Enantioselective Synthesis of 3,6-Dihydro-1*H*-pyridin-2-ones. Unexpected Regioselectivity in the Palladium Catalysed Decarboxylative Carbonylation of 5-Vinyloxazolidin-2-ones.

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General. Melting points were determined on a Linkham TC92 hot stage and are uncorrected. Optical rotations were measured on a polAAr 2001 digital polarimeter at ambient temperature and are reported as follows $[\alpha]^{T}_{D}$(*c* g/100 ml, solvent). Infrared spectra were recorded on a Nicolet 20 PCIR instrument. Mass spectra were recorded on Micromass autospec M and Kratos MS80 RF spectrometers in electron impact (EI) mode. ^{1}H NMR spectra were recorded on Bruker AC 200 (200 MHz), Bruker WM 300 (300 MHz), JEOL LA 500 (500 MHz) and Bruker AMX 500 (500 MHz) spectrometers at ambient temperature. Data are reported as follows: chemical shift in ppm from internal tetramethylsilane on the δ scale, integration, multiplicity (s = singlet, d = doublet, t = triplet, q = quartet and m = multiplet), coupling constant (Hz) and assignment. ^{13}C NMR were recorded on Bruker AC 200 (50 MHz) and JEOL LA 500 (125 MHz) spectrometers at ambient temperature. Chemical shifts are reported in ppm from tetramethylsilane on the δ scale, using solvent resonance as the internal standard [deuteriochloroform ($CDCl_3$) at 77.0 ppm and d_6-DMSO at 39.4 ppm]. Elemental analyses were performed on a Carlo Erba 1106 instrument.

Thin layer chromatography was performed on EM reagent 0.25mm silica gel 60-F plates. Visualization was accomplished with UV light and aqueous potassium manganate(VII) solution (followed by heating). Flash column chromatography[1] was performed on EM reagent silica gel 9385.

All reactions were carried out under an atmosphere of nitrogen in pre-dried glassware. Where necessary, solvents were dried prior to use. Triethylamine (NEt_3), pyridine and acetonitrile were distilled from calcium hydride under nitrogen and stored over 3Å molecular sieves. Dichloromethane (CH_2Cl_2) was distilled from calcium hydride under nitrogen immediately prior to use. Methanol was distilled from magnesium under nitrogen and stored over 4Å molecular sieves. Ether and tetrahydrofuran (THF) were distilled from sodium/benzophenone ketyl immediately prior to use. All chemicals were purchased from the Aldrich, Fluka, Sigma or Lancaster chemical companies and were used as supplied except where indicated.

2-Amino Alcohols. Amino alcohols were made from the corresponding amino acids by the procedure of Abiko and Masamune.[2]

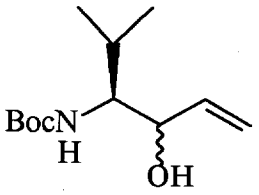
2-*N*-(*tert*-Butoxycarbonyl)amino Alcohols. The 2-amino alcohols were protected according to the procedure of Luly *et al.*[3] The protected amino alcohols were purified by flash column chromatography eluting with EtOAc/petrol.

2-*N*-(*tert*-Butoxycarbonyl)amino Aldehydes (2a-c). Swern oxidation[4] of the *2-N-(tert-*butoxycarbonyl)amino alcohols was performed according to the procedure of Pedersen *et al.*[5] The protected amino aldehydes (**2a-c**) were used immediately without further purification.

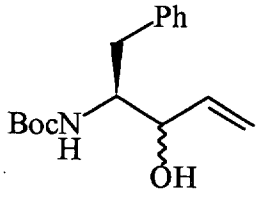
***N*-(tert-Butoxycarbonyl)valine methoxymethylamide[6] (2g).** The Weinreb amide[7] was prepared according to the procedure of Skiles.[8] The amides were purified by flash column chromatography eluting with EtOAc.

Allylic alcohols (3a-c) by Grignard addition to aldehydes (2a-c). (Adapted from the procedure of Hanson and Lindberg[9]). Vinylmagnesium bromide (1M solution in THF, 2.2 equivalents) was added dropwise to a -78°C solution of crude 2-*N*-(*tert*-butoxycarbonyl)amino aldehyde **(2)** in THF (30 ml per mmol of aldehyde) under nitrogen. The solution was warmed to room temperature and stirred for 2 hrs. 2M HCl (2 ml per mmol aldehyde) was added to quench the reaction, and the THF was evaporated under reduced pressure. The aqueous phase was extracted with CH_2Cl_2 (4 x 25 ml), and the combined organic layers were washed with H_2O (50 ml), brine (2 x 50 ml), dried ($MgSO_4$), filtered and evaporated under reduced pressure. Purification of the crude material by column chromatography (EtOAc:petrol / 1:3) afforded the allylic alcohol **(3)** as a mixture of diastereoisomers.

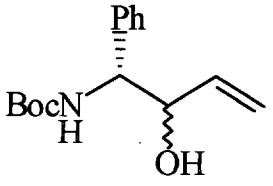
(3*RS*, 4*S*)-4-*N*-(*tert*-Butyloxycarbonyl)amino-3-hydroxy-5-methylhex-1-ene (3a). Crude (2*S*)-2-*N*-(*tert*-butoxycarbonyl)amino-3-methylbutanal **(2a)** (10g) gave the allylic alcohol **(3a)** (5.6g, 50% from the BOC protected amino alcohol) as a white solid. ^{1}H NMR indicated this to be a 2:1 mixture of diastereoisomers. The signals for the major diastereoisomer matched those reported[10] for the (3*S*, 4*S*) isomer. In addition to these, the following signals could be seen for the minor (3*R*, 4*S*) isomer: δ_H (500 MHz, $CDCl_3$) 1.37 (9H, s, $(CH_3)_3C$), 1.64-1.76 (1H, m, $CH(CH_3)_2$), 2.88 (1H, broad s, OH), 3.44-3.51 (1H, m, CHN), 4.43 (1H, broad s, NH), 5.10 (1H, dd, J 1.0, 10.5, one of $HC=CH_2$), and 5.22 (1H, dd, J 1.0, 16.5, one of $HC=CH_2$). All other signals for the minor diastereoisomer were overlapping with those of the major. Anal. Calcd for $C_{12}H_{23}NO_3$: C, 62.9; H, 10.1; N, 6.1. Found: C, 63.0; H, 10.5; N, 6.0.



(3*RS*, 4*S*)-4-*N*-(*tert*-Butyloxycarbonyl)amino-3-hydroxy-5-phenylpent-1-ene (3b). Crude (2*S*)-2-*N*-(*tert*-butoxycarbonyl)amino-3-phenylpropanal **(2b)** (9.92g) gave the allylic alcohol **(3b)** (7.55g, 68% from the BOC protected amino alcohol) as a white solid. ^{1}H NMR indicated this to be a 2:1 mixture of diastereoisomers. ν_{max}/cm^{-1} (KBr disc) 3361, 2981, 1686, 1605, 1528, 1495. ^{1}H NMR (500 MHz, $CDCl_3$) was in agreement with the published data for the two diastereoisomers.[9] The signals due to the major isomer corresponded to those reported for the (3*S*, 4*S*) stereochemistry. Anal. Calcd for $C_{16}H_{23}NO_3$: C, 69.3; H, 8.35; N, 5.1. Found: C, 69.0; H, 8.5; N, 4.9.



