Supporting Information

Novel Preparation of Chiral $\alpha$-Amino Acids Using the Mitsunobu-Tsunoda Reaction

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General Information

All reagents were purchased as reagent grade and used without further purification. Solvents for reactions were dried according to standard procedures.\textsuperscript{[1]} Sealed-tubes, screw cap vials or round-bottom flasks equipped with reflux condensers were used without noticeable differences. Analytical thin layer chromatography (TLC) was performed on 0.2 mm aluminium plates of silica gel 60 F\textsubscript{254} (Merck) and compounds were visualised by ultra-violet fluorescence or by staining with potassium permanganate, vanillin, or ninhydrin solutions, followed by heating the plate as appropriate. Preparative LCMS was carried out using Waters 600 Pumps linked to a Waters 2700 Sample Manager and a Waters micro mass ZMD mass detector. Samples were routinely filtered and injected at concentrations of around 50 mg of expected product per mL of DMF. Flash chromatography was performed using Davisil\textsuperscript{®} chromatographic silica (LC60Å 40-63 micron) (Grace GmbH & Co. KG) with indicated solvents. Ion-exchange chromatography was performed with Dowex resin 50W x4 20/50 mesh (Sigma-Aldrich) with water then 5% ammonia solution. Reversed-phase chromatography was performed using Davisil\textsuperscript{®} chromatographic C18 bonded silica (633NC18E 60Å 35-70 micron) (Grace GmbH & Co. KG) with indicated solvents. Infrared spectra were obtained using a Perkin Elmer Spectrum One Fourier Transform infrared spectrometer with a universal ATR sampling accessory using neat samples and absorption maxima are expressed in wavenumbers (cm\textsuperscript{-1}). Optical rotations were measured at 20 °C using either a Perkin Elmer Polarimeter or a Rudolph Research Analytical Autopol IV at \( \lambda = 598 \) nm and are given in units of \( 10^{-1} \) deg cm\textsuperscript{2} g\textsuperscript{-1}. Nuclear magnetic resonance (NMR) spectra were recorded on either a Bruker AVANCE DRX300 spectrometer operating at 300 MHz for \textsuperscript{1}H nuclei and 75 MHz for \textsuperscript{13}C nuclei or on a Bruker AVANCE DRX400 spectrometer operating at 400 MHz for \textsuperscript{1}H nuclei and 100 MHz for \textsuperscript{13}C nuclei or on a Bruker Biospin AVANCE 500 spectrometer operating at 500 MHz for \textsuperscript{1}H nuclei and 125 MHz for \textsuperscript{13}C nuclei at 298 K. Chemical shifts are reported in parts per million (ppm) relative to the TMS signal at \( \delta_{\text{H}} 0.00 \) ppm (\textsuperscript{1}H NMR) in CDCl\textsubscript{3}-SiMe\textsubscript{4} solvent or were referenced to the residual methanol signal at \( \delta_{\text{H}} 3.31 \) ppm in MeOD-\textsubscript{d}4 or were referenced to the residual water signal at \( \delta_{\text{H}} 4.79 \) ppm in D\textsubscript{2}O. The \textsuperscript{13}C values were referenced to the residual chloroform signal at \( \delta_{\text{C}} 77.0 \) ppm in CDCl\textsubscript{3}-SiMe\textsubscript{4} solvent or residual methanol signal at \( \delta_{\text{C}} 49.00 \) ppm. \textsuperscript{1}H NMR shift values are reported as chemical shift (\( \delta \)), relative integral, multiplicity (s, singlet; d, doublet; t, triplet; m, multiplet; br s, broad singlet; br d, broad doublet; dd, doublet of doublets; td, triplet of doublets; qd, quadruplet of doublets; ddd, doublet of doublets of doublets; ddt, doublet of
doublets of triplets), coupling constant ($J$ in Hz) and assignments. $^{13}$C values are reported as chemical shift ($\delta$) and assignment. Assignments were made with the aid of HSQC experiments. Electro spray ionisation mass spectra (ESI-MS) were recorded on a Bruker microOTOF-Q II spectrometer. Samples were introduced using direct flow injection at 0.1-0.2 mL/min into an ESI source in positive or negative mode. Enantiomeric excesses were determined by chiral HPLC on a Dionex Ultimate 3000 system using a Chirobiotic T 250x4.6 mm 5 µm column, at a flow rate of 1 mL/min. An isocratic mixture of water (A) and CH$_3$CN (B) was used with detection at 210 nm for aromatic amino acids and 200 nm for non-aromatic amino acids. The samples were injected at a volume of 5 µL and a concentration of 1 mg/mL for aromatic amino acids and of 5 mg/mL for non-aromatic ones.

Cyanomethylenetri$^2$butylphosphorane (CMBP) was purchased from Tokyo Chemical Industry Co., Ltd. (TCI) or was prepared according to the procedure by Tsunoda et al.$^{[2]}$ and used in the reaction without further purification$^1$. $N$-(Diphenylmethylene)glycine tert-butyl ester, 2-aminobenzophenone, $N$-methylimidazole, nickel nitrate hexahydrate, benzyl bromide and the alcohols were purchased from Sigma-Aldrich with the exception of 2-thienylmethanol, allyl alcohol and 4-chlorobenzyl alcohol purchased from Acros and benzyl alcohol purchased from Scharlau. L-Proline and glycine were purchased from GL Biochem.

$^1$ Similar yields were obtained when using either the commercially available or crude CMPB.
General Procedures

1) **General procedure A for the synthesis of racemic amino acid derivatives 3a-r**

\[
\begin{align*}
&\text{N-(Diphenylmethylene)-Gly-CO}_2\text{Bu} \ 2 \ (0.29 \text{ mmol}, \ 86 \text{ mg}), \ \text{(cyanomethylene)tributylphosphorane} \ 1a \ (0.58 \text{ mmol}, \ 152 \text{ µL}) \ \text{and alcohol (0.58 mmol)} \ \text{were combined in toluene (0.3 mL). The brown mixture was heated at 120 °C overnight. The brown solution was allowed to cool down to room temperature and was purified to yield the desired product.}
\end{align*}
\]

2) **General procedure B for the synthesis of alkylated glycine-nickel-(S)-BPB complexes 6a-h**

\[
\begin{align*}
&\text{Glycine-nickel-(S)-2-[N(N'-benzylprolyl)amino]benzophenone} \ 4 \ (0.29 \text{ mmol}, \ 145 \text{ mg}), \ \text{(cyanomethylene)tributylphosphorane} \ 1a \ (0.58 \text{ mmol}, \ 152 \text{ µL}) \ \text{and alcohol (0.58 mmol)} \ \text{were combined in toluene (0.3 mL) and the red mixture heated at 120 °C overnight. The red solution was allowed to cool to room temperature and then purified to yield the desired product.}
\end{align*}
\]
3) **General procedure C for the synthesis of enantiopure amino acids 7a-g**

![Chemical structure of 6a-g](image)

Substituted nickel complex 6 was dissolved in MeOH \((c = 0.05 \text{ mol/L})\) and 2 M HCl \((c = 0.1 \text{ mol/L})\) was added and the bright red solution was heated at reflux \((80^\circ \text{C})\) for 1h. The resulting yellow to green solution was allowed to cool to room temperature then 28% ammonia solution was added until the pH reached 9-10. The BPB was recovered by extraction with CH\(_2\)Cl\(_2\). The intense blue aqueous layer was concentrated to dryness. The blue solid was dissolved in water, purified by ion-exchange chromatography and then lyophilised to yield the desired product.

4) **Procedure for the synthesis of (S)-2-amino-nonanoic acid hydrochloride 7h**

![Chemical structure of 6h](image)

(S)-heptylglycine-Ni-(S)-BPB 6h \((0.16 \text{ mmol, 93 mg})\) was dissolved in MeOH \((c = 0.05 \text{ mol/L})\) and 2 M HCl \((c = 0.1 \text{ mol/L})\) was added, the bright red solution was heated at reflux \((80^\circ \text{C})\) for 1h. The resulting yellow to green solution was allowed to cool down to room temperature. The solvent was concentrated *in vacuo*, water was added, the beige precipitate was centrifuged and the aqueous layer was purified by reversed-phase C18 chromatography \((0-70\% \text{ MeOH in water})\) and lyophilized to yield the desired product as a white solid.
Characterization data

\textit{tert}-Butyl 2-(diphenylmethyleneamino)-3-phenylpropanoate 3a:

This compound was prepared following general procedure A using benzyl alcohol (60 µL). Purification by flash chromatography (Et₂O/hexane, 1/9 + 1% NEt₃) yielded the desired product as a brown oil. Yield: (91 mg, 82%).

$^1$H NMR and $^{13}$C NMR data are in agreement with that reported in the literature.$^{[3]}$

\textit{tert}-Butyl 2-(diphenylmethyleneamino)-3-(2-(chloro)phenyl)propanoate 3b:

This compound was prepared following general procedure A using 2-chlorobenzyl alcohol (83 mg). Purification by flash chromatography (Et₂O/hexane, 1/9 + 1% NEt₃) yielded the desired product as a brown oil. Yield: (71 mg, 58%).

