E. coli **growth and lysate preparation**

A sample of *Escherichia coli* pre-transformed with pSTB7 was purchased from the American Type Culture Collection (ATCC 37845, deposited by E. W. Miles). This was plated onto solid LB supplemented with ampicillin (100μgmL^{-1}). Following incubation of the plates at 37ºC for 12h, single bacterial colonies were used to inoculate sterile LB (4x10mL) contained within pre-sterilised and capped 15mL Falcon tubes. These tubes were incubated in an orbital shaker with a 1" throw at 180rpm, 37ºC. Once the optical density of the cultures had reached 1.89 at 600nm, typically after 12 hours incubation, the 10mL pre-cultures were poured into 4x500mL of LB supplemented with ampicillin (100μgmL^{-1}). contained within four 2L Erlenmeyer flasks stoppered with a sterile cotton wool plug. The cultures were incubated at 37ºC, 180rpm. After 12h, the cultures were centrifuged (20min, 5ºC, 13261g), the pellet re-suspended and washed with NaCl (1x30mL). The washed pellet was re-suspended in buffer A (80 mL). The cells were lysed by sonication, centrifuged (20min, 5ºC, 7750g) to remove cell debris, and the crude supernatant used in the reactions without further purification.

Biotransformations

L-serine (0.127g, 1.21mmol), haloindole (1eq, 1.21mmol), PLP (0.8mg), and Buffer B, were added to a 250mL Erlenmyer flask and cooled to 5ºC, Cell lysate (2mL at 5ºC) was then added to the flask. Reactions were incubated in an orbital shaker (37ºC, 180rpm, 3days). The reaction mixture was filtered and extracted with ethyl acetate (2 x 50mL) to remove any un-reacted indole. The combined organic layers were dried ($MgSO_4$) and the solvent removed under reduced pressure to give un-reacted starting material. The aqueous layer was reduced in volume to 20mL under reduced pressure prior to the material being purified by reverse-phase chromatography.

Procedure using dialysis membrane:-
The procedure above was followed, but cell free lysate (2 mL) and buffer B (8 mL) was first added to a tied 10cm length of dialysis tubing. At the end of the reaction the dialysis bag was removed and rinsed with buffer.

The procedure was also repeated using L-serine (0.508g, 4.84mmol) and haloindole (1eq, 4.84mmol), scaling all volumes 4 fold, the same yields obtained on this scale.

Compound purification

The tryptophan solution was added to reverse-phase silica (33g), purchased from Fluka (silica gel 100, c-18 reverse phase), packed in a column with a 40mm diameter. Deionised water was used as eluent. Fractions (50mL) were collected and visualised on TLC plates with ninhydrin. Once serine was no longer detected, one further fraction was collected prior to elution with methanol. Methanolic fractions containing the L-halotryptophan were combined and concentrated under reduced pressure, firstly using a warm water bath, and then by freeze drying. Following purification the compounds were converted to the hydrochloride salts to aid solubility in D_2O for NMR analysis.

Analysis

Compounds were analysed by mp, NMR and MS and these data compared to those previously reported in the literature.†

Enatiomeric purity was confirmed by reacting the free tryptophans with *p*-nitrobenzoyl-binol aldehyde as detailed in the literature for tryptophan.[14] For comparison 40:60 samples of D:L tryptophan and 6-fluorotryptophan were generated and analysed by this method.

Media and Buffers

LB:- tryptone (1%w/v, Becton Dickinson and Company), yeast extract (0.5%w/v, Becton Dickinson and Company), NaCl (1%w/v).
LB-agar:- tryptone (1%w/v), yeast extract (0.5%w/v), NaCl (1%w/v), agar 1.5%w/v).
Buffer A:- Trishydrochloride (500mM), EDTA (5mM), mercaptomethanol (10mM) PMSF(1mM), PLP(0.1mM) adjusted to pH 7.8.
Buffer B:- KH_2PO_4 (0.1M, pH7.8).

