A Chiral Biaryl P,N-Ligand for Asymmetric Catalysis

Concept:

- six-membered aromatic (QUINAP)
- five-membered heteroaromatic configurationally unstable

Synthesis of L1:

1. TBSCI, Et₃N, CH₂Cl₂, 78%  
2. NaH, THF, C₆F₅CH₂Br, -78 °C, 94%
3. Ni(PPh₃)₂Cl₂, ClPPh₂, Zn, DMF, 110 °C, 60%

Importance of π-stacking:

L₁ (X = F) half-life: 8.7 h at 75 °C in DCE  
L₁-H₂ (X = H) half-life: 22 min

Selected example:

CyCHO + HNBn₂ (1 equiv) L₁ (5.5 mol%) CuBr (5 mol%) 4 Å MS, PhMe 0 °C, 24 h  
95% yield 97% ee

Significance: The authors reported the preparation of a new chiral biaryl P,N-ligand incorporating a five-membered electron-rich heteroaromatic. This ligand is easy to prepare and an effective catalyst for the enantioselective alkynylation of imines.

Comment: In contrast to the six-membered P,N-ligands, five-membered P,N-ligands are configurationally unstable. The authors have succeeded in preparing a configurationally stable five-membered P,N-ligand involving π-stacking interaction, which would offer a new, unexplored chemical diversity.