$^1$H NMR data are in agreement with that reported in the literature.$^{[4]}$

\textit{tert}-Butyl 3-(2,6-dichlorophenyl)-2-(diphenylmethyleneamino)propanoate 3c:

This compound was prepared following general procedure A using 2,6-dichlorobenzyl alcohol (103 mg). Purification by preparative chromatography yielded the desired product as a brown oil. Yield: (90 mg, 68%).

$^1$H NMR and $^{13}$C NMR data are in agreement with that reported in the literature.$^{[5]}$
**tert-Butyl 2-(diphenylmethyleneamino)-3-(2-methoxyphenyl)propanoate 3d:**

This compound was prepared following general procedure A using 2-methoxybenzyl alcohol (77 µL). Purification by flash chromatography (Et₂O/hexane, 1/9 + 1% NEt₃) yielded the desired product as a brown oil. Yield: (93 mg, 77%); ¹H NMR (500 MHz, CDCl₃): δ 1.48 (9H, s, CH₃/CO₂tBu), 3.06 (1H, dd, J = 13.2, 9.5 Hz, βCH₂), 3.39 (1H, dd, J = 9.5, 4.4 Hz, αCH), 6.68 (2H, br d, J = 5.5 Hz, ar), 6.72 (1H, d, J = 8.1 Hz, 3-CH), 6.81 (1H, t, J = 7.3 Hz, 5-CH), 7.13 (1H, d, J = 7.3 Hz, 6-CH), 7.17 (1H, t, J = 8.1 Hz, 4-CH), 7.29-7.39 (6H, m, ar), 7.58 (2H, d, J = 7.3 Hz, ar); ¹³C NMR (125 MHz, CDCl₃): δ 28.0 (3 x CH₃/CO₂tBu), 34.3 (βCH₂), 54.7 (OCH₃), 65.5 (αCH), 80.8 (C/CO₂tBu), 109.8 (3-CH), 119.9 (5-CH), 126.4 (1-C), 127.5 (1 x CH/ar), 127.8 (4 x CH/ar), 127.9 (2 x CH/ar), 127.9 (1 x CH/ar), 128.7 (2 x CH/ar), 129.8 (1 x CH/ar), 131.9, 136.5, 139.8 (3 x C/ar), 157.7 (2-C), 169.9 *(C=N), 171.2 *(C=O/CO₂tBu); IR νₘₐₓ (neat): 2975, 1727, 1659, 1599, 1494, 1447, 1368, 1277, 1150, 1027, 941, 919, 845, 754, 698, 638 cm⁻¹; MS (ESI) m/z: 416.2226 [M + H]⁺, 360.1605 [M - C(CH₃)₃]⁺ ([M + H]⁺, C₂₇H₃₀NO₃ requires 416.2220).

**tert-Butyl 2-(diphenylmethyleneamino)-3-(3-methoxyphenyl)propanoate 3e:**

This compound was prepared following general procedure A using 3-methoxybenzyl alcohol (72 µL). Purification by flash chromatography (EtOAc/hexane, 1/9 + 1% NEt₃) yielded the desired product as a brown oil. Yield: (76 mg, 63%); ¹H NMR (400 MHz, CDCl₃): δ 1.45 (9H, s, CH₃/CO₂tBu), 3.14 (1H, dd, J = 13.3, 9.3 Hz, βCH₂), 3.21 (1H, dd, J = 13.3, 4.3 Hz, βCH₂), 3.65 (3H, s, OCH₃), 4.12 (1H, dd, J = 9.4, 4.4 Hz, αCH), 6.59 (1H, br s, ar), 6.62-6.67 (3H, m, ar), 6.72 (1H, dd, J = 8.0, 2.4 Hz, ar), 7.08-7.12 (1H, m, ar), 7.26-7.39 (6H,
m, ar), 7.58 (2H, d, \( J = 7.0 \) Hz, ar); \(^{13}\)C NMR (100 MHz, CDCl\(_3\)): \( \delta \) 28.1 (3 x CH\(_3\)/CO\(_2tBu\)), 39.7 (\( \beta \)CH\(_2\)), 55.0 (OCH\(_3\)), 67.9 (\( \alpha \)CH), 81.2 (C/CO\(_2tBu\)), 112.5 (4-CH), 114.7 (2-CH), 122.3 (6-C), 127.7, 127.9, 128.0 (6 x CH/ar), 128.2 (1 x CH/ar), 128.7 (2 x CH/ar), 129.0, 130.1 (2 x CH/ar), 136.4, 139.6, 139.9 (3 x C/ar), 159.4 (3-C), 170.3 *(C=N), 170.8 *(C=O/CO\(_2tBu\)); IR \( \nu \) max (neat): 2983, 1725, 1663, 1590, 1489, 1445, 1368, 1278, 1150, 1027, 945, 700, 640 cm\(^{-1}\); MS (ESI) \( m/z \): 438.2045 [M + Na]\(^+\), 416.2220 [M + H]\(^+\), 360.1596 [M - C(CH\(_3\))\(_3\)]\(^+\) ([M + H]\(^+\), C\(_{27}\)H\(_{30}\)NO\(_3\) requires 416.2220).

**tert-Butyl 2-(diphenylmethyleneamino)-3-(4-methoxyphenyl)propanoate 3f:**

![Diagram](image_url)

This compound was prepared following general procedure A using 4-methoxybenzyl alcohol (72 \( \mu \)L). Purification by flash chromatography (Et\(_2\)O/hexane, 1/9 + 1% NEt\(_3\)) yielded the desired product as a brown oil. Yield: (82 mg, 68%).

\(^1\)H NMR and \(^{13}\)C NMR data are in agreement with that reported in the literature.\(^{[6]}\)

**tert-Butyl 2-(diphenylmethyleneamino)-3-(4-(trifluoromethyl)phenyl)propanoate 3g:**

![Diagram](image_url)

\( N \)-(Diphenylmethylene)-Gly-CO\(_2tBu\) 2 (0.29 mmol, 86 mg), (cyanomethylene)tributyl phosphorane 1a (0.87 mmol, 228 \( \mu \)L) and 4-trifluoromethylbenzyl alcohol (0.87 mmol, 119 \( \mu \)L) were combined in toluene (0.3 mL). The brown mixture was heated at 120 °C overnight. The brown solution was allowed to cool down to room temperature. Purification by preparative chromatography yielded the desired product as a brown oil. Yield: (67 mg, 51%).

\(^1\)H NMR and \(^{13}\)C NMR data are in agreement with that reported in the literature.\(^{[3]}\)
tert-Butyl 2-(diphenylmethyleneamino)-3-(pyridin-2-yl)propanoate 3h:

This compound was prepared following general procedure A using pyridin-2-ylmethanol (56 µL). Purification by flash chromatography (EtOAc/hexane, 1/4 + 1% NEt₃) yielded the desired product as a yellow oil. Yield: (57 mg, 54%); Rf 0.29 (EtOAc/hexane, 1/4); ¹H NMR (400 MHz, CDCl₃): δ 1.44 (9H, s, CH₃/CO₂tBu), 3.37 (1H, dd, J = 13.3, 9.3 Hz, βCH₂), 3.44 (1H, dd, J = 9.4, 4.1 Hz, αCH), 6.70 (2H, d, J = 6.8 Hz, ar), 7.06 (1H, dddd, J = 7.5, 5.9, 4.9, 1.1 Hz, ar), 7.16 (1H, d, J = 7.7 Hz, ar), 7.25-7.40 (6H, m, ar), 7.48-7.58 (3H, m, ar), 8.41 (1H, dddd, J = 4.9, 2.7, 1.8, 0.8 Hz, 6-CH); ¹³C NMR (100 MHz, CDCl₃): δ 28.0 (3 x CH₃/CO₂tBu), 42.0 (βCH₂), 66.4 (αCH), 81.2 (C/CO₂tBu), 121.2 (5-CH), 124.6 (3-CH), 127.7, 127.9, 128.1 (6 x CH/ar), 128.4 (1 x CH/ar), 128.8 (2 x CH/ar), 130.1, 136.0 (2 x CH/ar), 136.2, 139.6 (2 x C/ar), 149.2 (6-CH), 158.7 (2-C), 170.7 *(C=N), 170.7 *(C=O/CO₂tBu); IR νmax (neat): 2977, 1728, 1592, 1252, 1148, 1068, 696 cm⁻¹; MS (ESI) m/z: 409.1875 [M + Na]⁺, 387.2056 [M + H]⁺, 331.1436 [M - C(CH₃)₃]⁺ (M + H)⁺, C₂₅H₂₇N₂O₂ requires 387.2067.

tert-Butyl 2-(diphenylmethyleneamino)-3-(pyridin-3-yl)propanoate 3i:

This compound was prepared following general procedure A using pyridin-3-ylmethanol (56 µL). Purification by preparative chromatography yielded the desired product as a brown oil. Yield: (41 mg, 37%).
¹H NMR and ¹³C NMR data are in agreement with that reported in the literature.⁷
**tert-Butyl 2-(diphenylmethyleneamino)-3-(thiophen-3-yl)propanoate 3j:**

![Chemical structure of tert-Butyl 2-(diphenylmethyleneamino)-3-(thiophen-3-yl)propanoate 3j]

This compound was prepared following general procedure A using 3-thiophenemethanol (55 µL). Purification by preparative chromatography yielded the desired product as a brown oil. Yield: (26 mg, 23%); $^1$H NMR (500 MHz, CDCl$_3$): $\delta$ 1.44 (9H, s, CH$_3$/CO$_2$tBu), 3.20 (1H, dd, $J$ = 13.9, 8.8 Hz, $\beta$CH$_2$), 3.25 (1H, dd, $J$ = 13.9, 4.5 Hz, $\beta$CH$_2$), 4.10 (1H, dd, $J$ = 8.8, 4.5 Hz, $\alpha$CH), 6.74 (2H, d, $J$ = 6.2 Hz, ar), 6.80 (1H, d, $J$ = 4.8 Hz, 4-CH), 6.91 (1H, d, $J$ = 3.0 Hz, 2-CH), 7.15 (1H, dd, $J$ = 4.8, 3.0 Hz, 5-CH), 7.30-7.39 (6H, m, ar), 7.60 (2H, d, $J$ = 7.2 Hz, ar); $^{13}$C NMR (125 MHz, CDCl$_3$): $\delta$ 28.0 (3x CH$_3$/CO$_2$tBu), 33.8 ($\beta$CH$_2$), 67.3 ($\alpha$CH), 81.1 (C/CO$_2$tBu), 122.3 (2-CH), 124.8 (5-CH), 127.6, 128.0, 128.1 (6 x CH/ar), 128.2 (1 x CH/ar), 128.7 (2 x CH/ar), 129.3, 130.1 (2 x CH/ar), 136.4 (1 x C/ar), 138.6 (3-C), 139.6 (1 x C/ar), 170.4 *(C=N), 170.7 *(C=O/CO$_2$tBu); IR $\nu_{\text{max}}$ (neat): 2976, 1728, 1658, 1598, 1447, 1368, 1317, 1276, 1149, 941, 919, 843, 768, 698, 637 cm$^{-1}$; MS (ESI) $m/z$: 414.1505 [M + Na]$^+$, 392.1688 [M + H]$^+$, 336.1070 [M - C(CH$_3$)$_3$]$^+$ ([M + H]$^+$, C$_{24}$H$_{26}$NO$_2$S requires 392.1679).

**tert-Butyl 2-(diphenylmethyleneamino)-3-(furan-3-yl)propanoate 3k:**

![Chemical structure of tert-Butyl 2-(diphenylmethyleneamino)-3-(furan-3-yl)propanoate 3k]

This compound was prepared following general procedure A using 3-furanmethanol (50 µL). Purification by preparative chromatography yielded the desired product as a brown oil. Yield: (68 mg, 62%); $^1$H NMR (500 MHz, CDCl$_3$): $\delta$ 1.44 (9H, s, CH$_3$/CO$_2$tBu), 2.99 (1H, dd, $J$ = 14.3, 8.5 Hz, $\beta$CH$_2$), 3.04 (1H, dd, $J$ = 14.3, 4.8 Hz, $\beta$CH$_2$), 4.06 (1H, dd, $J$ = 8.5, 4.8 Hz, $\alpha$CH), 6.16 (1H, s, 4-CH), 6.93 (2H, br s, ar), 7.19 (1H, s, 2-CH), 7.28 (1H, s, 5-CH), 7.33 (2H, t, $J$ = 7.7 Hz, ar), 7.36-7.39 (4H, m, ar), 7.63 (2H, d, $J$ = 7.3 Hz, ar); $^{13}$C NMR
(125 MHz, CDCl$_3$): δ 28.0 (3x CH$_3$/CO$_2$Bu), 28.9 (βCH$_2$), 66.8 (αCH), 81.1 (C/CO$_2$Bu), 112.0 (4-CH), 121.1 (3-C), 127.7, 128.0, 128.2 (6 x CH/ar), 128.3 (1 x CH/ar), 128.7 (2 x CH/ar), 130.2 (1 x CH/ar), 136.4, 139.5 (2 x C/ar), 140.2 (2-CH), 142.3 (5-CH), 170.3 *(C=N), 170.7 *(C=O/CO$_2$Bu); IR $\nu_{\text{max}}$ (neat): 2932, 1729, 1661, 1623, 1599, 1446, 1367, 1276, 1149, 1124, 847, 780, 697, 638 cm$^{-1}$; MS (ESI) m/z: 398.1712 [M + Na]$^+$, 376.1897 [M + H]$^+$, 320.1281 [M - C(CH$_3$)$_3$]$^+$ ([M + H]$^+$, C$_{24}$H$_{26}$NO$_3$ requires 376.1907).

tert-Butyl 2-(diphenylmethyleneamino)-3-(thiophen-2-yl)propanoate 3l:

![Diagram of tert-Butyl 2-(diphenylmethyleneamino)-3-(thiophen-2-yl)propanoate 3l]

This compound was prepared following general procedure A using 2-thiophenemethanol (55 µL). Purification by preparative chromatography yielded the desired product as a brown oil. Yield: (88 mg, 77%); $^1$H NMR (500 MHz, CDCl$_3$): δ 1.45 (9H, s, CH$_3$/CO$_2$Bu), 3.39-3.47 (2H, m, βCH$_2$), 4.13 (1H, dd, J = 7.9, 4.7 Hz, αCH), 6.78-6.91 (4H, m, ar), 7.10 (1H, d, J = 5.0 Hz, 5-CH), 7.32-7.41 (6H, m, ar), 7.66 (2H, d, J = 7.6 Hz, ar); $^{13}$C NMR (125 MHz, CDCl$_3$): δ 28.0 (3x CH$_3$/CO$_2$Bu), 33.6 (βCH$_2$), 67.5 (αCH), 81.3 (C/CO$_2$Bu), 124.1 (5-CH), 126.2 (3-CH), 126.5 (4-CH), 127.6, 127.9, 128.1 (6 x CH/ar), 128.3 (1 x CH/ar), 128.9 (2 x CH/ar), 130.2 (1 x CH/ar), 136.4, 139.5 (2 x C/ar), 140.4 (2-C), 170.2 *(C=N), 170.9 *(C=O/CO$_2$Bu); IR $\nu_{\text{max}}$ (neat): 2977, 1728, 1659, 1623, 1598, 1446, 1368, 1316, 1276, 1148, 941, 919, 845, 764, 695, 638 cm$^{-1}$; MS (ESI) m/z: 414.1506 [M + Na]$^+$, 392.1679 [M + H]$^+$, 336.1058 [M - C(CH$_3$)$_3$]$^+$ ([M + H]$^+$, C$_{24}$H$_{26}$NO$_2$S requires 392.1679).

tert-Butyl 2-(diphenylmethyleneamino)-3-(furan-2-yl)propanoate 3m:

![Diagram of tert-Butyl 2-(diphenylmethyleneamino)-3-(furan-2-yl)propanoate 3m]
This compound was prepared following general procedure A using 2-furanmethanol (50 µL). Purification by preparative chromatography yielded the desired product as a brown oil. Yield: (62 mg, 57%); 1H NMR (500 MHz, CDCl₃): δ 1.45 (9H, s, CH₃/CO₂tBu), 3.21 (1H, dd, J = 14.8, 8.8 Hz, βCH₂), 3.27 (1H, dd, J = 14.8, 4.4 Hz, βCH₂), 4.24 (1H, dd, J = 8.8, 4.4 Hz, αCH), 6.02 (1H, d, J = 2.9 Hz, 3-CH), 6.24 (1H, br s, 4-CH), 6.88 (2H, d, J = 6.3 Hz, ar), 7.24 (1H, s, 5-CH), 7.31 (2H, t, J = 7.7 Hz, ar), 7.36-7.39 (4H, m, ar), 7.60 (2H, d, J = 7.2 Hz, ar); 13C NMR (125 MHz, CDCl₃): δ 28.0 (3x CH₃/CO₂tBu), 32.0 (βCH₂), 65.3 (αCH), 81.2 (C/CO₂tBu), 107.3 (3-CH), 110.3 (4-CH), 127.8, 127.9, 128.1 (6 x CH/ar), 128.4 (1 x CH/ar), 128.8 (2 x CH/ar), 130.1 (1 x CH/ar), 136.3, 139.7 (2 x C/ar), 141.0 (5-CH), 152.3 (2-C), 170.3 *(C=N), 170.8 *(C=O/CO₂tBu); IR νmax (neat): 2978, 1728, 1657, 1598, 1447, 1368, 1316, 1276, 1149, 941, 919, 844, 763, 698, 637 cm⁻¹; MS (ESI) m/z: 398.1727 [M + Na]^+, 376.1905 [M + H]^+, 320.1285 [M - C(CH₃)₃]^+ ([M + H]^+, C₂₄H₂₈NO₃ requires 376.1907).

