ELECTRONIC SUPPLEMENTARY INFORMATION

Dynamic assembly of a zinc-templated bifunctional organocatalyst in the presence of water for the asymmetric aldol reaction.

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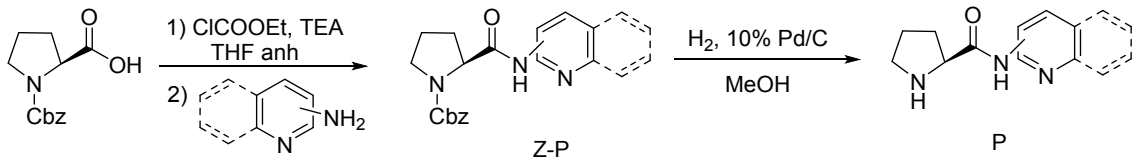
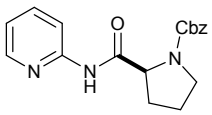
1) Synthesis of P ligands:

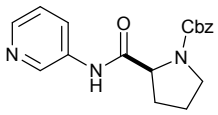


Typical procedure for the synthesis of **Z-P** [(1)]

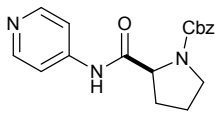
To a solution of the N-carbobenzyloxy-L-proline and TEA (1 g, 4mmol) in dry THF (15 mL) under nitrogen atmosphere at 0°C was added ethylchloroformate (382 µL, 4 mmol) dropwise and the reaction mixture was stirred for 30 min at 0 °C. After that, amine (4 mmol) was added and the resulting reaction was stirred at 0°C for 1 h and at 70°C for 24 hour. After cooled down to room temperature, the mixture was diluted with EtOAc (150 mL), filtered and the solvent was evaporated. The crude was purified by silica gel flash-column chromatography using a gradient of EtOAc in hexane to give **Z-P**.



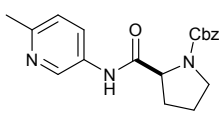
Benzyl (S)-2-(pyridin-2-ylcarbamoyl)pyrrolidine-1-carboxylate(Z-P2):Yield: 83% (yellow oil). **^{1}H NMR** (400 MHz, $CDCl_3$) δ (ppm) 9.52 (bs, 1H), 8.25 (m, 2H), 7.72 (m, 1H), 7.40 (m, 3H), 7.08(m, 3H), 5.15 (s, 2H), 4.45 (m, 1H), 3.57 (m, 2H), 2.21 (m, 2H), 1.95 (m, 2H). **^{13}C NMR** (101 MHz, $CDCl_3$) δ (ppm) 176.1, 152.0, 147.0, 146.0, 138.6, 128.5, 128.2, 128.0, 128.0, 127.7, 127.6, 119.8, 114.8, 67.2, 61.5, 47.1, 31.2, 24.0. **MS (ESI-TOF):** 326.1471 $(M+H)^+$, 348.1308 $(M+Na)^+$, 673.2852 $(2M+Na)^+$; calculated for $C_{18}H_{19}N_3O_3$: 326.1506 $(M+H)^+$, 348.1326 $(M+Na)^+$, 673.2752 $(2M+Na)^+$.



Benzyl (S)-2-(pyridin-3-ylcarbamoyl)pyrrolidine-1-carboxylate (Z-P3): Yield: 70% (colourless oil). **^{1}H NMR** (400 MHz, $CDCl_3$) δ (ppm) 9.50 (bs, 1H), 8.56 (bs, 1H), 8.26 (m, 1H), 8.02 (d, J = 8.2 Hz, 1H), 7.49 – 6.95 (m, 6H), 5.1 (m, 2H), 4.50 (m, 1H), 3.50 (m, 2H), 2.46 (m, 2H), 1.94 (m, 2H). **^{13}C NMR** (101 MHz, $CDCl_3$) δ (ppm) 170.1, 156.9, 144.5, 140.8, 136.1, 135.1, 128.6, 128.3, 127.9, 127.3, 123.6, 67.8, 60.9, 47.2, 27.5, 24.6. **MS (ESI-TOF):** 326.1471 $(M+H)^+$, 651.2960 $(2M+H)^+$; calculated for $C_{18}H_{19}N_3O_3$: 326.1506 $(M+H)^+$, 651.2932 $(2M+H)^+$.

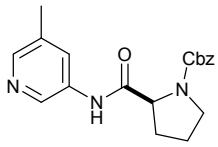


Benzyl (S)-2-(pyridin-4-ylcarbamoyl)pyrrolidine-1-carboxylate (Z-P4): **Yield:** 64% (colourless oil). **^{1}H NMR** (400 MHz, $CDCl_3$) δ (ppm) 9.72 (bs, 1H), 8.39 (d, J = 5.5 Hz, 2H), 7.36 (m, 7H), 5.24 (m, 2H), 4.50 (m, 1H), 3.46 (m, 2H), 2.43 (m, 2H), 2.03 – 1.83 (m, 2H). **^{13}C NMR** (101 MHz, $CDCl_3$) δ (ppm) 170.3, 150.0, 145.4, 136.0, 128.6, 128.3, 127.9, 113.7, 67.9, 61.1, 47.2, 27.2, 24.6. **MS (ESI-TOF):** 326.1465 $(M+H)^+$, 651.2927 $(2M+H)^+$; calculated for $C_{18}H_{19}N_3O_3$: 326.1506 $(M+H)^+$,651.2932 $(2M+H)^+$.

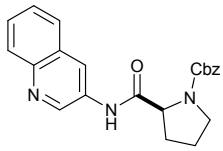


Benzyl (S)-2-((6-methylpyridin-3-yl)carbamoyl)pyrrolidine-1-carboxylate (Z-P5): Yield: 84% (brown oil). **^{1}H NMR** (400 MHz, $CDCl_3$) δ (ppm) 9.30 (bs, 1H), 8.46 (bs, 1H), 7.90 (m, 1H), 7.36 (m, 5H), 7.07 (d, *J* = 8.4 Hz, 1H), 5.20 (m, 2H), 4.51 (m, 1H), 3.68 – 3.36 (m, 2H), 2.50 (s, 3H), 1.94-2.16 (m, 4H).**^{13}C NMR** (101 MHz, $CDCl_3$) δ (ppm) 169.9, 153.4, 140.1, 136.1, 132.6, 128.6, 128.3, 127.9, 127.6, 123.2, 67.7, 60.9,

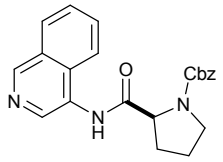
47.2, 27.5, 24.6, 23.4. **MS (ESI-TOF):** 340.1533 $(M+H)^+$, 679.3035 $(2M+H)^+$; calculated for $C_{19}H_{21}N_3O_3$: 340.1663 $(M+H)^+$, 679.3246 $(2M+H)^+$.



