HPLC: (Zorbax Rx-SIL, hexane/*i*-PrOH 95:5, 1.1 mL/min) R_t **5**=12.3 min, R_t **6**=18.2 min.

Analytical data for **5**: R_f 0.42 (pentane/EtOAc 1:1); mp 151–152 °C (from EtOH/H_2O); $[\alpha]_D^{25}$ −13.2 (*c* 1.0, CH_2Cl_2); δ_H ($CDCl_3$, 400 MHz) 3.90 (1H, dd, $J=7.6$, 4.5 Hz, C*H*NSO_2), 3.44 (2H, AB q, $J=13.8$ Hz, CH_2SO_2), 2.64–2.54 (1H, m, C*H*HCHN), 2.22 (1H, br s, N*H*), 2.07 (1H, A-part of AB dq, $J=14.6$, 7.3 Hz, C*H*HMe), 1.98–1.89 (5H, m, C*H*CMe_2, C*H*HCHN, CH_2N, CHCH_2C*H*H), 1.49–1.35 (3H, m, CHCH_2CH*H*, CHCH_2), 1.35–1.28 (1H, B-part of AB dq, 1H, $J=14.6$, 7.3 Hz, CH*H*Me), 1.19 (3H, s, Me), 0.98 (3H, s, Me), 0.95 (3H, t, $J=7.5$ Hz, CH_2*Me*); δ_C ($CDCl_3$, 100 MHz) 173.5, 77.2, 65.2, 52.9, 48.5, 47.9, 44.5, 43.1, 38.1, 32.7, 27.2, 26.6, 20.4, 19.9, 9.8; IR (neat) 3294, 2955, 1678, 1328, 1200, 1136 cm^{-1}; HRMS (FAB+) calcd for $C_{15}H_{25}N_2O_3S$ (M+H) 313.1586, found 313.1588.

4.2.9. ((*S*)-1-Benzyl-2-ethylaziridin-2-yl)methyl acetate (7). To **3a** (25.4 mg, 77 μmol) in MeCN (15 mL) was added K_2CO_3 (32 mg, 230 μmol) and BnBr (28 μL, 230 μmol) and the resultant mixture was heated to reflux. After 5 h the mixture was cooled to rt and H_2O was added. The phases were separated and the aqueous phase extracted with Et_2O. The combined organic phases were washed with H_2O, dried ($MgSO_4$) and concentrated. Flash chromatography (pentane/EtOAc 1:0→10:1) of the residue gave the corresponding benzylated aziridine (25.6 mg, 80%) as a colorless oil, which was used directly in the next step.

To the material from above (25.6 mg, 61 μmol) in Et_2O (5 mL) at −78 °C was added $LiAlH_4$ (183 μL, 183 μmol, 1M in THF) dropwise. After warming to rt for 1.5 h the reaction was quenched by addition of H_2O (7 μL), 15% aqueous NaOH (7 μL) and H_2O (21 μL). After stirring the resultant mixture for 15 min $MgSO_4$ was added and the slurry was filtered. Concentration gave a crude product that was used in the next step without further purification.

To the crude reaction mixture from above in CH_2Cl_2 (5 mL) at 0 °C was added DMAP (18.0 mg, 148 μmol) and Ac_2O (18.6 μL, 197 μmol). After stirring at rt for 3 h the reaction was quenched by addition of H_2O (1 mL). The resultant mixture was filtered through an Extrelut® NT3 tube eluting with CH_2Cl_2 (15 mL), EtOAc (15 mL) and CH_2Cl_2 (15 mL). Removal of the solvents and flash chromatography (pentane/EtOAc 1:0→1:1) gave **7** (11.1 mg, 79% over two steps) as a colorless oil.

Comparison of retention times between **7** and *ent*-**7** was performed by HPLC: (Chiralcel OJ, hexane/*i*-PrOH 99:1, 0.7 mL/min) R_t **7**=26.5 min, R_t *ent*-**7**=24.6 min.

Analytical data for **7**: R_f 0.18 (pentane/EtOAc 4:1); $[\alpha]_D^{25}$ −5.9 (*c* 0.58, CH_2Cl_2); δ_H ($CDCl_3$, 500 MHz, mixture of *N*-invertomers) 7.42–7.21 (10H, m, Ar), 4.42 (1H, d, $J=$ 12.4 Hz, C*H*HO), 4.17 (2H, AB q, $J=11.8$, 4.8 Hz, CH_2O), 3.89 (1H, d, $J=12.4$ Hz, CH*H*O), 3.73 (4H, m, CH_2Ph, CH_2Ph), 2.06 (3H, s, *Me*CO), 1.94 (C*H*HN1H, s), 1.91 (3H, s, *Me*CO), 1.89 (1H, s, C*H*HN), 1.84 (1H, m, C*H*HMe), 1.70 (1H, m, C*H*HMe), 1.62 (1H, m, CH*H*Me), 1.43 (1H, s, CH*H*N), 1.42 (1H, m, CH*H*Me), 1.34 (1H, s, CH*H*N), 1.03 (3H, t, $J=7.3$ Hz), 0.94 (3H, t, $J=7.3$ Hz); δ_C ($CDCl_3$, 125 MHz) 170.92, 170.88, 139.9, 139.8, 128.3, 127.59, 127.57, 126.7, 68.7, 62.6, 56.8, 56.0, 42.5, 42.4, 37.6, 37.3, 28.3, 20.9, 20.6, 19.6, 11.0, 9.5; IR (neat) 2970, 1740, 1235, 1097, 1034 cm^{-1}; HRMS (FAB+) calcd for $C_{14}H_{20}NO_2$ (M+H) 234.1494, found 234.1498.

4.2.10. ((*R*)-1-Benzyl-2-ethylaziridin-2-yl)methyl acetate (*ent*-7). *Ent*-**7** was prepared in analogy with **7** starting from **5** and was spectroscopically identical to **7**. Comparison of retention times between **7** and *ent*-**7** was performed by HPLC: (Chiralcel OJ, hexane/*i*-PrOH 99:1, 0.7 mL/min) R_t *ent*-**7**=24.6 min.

Additional analytical data for *ent*-**7**; $[\alpha]_D^{25}$ +8.3 (*c* 0.56, CH_2Cl_2); HRMS (FAB+) calcd for $C_{14}H_{20}NO_2$ (M+H) 234.1494, found 234.1489.

4.2.11. (*R*)-(+)-C^{α}-Ethyl serine (8). $[\alpha]_D^{25}$ +2.9 (*c* 0.90, 5 N HCl); δ_H (1 N DCl/D_2O, 400 MHz) 3.89 (1H, d, $J=$ 12.1 Hz, C*H*HOH), 3.61 (1H, d, $J=12.1$ Hz, CH*H*OH), 1.79 (1H, m, C*H*HMe), 1.63 (1H, m, CH*H*Me), 0.86 (3H, br t, $J=7.1$ Hz, CH_2*Me*).

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