**tert-Butyl 2-(diphenylmethyleneamino)-3-(1-methyl-1H-imidazol-2-yl)propanoate 3n:**

![Structure of 3n](image)

This compound was prepared following general procedure A using (1-methyl-imidazol-2-yl) methanol (65 mg). Purification by preparative chromatography yielded the desired product as a brown oil. Yield: (33 mg, 29%); 1H NMR (500 MHz, CDCl₃): δ 1.41 (9H, s, CH₃/CO₂tBu), 3.28 (1H, dd, J = 14.5, 9.5 Hz, βCH₂), 3.35 (1H, dd, J = 14.5, 4.2 Hz, βCH₂), 3.53 (3H, s, N-CH₃), 4.41 (1H, dd, J = 9.5, 4.2 Hz, αCH), 6.69 (1H, s, 5-CH), 6.73 (2H, d, J = 6.2 Hz, ar), 6.89 (1H, s, 4-CH), 7.30 (2H, t, J = 7.8 Hz, ar), 7.32-7.38 (4H, m, ar), 7.60 (2H, d, J = 7.4 Hz, ar); 13C NMR (125 MHz, CDCl₃): δ 27.9 (3x CH₃/CO₂tBu), 30.4 (βCH₂), 33.0 (N-CH₃), 66.0 (αCH), 81.3 (C/CO₂tBu), 120.4 (5-CH), 127.3 (4-CH), 127.6, 128.0, 128.2 (6 x CH/ar), 128.5 (1 x CH/ar), 128.7 (2 x CH/ar), 130.3 (1 x CH/ar), 135.8, 139.2 (2 x C/ar), 145.4 (2-C), 170.1 *(C=N), 171.0 *(C=O/CO₂tBu); IR νmax (neat): 2977, 1730, 1626, 1497, 1447, 1365, 1284, 1152, 1071, 844, 825, 774, 765, 699, 649 cm⁻¹; MS (ESI) m/z: 390.2188 [M + H]^+, 380.2176. [C₂₄H₂₈N₃O₂ requires 390.2176].
**tert-Butyl 2-(diphenylmethyleneamino)pent-4-enoate 3o:**

![Chemical structure image]

This compound was prepared following general procedure A using allyl alcohol (39 µL). Purification by preparative chromatography yielded the desired product as a brown oil. Yield: (69 mg, 70%).

$^1$H NMR and $^{13}$C NMR data are in agreement with that reported in the literature.$^{[3]}$

**tert-Butyl 2-(diphenylmethyleneamino)-4-methoxybutanoate 3p:**

![Chemical structure image]

This compound was prepared following general procedure A using 2-methoxyethanol (46 µL). Purification by preparative chromatography yielded the desired product as a brown oil. Yield: (38 mg, 37%); $^1$H NMR (500 MHz, CDCl$_3$): $\delta$ 1.43 (9H, s, CH$_3$/CO$_2$tBu), 2.13-2.25 (2H, m, $\beta$CH$_2$), 3.25 (3H, s, OCH$_3$), 3.33-3.39 (1H, m, CH$_2$OCH$_3$), 3.43-3.47 (1H, m, CH$_2$OCH$_3$), 4.09 (1H, dd, $J$ = 8.4, 5.3 Hz, $\alpha$CH), 7.18-7.20 (2H, m, ar), 7.33 (2H, t, $J$ = 7.7 Hz, ar), 7.39 (1H, t, $J$ = 7.3 Hz, ar), 7.41-7.46 (3H, m, ar), 7.66 (2H, d, $J$ = 7.3 Hz, ar); $^{13}$C NMR (125 MHz, CDCl$_3$): $\delta$ 28.0 (3x CH$_3$/CO$_2$tBu), 33.4 ($\beta$CH$_2$), 58.4 (OCH$_3$), 62.9 ($\alpha$CH), 69.1 (CH$_2$OCH$_3$), 80.9 (C/CO$_2$tBu), 127.8, 127.9, 128.2 (6 x CH/ar), 128.5 (1 x CH/ar), 128.7 (2 x CH/ar), 130.1 (1 x CH/ar), 136.5, 139.7 (2 x C/ar), 170.5 *(C=N), 171.2 *(C=O/CO$_2$tBu); IR $\nu$$_{max}$ (neat): 2976, 1729, 1660, 1447, 1368, 1277, 1150, 1118, 1028, 847, 780, 766, 697, 638 cm$^{-1}$; MS (ESI) m/z: 376.1887 [M + Na]$^+$, 354.2070 [M + H]$^+$, 298.1443 [M - C(CH$_3$)$_3$]$^+$ ([M + H]$^+$, C$_{22}$H$_{28}$NO$_3$ requires 354.2064).
**tert-Butyl 2-(diphenylmethyleneamino)-4,4-dimethylpentanoate 3q:**

![Diagram](image)

This compound was prepared following general procedure A using 2,2-dimethylpropanol (51 mg). Purification by preparative chromatography yielded the desired product as a brown oil. Yield: (34 mg, 32%); $^1$H NMR (500 MHz, CDCl$_3$): $\delta$ 0.78 (9H, s, CH$_3$/C(CH$_3$)$_3$), 1.45 (9H, s, CH$_3$/CO$_2$Bu), 1.75 (1H, dd, $J = 14.0$, 6.5 Hz, $\beta$CH$_2$), 2.08 (1H, dd, $J = 14.0$, 5.4 Hz, $\beta$CH$_2$), 4.00 (1H, dd, $J = 6.5$, 5.4 Hz, $\alpha$CH), 7.19-7.21 (2H, m, ar), 7.32 (2H, t, $J = 7.7$ Hz, ar), 7.37 (1H, t, $J = 7.2$ Hz, ar), 7.43-7.47 (3H, m, ar), 7.63 (2H, d, $J = 7.2$ Hz, ar); $^{13}$C NMR (125 MHz, CDCl$_3$): $\delta$ 28.0 (3x CH$_3$/CO$_2$Bu), 29.8 (C(CH$_3$)$_3$), 30.5 (C(CH$_3$)$_3$), 47.1 ($\beta$CH$_2$), 64.5 ($\alpha$CH), 80.7 (C/CO$_2$Bu), 127.8, 127.9, 128.3 (6 x CH/ar), 128.5 (1 x CH/ar), 128.7 (2 x CH/ar), 130.0 (1 x CH/ar), 136.8, 139.7 (2 x C/ar), 168.9 *(C=N), 172.2 *(C=O/CO$_2$Bu); IR $\nu_{\text{max}}$ (neat): 2974, 2941, 2905, 2868, 1711, 1627, 1444, 1366, 1273, 1251, 1156, 849, 780, 768, 704, 693, 653 cm$^{-1}$; MS (ESI) m/z: 388.2256 [M + Na]$^+$, 366.2434 [M + H]$^+$, 310.1808 [M - C(CH$_3$)$_3$]$^+$ ([M + H]$^+$, C$_{14}$H$_{23}$NO$_2$ requires 366.2434).

**tert-Butyl 4-(2-tert-butoxy-1-(diphenylmethyleneamino)-2-oxoethyl)piperidine-1-carboxylate 3r:**

![Diagram](image)

This compound was prepared following general procedure A using N-Boc-4-hydroxypiperidine (117 mg). Purification by preparative chromatography yielded the desired product as a brown oil. Yield: (58 mg, 42%); $^1$H NMR (500 MHz, CDCl$_3$): $\delta$ 1.14 (1H, br s, $^1$-CH$_3$), 1.39 (1H, br s, $^1$'-CH$_3$), 1.46 (18H, s, CH$_3$/Boc + CH$_3$/CO$_2$Bu), 1.66-1.74 (2H, m, 1,1'-CH$_3$), 2.19 (1H, br s, $\beta$CH), 2.69 (2H, br s, 2,2'-CH$_3$), 3.72 (1H, d, $J = 7.5$ Hz, $\alpha$CH), 4.10 (2H, br s, 2,2'-CH$_3$), 7.13-7.16 (2H, m, ar), 7.31 (2H, t, $J = 7.6$ Hz, ar), 7.38 (1H, t, $J = 7.2$ Hz, ar), 7.41-7.46 (3H, m, ar), 7.64 (2H, d, $J = 7.5$ Hz, ar); $^{13}$C NMR (125 MHz, CDCl$_3$): $\delta$ 28.3 $^1$(1-CH$_2$), 28.5 (3 x CH$_3$/Boc), 28.9 (3 x CH$_3$/CO$_2$Bu), 29.3 $^1$(1'-CH$_2$), 40.4
(βCH), 44.2 (2,2'-CH2), 71.3 (αCH), 79.7 (C/Boc), 81.5 (C/CO2tBu), 128.3, 128.4, 128.8 (6 x CH/ar), 128.9 (1 x CH/ar), 129.2 (2 x CH/ar), 130.7 (1 x CH/ar), 137.0, 139.9 (2 x C/ar), 155.2 (C=O/Boc), 170.8 *(C=N), 170.9 *(C=O/CO2tBu); IR υmax (neat): 2976, 1730, 1689, 1624, 1420, 1366, 1147, 845, 769, 697 cm⁻¹; MS (ESI) m/z: 501.2728 [M + Na]+, 479.2914 [M + H]+, 423.2293 [M - C(CH3)3]+ ([M + H]+, C29H39N2O4 requires 479.2904).