Benzyl (S)-2-((5-methylpyridin-3-yl)carbamoyl)pyrrolidine-1-carboxylate (Z-P6): Yield: 81% (brown oil). **^{1}H NMR** (400 MHz, $CDCl_3$) δ (ppm) 9.41 (bs, 1H), 8.37 (bs, 1H), 8.11 (bs, 1H), 7.86 (bs, 1H), 7.33 (m, 5H), 5.19 (m, 2H), 4.50 (m, 1H), 3.50 (m, 2H), 2.45 (m, 1H), 2.28 (s, 3H), 2.97 (m, 3H). **^{13}C NMR** (101 MHz, $CDCl_3$) δ (ppm) 170.1, 156.9, 144.9, 138.0, 136.1, 134.7, 133.6, 128.6, 128.3, 128.0, 127.7, 67.8, 60.9, 47.2, 27.5, 24.6, 18.3. **MS (ESI-TOF):** 340.1533 $(M+H)^+$, 679.3061 $(2M+H)^+$; calculated for $C_{19}H_{21}N_3O_3$: 340.1663 $(M+H)^+$,679.3246 $(2M+H)^+$.



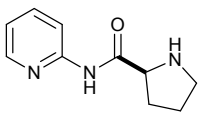
Benzyl (S)-2-(quinolin-3-ylcarbamoyl)pyrrolidine-1-carboxylate (Z-P7): Yield: 82% (yellow solid). **^{1}H NMR** (400 MHz, $CDCl_3$) δ (ppm) 9.77 (bs, 1H), 8.70 (m, 2H), 8.02 (d, *J* = 8.4 Hz, 1H), 7.75 (d, J=7.3 Hz, 1H), 7.59 (m, 1H), 7.50 (m, 1H), 7.36 (m, 4H), 7.17 (m, 1H), 5.23 (m, 2H), 4.59 (m, 1H), 3.53 (m, 2H), 2.55-2.26 (m, 2H), 1.99 (m, 2H). **^{13}C NMR** (101 MHz, $CDCl_3$) δ (ppm) 170.2, 157.1, 143.8, 136.0, 128.8, 128.6, 128.3, 128.1, 128.0, 127.6, 127.2, 123.8, 67.9, 61.0, 47.2, 27.3, 24.7. **MS (ESI-TOF):** 376.1544 $(M+H)^+$, 751.3065 $(2M+H)^+$; calculated for $C_{22}H_{21}N_3O_3$: 376.1663 $(M+H)^+$,751.3246 $(2M+H)^+$.



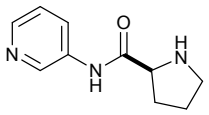
Benzyl (S)-2-(isoquinolin-4-ylcarbamoyl)pyrrolidine-1-carboxylate (Z-P8): Yield: 68% (brown oil). **^{1}H NMR** (400 MHz, $CDCl_3$) δ (ppm) 9.09 (bs, 1H), 8.50 (m, 1H), 8.09 (m, 2H), 7.87 (m, 2H), 7.65 (m, 2H), 7.30 (m, 4H), 5.15 (m, 2H), 4.61 (m, 1H), 3.62 (m, 2H), 2.55-2.26 (m, 2H), 1.99 (m, 2H).**^{13}C NMR** (101 MHz, $CDCl_3$) δ (ppm) 173.7, 149.9, 139.1, 131.0, 129.3, 128.1, 127.74, 127.69, 127.52, 127.47, 127.45, 124.17, 121.5, 121.2, 120.8, 67.1, 60.4, 47.2, 30.1, 23.4. **MS (ESI-TOF)**: 376.1557 $(M+H)^+$, 751.3105 $(2M+H)^+$; calculated for $C_{22}H_{21}N_3O_3$: 376.1663 $(M+H)^+$, 751.3246 $(2M+H)^+$.

Typical procedure for the synthesis of **P** ligands

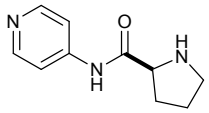
Compounds Z-P (2.58mmol) was dissolved in MeOH (20 mL) under nitrogen. After addition of 10 % Pd/C catalyst, the reaction mixture was stirred at rt for 24 h under hydrogen atmosphere. After this time, catalyst was removed by filtration through celite, and the solvent was evaporated.The crude product was purified by flash chromatography using AcOEt/MeOH mixtures with some drops of aqueous ammonia to give **P**.



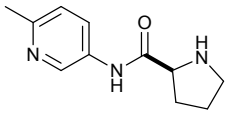
(*S*)-*N*-(pyridin-2-yl)pyrrolidine-2-carboxamide (P2): **Yield:** 54% (yellow oil). **^{1}H NMR** (400 MHz, $CDCl_3$) δ (ppm) 10.22 (bs, 1H), 8.24 (m, 2H), 7.68 (m, 1H), 7.01 (m, 1H), 3.93 (dd, *J* = 9.3, 5.2 Hz, 1H), 3.22 (bs, 1H), 3.06 (m, 2H), 2.22 (m, 1H), 2.03 (m, 1H), 1.77 (m, 2H). **^{13}C NMR** (101 MHz, $CDCl_3$) δ (ppm) 174.4, 151.1, 147.9, 138.2, 119.5, 113.5, 60.9, 47.3, 30.8, 26.2. **MS (ESI-TOF):** 192.1112 $(M+H)^+$, 214.0954 $(M+Na)^+$; calculated for $C_{10}H_{13}N_3O$: 192.1139 $(M+H)^+$, 214.1059 $(M+Na)^+$. **$[\alpha]^{20}_D$** = -56.5 (c = 1.0, CH_3OH).



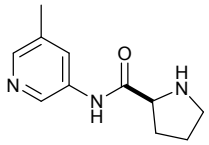
(*S*)-*N*-(pyridin-3-yl)pyrrolidine-2-carboxamide (P3): Yield: 90% (colourless oil). **^{1}H NMR** (400 MHz, $CDCl_3$) δ (ppm) 9.85 (s, 1H), 8.58 (d, *J* = 2.6, 1H), 8.31 (dd, *J* = 4.8, 1.5 Hz, 1H), 8.24 (ddd, *J* = 8.3, 2.6, 1.5 Hz, 1H), 7.26 (m, 1H), 3.86 (dd, *J* = 9.3, 5.2 Hz, 1H), 3.08 (m, 1H), 2.98 (m, 1H), 2.21 (m, 1H), 2.02 (m, 1H), 1.86 (bs, 1H), 1.75 (m, 2H). **^{13}C NMR** (101 MHz, $CDCl_3$) δ (ppm) 174.1, 144.9, 140.8, 134.5, 126.3, 123.6, 60.9, 47.3, 30.7, 26.3. **MS (ESI-TOF):** 192.1108 $(M+H)^+$, 214.0924 $(M+Na)^+$, 405.2014 $(2M+Na)^+$; calculated for $C_{10}H_{13}N_3O$: 192.1139 $(M+H)^+$, 214.1059 $(M+Na)^+$, 405.2118 $(2M+Na)^+$. **$[\alpha]^{20}_D$** = -60.2 (c = 1.0, CH_3OH).



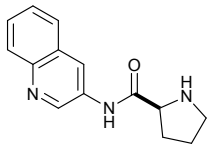
(*S*)-*N*-(pyridin-4-yl)pyrrolidine-2-carboxamide (P4): Yield: quant. (brown oil). **^{1}H NMR** (400 MHz, CD_3OD-d_4) δ (ppm) 8.52 (m, 2H), 7.86 (m, 2H), 4.53 (m, 1H), 3.45 (m, 2H), 2.59 (m, 1H), 2.12 (m, 3H). **^{13}C NMR** (101 MHz, , CD_3OD-d_4) δ (ppm) 176.4, 150.8, 147.9, 115.1, 62.3, 48.0, 32.0, 27.1. **MS (ESI-TOF):** 192.1120 $(M+H)^+$; calculated for $C_{10}H_{13}N_3O$: 192.1139 $(M+H)^+$. **$[\alpha]^{20}_D$** = -43.8 (c = 1.0, CH_3OH).



