1. **Fe(CO)₃**

   1)Mel, THF, 0 °C; A, THF-DMF
   0 to 80 °C, 50%

   2) Me₃NO, acetone
   56 °C, 64%

   |Ethylene (1 atm) Grubbs 2nd (5 mol%)| benzene, 50 °C to reflux |
   |74%|


2. **EtO₃**

   **Me**

   + **Ph**

   Ph**Br**

   **EtO**

   **Me**

   t-Bu

   |**Pd(PPh₃)₄**
   |**i-Pr₂NEt**
   |**DMF**, 90 °C |
   |45%|


3. **O**

   **Me**

   + **Cl**

   **O**

   **Me**

   |**TiCl₄·(THF)₂** (cat)
   |**i-Pr₂NEt**
   |**CH₂Cl₂**, rt |
   |syn : anti = >99 : 1|


4. **OTBS**

   |1) **O₂**, **hν**
   |rose bengal
   |MeOH-CH₂Cl₂; Me₂S|
   |2) **Ac₂O**, **Et₃N**
   |DMAP, CH₂Cl₂|
   |3) DBU, toluene |
   |**OTBS**|

   OTBS

   110 °C

5. 

\[
\text{PhSO}_2\text{NH}_2 \xrightarrow{1) \text{ SOCl}_2, \text{ benzene, reflux}} \xrightarrow{2) \text{ pyridine, benzene, } 23 \, ^\circ\text{C}} \xrightarrow{\text{DME, } 23 \, ^\circ\text{C; CuBr\textsubscript{2}SMe}_2 (2 \text{ mol\%}), \text{ PhMgBr (3 equiv.)}} \xrightarrow{-78 \text{ to } 23 \, ^\circ\text{C}} \xrightarrow{72\%, (2 \text{ steps})} \text{Ph\quad\xrightarrow{\text{NHSO}_2\text{Ph}}} 
\]


6. 

\[
\text{NC-S-CNC} \xrightarrow{\text{EtO}_2\text{C-CI, NaH (3.0 eq), THF, } 0 \, ^\circ\text{C}} \xrightarrow{55\%} \text{NC-CO}_2\text{Et-CNC}
\]