(S)-Phenylalanine-Ni-(S)-BPB 6a:

This compound was prepared following general procedure B using benzyl alcohol (60 µL). Diastereoisomeric ratio: 90/10 (99/1). Purification by flash chromatography (acetone/CH2Cl2, 1/9) yielded the desired product as a red oil. Yield: (128 mg, 75%). [α]D20 +2196.9 (c 0.1, CHCl3).

¹H NMR data are in agreement with that reported in the literature for (S,S)-diastereoisomer.[8]

(S)-2-Methoxyphenylalanine-Ni-(S)-BPB 6b:

This compound was prepared following general procedure B using 2-methoxybenzyl alcohol (77 µL). Diastereoisomeric ratio: 87/13 (99/1). Purification by flash chromatography (acetone/CH2Cl2, 1/9) yielded the desired product as a red oil. Yield: (129 mg, 72%); Rf 0.28 (acetone/CH2Cl2, 1/9); [α]D20 +1771.0 (c 0.1, CHCl3); ¹H NMR (400 MHz, CDCl3): δ 1.56-1.64 (1H, m, Pro γCH2), 1.93-1.99 (1H, m, Pro δCH2), 2.18-2.32 (3H, m, Pro βCH2 + Pro γCH2), 2.86 (1H, dd, J = 13.5, 4.3 Hz, βCH2), 3.01-3.06 (1H, m, Pro δCH2),
3.26-3.34 (5H, m, Pro αCH + OCH₃ + βCH₂), 3.47 (1H, d, J = 12.7 Hz, NCH₂Ph), 4.21 (1H, dd, J = 5.0, 4.6 Hz, αCH), 4.25 (1H, d, J = 12.7 Hz, NCH₂Ph), 6.63-6.68 (2H, m, ar), 6.96 (1H, d, J = 8.3 Hz, ar), 6.99-7.05 (2H, m, ar), 7.10-7.16 (2H, m, ar), 7.23-7.30 (4H, m, ar), 7.37-7.45 (2H, m, ar), 7.48-7.55 (2H, m, ar), 8.00 (2H, d, J = 7.0 Hz, ar), 8.28 (1H, d, J = 8.5 Hz, ar); ¹³C NMR (100 MHz, CDCl₃): δ 23.1 (Pro γCH₂), 30.8 (Pro βCH₂), 34.6 (βCH₂), 54.6 (OCH₃), 57.1 (Pro δCH₂), 63.4 (NCH₂Ph), 70.3 (Pro αCH), 71.7 (αCH), 110.3 (3-CH), 120.4, 121.1, 123.1 (3 x CH/ar), 124.5, 126.2 (2 x C/ar), 127.2, 128.3 (2 x CH/ar), 128.7 (3 x CH/ar), 128.8 (2 x CH/ar), 128.9, 129.5 (2 x CH/ar), 131.5 (2 x CH/ar), 132.1, 132.7 (2 x CH/ar), 133.3 (1 x C/ar), 133.4 (1 x CH/ar), 134.4, 142.6 (2 x C/ar), 158.5 (2-C), 171.3 (C=N), 178.8 *(CO₂), 180.3 *(CON); IR νmax (neat): 2939, 1662, 1630, 1589, 1438, 1334, 1250, 11643, 910, 751, 725, 702 cm⁻¹; MS (ESI) m/z: 640.1694 [M + Na]⁺, 618.1889 [M + H]⁺ ([M + H]⁺, C₃₅H₃₄N₃NiO₄ requires 618.1897).

(S)-4-Methoxyphenylalanine-Ni-(S)-BPB 6c:

This compound was prepared following general procedure B using 4-methoxybenzyl alcohol (80 mg). Diastereoisomeric ratio: 90/10 (99/1). Purification by flash chromatography (acetone/CH₂Cl₂, 1/9) yielded the desired product as a red oil. Yield: (106 mg, 59%). [α]D²⁰⁺1830.0 (c 0.1, CHCl₃).

¹H NMR data are in agreement with that reported in the literature for (S,S)-diastereoisomer.⁹
(S)-3-(Thien-2-yl)alanine-Ni-(S)-BPB 6d:

This compound was prepared following general procedure B using 2-ethanolthiophene (55 mg). Diastereoisomeric ratio: 96/4 (99/1). Purification by flash chromatography (acetone/CH₂Cl₂, 1/9) yielded the desired product as a red oil. Yield: (117 mg, 68%); Rₚ 0.28 (acetone/CH₂Cl₂, 1/9); [α]D²⁰ +1598.0 (c 0.1, CHCl₃); ¹H NMR (500 MHz, CDCl₃): δ 1.69-1.75 (1H, m, Pro γCH₂), 1.91-1.96 (1H, m, Pro δCH₂), 2.29-2.50 (3H, m, Pro γCH₂ + Pro βCH₂), 2.89 (1H, dd, J = 14.9, 5.9 Hz, βCH₂), 3.16-3.19 (1H, m, Pro δCH₂), 3.29-3.34 (2H, m, βCH₂ + Pro αCH), 3.53 (1H, d, J = 12.7 Hz, NCH₂Ph), 4.26 (1H, dd, J = 5.6, 3.7 Hz, αCH), 4.33 (1H, d, J = 12.7 Hz, NCH₂Ph), 6.68 (2H, d, J = 4.1 Hz, ar), 6.96 (1H, d, J = 7.5 Hz, ar), 7.01 (1H, d, J = 2.9 Hz, ar), 7.12-7.19 (3H, m, ar), 7.29-7.33 (3H, m, ar), 7.37 (1H, d, J = 5.0 Hz, ar), 7.45 (1H, t, J = 7.2 Hz, ar), 7.51-7.56 (2H, m, ar), 7.98 (2H, d, J = 7.4 Hz, ar), 8.26 (1H, d, J = 8.7 Hz, ar); ¹³C NMR (125 MHz, CDCl₃): δ 22.9 (Pro γCH₂), 30.6 (Pro βCH₂), 33.3 (βCH₂), 56.9 (Pro δCH₂), 63.2 (NCH₂Ph), 70.3 (Pro αCH), 70.9 (αCH), 120.6, 123.5, 125.5 (3 x CH/ar), 126.2 (1 x C/ar), 126.9, 127.5, 127.9, 128.1 (4 x CH/ar), 128.8 (2 x CH/ar), 128.8, 129.0, 129.1, 129.9 (4 x CH/ar), 131.5 (2 x CH/ar), 132.4 (1 x CH/ar), 133.1 (1 x C/ar), 133.5 (1 x CH/ar), 134.3, 137.0, 142.9 (3 x C/ar), 171.7 (C=N), 178.7 *(CO₂), 180.2 *(CON); IR νmax (neat): 3061, 2939, 2231, 1666, 1631, 1585, 1542, 1438, 1336, 1254, 1164, 909, 751, 725, 700 cm⁻¹; MS (ESI) m/z: 616.1159 [M + Na]⁺, 594.1346 [M + H]⁺ ([M + Na]⁺, C₃₂H₂₉Ni₃NaNiO₃S requires 616.1175).
(S)-β-(2-Pyridyl)-α-alanine-Ni-(S)-BPB 6e:

This compound was prepared following general procedure B using 2-pyridylcarbinol (56 µL). Diastereoisomeric ratio: 87/13 (99/1). Purification by flash chromatography (acetone/CH₂Cl₂, 3/7) yielded the desired product as a red oil. Yield: (142 mg, 83%); Rf 0.17 (acetone/CH₂Cl₂, 3/7); [α]D²⁰ +1914.6 (c 0.1, CHCl₃); ¹H NMR (400 MHz, CDCl₃): δ 1.78-1.86 (1H, m, Pro γCH₂), 1.97 (1H, ddd, J = 17.2, 10.6, 6.7 Hz, Pro δCH₂), 2.31-2.46 (2H, m, Pro βCH₂), 2.63-2.76 (1H, m, Pro γCH₂), 3.13 (1H, dd, J = 13.6, 6.7 Hz, βCH₂), 3.22-3.26 (2H, m, βCH₂ + Pro βCH₂), 3.33 (1H, dd, J = 10.0, 7.0 Hz, Pro αCH), 3.54 (1H, d, J = 12.6 Hz, NCH₂Ph), 4.31-4.36 (2H, m, NCH₂Ph + αCH), 6.65 (2H, d, J = 4.3 Hz, ar), 7.05 (1H, d, J = 7.7 Hz, ar), 7.11-7.19 (3H, m, ar), 7.23-7.33 (4H, m, ar), 7.41 (1H, t, J = 7.7 Hz, ar), 7.48-7.56 (2H, m, ar), 7.65 (1H, td, J = 7.9, 1.9 Hz, ar), 7.99 (2H, d, J = 7.2 Hz, ar); ¹³C NMR (100 MHz, CDCl₃): δ 23.3 (Pro γCH₂), 30.6 (Pro βCH₂), 42.0 (βCH₂), 56.9 (Pro δCH₂), 63.1 (NCH₂Ph), 70.3 #(Pro αCH), 70.5 #(αCH), 120.6, 122.1, 123.4, 124.4 (4 x CH/ar), 126.4 (1 x C/ar), 127.0, 128.2 (2 x CH/ar), 128.8 (2 x CH/ar), 128.8 (3 x CH/ar), 129.6 (1 x CH/ar), 131.5 (2 x CH/ar), 132.2 (1 x CH/ar), 133.1 (1 x C/ar), 133.5 (1 x CH/ar), 134.3 (1 x C/ar), 136.5 (1 x CH/ar), 142.6 (1 x C/ar), 149.7 (6-C), 156.5 (2-C), 171.4 (C=N), 178.8 *(CO₂), 180.1 *(CON); IR νmax (neat): 2953, 2234, 1667, 1631, 1587, 1438, 1335, 1256, 1165, 910, 751, 725, 702 cm⁻¹; MS (ESI) m/z: 611.1548 [M + Na]⁺, 589.1733 [M + H]⁺ ([M + H]⁺, C₃₃H₃₁N₄NiO₃ requires 589.1744).
This compound was prepared following general procedure B using allyl alcohol (39 µL). Diastereoisomeric ratio: 90/10. Purification by flash chromatography (acetone/CH$_2$Cl$_2$, 1/9) yielded the desired product as a red oil. Yield: (123 mg, 78%). [α]$_D^{20}$ +1843.0 (c 0.1, CHCl$_3$).

$^1$H NMR and $^{13}$C NMR data are in agreement with that reported in the literature for the (S,S)-diastereoisomer.$^{[10]}$

This compound was prepared following general procedure B using 5-hexen-1-ol (70 µL). Diastereoisomeric ratio: 89/11 (99/1). Purification by flash chromatography (acetone/CH$_2$Cl$_2$, 1/9) yielded the desired product as a red oil. Yield: (78 mg, 46%); R$_f$ 0.30 (acetone/CH$_2$Cl$_2$, 1/9); [α]$_D^{20}$ +2285.0 (c 0.1, CHCl$_3$); $^1$H NMR (400 MHz, CDCl$_3$): δ 1.20-1.32 (2H, m, 2-CH$_2$), 1.60-1.68 (2H, m, βCH$_2$ + 1-CH$_2$), 1.77-1.89 (1H, m, 1-CH$_2$), 1.90-1.97 (1H, m, βCH$_2$), 2.00-2.08 (3H, m, 3-CH$_2$ + Pro δCH$_2$), 2.12-2.19 (1H, m, Pro γCH$_2$), 2.48-2.58 (1H, m, Pro βCH$_2$), 2.73-2.82 (1H, m, Pro βCH$_2$), 3.44-3.55 (3H, m, Pro γCH$_2$ + Pro δCH$_2$ + Pro αCH), 3.59 (1H, d, J = 12.7 Hz, NCH$_2$Ph), 3.92 (1H, dd, J = 8.0, 3.4 Hz, αCH), 4.44 (1H, d, J = 12.7 Hz, NCH$_2$Ph), 4.92-5.00 (2H, m, H$_b$ + H$_c$), 5.71-5.81 (1H, m, H$_b$), 6.61-6.68 (2H, m, ar), 6.92 (1H, d, J = 6.9 Hz, ar), 7.14 (1H, ddd, J = 8.8, 6.6, 2.2 Hz, ar), 7.19 (1H, t, J = 7.5 Hz, ar), 7.25-7.27 (1H, m, ar), 7.35 (2H, t, J = 7.6 Hz ar), 7.43-7.54 (3H, m, ar), 8.04 (2H, d, J = 7.0 Hz, ar), 8.14 (1H, d, J = 9.2 Hz, ar); $^{13}$C NMR (100 MHz, CDCl$_3$): δ 23.7
(Pro-γCH₂, 24.8 (1-CH₂), 28.6 (2-CH₂), 30.8 (Pro-βCH₂), 33.5 (3-CH₂), 35.2 (βCH₂), 56.9 (Pro-δCH₂), 63.1 (NCH₂Ph), 70.3 *(αCH), 70.3 *(Pro-αCH), 114.7 (CH₃H₂), 120.7, 123.7 (2 CH/ar), 126.6 (1 CH/ar), 127.2, 127.6 (2 CH/ar), 128.9 (5 CH/ar), 129.7 (1 CH/ar), 131.6 (2 CH/ar), 132.1 (1 CH/ar), 133.2 (1 CH/ar), 133.9 (1 CH/ar), 138.5 (CH₃), 142.3 (1 CH/ar), 170.4 (C=N), 179.5 *(CO₂), 180.4 *(CON); IR υmax (neat): 2923, 2857, 1670, 1634, 1165, 1065, 912, 752, 702 cm⁻¹; MS (ESI) m/z: 602.1915 [M + Na]⁺, 580.2100 [M + H]⁺ ([M + H]⁺, C₃₃H₅₆N₂NiO₃ requires 580.2105).

(S)-Heptylglycine-Ni-(S)-BPB 6h:

[Diagram of the compound]

This compound was prepared following general procedure B using heptan-1-ol (82 µL). Diastereoisomeric ratio: 86/14 (99/1). Purification by flash chromatography (acetone/CH₂Cl₂, 1/9) yielded the desired product as a red oil. Yield: (104 mg, 60%); Rf 0.37 (acetone/CH₂Cl₂, 1/9); [α]D²⁰ +2280.0 (c 0.1, CHCl₃); ¹H NMR (400 MHz, CDCl₃): δ 0.87 (3H, m, 6-CH₃), 1.22-1.30 (8H, m, 2-CH₂ + 3-CH₂ + 4-CH₂ + 5-CH₂), 1.58-1.67 (3H, m, βCH₂ + 1-CH₂), 1.89-1.98 (1H, m, βCH₂), 2.03-2.18 (2H, m, Pro-γCH₂ + Pro-δCH₂), 2.48-2.58 (1H, m, Pro-βCH₂), 2.74-2.81 (1H, m, Pro-βCH₂), 3.47 (1H, dd, J = 10.9, 5.9 Hz, Pro-αCH), 3.50-3.58 (2H, m, Pro-γCH₂ + Pro-δCH₂), 3.59 (1H, d, J = 12.7 Hz, NCH₂Ph), 3.92 (1H, dd, J = 8.0, 3.2 Hz, αCH), 4.44 (1H, d, J = 12.7 Hz, NCH₂Ph), 6.61-6.68 (2H, m, ar), 6.92 (1H, d, J = 7.3 Hz, ar), 7.13 (1H, ddd, J = 8.6, 6.6, 2.1 Hz, ar), 7.19 (1H, t, J = 7.5 Hz, ar), 7.25-7.27 (1H, m, ar), 7.35 (2H, t, J = 7.6 Hz, ar), 7.42-7.53 (3H, m, ar), 8.05 (2H, d, J = 7.4 Hz, ar), 8.14 (1H, d, J = 8.6 Hz, ar); ¹³C NMR (100 MHz, CDCl₃): δ 14.1 (6-CH₃), 22.6 (5-CH₃), 23.6 (Pro-γCH₂), 25.4 (1-CH₂), 29.1 *(2-CH₂), 29.3 *(3-CH₂), 30.8 (Pro-βCH₂), 31.7 (4-CH₂), 35.4 (βCH₂), 57.0 (Pro-δCH₂), 63.1 (NCH₂Ph), 70.3 *(αCH), 70.5 *(Pro-αCH), 120.7, 123.7 (2 CH/ar), 126.6 (1 CH/ar), 127.2, 127.6 (2 CH/ar), 128.9 (3 CH/ar), 128.9 (2 CH/ar), 129.7 (1 CH/ar), 131.6 (2 CH/ar), 132.1 (1 CH/ar), 133.2 (1 CH/ar + 1 CH/ar), 133.9, 142.2 (2 CH/ar), 170.3 (C=N), 179.5 *(CO₂), 180.4 *(CON); IR υmax (neat): 2924, 2855,

L-Phenylalanine 7a:

This compound was prepared following general procedure C using (S)-phenylalanine-Ni-(S)-BPB (1.69 mmol, 990 mg) to yield the desired product as a white solid. Yield: (220 mg, 79%); ee: 95% (according to analytical chiral HPLC: Rₜ (major) 11.8 min, Rₜ (minor) 13.5 min, 80% B); [α]D²⁰ -23.0 (c 0.1, H₂O) (lit.,[11] -34.7 (c 2, H₂O)).