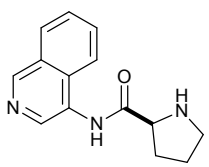
(*S*)-*N*-(6-methylpyridin-3-yl)pyrrolidine-2-carboxamide (P5): Yield: quant. (yellow oil). **^{1}H NMR** (400 MHz, $CDCl_3$) δ(ppm) 9.77 (bs, 1H), 8.46 (d, *J* = 2.6 Hz, 1H), 8.13 (dd, *J* = 8.4, 2.6 Hz, 1H), 7.11 (d, *J* = 8.4 Hz, 1H), 3.86 (dd, *J* = 9.3, 5.2 Hz, 1H), 3.06 (m, 1H), 2.96 (m, 1H), 2.93 (bs, 1H) 2.50 (s, 3H), 2.02 (m, 1H), 1.92 (m, 1H), 1.76 (m, 2H). **^{13}C NMR** (101 MHz, $CDCl_3$) δ (ppm) 173.6, 153.7, 140.2, 132.3, 127.4, 123.3, 61.0, 47.4, 30.8, 26.3, 23.8. **MS (ESI-TOF):** 206.1255 $(M+H)^+$, 228.1084 $(M+Na)^+$, 433.2311 $(2M+Na)^+$; calculated for $C_{11}H_{15}N_3O$: 206.1295 $(M+H)^+$,228.1115 $(M+Na)^+$, 433.233 $(2M+Na)^+$. **$[\alpha]^{20}_D$** = -45.6 (c = 1.0, CH_3OH).



(*S*)-*N*-(5-methylpyridin-3-yl)pyrrolidine-2-carboxamide (P6): Yield: quant. (brown oil). **^{1}H NMR** (400 MHz, $CDCl_3$) δ (ppm) 9.96 (bs, 1H), 8.41 (d, *J* = 2.3 Hz, 1H), 8.13 (bs, 1H), 8.07 (bs, 1H), 3.97 (dd, *J* = 9.2, 5.3 Hz, 1H), 3.28 (bs, 1H), 3.12 (m, 2H), 3.02 (m, 2H), 2.30 (s, 3H), 2.23 (m, 1H), 2.04 (m, 1H), 1.79 (m, 2H). **^{13}C NMR** (101 MHz, $CDCl_3$) δ (ppm) 174.1, 145.5, 138.2, 134.3, 133.6, 127.0, 61.0, 47.4, 30.8, 26.6, 18.7. **MS (ESI-TOF):** 206.1263 $(M+H)^+$, 228.1093 $(M+Na)^+$, 433.2310 $(2M+Na)^+$; calculated for $C_{11}H_{15}N_3O$: 206.1295 $(M+H)^+$,228.1115 $(M+Na)^+$, 433.2330 $(2M+Na)^+$.**$[\alpha]^{20}_D$** = -44.6 (c = 1.0, CH_3OH).



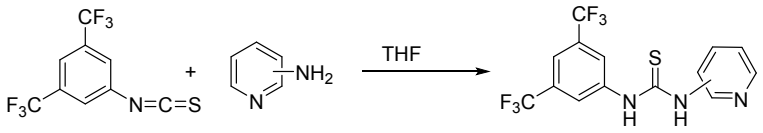
(*S*)-*N*-(quinolin-3-yl)pyrrolidine-2-carboxamide (P7): Yield: 71% (yellowoil). **^{1}H NMR** (400 MHz, $CDCl_3$) δ (ppm) 10.10 (bs, 1H), 8.85 (d, *J* = 2.6, 1H), 8.78 (d, *J* = 2.6 Hz, 1H), 8.03 (d, *J* = 8.4 Hz, 1H), 7.80 (dd, *J* = 8.2, 1.5 Hz, 1H), 7.61 (ddd, *J* = 8.4, 6.9, 1.5 Hz, 1H), 7.52 (ddd, *J* = 8.2, 6.9, 1.3 Hz, 1H), 3.94 (dd, *J* = 9.3, 5.2 Hz, 1H), 3.13 (m, 1H), 3.05 (m, 1H) , 2.25 (m, 2H), 1.87 (bs, 1H), 1.80 (m, 2H). **^{13}C NMR** (101 MHz, $CDCl_3$) δ (ppm) 174.5, 145.2, 144.1, 131.5, 129.1, 128.4, 128.2, 127.9, 127.3, 123.1, 61.2, 47.3, 30.9, 26.5. **MS (ESI-TOF):** 242.1258 $(M+H)^+$; calculated for $C_{14}H_{15}N_3O$: 242.1295 $(M+H)^+$. **$[\alpha]^{20}_D$** = -85.9 (c = 1.0, CH_3OH).



(*S*)-*N*-(isoquinolin-4-yl)pyrrolidine-2-carboxamide (P8) :Yield:42% (brown oil). **^{1}H NMR** (400 MHz, $CDCl_3$) δ (ppm) 10.42 (bs, 1H), 9.24 (s, 1H), 9.05 (d, *J* = 0.8 Hz, 1H), 7.98 (m, 1H), 7.83 (dd, *J* = 8.5, 1.0 Hz, 1H), 7.73 (ddd, *J* = 8.4, 6.8, 1.3 Hz, 1H), 7.61 (ddd, *J* = 8.0, 6.8, 1.1 Hz, 1H), 4.02 (dd, *J* = 9.3, 5.1 Hz,

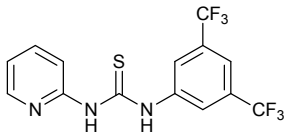
1H), 3.14 (m, 2H), 2.25 (m, 2H), 2.10 (bs, 1H) 1.82 (m, 2H). **^{13}C NMR** (101 MHz $CDCl_3$) δ (ppm) 173.8, 148.9, 136.1, 130.6, 129.1, 128.7, 128.3, 128.0, 127.3, 119.9, 61.5, 47.7, 31.0, 26.7. **MS (ESI-TOF):** 242.1282 $(M+H)^+$, 483.2436 $(2M+H)^+$; calculated for $C_{14}H_{15}N_3O$: 242.1295 $(M+H)^+$,483.2510 $(2M+H)^+$.**$[\alpha]^{20}_D$** = -24.4 (c = 0.5, CH_3OH)

2) Synthesis of T ligands:

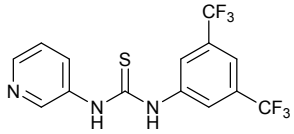


T

To a solution of amine (10.6 mmol) in dry THF (19 mL) under nitrogen atmosphere at 0°C was added 3,5-Bis(trifluoromethyl)phenyl Isothiocyanate (2 mL, 10.6 mmol) and the mixture was stirred overnight at room temperature. The solvent was evaporated and the crude was purified by silica gel flash-column chromatography using a gradient of EtOAc in hexane to give **T**.