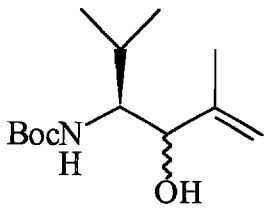
(3*RS*, 4*R*)-4-*N*-(*tert*-Butyloxycarbonyl)amino-3-hydroxy-4-phenylbut-1-ene (3c). Crude (2*R*)-2-*N*-(*tert*-butoxycarbonyl)amino-2-phenylethanal **(2c)** (9.00g) gave the allylic alcohol **(3c)** (6.58g, 66% from the BOC protected amino alcohol) as a white gum. ^{1}H NMR indicated this to be a 1.5:1 mixture of diastereoisomers. The infra red and mass spectral data for the mixture, and the ^{1}H NMR signals for the



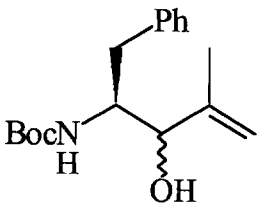
major diastereoisomer matched those reported[11] for the (3*S*, 4*S*) isomer in the enantiomeric series. In addition to these, the following signals could be seen for the minor (3*S*, 4*R*)-isomer: δ_H (200 MHz, $CDCl_3$) 1.39 (9H, s, $(CH_3)_3C$), 5.19 (1H, dd, J 1.5, 10.5, one of HC=CH_2), 5.31 (1H, dd, J 1.5, 17, one of HC=CH_2), 5.68 (1H, ddd, J 5.5, 10.5, 17, *H*C=CH_2). All other signals for the minor diastereoisomer were overlapping with those of the major. Found: (M^+) 263.1519, $C_{15}H_{21}NO_3$ requires 263.1521

Allylic alcohols (3d-f) by Grignard addition to aldehydes (2a-c). Two crystals of I_2 were added to Mg turnings (9 equivalents) in THF (0.5 ml per mmol Mg) under nitrogen, and the suspension was stirred for 5 mins. 2-Bromopropene (3 equivalents) was then added in several portions and the mixture was warmed to initiate the reaction. The suspension was stirred at room temperature until all the magnesium had reacted, and was then added by cannula to a -78°C solution of the crude BOC-amino aldehyde **(2)** in THF (7 ml per mmol aldehyde) under nitrogen. The solution was warmed to room temperature and stirred for 2 hr, after which time 2M HCl (4 ml per mmol aldehyde) was added to quench the reaction. The solvent was evaporated under reduced pressure, and the aqueous phase was extracted with CH_2Cl_2 (4 x 30 ml). The combined organic extracts were washed with H_2O (2 x 50 ml), brine (2 x 50 ml), dried ($MgSO_4$), filtered and concentrated under reduced pressure. Purification of the crude material by recrystallisation EtOAc/petrol (**3e**, **3f**) or flash chromatography (EtOAc:petrol / 1:3) (**3d**) afforded the allylic alcohol **(3)** as a mixture of diastereoisomers.

(4*S*, 3*RS*)-4-*N*-(*tert*-Butyloxycarbonyl)amino-3-hydroxy-2,5-dimethylhex-1-ene (3d). Crude (2*S*)-2-*N*-(*tert*-butoxycarbonyl)amino-3-methylbutanal **(2a)** (5.00g) gave the allylic alcohol **(3d)** 2.99g (50% from the BOC protected amino alcohol) as a colourless oil. ^{1}H NMR indicated this to be a 5:1 mixture of diastereoisomers: ν_{max}/cm^{-1} (Film) 3440, 2972, 1693. For the major diastereoisomer: δ_H (200 MHz, $CDCl_3$) 0.92 (3H, d with fine splitting, J 6.5, one of $(CH_3)_2CH$), 0.96 (3H, d with fine splitting, J 6.5, one of $(CH_3)_2CH$), 1.40 (9H, broad s, $(CH_3)_3C$), 1.73 (3H, broad s, $CH_3C=CH_2$), 3.35-3.42 (1H, broad m, CHN), 4.09-4.13 (1H, broad m, C*H*OH), 4.65-4.85 (1H, broad m, NH), 4.88 (1H, broad s, one of MeC=CH_2), 4.97 (1H, broad s, one of MeC=CH_2). In addition, the following signals due to the minor isomer could also be seen: 3.60-3.68 (1H, broad m, CHN), 4.04 (1H, d, J 6.5, C*H*OH). All other signals due to the minor isomer overlapped with those of the major. m/z 172 (M^+-H_2C=C(Me)CHOH, 30%), 170 (8), 116 (100), 100 (21), 72 (61), 57 (65), 41 (26). Found: (M^+-H_2C=C(Me)CHOH) 172.1342, $C_9H_{18}NO_2$ requires 172.1338.

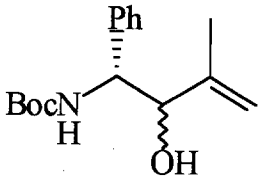


(3*RS*, 4*S*)-4-*N*-(*tert*-Butyloxycarbonyl)amino-3-hydroxy-2-methyl-5-phenylpent-1-ene (3e). Crude (2*S*)-2-*N*-(*tert*-butoxycarbonyl)amino-3-phenylpropanal **(2b)** (5.50g) gave the allylic alcohol **(3e)** 5.11g (85% from the BOC protected amino alcohol) as a white gum. ^{1}H NMR indicated this to be a 2:1 mixture of diastereoisomers: ν_{max}/cm^{-1} (Film) 3421, 2978, 1693, 1604, 1498. For the major diastereoisomer: δ_H (500 MHz, $CDCl_3$) 1.36 (9H, s, $C(CH_3)_3$), 1.67 (3H, s, $CH_3C=CH_2$), 2.43-2.53

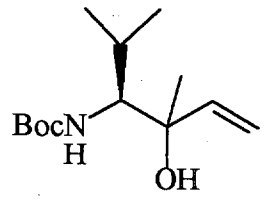


(1H, broad s, OH), 2.84-2.92 (2H, m, PhCH_2), 3.85-400 (1H, broad m, CHN), 3.93 (1H, broad s, C*H*OH), 4.78 (1H, broad s, NH), 4.90 (1H, s one of MeC=CH_2), 5.01 (1H, s, one of MeC=CH_2), 7.15-7.30 (5H, m, Ar-H). In addition, the following signals could be seen for the minor diastereoisomer: δ_H (500 MHz, $CDCl_3$) 1.32 (9H, s, $C(CH_3)_3$), 1.79 (3H, s, CH_3C=CH_2), 2.64-2.74 (1H, broad s, OH), 4.18 (1H, broad s, C*H*OH), 4.67 (1H, broad s, NH), 4.97 (1H, s, one of MeC=CH_2), 5.06 (1H, s, one of MeC=CH_2). All other signals due to the minor isomer overlapped with those of the major. m/z 220 (M^+-H_2C=C(Me)CHOH, 11%), 200 (6), 164 (41), 120 (100), 100 (30), 91 (37), 57 (57), 41 (14). Anal. Calcd for $C_{17}H_{25}NO_3$: C, 70.1; H, 8.65; N, 4.8. Found: C, 69.7; H, 8.6; N, 4.9.

(3*RS*, 4*R*)-4-*N*-(*tert*-Butyloxycarbonyl)amino-3-hydroxy-2-methyl-4-phenylbut-1-ene (3f). Crude (2*R*)-2-*N*-(*tert*-butoxycarbonyl)amino-2-phenylethanal **(2c)** (7.00g) gave the allylic alcohol **(3f)** 2.26g (28% from the BOC protected amino alcohol) as a white solid. ^{1}H NMR indicated this to be a 1.5:1 mixture of diastereoisomers. ν_{max}/cm^{-1} (KBr disc) 3414, 3396, 2973, 1685, 1672, 1604, 1524. For the major diastereoisomer: δ_H (500 MHz, d_6-DMSO) 1.39 (9H, s, $(CH_3)_3$C), 1.72 (3H, s, CH_3C=), 4.10-4.15 (1H, m, CHN), 4.53 (1H, broad m, C*H*OH), 4.78 (1H, broad s, one of CH_3C=CH_2), 4.84 (1H, broad s, one of CH_3C=CH_2), 4.95 (1H, d, J 5.5, OH), 6.89 (1H, broad m, NH), 7.30-7.41 (5H, m, Ar-H,). In addition, the following signals could be seen for the minor isomer: δ_H (500 MHz, d_6-DMSO) 1.41 (9H, s, $(CH_3)_3$C), 1.74 (3H, s, CH_3C=CH_2), 4.68 (1H, broad t, J 7, C*H*OH), 4.87 (1H, broad s, one of CH_3C=CH_2), 4.93 (1H, broad s, one of CH_3C=CH_2), 5.01 (1H, d, J 5.5, OH), 7.13 (1H, broad m, NH). The other signals due to the minor isomer overlapped with those of the major. m/z 277 (M^+, 0.2%), 206 (91), 204 (6), 151 (38), 106 (90), 91 (28), 77 (40), 57 (100), 41 (88), 29 (50). Found: (M^+) 277.1666, $C_{16}H_{23}NO_3$ requires 277.1678.