¹H NMR data are in agreement with that reported in the literature.[12]

2-Methoxy-L-phenylalanine 7b:

This compound was prepared following general procedure C using (S)-2-methoxy phenylalanine-Ni-(S)-BPB (0.21 mmol, 132 mg) to yield the desired product as a white solid. Yield: (28 mg, 67%). ee: >99% (according to analytical chiral HPLC: Rₜ (major) 13.0 min, Rₜ (minor) 14.5 min, 80% B); [α]D²⁰ -38.0 (c 0.1, H₂O) (lit.,[13] -52.85 (c 1, H₂O)).

4-Methoxy-L-phenylalanine 7c:

This compound was prepared following general procedure C using (S)-4-methoxy phenylalanine-Ni-(S)-BPB (0.15 mmol, 91 mg) to yield the desired product as a white solid. Yield: (25 mg, 87%); ee: 96% (according to analytical chiral HPLC: Rₜ (major) 12.0 min, Rₜ (minor) 13.5 min, 80% B); [α]D²⁰ -18.0 (c 0.1, H₂O) (lit.,[14] -9 (c 0.71, 1 M HCl)).

¹H NMR and ¹³C NMR data are in agreement with that reported in the literature.[15]
3-Thiophen-2-yl-L-alanine 7d:

This compound was prepared following general procedure C using (S)-3-(thien-2-yl)alanine-Ni-(S)-BPB (0.16 mmol, 97 mg) to yield the desired product as a white solid. Yield: (22 mg, 79%); ee: 92% (according to analytical chiral HPLC: R_t (major) 11.9 min, R_t (minor) 13.3 min, 80% B); [α]_D^{20} -18.0 (c 0.1, H_2O) (lit.,[16] -30 (c 0.5, H_2O)).

^1^H NMR data are in agreement with that reported in the literature.[16]

3-Pyridin-2-yl-L-alanine 7e:

This compound was prepared following general procedure C using (S)-β-(2-pyridyl)-α-alanine-Ni-(S)-BPB (0.13 mmol, 77 mg) to yield the desired product as a white solid. Yield: (22 mg, >99%); ee: 96% (according to analytical chiral HPLC: R_t (major) 18.2 min, R_t (minor) 21.4 min, 70% B); [α]_D^{20} +46.0 (c 0.1, 1 M HCl) (lit.,[17] +49.7 (c 0.9, 1 M HCl)); ^1^H NMR (400 MHz, D_2O): δ 3.30 (1H, dd, J = 15.1, 7.9 Hz, βCH_2), 3.44 (1H, dd, J = 15.1, 5.1 Hz, βCH_2), 4.16 (1H, dd, J = 7.9, 5.1 Hz, αCH), 7.39-7.42 (2H, m, ar), 7.87 (1H, td, J = 7.8, 1.8 Hz, 4-CH), 8.52 (1H, d, J = 4.8 Hz, 6-CH); ^13^C NMR (100 MHz, D_2O): δ 37.2 (βCH_2), 54.6 (αCH), 123.1, 124.6 (3.5-CH), 138.5 (4-CH), 148.7 (6-CH), 155.4 (2-C), 173.5 (CO_2H); IR ν_max (neat): 3005, 2921, 1578, 1512, 1400, 1313, 1134, 1076, 851, 691 cm⁻¹; MS (ESI) m/z: 189.0639 [M + Na]^+, 167.0819 [M + H]^+ ([M + H]^+, C_8H_11N_2O_2 requires 167.0815).
(S)-Allylglycine 7f:

This compound was prepared following general procedure C using (S)-allylglycine-Ni-(S)-BPB (0.13 mmol, 71 mg) to yield the desired product as a white solid. Yield: (15 mg, >99%); ee: 81% (according to analytical chiral HPLC: R_t (major) 13.8 min, R_t (minor) 16.5 min, 80% B); [α]_D^{20} -23.0 (c 0.1, H_2O) (lit.,[18] -36.5 (c 4, H_2O)).

^1^H NMR and ^13^C NMR data are in agreement with that reported in the literature.[19]

(S)-2-Amino-7-octenoic acid 7g:

This compound was prepared following general procedure C using (S)-hex-5-enyl-glycine-Ni-(S)-BPB (0.13 mmol, 77 mg) to yield the desired product as a white solid. Yield: (21 mg, >99%); ee: 95% (according to analytical chiral HPLC: R_t (major) 7.3 min, R_t (minor) 8.3 min, 70% B); [α]_D^{20} +26.0 (c 0.1, H_2O); ^1^H NMR (400 MHz, D_2O): δ 1.34-1.52 (4H, m, 1, 2-CH_2), 1.86-1.93 (2H, m, βCH_2), 2.09-2.15 (2H, m, 3-CH_2), 3.76 (1H, dd, J = 6.3, 6.3 Hz, αCH), 5.03 (1H, dd, J = 10.3, 0.9 Hz, H_b), 5.10 (1H, dd, J = 17.0, 1.8 Hz, H_c), 5.93 (1H, ddt, J = 17.0, 10.3, 6.7 Hz, H_a); ^13^C NMR (100 MHz, D_2O): δ 23.7 (1-CH_2), 27.6 (2-CH_2), 30.2 (βCH_2), 32.6 (3-CH_2), 54.8 (αCH), 114.4 (CH_3H_2), 139.6 (CH_3), 179.5 (CO_2H); IR δ max (neat): 2922, 1577, 1513, 1406, 1320, 1096, 910, 661 cm^{-1}; MS (ESI) m/z: 180.0999 [M + Na]^+, 158.1178 [M + H]^+ ([M + H]^+, C_8H_16NO_2 requires 158.1176).
(S)-2-Amino-nonanoic acid hydrochloride 7h:

(S)-heptylglycine-Ni-(S)-BPB (0.16 mmol, 93 mg) 6h was dissolved in MeOH (c = 0.05 mol/L) and 2 M HCl (c = 0.1 mol/L) was added, the bright red solution was heated at reflux (80°C) for 1h. The resulting yellow to green solution was allowed to cool down to room temperature. The solvent was concentrated in vacuo, water was added, the beige precipitate was centrifuged and the aqueous layer was purified by reversed-phase C18 chromatography (0-70% MeOH in water) and lyophilized to yield the desired product as a white solid. Yield: (21 mg, 64%); ee: 97% (according to analytical chiral HPLC: R\textsubscript{t} (major) 6.2 min, R\textsubscript{t} (minor) 7.5 min, 70% B); [α\textsubscript{D}]	extsuperscript{20} +25.0 (c 0.1, AcOH) (lit.,\textsuperscript{20} -25 (c 0.5, AcOH) for (R)-2-amino-nonanoic acid hydrochloride).

\(^1\)H NMR data are in agreement with that reported in the literature.\textsuperscript{20}
References