1-(3,5-bis(trifluoromethyl)phenyl)-3-(pyridin-2-yl)thiourea (T2): Yield:95% (white solid). **^{1}H NMR** (400 MHz, $CDCl_3$) δ (ppm) 14.21 (bs, 1H), 9.31 (bs, 1H), 8.29 (dd, *J* = 5.1, 1.9, 1H), 8.26 (bs, 2H), 7.78 – 7.70 (m, 2H), 7.08 (ddd, *J* = 7.4, 5.2, 0.9 Hz, 1H), 6.96 (d, *J* = 8.3 Hz, 1H). **^{13}C NMR** (101 MHz $CDCl_3$) δ (ppm) 179.2, 152.8, 145.7, 140.1, 139.5, 132.1 (q, *J* = 33.3 Hz), 124.5 (bq), 124.4, 121.7, 119.3 (m), 118.9, 112.5. **MS (ESI-TOF):**366.0485 $(M+H)^+$; calculated for $C_{14}H_9F_6N_3S$: 366.0501 $(M+H)^+$.



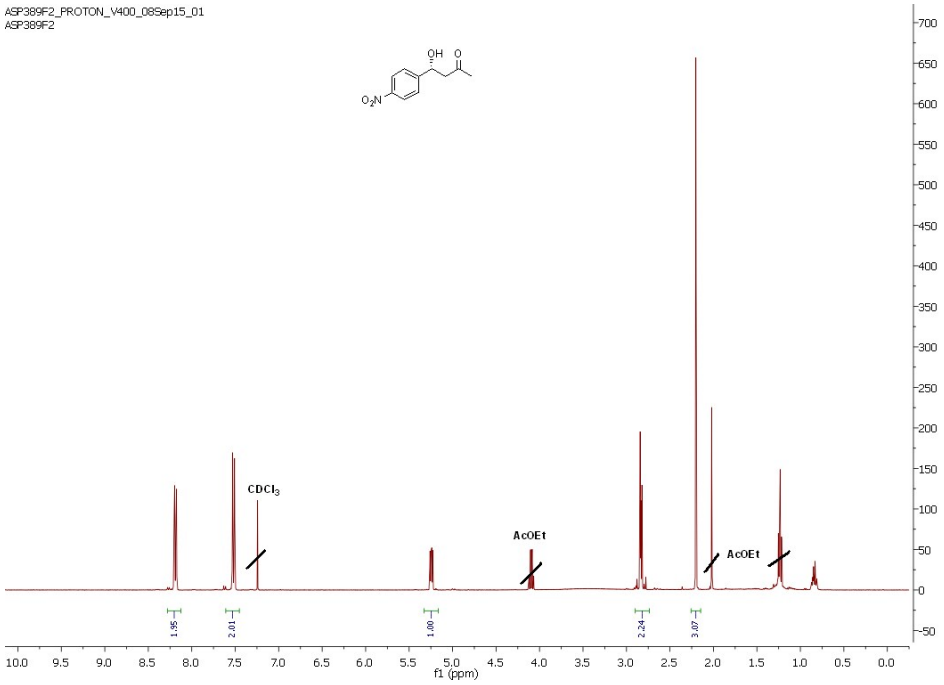
1-(3,5-bis(trifluoromethyl)phenyl)-3-(pyridin-3-yl)thiourea (T3): Yield:90% (white solid). **^{1}H NMR** (400 MHz, CD_3OD-d_4) δ (ppm) 8.66 (dd, *J* = 2.6, 0.7 Hz, 1H), 8.37 (dd, *J* = 4.9, 1.5 Hz, 1H), 8.24 (bs, 2H), 8.09 (ddd, *J* = 8.3, 2.6, 1.5 Hz, 1H), 7.72 (bs, 1H), 7.47 (dd, *J* = 8.3, 4.9, 1H).**^{13}C NMR** (101 MHz, CD_3OD-d_4) δ (ppm) 182.9, 146.6, 146.3, 142.8, 137.8, 134.1, 132.6 (q, *J* = 33.3 Hz), 126.0, 125.0, 124.8, 123.3 (bq), 118.6 (m). **MS (ESI-TOF):** 366.0468 $(M+H)^+$; calculated for $C_{14}H_9F_6N_3S$: 366.0501 $(M+H)^+$.

3) Typical procedure for the asymmetric aldol reaction.

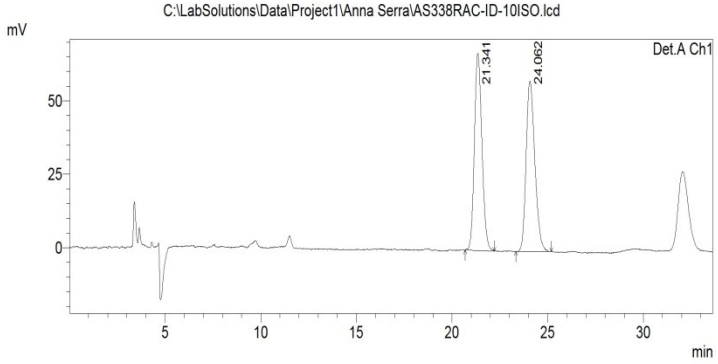
A mixture of $ZnCl_2$ (10 mg, 0.074 mmol, 20 mol %), P (0.074 mmol, 20 mol %) and T (0.074 mmol, 20 mol %) was stirred in dry THF (528 µL) and H_2O (20 µL, 1.1 mmol) at room temperature for 1 h and at -20°C for 30 min. Then, the aldehyde (0.37 mmol) and cyclohexanone (3.7 mmol) were added. The resulting mixture was stirred at -20°C for 24-48 h. The product was extracted with ethyl acetate and the organic phase was washed with water, dried over anhydrous $MgSO_4$ and filtered, and the solvent was removed in *vacuo*. The crude product was purified by flash chromatography eluting with hexane:ethyl acetate mixtures of increasing polarity.

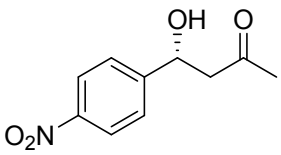
4) ^{1}H NMR and HPLC data of aldol products.[2]

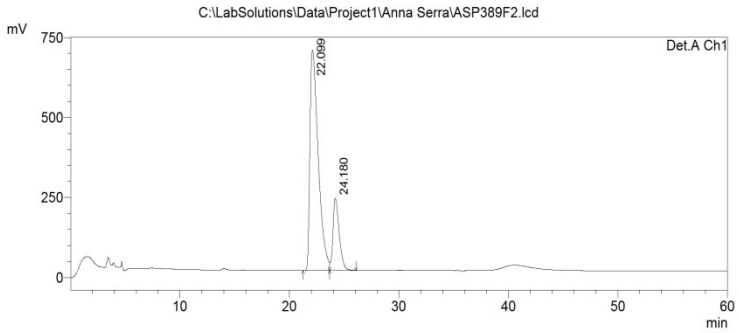
All the aldol products except 4-hydroxy-4-(4-nitrophenyl)butan-2-one (shown below) are described and characterized in ref. 2.