† Synthetic tryptophans

5-F	E. Hoffmann, R. Ikan, A. B. Galun, *J. Heterocycl. Chem*., 1965, 298.
6-F	E. D. Bergmann and E. Hoffmann, *J. Chem. Soc*., 1962, 2827.
7-F	J. C. Gebler, A. B. Woodside and C. D. Poulter, *J. Am. Chem. Soc*., 1992, 7354.
5-Cl; 6-Cl; 7-Cl	H. N. Rydon and J. C. Tweddle, *J. Chem. Soc*., 1955, 3499.
4-Br	C. R. Hurt, R. Lin and H. Rapoport, *J. Org. Chem*., 1999, 225.
5-Br; 7-Br	M. C. Allen, D. E. Brundish and R. Wade, *J. Chem. Soc. Perkin Trans. 1*, 1980, 1928.
6-Br	a) U. Schmidt, A. Lieberknecht, H. Griesser, H. Bökens, *Tetrahedron Lett*., 1982, 4911. b) T. L. Gilchrist, D. A. Lingham and T. G. Roberts, *J. Chem. Soc. Chem. Commun*., 1979, 1089.
2-Me; 4-Me; 5-Me; 6-Me; 7-Me	H. N. Rydon, *J. Chem. Soc*., 1948, 705.

Supplementary Material (ESI) for Chemical Communications

^{1}H NMR and MS Data

All NMR spectra were recorded on a Varian 400 NMR specrometer.
All mass spectra were recorded on a Shimadzu LCMS-2010A instrument.

5-Fluoro-L-tryptophan hydrochloride

^{1}H NMR: $\delta_H(D_2O)$: 3.10-3.15 (dd, 1H, *J* = 7.2, 15.6 Hz), 3.16-3.22 (dd, 1H, *J* = 5.6, 15.6 Hz), 4.08 (t, 1H, *J* = 6.2 Hz), 6.76-6.81 (dt, 1H, *J* = 2.4, 9.2 Hz), 7.07 (d, 1H, *J* = 2.4 Hz), 7.10 (s, 1H), 7.18-7.22 (dd, 1H, *J* = 4.6, 9.0 Hz).
MS: (E.I.) m/z = 222.95 (M^+).

6-Fluoro-L-tryptophan hydrochloride

^{1}H NMR: $\delta_H(D_2O)$: 3.12-3.18 (dd, 1H, *J* = 7.2, 15.6 Hz), 3.20-3.25 (dd, 1H, *J* = 5.4, 15.4 Hz), 4.08-4.11 (dd, 1H, *J* = 5.4, 7.0 Hz), 6.70-6.75 (ddd, 1H, *J* = 2.3, 8.9, 9.9 Hz), 6.96-6.99 (dd, 1H, *J* = 2.2, 10.2 Hz), 7.04 (s, 1H), 7.33-7.37 (dd, 1H, *J* = 5.2, 8.8 Hz).
MS: (E.I.) m/z = 222.95 (M^+).

7-Fluoro-L-tryptophan hydrochloride

^{1}H NMR: $\delta_H(D_2O)$: 3.13-3.19 (dd, 1H, *J* = 7.0, 15.4 Hz), 3.21-3.27 (dd, 1H, *J* = 5.4, 15.4 Hz), 4.09-4.12 (dd, 1H, *J* = 5.6, 7.2 Hz), 6.73-6.78 (dd, 1H, *J* = 8.0, 11.6 Hz), 6.83-6.89 (ddt, 1H, *J* = 1.2, 4.7, 7.9 Hz), 7.09 (s, 1H), 7.20 (d, 1H, *J* = 8.0 Hz).
MS: (E.I.) m/z = 223.00 (M^+).