$^{1}$H NMR spectra (400 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-phenylpropanoate (3a)
$^{13}$C NMR spectra (100 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-phenylpropanoate (3a)
$^1$H NMR spectra (400 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-(2-(chloro)phenyl)propanoate (3b)
$^{13}$C NMR spectra (100 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-(2-(chloro)phenyl)propanoate (3b)
$^1$H NMR spectra (500 MHz, CDCl$_3$) of tert-Butyl 3-(2,6-dichlorophenyl)-2-(diphenylmethyleneamino)propanoate (3c)
$^{13}$C NMR spectra (125 MHz, CDCl$_3$) of tert-Butyl 3-(2,6-dichlorophenyl)-2-(diphenylmethyleneamino)propanoate (3c)
$^1$H NMR spectra (500 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-(2-methoxyphenyl)propanoate (3d)
$^{13}$C NMR spectra (125 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-(2-methoxyphenyl)propanoate (3d)
$^1$H NMR spectra (400 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-(3-methoxyphenyl)propanoate (3e)
$^{13}$C NMR spectra (100 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-(3-methoxyphenyl)propanoate (3e)
$^1$H NMR spectra (400 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-(4-methoxyphenyl)propanoate (3f)
$^{13}$C NMR spectra (100 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-(4-methoxyphenyl)propanoate (3f)
$^1$H NMR spectra (500 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-(4-(trifluoromethyl)phenyl)propanoate (3g)
$^{13}$C NMR spectra (125 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-(4-(trifluoromethyl)phenyl)propanoate (3g)
$^1$H NMR spectra (400 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-(pyridin-2-yl)propanoate (3h)
$^{13}$C NMR spectra (100 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-(pyridin-2-yl)propanoate (3h)
$^1$H NMR spectra (500 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-(pyridin-3-yl)propanoate (3i)
$^{13}$C NMR spectra (100 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-(pyrid-3-yl)propanoate (3i)
$^1$H NMR spectra (500 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-(thiophen-3-yl)propanoate (3j)
$^{13}$C NMR spectra (125 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-(thiophen-3-yl)propanoate (3j)
$^1$H NMR spectra (500 MHz, CDCl₃) of tert-Butyl 2-(diphenylmethyleneamino)-3-(furan-3-yl)propanoate (3k)
\[^{13}\text{C} \text{NMR spectra (125 MHz, CDCl}_3\) of tert-Butyl 2-(diphenylmethyleneamino)-3-(furan-3-yl)propanoate (3k)\]
$^1$H NMR spectra (500 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-(thiophen-2-yl)propanoate (3l)
$^{13}$C NMR spectra (125 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-(thiophen-2-yl)propanoate (3I)
$^1$H NMR spectra (500 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-(furan-2-yl)propanoate (3m)
$^{13}$C NMR spectra (125 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-(furan-2-yl)propanoate (3m)
$^1$H NMR spectra (500 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-(1-methyl-1H-imidazol-2-yl)propanoate (3n)
$^{13}$C NMR spectra (125 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-3-(1-methyl-1H-imidazol-2-yl)propanoate (3n)
$^1$H NMR spectra (500 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)pent-4-enoate (3o)
$^{13}$C NMR spectra (125 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)pent-4-enoate (3o)
$^1$H NMR spectra (500 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-4-methoxybutanoate (3p)
$^{13}$C NMR spectra (125 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-4-methoxybutanoate (3p)
$^1$H NMR spectra (500 MHz, CDCl$_3$) of tert-Butyl 2-(diphenylmethyleneamino)-4,4-dimethylpentanoate (3q)
\[ ^{13}C \text{ NMR spectra (125 MHz, CDCl}_3 \text{) of } \text{tert-Butyl 2-(diphenylmethyleneamino)-4,4-dimethylpentanoate (3q)} \]
$^1$H NMR spectra (500 MHz, CDCl$_3$) of tert-Butyl 4-(2-tert-butoxy-1-(diphenylmethyleneamino)-2-oxoethyl)piperidine-1-carboxylate (3r)
$^{13}$C NMR spectra (125 MHz, CDCl$_3$) of tert-Butyl 4-(2-tert-butoxy-1-(diphenylmethyleneamino)-2-oxoethyl)piperidine-1-carboxylate (3r)
$^1$H NMR spectra (400 MHz, CDCl$_3$) of (S)-Phenylalanine-Ni-(S)-BPB (6a)
$^{13}$C NMR spectra (125 MHz, CDCl$_3$) of (S)-Phenylalanine-Ni-(S)-BPB (6a)
$^1$H NMR spectra (400 MHz, CDCl$_3$) of (S)-2-Methoxyphenylalanine-Ni-(S)-BPB (6b)
$^{13}$C NMR spectra (100 MHz, CDCl$_3$) of (S)-2-Methoxyphenylalanine-Ni-(S)-BPB (6b)
$^1$H NMR spectra (400 MHz, CDCl$_3$) of (S)-4-Methoxyphenylalanine-Ni-(S)-BPB (6c)
$^{13}$C NMR spectra (125 MHz, CDCl$_3$) of (S)-4-Methoxyphenylalanine-Ni-(S)-BPB (6c)
$^1$H NMR spectra (400 MHz, CDCl$_3$) of (S)-3-(Thien-2-yl)alanine-Ni-(S)-BPB (6d)
$^{13}$C NMR spectra (125 MHz, CDCl$_3$) of (S)-3-(Thien-2-yl)alanine-Ni-(S)-BPB (6d)
<p>$^1$H NMR spectra (400 MHz, CDCl$_3$) of (S)-β-(2-Pyridyl)-α-alanine-Ni-(S)-BPB (6e)</p>
$^{13}$C NMR spectra (100 MHz, CDCl$_3$) of (S)-β-(2-Pyridyl)-α-alanine-Ni(S)-BPB (6e)
$^1$H NMR spectra (400 MHz, CDCl$_3$) of (S)-Allylglycine-Ni-(S)-BPB (6f) (dr: 90/10)
$^{13}$C NMR spectra (100 MHz, CDCl$_3$) of (S)-Allylglycine-Ni-(S)-BPB (6f) (dr: 90/10)
$^1$H NMR spectra (400 MHz, CDCl$_3$) of (S)-Hex-5-enyl-glycine-Ni-(S)-BPB (6g)
\(^{13}\)C NMR spectra (100 MHz, CDCl\(_3\)) of (S)-Hex-5-enyl-glycine-Ni-(S)-BPB (6g)
$^1$H NMR spectra (400 MHz, CDCl$_3$) of (S)-Heptylglycine-Ni-(S)-BPB (6h)
$^{13}$C NMR spectra (100 MHz, CDCl$_3$) of (S)-Heptylglycine-Ni-(S)-BPB (6h)
$^1$H NMR spectra (400 MHz, D$_2$O) of L-Phenylalanine (7a)
$^{13}$C NMR spectra (100 MHz, D$_2$O) of l-Phenylalanine (7a)
$^1$H NMR spectra (400 MHz, D$_2$O) of 2-Methoxy-L-phenylalanine (7b)
$^{13}$C NMR spectra (100 MHz, D$_2$O) of 2-Methoxy-L-phenylalanine (7b)
$^1$H NMR spectra (400 MHz, D$_2$O) of 4-Methoxy-L-phenylalanine (7c)
$^{13}$C NMR spectra (100 MHz, D$_2$O) of 4-Methoxy-L-phenylalanine (7c)
$^1$H NMR spectra (400 MHz, D$_2$O) of 3-Thiophen-2-yl-l-alanine (7d)
$^{13}$C NMR spectra (100 MHz, D$_2$O) of 3-Thiophen-2-yl-L-alanine (7d)
$^1$H NMR spectra (400 MHz, D$_2$O) of 3-Pyridin-2-yl-L-alanine (7e)
$^{13}$C NMR spectra (100 MHz, D$_2$O) of 3-Pyridin-2-yl-L-alanine (7e)
\(^1\)H NMR spectra (400 MHz, D\(_2\)O) of (S)-Allylglycine (7f)
$^{13}$C NMR spectra (100 MHz, D$_2$O) of (S)-Allylglycine (7f)
$^1$H NMR spectra (400 MHz, D$_2$O) of (S)-2-Amino-7-octenoic acid (7g)
$^{13}$C NMR spectra (100 MHz, D$_2$O) of (S)-2-Amino-7-octenoic acid (7g)
$^1$H NMR spectra (400 MHz, D$_2$O) of (S)-2-Amino-nonanoic acid hydrochloride (7h)
$^{13}$C NMR spectra (100 MHz, D$_2$O) of (S)-2-Amino-nonanoic acid hydrochloride (7h)

Electronic Supplementary Material (ESI) for Chemical Communications
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Analytical chiral reversed-phase HPLC profiles of L-phenylalanine (7a) and D,L-phenylalanine

7a: $R_t$ (major) 11.8 min, $R_t$ (minor) 13.5 min, $\lambda = 210$ nm, 80% B, ee = 95%

Analytical chiral reversed-phase HPLC profiles of 2-methoxy-L-phenylalanine (7b) and 2-methoxy-D,L-phenylalanine

7b: $R_t$ (major) 13.0 min, $R_t$ (minor) 14.5 min, $\lambda = 210$ nm, 80% B, ee: > 99%
Analytical chiral reversed-phase HPLC profiles of 4-methoxy-L-phenylalanine (7c) and 4-methoxy-D,L-phenylalanine

7c: $R_t$ (major) 12.0 min, $R_t$ (minor) 13.5 min, $\lambda = 210$ nm, 80% B, ee: 96%

Analytical chiral reversed-phase HPLC profiles of 3-thiophen-2-yl-L-alanine (7d) and 3-thiophen-2-yl-D,L-alanine

7d: $R_t$ (major) 11.9 min, $R_t$ (minor) 13.3 min, $\lambda = 210$ nm, 80% B, ee: 92%
Analytical chiral reversed-phase HPLC profiles of 3-pyridin-2-yl-L-alanine (7e) and 3-pyridin-2-yl-D,L-alanine

7e: $R_t$ (major) 18.2 min, $R_t$ (minor) 21.4 min, $\lambda = 210$ nm, 70% B, ee: 96%

Analytical chiral reverse-phase HPLC profiles of L-allylglycine (7f) and D,L-allylglycine

7f: $R_t$ (major) 13.8 min, $R_t$ (minor) 16.5 min, $\lambda = 200$ nm, 80% B, ee: 81%
Analytical chiral reversed-phase HPLC profiles of L,2-amo-7-octenoic acid (7g) and D,L,2-amo-7-octenoic acid

7g: $R_t$ (major) 7.3 min, $R_t$ (minor) 8.3 min, $\lambda = 200$ nm, 70% B, ee: 95%

Analytical chiral reversed-phase HPLC profiles of L,2-amino-7-octanoic acid hydrochloride (7h) and D,L,2-amino-7-octanoic acid hydrochloride

7h: $R_t$ (major) 6.2 min, $R_t$ (minor) 7.5 min, $\lambda = 200$ nm, 70% B, ee: 97%