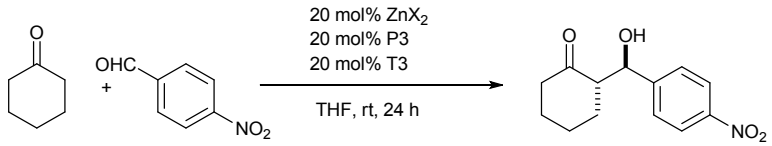
HPLC: ID column, 1 ml/min, 10% *iso*-propanol, 209 nm.







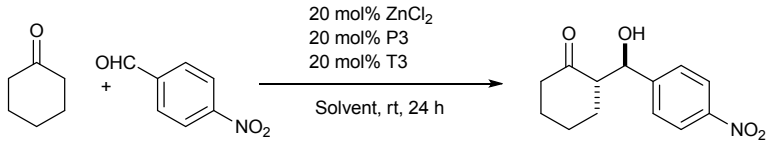
5) Effect of the zinc salt in the asymmetric aldol reaction:



ZnX_2	***Solvent***	***Conversion/%***	***dr anti/syn***	***ee/%***
$Zn(OAc)_2 \cdot 2H_2O$	THF anhyd. + 3 equiv. water	89	71/29	67
	THF anhyd.	91	75/25	47
$ZnCl_2$	THF anhyd. + 3 equiv. water	99	87/13	79
	THF anhyd.	97	84/16	14
$ZnBr_2$	THF anhyd. + 3 equiv. water	100	85/15	59
ZnI_2	THF anhyd. + 3 equiv. water	89	83/17	62
$Zn(OTf)_2$	THF anhyd. + 3 equiv. water	45	68/32	73
$Zn(ClO_4)_2 \cdot 6H_2O$	THF anhyd. + 3 equiv. water	60	72/28	79
	THF anhyd.	60	48/52	42

Best results in terms of ee were obtained with $ZnCl_2$ and $Zn(ClO_4)_2$. However conversion and diastereoselectivity were clearly superior with $ZnCl_2$.

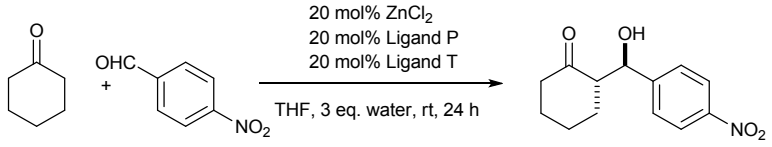
6) Effect of the solvent in the asymmetric aldol reaction:

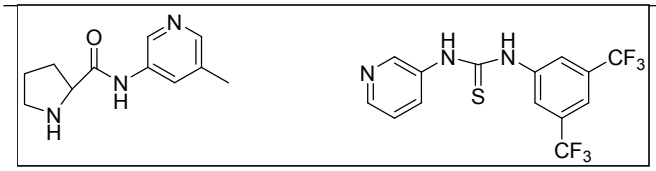
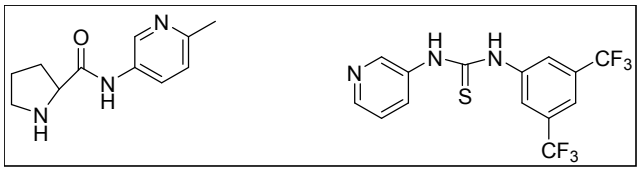
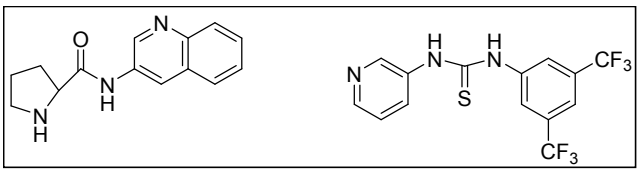
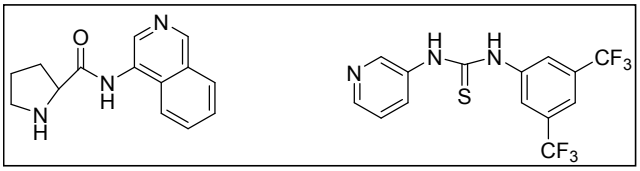


Solvent	***Conversion/%***	***dr anti/syn***	***ee/%***
THF anhyd. + 3 equiv. water	**99**	**87/13**	**79**
THF anhyd.	97	84/16	14
DCM + 3 eq. water	65	81/19	70
DCM anhyd.	72	85/15	34
Toluene + 3 eq. water	98	80/20	61
2-methyltetrahydrofuran + 3 eq. water	97	83/17	67

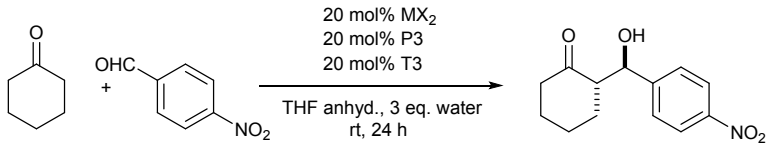
DME + 3 eq. water	89	84/16	60
EtOH + 3 eq. water	76	81/19	44
Et_2O + 3 eq. water	93	83/17	69
tBuOH + 3 eq. water	98	84/16	59
AcOEt + 3 eq. water	91	85/15	64
DMF + 3 eq. water	100	83/17	52
Dioxane + 3 eq. water	100	86/14	57
Tetrahydropyran + 3 eq. water	100	82/18	65
ACN + 3 eq. water	88	87/13	57

7) Effect of substituted pyridine, quinoline and isoquinoline ligands in the asymmetric aldol reaction:



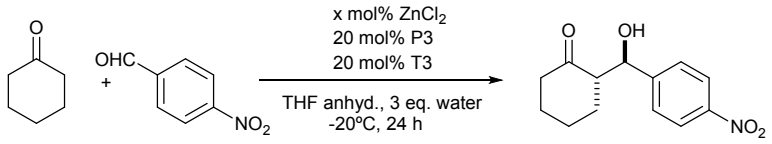
P + T3	***Conversion/%***	***dr anti/syn***	***ee/%***
	98	83/17	62
	98	84/16	62
	98	83/17	66
	83	83/17	60

8) Effect of the metal salt in the asymmetric aldol reaction:



MX_2	***Conversion/%***	***dr anti/syn***	***ee/%***
$CdCl_2$	38	75/25	61
$CuCl_2 \cdot 2H_2O$	17	95/5	98
$CaCl_2$	59	70/30	68
$NiCl_2 \cdot 6\ H_2O$	3	76/24	nd

