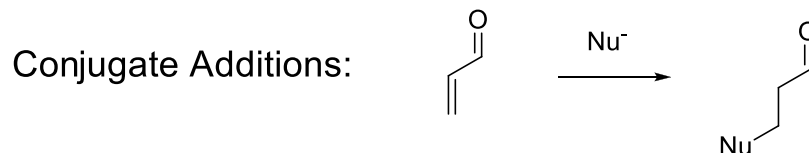
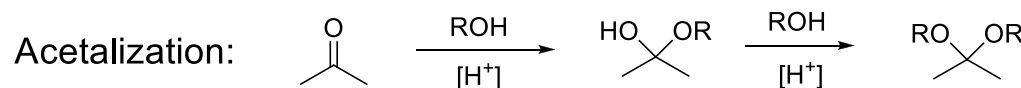
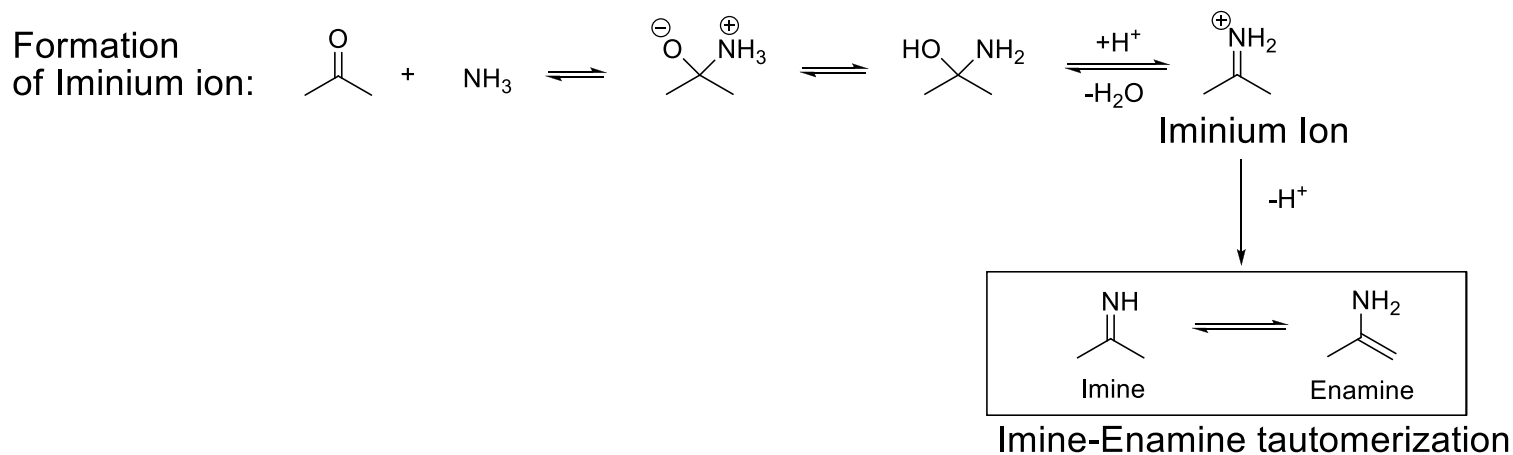
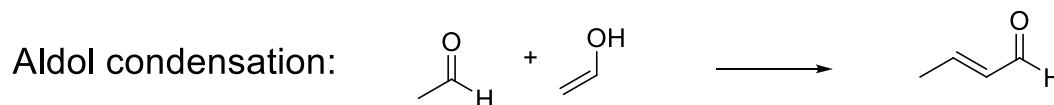
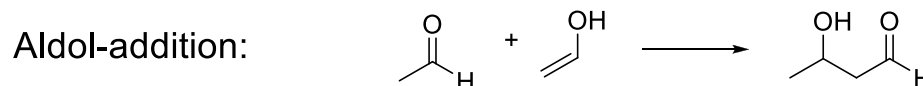