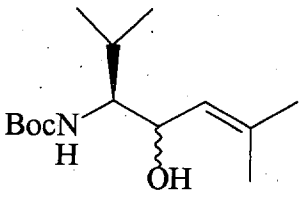


(4*S*)-4-*N*-(*tert*-Butyloxycarbonyl)amino-3-hydroxy-3,5-dimethylhex-1-ene (3g). MeMgBr (22.5 ml, 3 M solution in Et_2O, 0.068 mol) was added dropwise to a solution of *N*-(*tert*-butoxycarbonyl)valine methoxymethylamide[6] **(2e)** (5.00g, 0.019 mol) in THF (120 ml) at –78°C. The mixture was stirred at this temperature for 10 min, allowed to warm to 0°C and then stirred at this temperature for 2h. Saturated aqueous ammonium chloride solution (100 ml) was added, the layers were separated, and the aqueous layer was extracted with Et_2O (3 x 60 ml). The combined organic extracts were washed with brine (30 ml), dried (Na_2SO_4), and the solvent was removed under reduced pressure to give the crude ketone, **(3*S*)-3-*N*-(*tert*-Butyloxycarbonyl)amino-4-methylpentan-2-one (2d)**, (4.95 g) as a colourless oil which was used immediately without further purification. Vinylmagnesium chloride (24.1 ml, 1.7 M solution in THF, 0.041 mol) was added dropwise to a stirred solution of the crude ketone **(2d)** (3.525 g, 0.016 mmol) in THF (100 ml) at –78 °C. The reaction mixture was allowed to warm to room temperature and stirred for 2h. Water (30 ml) and HCl (30 ml, 2 M) were added and most of the organic solvent was removed under reduced pressure. The remaining mixture was extracted with CH_2Cl_2 (3 x 30

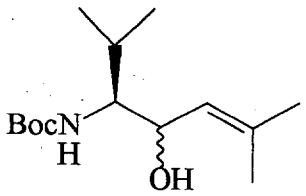


ml) and the combined organic extracts were washed with saturated aqueous sodium bicarbonate solution (30 ml), dried (Na_2SO_4), and the solvent was removed under reduced pressure. The resulting yellow-brown oil was purified by flash column chromatography eluting with petrol:EtOAc 5:1 to 3:1 (gradient) to give the allylic alcohol **(3g)** (1.58 g, 40%) as a pale yellow oil. ν_{max}/cm^{-1} (Film) 3450, 3350, 2950, 2900, 2873, 1700, 1625, 1497, 1370, 1175. δ_H (200 MHz, $CDCl_3$) 0.91 (3H, d, J 7.0, one of $(CH_3)_2CH$), 0.95 (3H, d, J 7.0, one of $(CH_3)_2CH$), 1.31 (3H, broad s, CH_3COH), 1.44 (9H, s, $(CH_3)_3C$), 1.80 (1H, broad s, OH), 2.05-2.12 (1H, m, $CH(CH_3)_2$), 3.47 (1H, dd, *J* 2.5, 10.5, CHN), 5.07 (1H, d, J 10.5, one of $C=CH_2$), 5.23 (1H, dd, *J* 1, 17.5, one of $C=CH_2$), 5.95 (1H, dd, *J* 10.5, 17.5, $H_2C=CH$), 5.1-5.2 (1H, broad s, obscured, NH). m/z 200 (M^+-^{i}Pr, 0.5%), 172 (M^+-C_4H_7O, 10), 116 (^{t}BuOCONH, 50), 72 ($C_4H_{10}N^+$, 95), 57 (^{t}Bu$^+$, 100). Found: (M^+-^{i}Pr,) 200.129433, $C_{10}H_{18}NO_3$ requires 200.128669.

Allylic alcohol (3h) by Grignard addition to aldehyde (2a). I_2 (0.5 g) were added to Mg turnings (3.25 g, 0.133 mol) in THF (50 ml) under nitrogen, and the suspension was heated for 5 mins. 1-Bromo-2-methylpropene (4.5 ml, 0.043 mol) was then added and the mixture was warmed to initiate the reaction. The suspension was stirred at reflux for 2 h, and was then added by cannula to a -78°C solution of the crude BOC-amino aldehyde **(2a)** (2.5 g, 0.012 mol) in THF (50 ml) under nitrogen. The solution was warmed to room temperature and stirred for 12 h, after which time 2M HCl (100 ml) was added to quench the reaction. The solvent was evaporated under reduced pressure, and the aqueous phase was extracted with CH_2Cl_2 (4 x 30 ml). The combined organic extracts were dried ($Na2SO_4$), filtered and concentrated under reduced pressure. Purification of the crude material by flash chromatography (EtOAc:petrol / 1:4 to 1:2) afforded the allylic alcohol **(3h)** (0.886 g 28%) as a mixture of diastereoisomers together with the oxazolidinone **(1h)** (0.524 g, 23%).

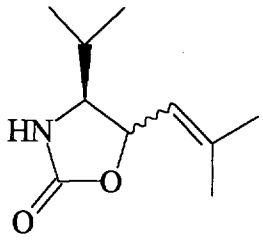


(5*S*, 4*RS*)-5-*N*-(*tert*-Butyloxycarbonyl)amino-4-hydroxy-2,6-dimethylhex-2-ene (3h). Colourless oil. ^{1}H NMR indicated this to be a 3:2 mixture of diastereoisomers: ν_{max}/cm^{-1} (Film) 3442, 3386, 2968, 2931, 2873, 1693, 1506, 1392, 1365, 1173. For the major diastereoisomer: δ_H (500 MHz, $CDCl_3$) 0.89 (3H, d, J 6.5, one of $(CH_3)_2CH$), 0.98 (3H, d, J 6.5, one of $(CH_3)_2CH$), 1.46 (9H, s, $(CH_3)_3C$), 1.71 (3H, broad s, $CH_3C=C$), 1.74 (3H, broad s, $CH_3C=C$), 1.65-1.80 (1H, m, $CH(CH_3)_2$), 3.24-3.30 (1H, m, CHN), 4.38-4.42 (1H, m, CHOH), 4.77 (1H, broad d, *J* 9, NH), 5.19-5.26 (1H, m, $Me_2C=CH$). In addition, the following signals due to the minor isomer could also be seen: 0.92 (3H, d, J 7.0, one of $(CH_3)_2CH$), 0.95 (3H, d, J 7.0, one of $(CH_3)_2CH$), 1.44 (9H, s, $(CH_3)_3C$), 1.73 (3H, broad s, $CH_3C=C$), 1.75 (3H, broad s, $CH_3C=C$), 3.51-3.57 (1H, m, CHN), 4.45 (1H, broad d, *J* 9, NH). All other signals due to the minor isomer overlapped with those of the major. δ_C (125 MHz, $CDCl_3$) 18.34, 18.42, 18.71, 18.90, 20.60, 20.74, 26.31, 26.42, 28.76, 29.08, 29.97, 61.03, 60.88, 69.07, 69.85, 79.56, 79.85, 124.12, 125.79, 136.82, 137.55, 157.36. m/z 258 (M^++H, 0.4%), 240 (M^+-OH, 0.8), 184 (M^+-O^{t}Bu, 25), 172 (M^+-



Me_2C=CHCHOH, 20), 116 ($^tBuOCONH$, 65), 85 (Me_2C=CHCHOH, 40), 72 ($C_4H_{10}N^+$, 100), 57 ($^tBu^+$, 100). Found: (M^++H) 258.206482, $C_{14}H_{28}NO_3$ requires 258.206919. Anal. Calcd for $C_{14}H_{27}NO_3$: C, 65.3; H, 10.6; N, 5.4. Found: C, 65.2; H, 10.8; N, 5.4.

(4*S*, 5*RS*)-5-(2-Methylprop-1-enyl)-4-(2-propyl)oxazolidin-2-one (1h).



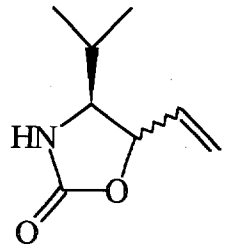
Colourless oil. ^{1}H NMR indicated this to be a 3:2 mixture of diastereoisomers. ν_{max}/cm^{-1} (Film) 3253, 2964, 1747, 1674, 1385, 1234, 991. δ_H (500 MHz, $CDCl_3$) For the major diastereoisomer: 0.82 (3H, d, *J* 6.5, one of $(CH_3)_2CH$), 0.88 (3H, d, *J* 6.5, one of $(CH_3)_2CH$), 1.68 (3H, broad s, CH_3C=C), 1.72 (3H, broad s, CH_3C=C), 1.60-1.90 (1H, m, Me_2CH), 3.23 (1H, t, J 9.5, CHN), 4.92 (1H, dd, J 6.0, 9.5, CHO), 5.23-5.31 (1H, m, C=C*H*), 6.11 (1H, broad s, NH). In addition, signals due to the minor isomer could be seen at: 0.76 (3H, d, *J* 6.5, one of $(CH_3)_2CH$), 0.90 (3H, d, *J* 6.5, one of $(CH_3)_2CH$), 1.65 (3H, broad s, CH_3C=C), 1.74 (3H, broad s, CH_3C=C), 3.53 (1H, t, J 7.5, CHN), 5.41 (1H, broad d, *J* 10, C=C*H*), 6.03 (1H, broad s, NH). All other signals due to the minor isomer overlapped with those of the major. δ_C (125 MHz, $CDCl_3$) 18.13, 18.16, 18.24, 18.45, 18.89, 19.38, 25.96, 26.07, 28.51, 29.75, 32.10, 32.12, 62.32, 64.78, 117.76, 122.38, 140.44, 140.50, 159.51, 160.00. m/z 18 (M^+, 7%), 140 (M^+-^{i}Pr, 8), 105 (6), 96 (25), 85 ($Me_2CCHCHOH^+$, 100). Found: (M^+) 183.125904, $C_{10}H_{17}NO_2$ requires 183.125929. Anal. Calcd for $C_{10}H_{17}NO_2$: C, 65.4; H, 9.4; N, 7.8. Found: C, 65.5; H, 9.35; N, 7.6.

5-Vinyloxazolidin-2-ones (1a-h) by NaH cyclisation of allylic alcohols (3a-h). (Adapted from the procedure of Kano *et al*[12]). To a stirred solution of the BOC-protected allylic alcohol **(3)** in THF (30 ml per mmol of **3**), under nitrogen at -78°C, was added NaH (60% dispersion in oil, 2.4 equivalents). The suspension was stirred at room temperature for 17 hrs, and then a further portion of NaH (60% dispersion in oil, 1 equivalent) was added. Stirring was continued for a further 4 hrs and then 2M HCl (10 ml per mmol **3**) was added to quench the reaction. The THF was evaporated under reduced pressure, and the aqueous phase was extracted with CH_2Cl_2 (4 x 20 ml). The combined organic layers were washed with H_2O (50 ml), brine (2 x 50 ml), dried ($MgSO_4$), filtered and evaporated under reduced pressure. Purification of the crude material by column chromatography (EtOAc:petrol / 1:1) afforded the vinyl oxazolidinone **(1)**.

Stereochemical assignment of 5-vinyloxazolidin-2-ones. The tentative stereochemical assignments are based on the reported tendency for the ^{1}H NMR signals due to 4-H and 5-H to occur further downfield and to display a larger coupling constant in the *syn*-isomer (4*S*, 5*R*) than in the *anti* (4*S*, 5*S*).[13]

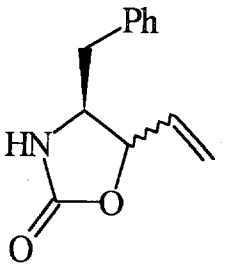
(4*S*, 5*RS*)-5-Ethenyl-4-(2-propyl)oxazolidin-2-one (1a).

(3*RS*, 4*S*)-4-*N*-(*tert*-Butyloxycarbonyl)amino-3-hydroxy-5-methylhex-1-ene **(3a)** (0.10g) afforded the vinyl oxazolidinone **(1a)** (76%) as a yellow oil. ^{1}H NMR indicated this to be a 2:1 mixture of (4*S*, 5*S*) and (4*S*, 5*R*) diastereoisomers: ν_{max}/cm^{-1} (Film) 3269, 2964, 1749, 1647; δ_H (500 MHz, $CDCl_3$) for the major diastereoisomer: 0.87 (3H, d, J 7, one of $(CH_3)_2CH$), 0.90 (3H, d, J 7, one of $(CH_3)_2CH$), 1.67-1.83 (1H, m, Me_2CH), 3.24 (1H, t, J 6.5, CHN), 4.61 (1H, t, J 6.5, CHO), 5.22 (1H, d, J 10.5, one of $HC=CH_2$), 5.34 (1H, d, J 17, one of $HC=CH_2$), 5.83 (1H, ddd, J 6.5, 10.5, 17, $HC=CH_2$), 6.75 (1H, broad s, NH). For the minor diastereoisomer, signals could also be seen at: 0.82 (3H, d, J 7, one of $(CH_3)_2CH$), 0.91 (3H, d, J 7, one of $(CH_3)_2CH$), 3.55 (1H, t, J 7.5, CHN), 4.93 (1H, t, J 7.5, CHO), 5.32 (1H, d, J 10.5, one of $HC=CH_2$), 5.40 (1H, d, J 17.5, one of $HC=CH_2$), 5.90 (1H, ddd, J 7.5, 10.5, 17.5, $HC=CH_2$), 6.66 (1H, broad s, NH). All other signals due to the minor isomer overlapped with those of the major. δ_C (125 MHz, $CDCl_3$) 18.03, 18.21, 18.94, 19.59, 28.58, 32.61, 62.59, 64.07, 80.85, 80.97, 118.45, 120.66, 130.97, 135.46, 159.71, 160.30; m/z 155 (M^+, 50%), 127 (15), 112 (100), 68 (85), 57 (27), 43 (15), 41 (40). Found: (M^+) 155.0949, $C_8H_{13}NO_2$ requires: 155.0946.



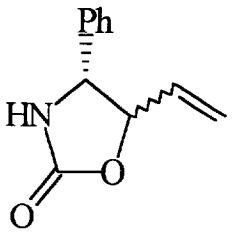
(4*S*, 5*RS*)-5-Ethenyl-4-phenylmethyloxazolidin-2-one (1b).

(3*RS*, 4*S*)-4-*N*-(*tert*-Butyloxycarbonyl)amino-3-hydroxy-5-phenylpent-1-ene **(3b)** (1.50g) (1:1 mixture of diastereoisomers) gave the vinyl oxazolidinone **(1b)** (91%) as a white solid. ^{1}H NMR indicated this to be a 1:1 mixture of diastereoisomers: ν_{max}/cm^{-1} (Film) 3282, 2990, 1755, 1647, 1604, 1496. ^{1}H NMR signals for one isomer matched those reported for the pure (4*S*, 5*S*) isomer.[10] In addition to these, signals due to the (4*S*, 5*R*) isomer could be seen at: δ_H (200 MHz, $CDCl_3$) 4.05 (1H, ddd, J 4, 7.5, 11, CHN), 5.13 (1H, dd, J 7, 7.5, CHO), 5.53 (1H, dd, J 1, 17, one of $HC=CH_2$), 5.96 (1H, ddd, J 6.5, 10.5, 17, $HC=CH_2$). All other signals due to this isomer overlapped with those of the other. m/z 204 (MH^+, 59%), 203 (8), 160 (22), 128 (29), 111 (80), 103 (36), 92 (93), 91 (94), 77 (66), 69 (54), 68 (100), 55 (42); Anal. Calcd for $C_{12}H_{13}NO_2$: C, 70.9; H, 6.45; N, 6.9. Found: C, 70.9; H, 6.3; N, 6.8.



(4*R*, 5*RS*)-5-Ethenyl-4-phenyloxazolidin-2-one (1c).

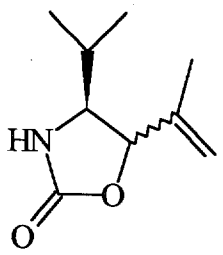
(3*RS*, 4*R*)-4-*N*-(*tert*-Butyloxycarbonyl)amino-3-hydroxy-4-phenylbut-1-ene **(3c)** (1.62 g) gave vinyl oxazolidinone **(1c)** (0.594 g, 85%) as a 3.5:1 mixture of diastereoisomers. The major isomer was assigned as (4*R*, 5*R*) by comparison of the ^{1}H NMR data to that reported for the (4*S*, 5*S*) isomer.[14] ν_{max}/cm^{-1} (nujol mull) 3205, 2926, 1753, 1606, 1498. δ_H (500MHz, $CDCl_3$) For the major isomer: 4.54 (1H, d, J 7.5, CHN), 4.64 (1H, broad t, J 7.5, CHO), 5.27 (1H, dd, J 1, 17, one of $HC=CH_2$), 5.28 (1H, dd, J 1, 10, one of $HC=CH_2$), 5.91 (1H, ddd, J 7.5, 10, 17, $HC=CH_2$), 6.01 (1H, broad s, NH), 7.25-7.36 (5H, m, Ar-H). In



addition, signals for the minor isomer could be seen at: 4.92 (1H, d, J 8, CHN), 5.04 (1H, d, J 10.5, one of HC=CH_2). All other signals for the minor isomer overlapped with those of the major. m/z 189 (M^+, 21%), 146 (3), 133 (100), 132 (87), 105 (50), 104 (81), 77 (11), 69 (8), 57 (13), 44 (2). Found: (M^+) 189.0795, $C_{11}H_{11}NO_2$ requires 189.0790.

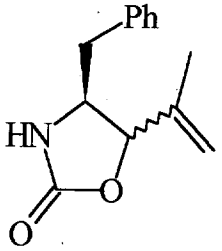
(4*S*, 5*RS*)-4-(2-Propyl)-5-(2-propenyl)oxazolidin-2-one (1d).

(4*S*, 3*RS*)-4-*N*-(*tert*-Butyloxycarbonyl)amino-3-hydroxy-2,5-dimethylhex-1-ene **(3d)** (1.00g) gave the vinyl oxazolidinone **(1d)** (0.594 g, 85%) as a colourless oil. ^{1}H NMR indicated this to be a 4:1 mixture of (4*S*, 5*S*) and (4*S*, 5*R*) diastereoisomers. ν_{max}/cm^{-1} (Film) 3269, 2964, 1749, 1655. δ_H (200 MHz, $CDCl_3$) For the major diastereoisomer: 0.83-0.99 (6H, m, (CH_3)$_2$CH), 1.76 (3H, s, CH_3C=CH$_2$), 1.60-1.90 (1H, m, Me$_2$C*H*), 3.31 (1H, t, J 5, CHN), 4.63 (1H, d, J 5, CHO), 4.95 (1H, broad s, one of MeC=CH_2), 5.04 (1H, broad s, one of MeC=CH_2), 6.74 (1H, broad s, NH). In addition, signals due to the minor isomer could be seen at: 1.80 (3H, s, CH_3C=CH$_2$), 3.65 (1H, t, J 7, CHN), 5.00 (1H, broad s, one of MeC=CH_2), 5.14 (1H, broad s, one of MeC=CH_2), 6.62 (1H, broad s, NH). All other signals due to the minor isomer overlapped with those of the major. m/z 169 (M^+, 44%), 141 (16), 126 (100), 98 (18), 82 (54), 71 (56), 67 (19), 55 (31), 44 (2), 41 (21). Found: (M^+) 169.1098, $C_9H_{15}NO_2$ requires 169.1103.



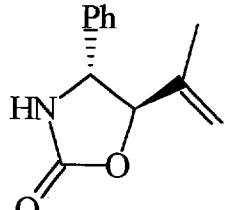
(4*S*, 5*RS*)-4-Phenylmethyl-5-(2-propenyl)oxazolidin-2-one (1e).

(3*RS*, 4*S*)-4-*N*-(*tert*-Butyloxycarbonyl)amino-3-hydroxy-2-methyl-5-phenylpent-1-ene **(3e)** (5:1 mixture of diastereoisomers) (1.83g) gave the vinyl oxazolidinone **(1e)** 1.28g (89%) as a white solid. ^{1}H NMR showed this to be a 5:1 mixture of (4*S*, 5*R*) and (4*S*, 5*S*) diastereoisomers. ν_{max}/cm^{-1} (nujol mull) 3275, 2922, 1740, 1716, 1657, 1606, 1498; δ_H (200 MHz, $CDCl_3$) For the major diastereoisomer: 1.83 (3H, s, CH_3C=CH$_2$), 2.51 (1H, dd, J 11, 13.5, one of PhCH_2), 2.71 (1H, dd, J 3.5, 13.5, one of PhCH_2), 4.01 (1H, ddd, J 3.5, 7.5, 11, CHN), 5.07 (1H, d, J 7.5, CHO), 5.15 (1H, s, one of MeC=CH_2), 5.26 (1H, s, one of MeC=CH_2), 7.11-7.35 (5H, m, Ar-H). In addition, the following signals could be seen for the minor isomer: 1.68 (3H, s, CH_3C=CH$_2$), 2.60-3.00 (2H, m, PhCH_2), 3.63-3.82 (1H, m, CHN), 4.64 (1H, d, J 6, CHO). The other signals due to the minor isomer overlapped with those of the major. m/z 217 (M^+, 2%), 156 (7), 126 (100), 125 (35), 92 (63), 91 (63), 82 (93), 77 (7), 69 (8), 55 (12), 44 (6). Found: (M^+) 217.1101, $C_{13}H_{15}NO_2$ requires 217.1103. Anal. Calcd for $C_{13}H_{15}NO_2$: C, 71.9; H, 7.0; N, 6.5. Found: C, 71.5; H, 6.9; N, 6.4.



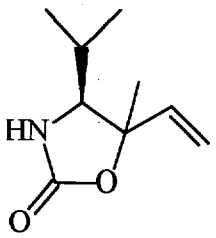
(4*R*, 5*S*)-4-Phenyl-5-(2-propenyl)oxazolidin-2-one (1f).

(3*RS*, 4*R*)-4-*N*-(*tert*-Butyloxycarbonyl)amino-3-hydroxy-2-methyl-4-phenylbut-1-ene **(3f)** (1.06g) gave vinyl oxazolidinone **(1f)** (0.35 g, 45%) as a single diastereoisomer after column chromatography (EtOAc:petrol / 1:1). m.p. 95-97°C; ν_{max}/cm^{-1} (nujol



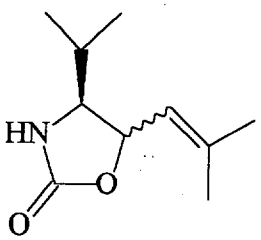
mull) 3269, 2922, 1753, 1720, 1655, 1604; δ_H (500 MHz, $CDCl_3$) 1.77 (3H, s, $CH_3C=CH_2$), 4.55 (1H, d, J 6.5, CHN), 4.64 (1H, d, J 6.5, CHO), 4.91 (1H, s, one of MeC=CH_2), 4.94 (1H, s, one of MeC=CH_2), 6.08 (1H, s, NH), 7.24-7.35 (5H, m, Ar-H); δ_C (125 MHz, $CDCl_3$) 16.83, 60.69, 87.83, 115.08, 126.18, 128.77, 129.11, 139.35, 140.19, 158.96; m/z 203 (M^+, 11%), 160 (18), 133 (100), 132 (51), 105 (63), 104 (90), 77 (30), 57 (6), 51(7), 44 (3), 41 (7). Found: (M^+) 203.0943, $C_{12}H_{13}NO_2$ requires 203.0946. Anal. Calcd for $C_{12}H_{13}NO_2$: C, 70.9; H, 6.45; N, 6.9. Found: C, 70.8; H, 6.4; N, 6.8.

(4*S*)-5-Ethenyl-4-(2-propyl)-5-methyloxazolidin-2-one (1g).



(4*S*)-4-*N*-(*tert*-Butyloxycarbonyl)amino-3-hydroxy-3,5-dimethylhex-1-ene **(3g)** (0.75 g, 3.1 mmol) gave the vinyl oxazolidinone **(1g)** (0.391 g, 75%) as a colourless oil. ^1H NMR indicated this to be a single diastereoisomer (after column chromatography). $[\alpha]_D^{21}$ –7.7° (c = 0.92, $CHCl_3$), ν_{max}/cm^{-1} (Film) 3248, 3135, 2964,2927, 2875, 1753, 1381. δ_H (500 MHz, $CDCl_3$) 0.90 (3H, d, *J* 6.5, one of $(CH_3)_2CH$), 1.02 (3H, d, *J* 6.5, one of $(CH_3)_2CH$), 1.48 (3H, s, CH_3CO), 1.84-1.92 (1H, m, Me_2CH), 3.32 (1H, d, J 9.0, CHN), 5.23 (1H, d, *J* 11, one of C=CH_2), 5.42 (1H, d, *J* 17.0, one of C=CH_2), 5.93 (1H, dd, *J* 11.0, 17.0, CH=CH_2), 6.73 (1H, broad s, NH). δ_C (125 MHz, $CDCl_3$) 19.10, 19.90, 20.15, 28.66, 67.53, 84.83, 115.59, 140.16, 159.04. m/z 170 (M^++H, 15%), 126 (M^+-^{I}Pr, 20), 82 (M^+-^{I}Pr, CO_2, 54), 71 ($C_4H_9N^+$, 100). Found: (M^++H) 170.117695, $C_9H_{16}NO_2$ requires 170.118104. Anal. Calcd for $C_9H_{15}NO_2$: C, 63.9; H, 8.9; N, 8.3. Found: C, 63.9; H, 9.2; N, 7.9.

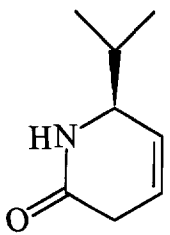
(4*S*, 5*RS*)-5-(2-Methylprop-1-enyl)-4-(2-propyl)oxazolidin-2-one (1h).



(5*S*, 4*RS*)-5-*N*-(*tert*-Butyloxycarbonyl)amino-4-hydroxy-2,6-dimethylhex-2-ene **(3h)** (0.489 g, 1.9 mmol) gave vinyl oxazolidinone **(1h)** (0.174 g, 50%) as a colourless oil. This was found to be identical to the compound isolated directly from the Grignard addition to the BOC protected aldehyde (vide supra).

3,6-Dihydro-1*H*-pyridin-2-ones (4a-g) by carbonylation of oxazolidinones (1a-g). The vinyl oxazolidinone **(1)** and $(PPh_3)_2Pd(OAc)_2$ (5 mol%) were dissolved in EtOH (20 ml per mmol of **1**) and transferred to a 300 ml autoclave. The autoclave was pressurized with CO (55 atm) and heated to 70°C (the pressure increased to 65 atm) for 5 days. After cooling and depressurization the crude reaction mixture was removed and the solvent was evaporated under reduced pressure. Purification of the crude material by column chromatography (EtOAc:petrol / 2:1) afforded the δ-lactam **(4)**.

(6*S*)-3,6-Dihydro-6-(2-propyl) -1*H*-pyridin-2-one (4a).

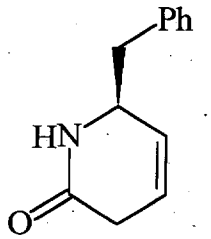


(4*S*, 5*RS*)-5-Ethenyl-4-(2-propyl)oxazolidin-2-one **(1a)** (200mg) gave the δ-lactam **(4a)** (0.156 g, 87%) as a colourless oil. $[\alpha]_D^{21}$ +58.0° (c = 1.2, $CHCl_3$). ν_{max}/cm^{-1} (Film) 3214,

2961, 1665. δ_H (500MHz, $CDCl_3$) 0.92 (3H, d, J 7, one of $(CH_3)_2CH$), 0.94 (3H, d, J 7, one of $(CH_3)_2CH$), 1.82 (1H, d septet, J 4, 7, Me_2CH), 3.93 (1H, broad s, CHN), 5.64-5.69 (1H, m, one of HC=CH), 5.80-5.85 (1H, m, one of HC=CH), 6.11 (1H, broad s, NH). δ_C (125MHz, $CDCl_3$) 16.90, 17.46, 31.43, 33.79, 59.25, 122.69, 123.48, 170.23. m/z 139 (M^+, 7%), 96 (100), 78 (57), 68 (74), 53 (29), 41 (99), 28 (84). Anal. Calcd for $C_8H_{13}NO$: C, 69.0; H, 9.4, N, 10.1. Found: C, 69.2; H, 9.6; N, 10.0.

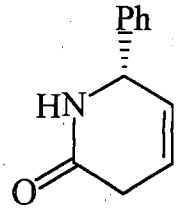
(6*S*)-3,6-Dihydro-6-phenylmethyl-1*H*-pyridin-2-one (4b).

(4*S*, 5*RS*)-5-Ethenyl-4-phenylmethyloxazolidin-2-one **(1b)** (100mg) gave the δ-lactam **(4b)** (0.077 g, 78%) as a white solid. This compound has been reported[15] but no data are given. m.p. 73-74°C. $[\alpha]_D^{25}$ +3.7° (c = 1.0, $CHCl_3$); ν_{max}/cm^{-1} (Film) 3217, 3033, 1679, 1658, 1603; δ_H (500MHz, $CDCl_3$) 2.72 (1H, dd, J 8.5, 13.5, one of $PhCH_2$), 2.75-2.92 (2H, m, CH_2CO), 2.95 (1H, dd, J 5, 13.5, one of $PhCH_2$), 4.26 (1H, broad s, CHN), 5.71-5.78 (2H, broad m, HC=CH), 6.27 (1H, broad s, NH), 7.19-7.34 (5H, m, Ar-H). δ_C (125MHz, $CDCl_3$) 30.79, 31.52, 62.57, 118.42, 128.40, 128.52, 130.95, 132.00, 132.10, 170.86; m/z 188 (MH^+, 5%), 187 (0.2), 96 (100), 95 (16), 92 (4), 91 (13), 78 (7). Anal. Calcd for $C_{12}H_{13}NO$: C, 77.0; H, 7.0; N, 7.5. Found: C, 77.1; H, 7.1; N, 7.6.



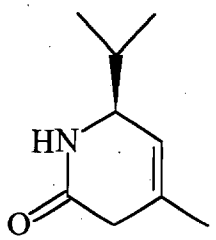
(6*R*)-3,6-Dihydro-6-phenyl-1*H*-pyridin-2-one (4c).

(4*R*, 5*RS*)-5-Ethenyl-4-phenyloxazolidin-2-one **(1c)** (190mg) gave the δ-lactam **(4c)** (0.10 g, 58%) as a white oil: $[\alpha]_D^{21}$ -9.9° (c = 1.7, CH_2Cl_2); ν_{max}/cm^{-1} (Film) 3433, 2970, 1649. δ_H (500MHz, $CDCl_3$) 2.98-3.10 (2H, m, CH_2CO), 5.13 (1H, broad s, CHN), 5.72-5.77 (1H, m, one of HC=CH), 5.79-5.83 (1H, m, one of HC=CH), 6.27 (1H, broad s, NH), 7.26-7.39 (5H, m, Ar-H); δ_C (125MHz, $CDCl_3$) 30.97, 58.82, 125.52, 126.63, 128.46, 128.56, 129.06, 132.97, 168.90; m/z 173 (M^+, 100%), 145(8), 130(22), 96(19), 77(18). Found: (M^+) 173.0839, $C_{11}H_{11}NO$ requires 173.0841.

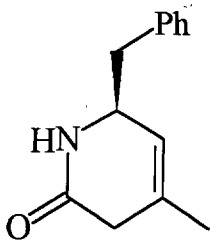


(6*S*)-3,6-Dihydro-4-methyl-6-(2-propyl) -1*H*-pyridin-2-one (4d).

(4*S*, 5*RS*)-4-(2-Propyl)-5-(2-propenyl)oxazolidin-2-one **(1d)** (168mg) gave the δ-lactam **(4d)** (0.113 g, 74%) as a colourless oil: $[\alpha]_D^{21}$ +55.4° (c = 3.3, CH_2Cl_2); ν_{max}/cm^{-1} (Film) 3408, 2960, 1697, 1655; δ_H (500MHz, $CDCl_3$) 0.89 (3H, d, J 6.5, one of $(CH_3)_2CH$), 0.91 (3H, d, J 6.5, one of $(CH_3)_2CH$), 1.75 (3H, s, CH_3C=CH), 1.77-1.83 (1H, m, Me_2CH), 2.74-2.86 (2H, broad m, CH_2CO), 3.86 (1H, broad s, CHN), 5.37 (1H, broad s, MeC=CH), 6.72 (1H, broad s, NH); δ_C (125MHz, $CDCl_3$) 17.05, 17.55, 22.12, 34.10, 36.09, 59.04, 117.80, 132.98, 170.75; m/z 110 (M^+-Me_2CH, 100%), 92 (7), 91 (8), 69 (43), 56 (15), 43 (32), 41 (45); Found: (M^+-Me_2CH) 110.0604, C_6H_8NO requires 110.0606.

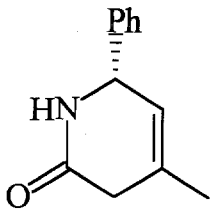


(6*S*)-3,6-Dihydro-4-methyl-6-phenylmethyl-1*H*-pyridin-2-one (4e).



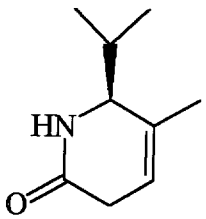
(4*S*, 5*RS*)-4-Phenylmethyl-5-(2-propenyl)oxazolidin-2-one **(1e)** (170mg) gave the δ-lactam **(4e)** (0.104 g, 66%) as a colourless oil: $[\alpha]_D^{21}$ +2.7° (c = 1.1, CH_2Cl_2); ν_{max}/cm^{-1} (nujol mull) 3390, 2922, 1697, 1660, 1603; δ_H (500MHz, $CDCl_3$) 1.73 (3H, s, CH_3C=CH), 2.64 (1H, dd, partially obscured, J 21.5, one of CH_2CO), 2.65 (1H, dd, J 8.5, 13.5, one of $PhCH_2$), 2.75 (1H, dd, J 4.5, 21.5, one of CH_2CO), 2.92 (1H, dd, J 5, 13.5, one of $PhCH_2$), 4.19 (1H, broad s, CHN), 5.44 (1H, broad s, MeC=C*H*), 6.12 (1H, broad s, NH), 7.16-7.34 (5H, m, Ar-H); δ_C (125MHz, $CDCl_3$) 22.00, 35.89, 44.02, 54.96, 119.21, 126.95, 128.72, 129.49, 132.15, 136.55, 169.79; m/z 201 (M^+, 0.5%), 110 (100), 92 (10), 91 (10), 77 (2); Found: (M^+) 201.1144, $C_{13}H_{15}NO$ requires 201.1154.

(6*R*)-3,6-Dihydro-4-methyl-6-phenyl-1*H*-pyridin-2-one (4f).



(4*R*, 5*S*)-4-Phenyl-5-(2-propenyl)oxazolidin-2-one **(1f)** (102mg) gave the δ-lactam **(4f)** (0.054 g, 57%) as a colourless oil: $[\alpha]_D^{21}$ -4.3° (c = 1.4, CH_2Cl_2); ν_{max}/cm^{-1} (Film) 3408, 2916, 1649; δ_H (500MHz, $CDCl_3$) 1.76 (3H, s, CH_3C=CH), 2.85-2.98 (2H, m, CH_2CO), 5.06 (1H, broad s, CHN), 5.44-5.48 (1H, m, MeC=C*H*), 6.31 (1H, d, J 7, NH), 7.23-7.38 (5H, m, Ar-H); δ_C (125MHz, $CDCl_3$) 22.04, 35.56, 58.53, 119.95, 126.54, 128.48, 129.17, 132.90, 141.83, 169.48; m/z 187 (M^+, 17%), 172 (20), 138 (100), 110 (13), 95 (48), 77 (6), 67 (20), 40 (12); Found: (M^+) 187.0988, $C_{12}H_{13}NO$ requires 187.0997.

(6*S*)-3,6-Dihydro-5-methyl-6-(2-propyl) -1*H*-pyridin-2-one (4g).



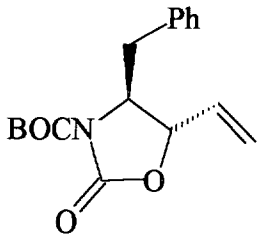
(4*S*)-5-Ethenyl-4-(2-propyl)-5-methyloxazolidin-2-one **(1g)** (0.090 g) gave the δ-lactam **(4g)** (0.070 g, 85%) as a colourless oil: $[\alpha]_D^{21}$ +50.5° (c = 0.8, $CHCl_3$); ν_{max}/cm^{-1} (Film) 3207, 2962, 2918, 1660; δ_H (500MHz, $CDCl_3$) 0.73 (3H, d, J 7.0, one of $(CH_3)_2CH$), 1.01 (3H, d, J 7.0, one of $(CH_3)_2CH$), 1.73 (3H, s, CH_3C=CH), 2.00-2.09 (1H, m, Me_2CH), 2.80-2.92 (2H, broad m, CH_2CO), 3.71-3.74 (1H, m, CHN), 5.44-5.53 (1H, m, MeC=C*H*), 6.24 (1H, broad s, NH); δ_C (125MHz, $CDCl_3$) 14.12, 19.35, 19.85, 30.85, 31.62, 62.62, 118.48, 131.00, 170.90; m/z 110 (M^+-Me_2CH, 100%), 57 (22); Found: (M^+-Me_2CH) 110.060493, C_6H_8NO requires 110.060589.

(4*S*, 5*R*)-*N*-(*tert*-Butyloxycarbonyl)-5-Ethenyl-4-phenylmethyloxazolidin-2-one (5) and (4*S*, 5*S*)-*N*-(*tert*-Butyloxycarbonyl)-5-Ethenyl-4-phenylmethyloxazolidin-2-one (5).

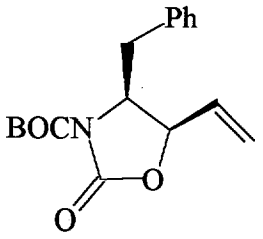
Triethylamine (90 mg, 0.12 ml, 0.86 mmol), 4-*N*,*N*-dimethylaminopyridine (100 mg, 0.82 mmol) and di-*tert*-butyldicarbonate (195 mg, 0.89 mmol) were added to a solution of (4*S*, 5*RS*)-5-Ethenyl-4-phenylmethyloxazolidin-2-one **(1b)** (0.165g, 0.81 mmol) in THF (5 ml). The mixture was allowed to stir overnight and then the solvent was removed under reduced pressure. The residue was diluted with EtOAc (50 ml), washed with HCl (2M, 2 x 20 ml), saturated sodium bicarbonate solution (2 x 20 ml), brine (2 x

20 ml), dried (Na_2SO_4) and the solvent was removed under reduced pressure. The products were purified by flash column chromatography eluting with petrol:EtOAc 10:1 to give:

First eluted from the column: **(4*S*, 5*S*)-*N*-(*tert*-Butyloxycarbonyl)-5-Ethenyl-4-phenyl methyloxazolidin-2-one (5)** (110 mg, 45%) white solid, m.p. 111-112 °C, $[\alpha]_D^{21}$ +0.8° (c = 0.84, $CHCl_3$)ν_{max}/cm^{-1} (Film) 2980, 1817, 1722, 1369, 1329, 1157, 1068. δ_H (500 MHz, $CDCl_3$) 1.59 (9H, s, $C(CH_3)_3$), 2.84 (1H, dd, *J* 10, 13.5, one of $PhCH_2$), 3.34 (1H, dd, *J* 3.5, 13.5, one of $PhCH_2$), 4.17 (1H, ddd, *J* 3, 3.5, 10, CHN), 4.62 (1H, ddd, *J* 1.5, 3, 5.5, CHO), 5.16 (1H, broad d, *J* 10.5, one of $C=CH_2$), 5.17 (1H, broad d, *J* 17, one of $C=CH_2$), 5.62 (1H, ddd, *J* 5.5, 10.5, 17, $CH=CH_2$), 7.18-7.36 (5H, m, Ph); δ_C (125MHz, $CDCl_3$) 28.03, 38.8, 61.3, 84.1, 118.1, 127.4, 129.0, 129.4, 133.8, 135.0, 149.3, 151.4; m/z 303 (M^+, 0.02%), 247 (MH^+-^{t}Bu, 35), 203 (MH^+-^{t}BuOCO, 7), 142 (16), 112 (85), 91 ($PhCH_2^+$, 65), 57 ($^tBu^+$, 100); Found: (M^+) 303.146545, $C_{17}H_{21}NO_4$ requires 303.147048. Anal. Calcd for $C_{17}H_{21}NO_4$: C, 67.3; H, 7.0; N, 4.6. Found: C, 67.5; H, 7.1; N, 4.6.

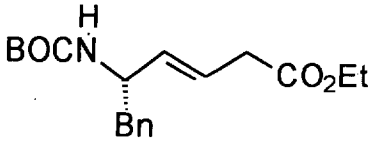


Second eluted from the column: **(4*S*, 5*R*)-*N*-(*tert*-Butyloxycarbonyl)-5-Ethenyl-4-phenyl methyloxazolidin-2-one (5)** (65 mg, 26%), white solid, m.p. 107-109 °C, $[\alpha]_D^{21}$ +2.2° (c = 0.36, $CHCl_3$), ν_{max}/cm^{-1} (Film) 2980, 1817, 1720, 1367, 1159, 1078. δ_H (500 MHz, $CDCl_3$) 1.43 (9H, s, $C(CH_3)_3$), 2.93 (1H, dd, *J* 8, 14, one of $PhCH_2$), 2.97 (1H, dd, *J* 6, 14, one of $PhCH_2$), 4.62 (1H, ddd, *J* 6, 7, 8, CHN), 5.02 (1H, tdd, *J* 1.5, 5.5, 7, CHO), 5.37 (1H, td, *J* 1.5, 10.5, one of $C=CH_2$), 5.53 (1H, td, *J* 1.5, 17, one of $C=CH_2$), 5.76 (1H, ddd, *J* 5.5, 10.5, 17, $CH=CH_2$), 7.18-7.31 (5H, m, Ph); δ_C (125MHz, $CDCl_3$) 27.84, 35.56, 59.54, 78.06, 83.90, 120.41, 126.84, 128.62, 129.53, 129.63, 136.41, 148.97, 151.50; m/z 303 (M^+, 0.1%), 247 (MH^+-^{t}Bu, 50), 203 (MH^+-^{t}BuOCO, 15), 142 (40), 112 (55), 91 ($PhCH_2^+$, 65), 57 ($^tBu^+$, 100); Found: (M^+) 303.146561, $C_{17}H_{21}NO_4$ requires 303.147048.



Ethyl (3*E*, 5*S*)-5-*N*-(*tert*-Butyloxycarbonyl)amino-6-phenylhex-3-enoate (6).

(4*S*, 5*S*)-*N*-(*tert*-Butyloxycarbonyl)-5-Ethenyl-4-phenylmethyloxazolidin-2-one **(5)** (0.070g, 0.23 mmol) was subjected to carbonylation by the same procedure as the 5-vinyloxazolidinones **1a-h** above. The product was purified by flash column chromatography eluting with petrol:EtOAc 3:1 to give the ester **(6)** (0.037g, 48%) as a pale yellow oil. $[\alpha]_D^{21}$ -0.8° (c = 1.12, $CHCl_3$); ν_{max}/cm^{-1} (Film) 3450, 2978, 2931, 1817, 1730, 1508, 1365, 1247, 1166. δ_H (500 MHz, $CDCl_3$) 1.14 (3H, t, *J* 7, CH_3CH_2), 1.32 (9H, s, $C(CH_3)_3$), 2.73-2.78 (2H, m, $PhCH_2$), 4.05 (2H, q, *J* 7, CH_3CH_2), 4.30-4.48 (2H, m, CHN and NH), 5.48 (1H, broad dd, *J* 5.5, 15.5, C=CHCH), 5.58 (1H, broad ddt, *J* 1, 15.5, 7, $C=CHCH_2$), 7.08-7.22 (5H, m, Ph); δ_C (125MHz, $CDCl_3$) 14.21, 28.30, 37.72, 41.60, 52.50, 60.63, 78.80, 122.62, 126.41, 128.28, 129.52, 133.80, 137.36, 155.08, 171.48; m/z 334 (MH^+, 0.2%), 333 (M^+, 0.02), 278 (MH^+-C_4H_8, 0.9), 260 (M^+-



^{t}BuO, 0.6), 242 (M^+-Bn, 30), 186 (M^+- ^{t}BuOH, CO_2Et, 70), 142 (70), 91 ($PhCH_2^+$, 30), 57 ($^tBu^+$, 100); Found: (M^+) 333.193687, $C_{19}H_{27}NO_4$ requires 333.194009.

Measurement of the enantiomeric purity of (6*S*)-3,6-Dihydro-6-(2-propyl)-1*H*-pyridin-2-one (4a) and (6*S*)-3,6-Dihydro-5-methyl-6-(2-propyl)-1*H*-pyridin-2-one (4g) by chiral GC. (6*R*)-3,6-Dihydro-6-(2-propyl)pyridin-2-one (**ent-4a**) was prepared from (*R*)-valine in the same way as the (6*S*) isomer. The *R* isomer was identical to the *S* by NMR and gave: $[\alpha]_D^{20}$ –55.6° (c = 1.1, $CHCl_3$). Both isomers were analyzed by GC at 138 °C using as stationary phase heptakis(2,6-di-*O*-methyl-3-*O*-pentyl)-β-cyclodextrin.[16] Both the product derived from (*S*)-valinol (retention time 27.20 min) and that derived from (*R*)-valinol (retention time 28.05 min) appeared to be enantiomerically pure within our limits of detection (> 97% ee). (6*R*)-3,6-Dihydro-5-methyl-6-(2-propyl)-1*H*-pyridin-2-one (**ent-4g**) was prepared from (*R*)-valine in the same way as the (6*S*) isomer. The *R* isomer was identical to the *S* by NMR and gave: $[\alpha]_D^{20}$ -52.4° (c = 0.8, $CHCl_3$). Both isomers were analyzed by GC as above. Both the product derived from (*S*)-valine (retention time 25.70 min) and that derived from (*R*)-valine (retention time 25.20 min) appeared to be enantiomerically pure within our limits of detection (> 97% ee).

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