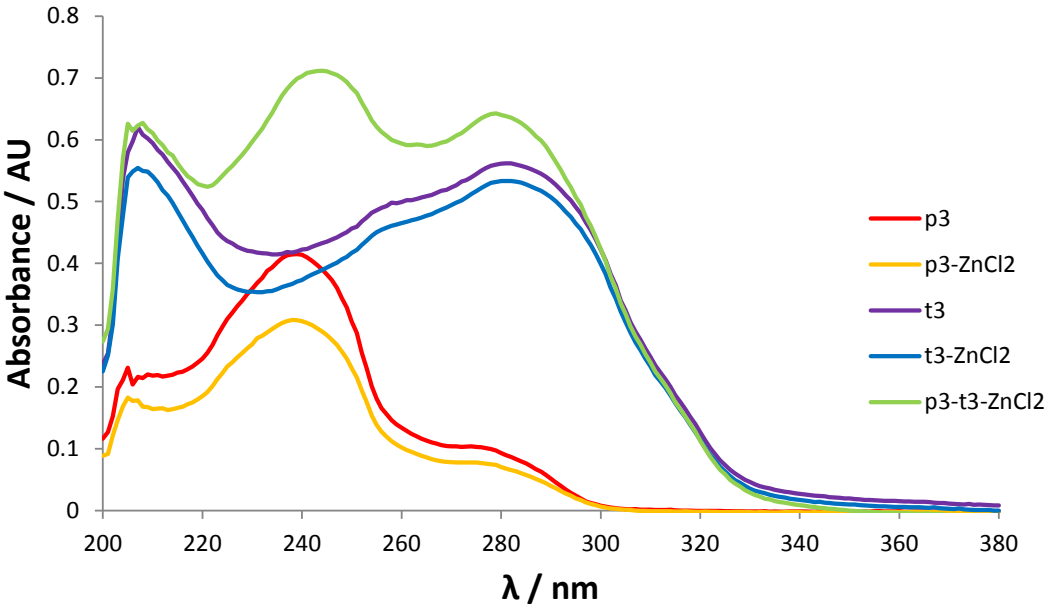
9) Reactions with variable amounts of zinc chloride and constant amounts of ligands:

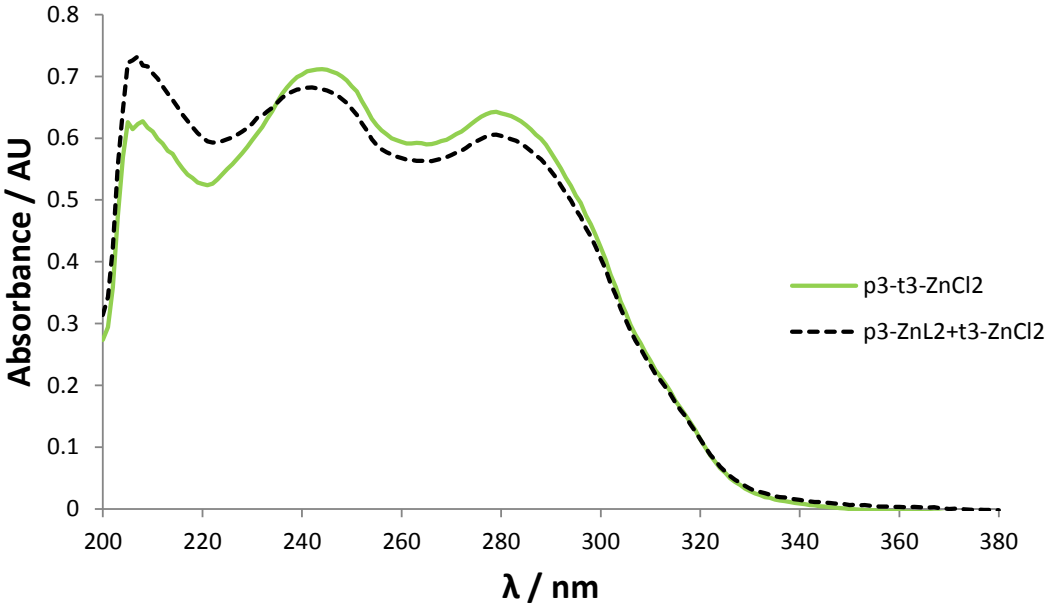


mol % $ZnCl_2$	***Conversion/%***	***dr anti/syn***	***ee/%***
1	33	94/6	92
5	41	94/6	90
10	57	95/5	89
20	81	95/5	92
25	84	95/5	93

10) UV/VIS spectra of ligands T3, P3, and mixtures $ZnCl_2$-T3, $ZnCl_2$-P3 and $ZnCl_2$-T3-P3.

All solutions were prepared at 24 µM in THF (spectroscopic grade) and 1.5 % (v/v) water.

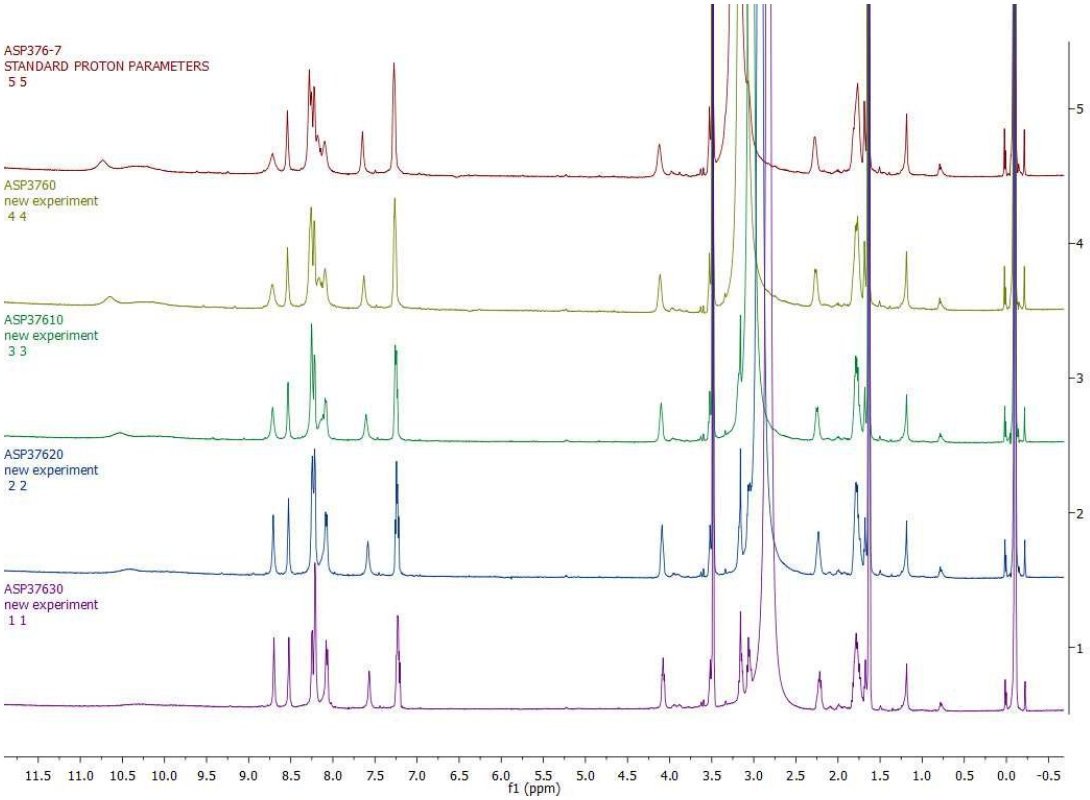




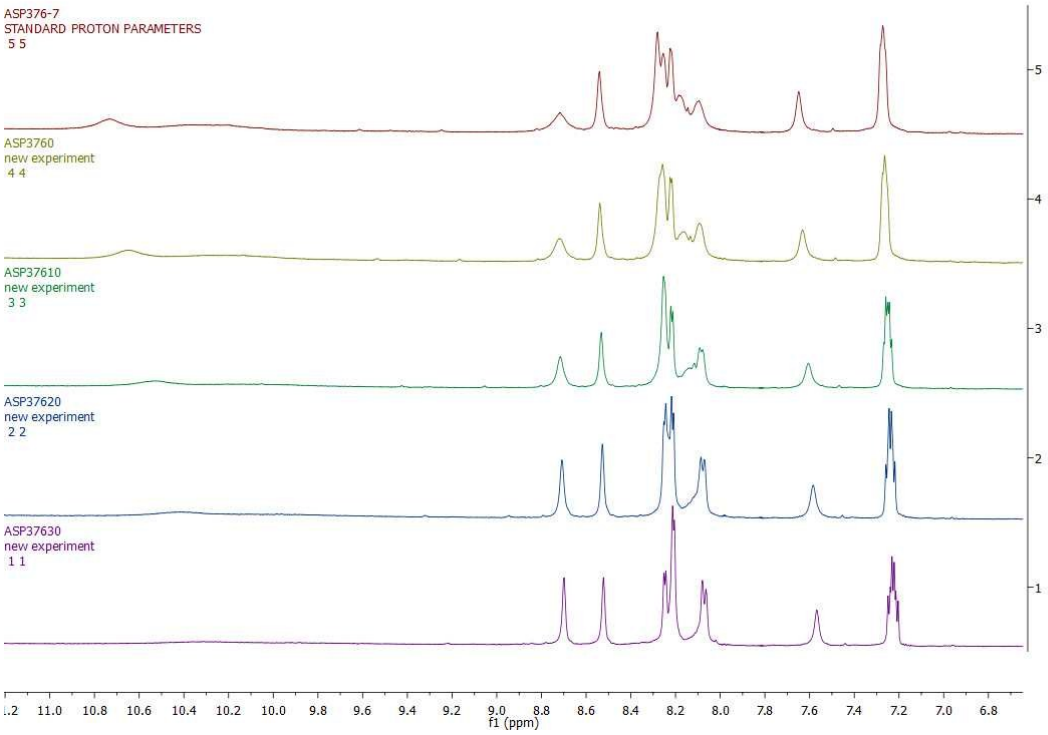
11) ^{1}H NMR at variable temperature of the $ZnCl_2$-T3-P3 mixture.

Spectra recorded in a Varian 500 MHz spectrometer at -7, 0, 10, 20 and 30 ºC (from top to down) in THF-d^8+ 1.5% (v/v) H_2O. Reference was set to TMS according to ref. 3.

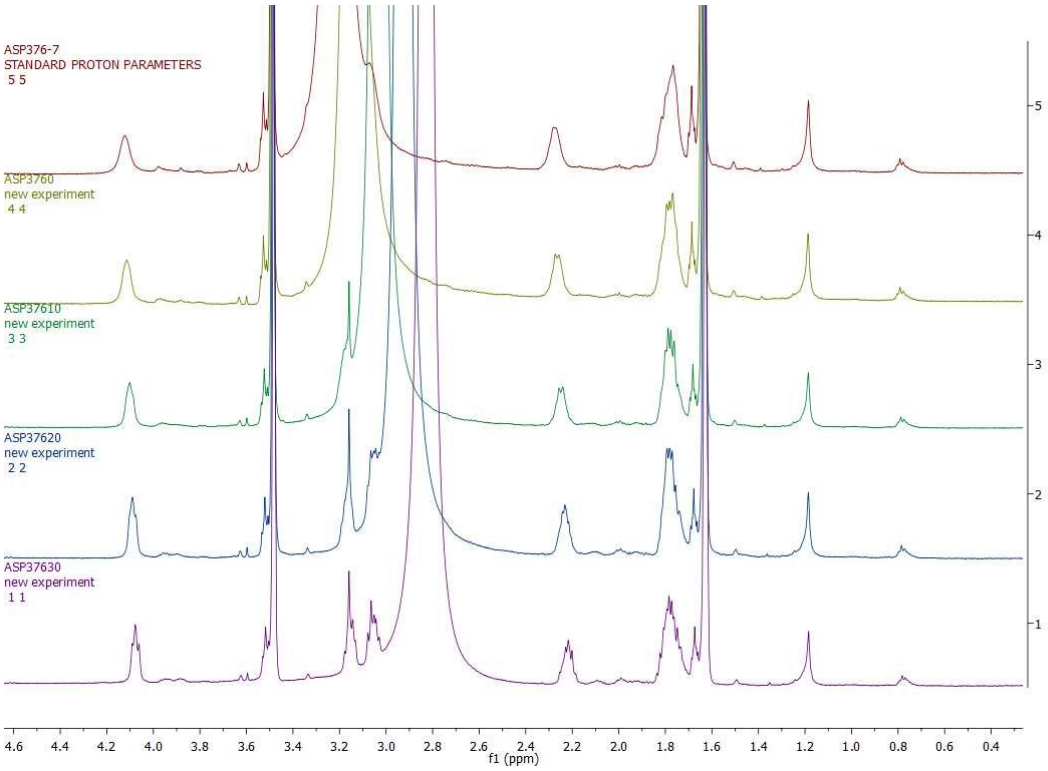
A) Full scale spectra:



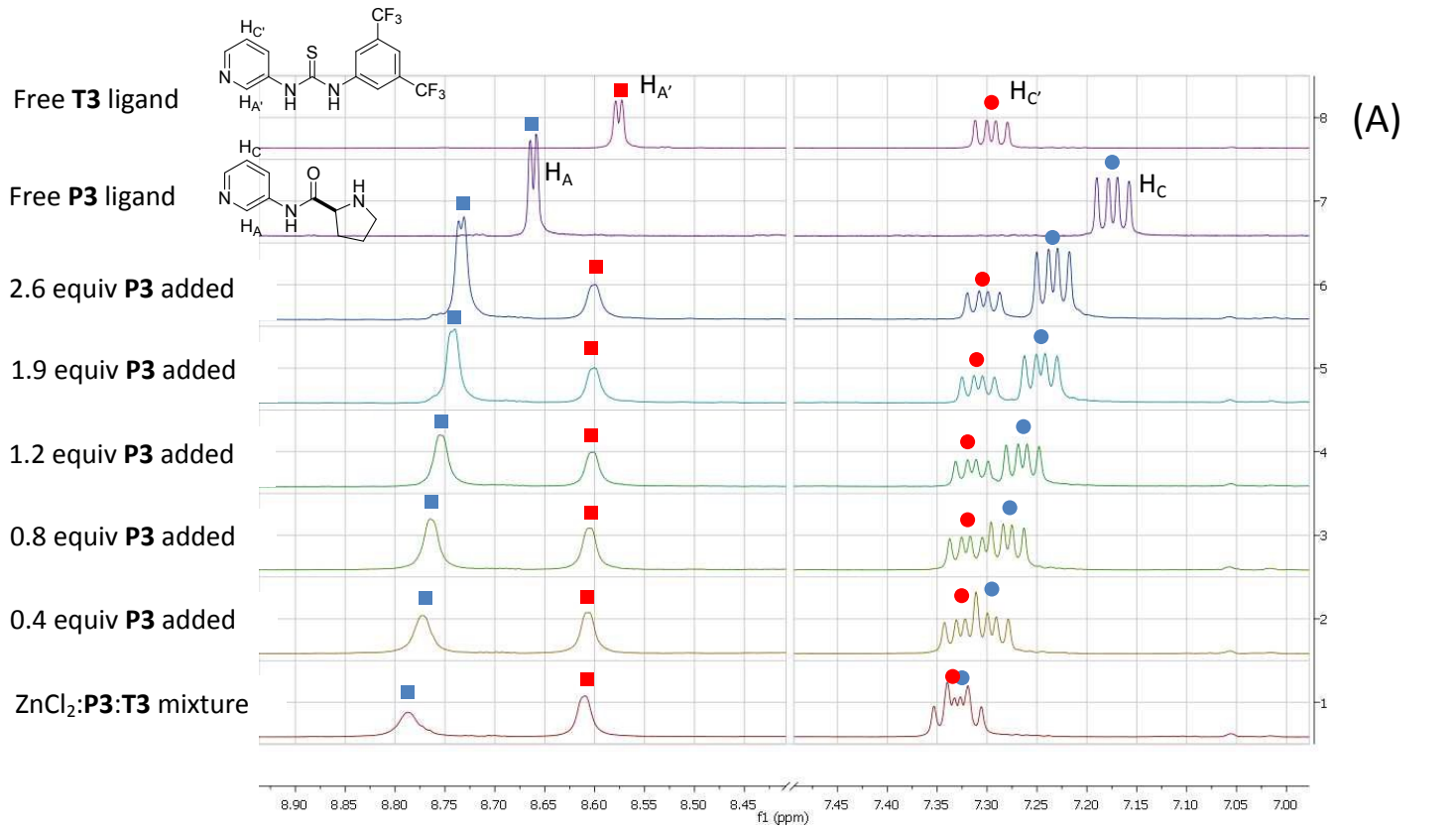
B) 6.7 – 11.2 ppm EXPANSION (PYRIDINE, AROMATIC, AND H-BONDING REGION): Changes in the 8.0-8.4 ppm region can be appreciated. Broad, separated signals at -7 ºC coalesce and get defined upon heating. Indication of the presence of several species in fast exchange.