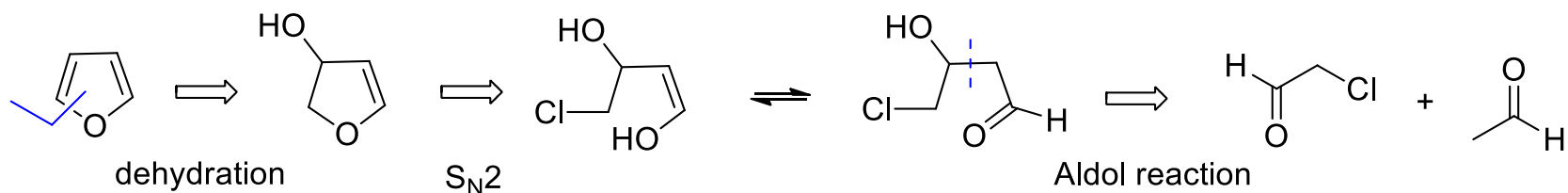
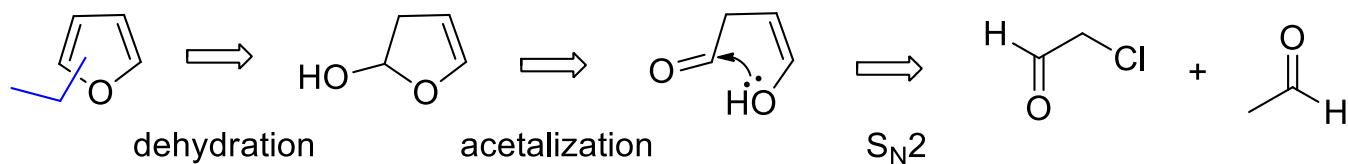
2.3.1. Synthesis of five-membered ring heteroaromatics

■ Recapitulation of some relevant carbonyl chemistry



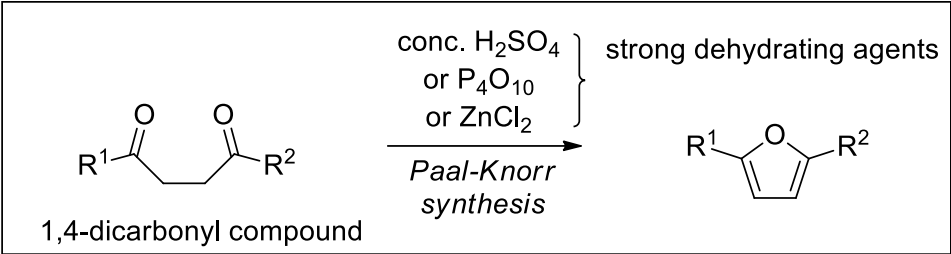
2.3.1. Furane syntheses

From a formal retrosynthesis perspective:
same starting materials, two different pathways

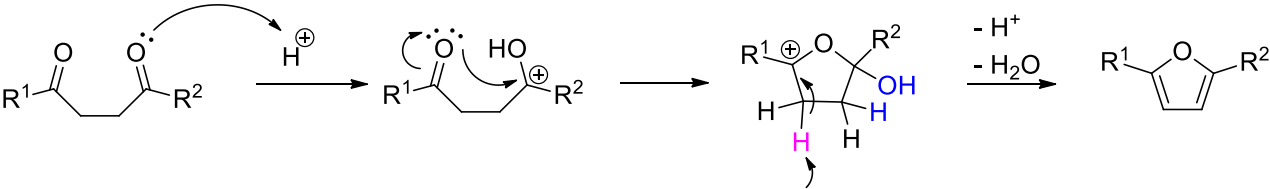


2.3.1. Furane syntheses

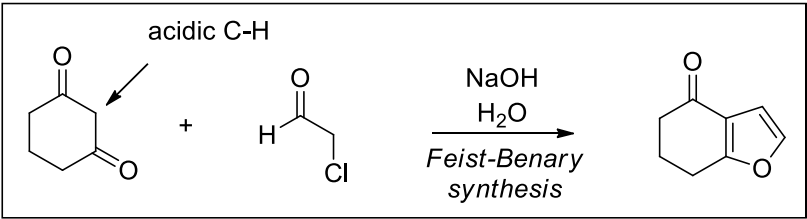
- Paal-Knorr synthesis:



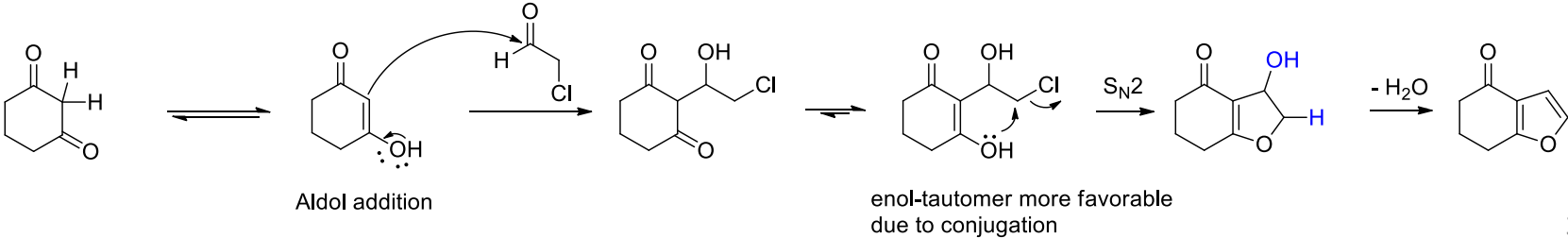
Mechanism:



- Feist-Benary synthesis:

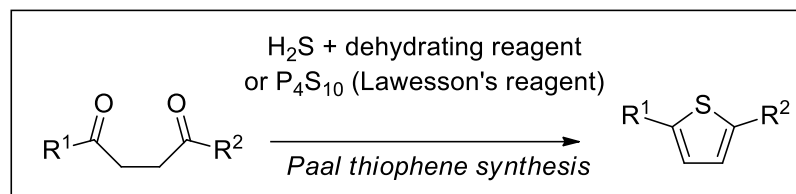


Mechanism:



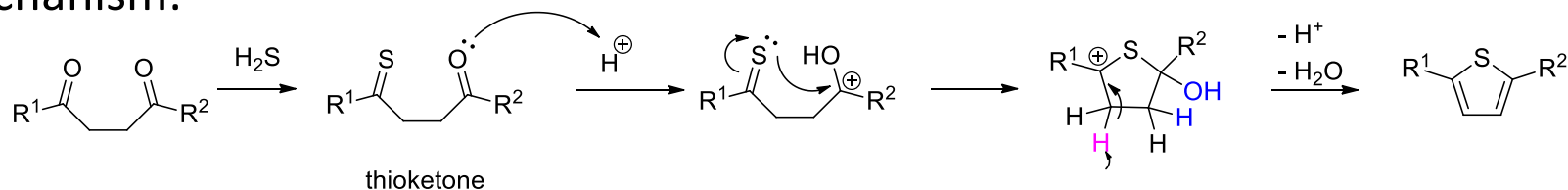
2.3.2. Thiophene syntheses

- Paal-Knorr thiophene synthesis:

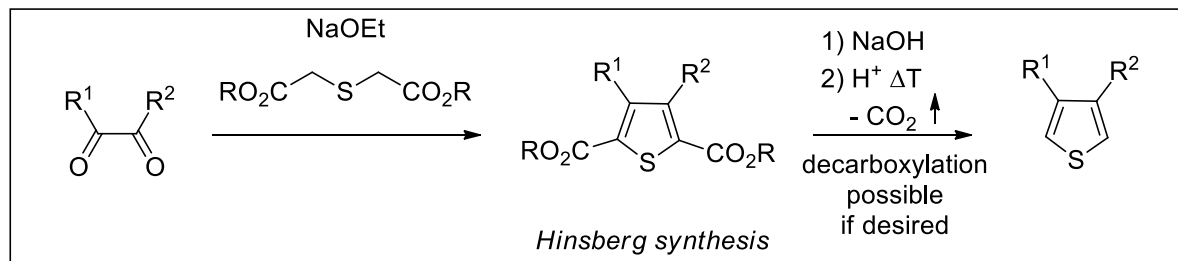


P₄S₁₀: transfer of sulfur and dehydrating agent at once

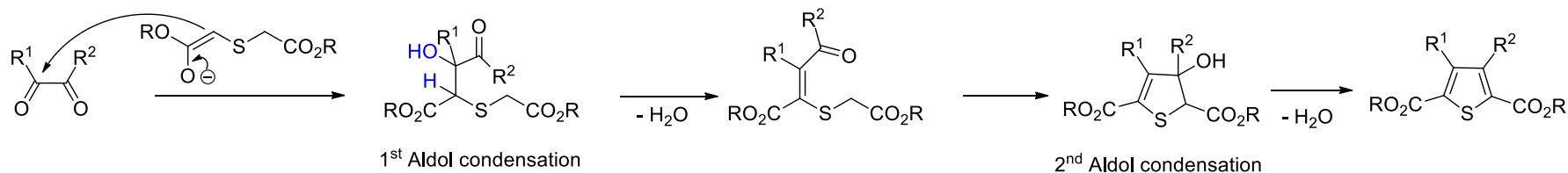
Mechanism:



- Hinsberg synthesis:

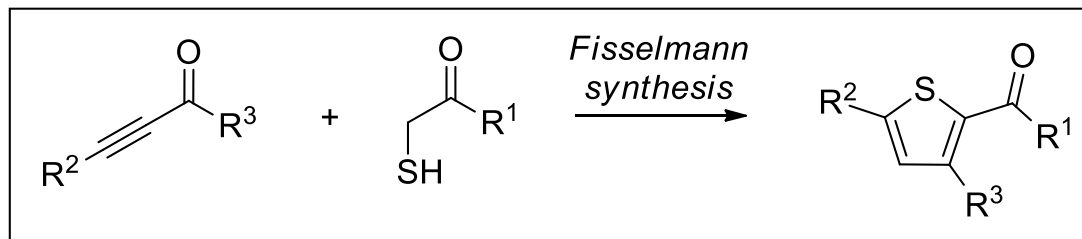


Mechanism:

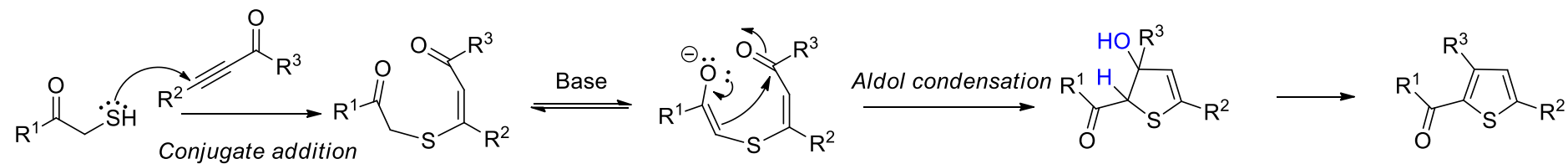


2.3.2. Thiophene syntheses

- Fisselmann thiophene synthesis:

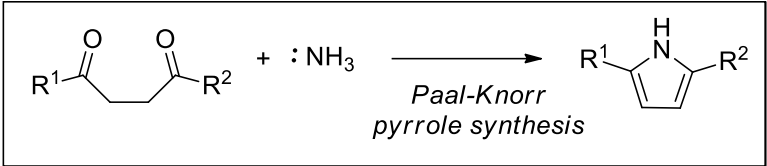


Mechanism:

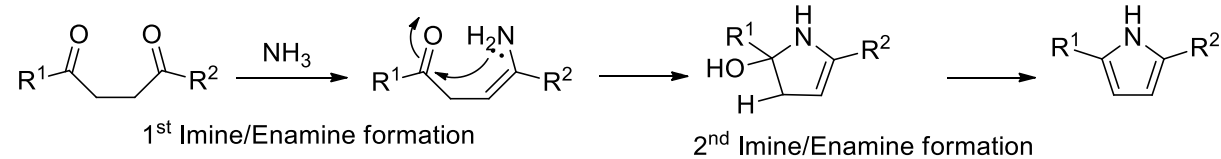


2.3.3. Pyrrole syntheses

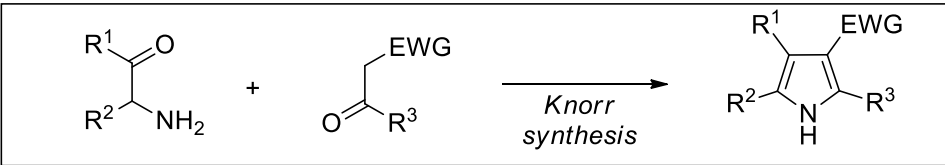
- Paal-Knorr pyrrole synthesis:



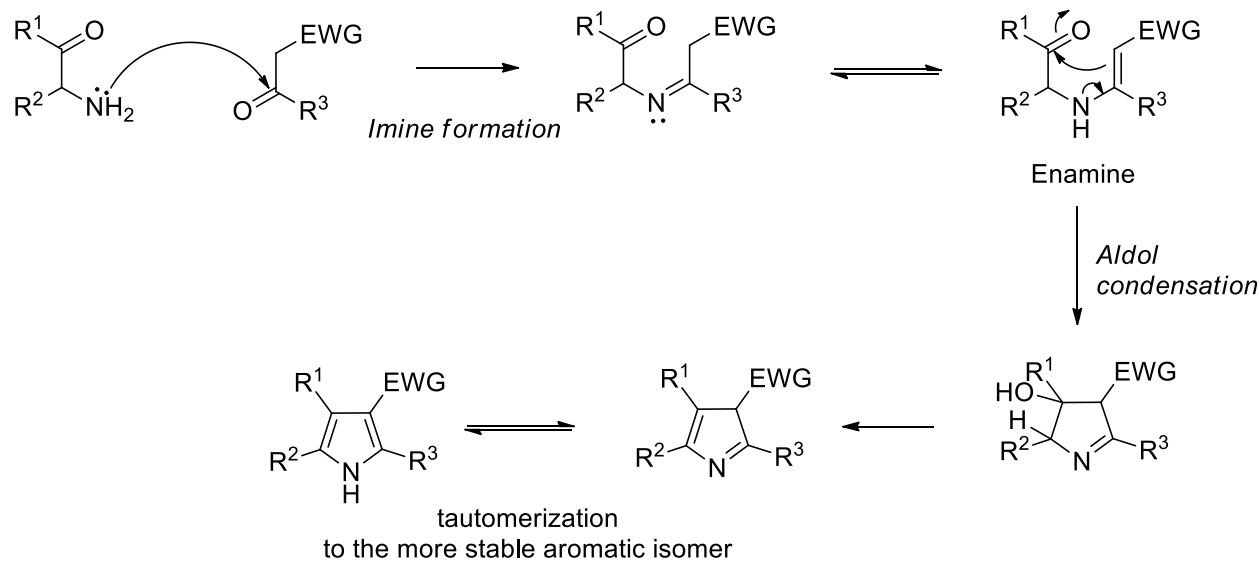
Mechanism:



- The Knorr synthesis:

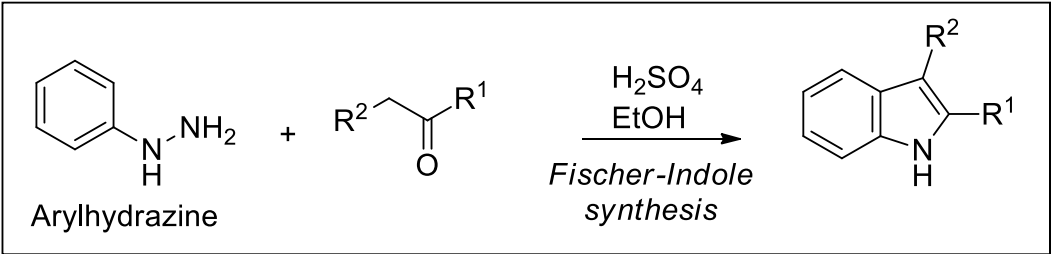


Mechanism:



2.3.4. Indole syntheses

- Fischer-Indole synthesis:



Mechanism:

