Synopsis of Experiments # 1-5 and Report Due Dates

Chemistry 2312 Tuesday, September 3, 2019
Honors Organic Chemistry Laboratory T. R. Hoye

Course Outline: Experiments # 1-5.

1. Ketone Reduction by Sodium Borohydride:
   3-Nitroacetophenone to 1-(3-Nitrophenyl)-1-ethanol and 9H-Fluoren-9-one to 9H-Fluoren-9-ol

2. Ozonolysis and Hydrogenation of Naturally Occurring Alkenes:
   Nopinone from β-Pinene and Menthone from Pulegone

3. Reactions of Carboxylic Acid Derivatives:
   Enolate Alkylation, Ester Hydrolysis, and EDCI-Coupling in the Preparation of Phenyl-N-(1-phenylethyl)propanamide

4. Catalysis: Palladium Coupling of an Alkyne with an Aryl Halide, Enzymatic Kinetic Resolution of a Chiral Alcohol, and Mosher Ester Analysis of Absolute Configuration

5. Diels-Alder Cycloaddition Reaction, Photochemical 2+2 Cycloaddition, and Diketone Reduction: Preparation of a Starting Material for Synthesis of Analogs of Otteliones A and B, Natural Antitumor Agents

Points

<table>
<thead>
<tr>
<th>Points</th>
<th>Experiment 1</th>
<th>110 points</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Experiment 2</td>
<td>220 points</td>
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<tr>
<td></td>
<td>Experiment 3–5</td>
<td>330 points each</td>
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</tbody>
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Due Dates (all due by lab closing time in a collection box in 491 Kolthoff)

Report 1. Experiment 1 Thursday, September 19, 2019
Report 2. Experiment 2 Saturday, October 5, 2019
Report 3. Experiment 3 (or 4 or 5) Saturday, October 26, 2019
Report 4. Experiment 4 (or 5 or 3) Saturday, November 16, 2019
Report 5. Experiment 5 (or 3 or 4) Wednesday, December 11, 2019

Late Penalty A 10% penalty will be assessed for each week (or portion thereof) that a report is turned in late.
Graphical Synopsis of Experiments # 1-5

1. Ketone Reduction by Sodium Borohydride:
   \(1-(3\text{-Nitrophenyl})\text{-1-ethanol (1a)}\) and \(9\text{H}\text{-Fluoren-9-ol (1b)}\)

   \[
   \text{3-nitroacetophenone} \xrightarrow{\text{NaBH}_4, \text{EtOH}} \text{1a} \quad \text{room temperature}
   \]
   \[
   \text{9H-fluoren-9-one} \xrightarrow{\text{NaBH}_4, \text{MeOH}} 0°C \quad \text{1b}
   \]

2. Ozonolysis and Hydrogenation of Naturally Occurring Alkenes:
   \(\text{Nopinone (3) from } \beta\text{-Pinene (2)}\) and \(\text{Menthone Diastereomers (5) from Pulegone (4)}\)

   \[
   \text{(+)-}\beta\text{-Pinene} \quad 2 \\
   \xrightarrow{1) \text{MeOH, CH}_2\text{Cl}_2} \quad \text{O} \\
   \xrightarrow{2) \text{MeSMe}} \quad \text{Nopinone (3)}
   \]

   \[
   \text{(R)-(+)-Pulegone} \quad 4 \\
   \xrightarrow{\text{H}_2, \text{Pd/C}} \quad \text{5-cis} \quad + \quad \text{5-trans}
   \]

3. Reactions Relevant to Bioorganic Chemistry: Enolate Alkylation, Ester Hydrolysis, and EDCI-Coupling in the Preparation of Phenyl-\(N\text{-}(1\text{-phenylethyl})\text{propanamide (9)}\)

   \[
   \text{6} \quad \xrightarrow{1) \text{LiOH, MeOH}} \quad \text{R-7} \quad + \quad \text{LiOH, MeOH} \quad \text{S-7}
   \]

   \[
   \text{R-8} \quad + \quad \text{LiOH, MeOH} \quad \text{(R)-PhCH(Me)NH2} \quad \xrightarrow{\text{El N}_2\text{C}_2\text{N}} \quad \text{S-8} \quad \xrightarrow{\text{EDCI, NHMe_2+HCl}} \quad \text{R,R-9}
   \]

   \[
   \text{S,R-9}
   \]

4. Catalysis: Palladium Coupling of an Alkyne (11) with an Aryl Halide (10), Enzymatic Kinetic Resolution of a Chiral Alcohol (12 to 13), and Mosher Ester Analysis of Absolute Configuration

   \[
   \text{Br} \quad \text{Me} \quad \text{Me} \quad \text{F} \quad \text{Me} \quad \text{H} \quad \text{H} \quad \text{F} \quad \text{Me} \quad \text{Me} \quad \text{H}
   \]

   \[
   \xrightarrow{(\text{Ph}_3\text{P})_2\text{PdCl}_2} \quad \xrightarrow{\text{Cul amine, THF}} \quad \xrightarrow{\text{Amano-PS or SP-435}} \quad \text{isopropenyl acetate}
   \]

   \[
   \text{10} \quad (\pm)-11 \\
   \xrightarrow{(\text{mostly}) \text{ one enant of 13}} \quad \xrightarrow{(\text{mostly}) \text{ one enant of 12}} \quad \text{14 (Mosher esters)}
   \]

5. Diels-Alder Cycloaddition, Photochemical 2+2 Cycloaddition, and Diketone Reduction

   \[
   \text{15} \quad \text{16} \quad \xrightarrow{\text{NaBH}_4 \quad \text{CeCl}_3 \quad \text{H}_2\text{O}_2 \quad \text{MeOH}} \quad \text{17} \quad \text{room temperature} \quad \xrightarrow{\text{hv}} \quad \text{18} \quad \text{19}
   \]