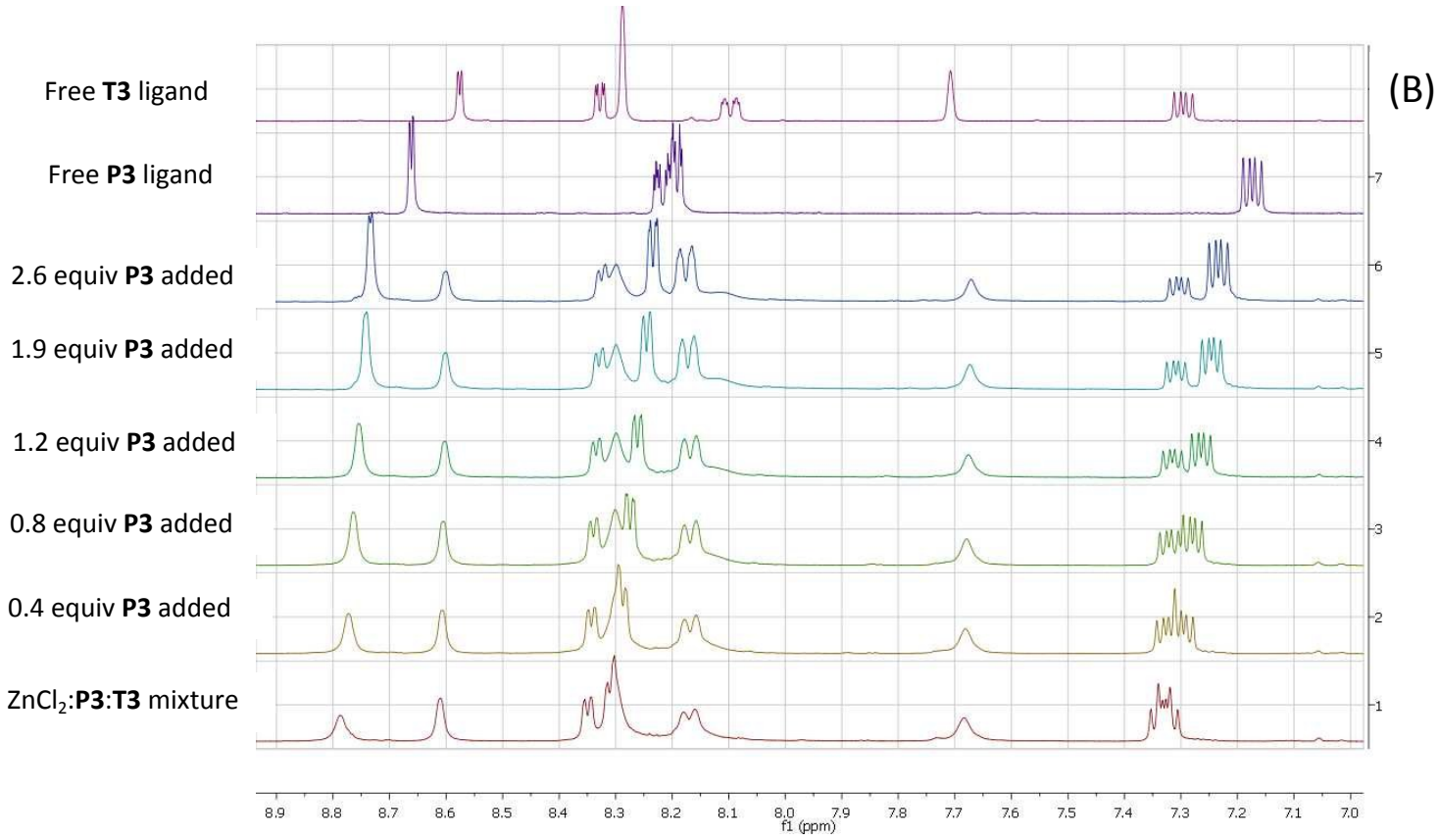
C) 0.4 – 4.6 ppm EXPANSION (PROLINAMIDE REGION): No changes observed.



12) NMR TITRATION OF THE $ZnCl_2$:P3:T3 MIXTURE WITH P3 LIGAND:



(A)



(B)

Experiments were performed in a Varian 400 spectrometer in THF-d8 plus 20 µl of water. Above, the aromatic region (B) and the expanded region corresponding to clearly assigned signals (A) are shown.

Signals corresponding to ligand **P3** (blue) increase in intensity and shift upfield upon addition of more **P3**, approaching the chemical shift and shape of the free ligand. Signals corresponding to ligand **T3** (red) also shift towards the free ligand value, although less markedly. No signals corresponding to free ligand (either **P3** or **T3**) or to a particular zinc complex appear. Therefore free ligands and complexes are in fast exchange, and only average signals can be recorded by ^{1}H NMR.

12) References.

(1) Zhuo Tang , Lin-Feng Cun , Xin Cui , Ai-QiaoMi , Yao-Zhong Jiang , and Liu-Zhu Gong . *Org.Lett*., 2006, **8**, 1263–1266.

(2) A. M. Valdivielso, A. Catot, I. Alfonso and C. Jimeno, *RSC Adv.*, 2015, **5**, 62331-62335.

(3) R. E. Hoffman, *Magn. Res. Chem*. 2006, **44**, 606-616.