5-Chloro-L-tryptophan hydrochloride

^{1}H NMR: $\delta_H(D_2O)$: 3.06-3.12 (dd, 1H, *J* = 7.0, 15.4 Hz), 3.14-3.19 (dd, 1H, *J* = 5.2, 15.2 Hz), 4.05-4.08 (dd, 1H, *J* = 5.4, 7.0 Hz), 6.94-6.96 (dd, 1H, *J* = 1.6, 8.8 Hz), 7.06 (s, 1H), 7.18 (d, 1H, *J* = 8.4 Hz), 7.36 (d, 1H, *J* = 1.6 Hz).
MS: (E.I.) m/z = 238.95 (M^+).

6-Chloro-L-tryptophan hydrochloride

^{1}H NMR: $\delta_H(D_2O)$: 3.10-3.15 (dd, 1H, *J* = 7.2, 15.2 Hz), 3.17-3.22 (dd, 1H, *J* = 5.6, 15.6 Hz), 4.06-4.09 (dd, 1H, *J* = 5.6, 7.2 Hz), 6.87-6.89 (ddd, 1H, *J* = 0.8, 1.8, 8.6 Hz), 7.03 (s, 1H), 7.25 (t, 1H, *J* = 2.0 Hz), 7.30 (d, 1H, *J* = 8.8 Hz).
MS: (E.I.) m/z = 238.95 (M^+).

7-Chloro-L-tryptophan hydrochloride

^{1}H NMR: $\delta_H(D_2O)$: 3.15-3.20 (dd, 1H, *J* = 7.2, 15.2 Hz), 3.24-3.29 (dd, 1H, *J* = 5.0, 15.4 Hz), 4.08 (t, 1H, *J* = 5.8 Hz), 6.91 (t, 1H, *J* = 7.6 Hz), 7.07 (d, 1H, *J* = 7.6 Hz), 7.14 (s, 1H), 7.38 (d, 1H, *J* = 8.0 Hz).
MS: (E.I.) m/z = 238.95 (M^+).

4-Bromo-L-tryptophan hydrochloride

^{1}H NMR: $\delta_H(D_2O)$: 2.99-3.05 (dd, 1H, *J* = 10.0, 14.8 Hz), 3.66-3.71 (dd, 1H, *J* = 5.2, 14.8 Hz), 4.19-4.23 (dd, 1H, *J* = 5.0, 9.8 Hz), 6.88 (t, 1H, *J* = 7.8 Hz), 7.11 (s, 1H), 7.12 (d, 1H, *J* = 4.4 Hz), 7.26 (d, 1H, *J* = 7.6 Hz).
MS: (E.I.) m/z = 282.95 (M^+).

5-Bromo-L-tryptophan hydrochloride

^{1}H NMR: $\delta_H(D_2O)$: 3.10-3.16 (dd, 1H, *J* = 7.4, 15.4 Hz), 3.19-3.24 (dd, 1H, *J* = 5.2, 15.2 Hz), 4.05-4.08 (dd, 1H, *J* = 5.4, 7.0 Hz), 7.08 (s, 1H), 7.10-7.12 (dd, 1H, *J* = 1.8, 8.6 Hz), 7.18 (d, 1H, *J* = 8.8 Hz), 7.59 (d, 1H, *J* = 1.6 Hz).
MS: (E.I.) m/z = 282.90 (M^+).

6-Bromo-L-tryptophan hydrochloride

^{1}H NMR: $\delta_H(D_2O)$: 3.08-3.14 (dd, 1H, *J* = 7.2, 15.6 Hz), 3.16-3.21 (dd, 1H, *J* = 5.6, 15.2 Hz), 4.06 (t, 1H, *J* = 6.2 Hz), 6.99 (dd, 1H, *J* = 1.6, 8.4 Hz), 7.01 (s, 1H), 7.25 (d, 1H, *J* = 8.4 Hz), 7.39 (s, 1H).
MS: (E.I.) m/z = 282.90 (M^+).

7-Bromo-L-tryptophan hydrochloride

^{1}H NMR: $\delta_H(D_2O)$: 3.10-3.15 (dd, 1H, *J* = 7.0, 15.4 Hz), 3.18-3.23 (dd, 1H, *J* = 5.2, 15.2 Hz), 4.06-4.09 (dd, 1H, *J* = 5.6, 6.8 Hz), 6.82 (t, 1H, *J* = 7.8 Hz), 7.09 (s, 1H), 7.18 (d, 1H, *J* = 8.0 Hz), 7.36 (d, 1H, *J* = 8.0 Hz).
MS: (E.I.) m/z = 282.85 (M^+).

2-Methyl-L-tryptophan hydrochloride

^{1}H NMR: $\delta_H(D_2O)$: 2.11 (s, 3H), 3.01-3.07 (dd, 1H, *J* = 7.6, 15.2 Hz), 3.13-3.18 (dd, 1H, *J* = 6.0, 15.6 Hz), 4.03-4.06 (dd, 1H, *J* = 6.2, 7.4 Hz), 6.87-6.91 (dt, 1H, *J* = 1.1, 7.4 Hz), 6.93-6.97 (dt, 1H, *J* = 1.1, 7.4 Hz), 7.17 (d, 1H, *J* = 7.6 Hz), 7.29 (d, 1H, *J* = 8.0 Hz).
MS: (E.I.) m/z = 219.00 (M^+).

4-Methyl-L-tryptophan hydrochloride

^{1}H NMR: $\delta_H(D_2O)$: 2.42 (s, 3H), 2.97-3.04 (dd, 1H, *J* = 10.4, 15.2 Hz), 3.45-3.50 (dd, 1H, *J* = 4.6, 15.4 Hz), 3.95-3.98 (dd, 1H, *J* = 4.2, 9.8 Hz), 6.67 (d, 1H, *J* = 6.8 Hz), 6.90 (t, 1H, *J* = 7.4 Hz), 7.00 (s, 1H), 7.11 (d, 1H, *J* = 8.0 Hz).
MS: (E.I.) m/z = 219.00 (M^+).

5-Methyl-L-tryptophan hydrochloride

^{1}H NMR: $\delta_H(D_2O)$: 2.20 (s, 3H), 3.10-3.16 (dd, 1H, *J* = 7.6, 15.2 Hz), 3.21-3.26 (dd, 1H, *J* = 5.2, 15.2 Hz), 4.07-4.11 (dd, 1H, *J* = 5.4, 7.4 Hz), 6.88 (d, 1H, *J* = 8.8 Hz), 7.03 (s, 1H), 7.18 (d, 1H, *J* = 8.4 Hz), 7.24 (t, 1H, *J* = 0.8 Hz).
MS: (E.I.) m/z = 218.95 (M^+).

6-Methyl-L-tryptophan hydrochloride

^{1}H NMR: $\delta_H(D_2O)$: 2.19 (s, 3H), 3.11-3.17 (dd, 1H, *J* = 7.2, 15.6 Hz), 3.20-3.25 (dd, 1H, *J* = 5.4, 15.4 Hz), 4.07-4.11 (dd, 1H, *J* = 5.2, 7.2 Hz), 6.78-6.81 (dd, 1H, *J* = 1.0, 8.2 Hz), 6.99 (s, 1H), 7.09 (t, 1H, *J* = 0.8 Hz), 7.31 (d, 1H, *J* = 8.0 Hz).
MS: (E.I.) m/z = 219.00 (M^+).

7-Methyl-L-tryptophan hydrochloride

^{1}H NMR: $\delta_H(D_2O)$: 2.26 (s, 3H), 3.14-3.19 (ddd, 1H, *J* = 0.6, 7.4, 15.4 Hz), 3.23-3.28 (ddd, 1H, *J* = 0.8, 5.4, 15.4 Hz), 4.08-4.11 (dd, 1H, *J* = 5.4, 7.4 Hz), 6.88 (t, 1H, *J* = 7.2 Hz), 6.84-6.86 m, 1H, 7.09 (s, 1H), 7.28-7.30 (ddd, 1H, *J* = 0.6, 1.8, 7.4 Hz).
MS: (E.I.) m/z = 219.00 (M^+).