GOAL
To noninvasively detect *H. pylori* infections in patients within one hour for under $10

BACKGROUND
* H. pylori* infects the Upper Gastrointestinal Tract and causes:
  1. Peptic Ulcers
  2. Stomach Cancer
  3. Dyspepsia
  4. Heartburn
  5. Abdominal Pain
  6. Early Satiety & Bloating
  7. 70% of Developing World’s Population
  8. 30-40% of Developed Nation’s Population

DESIGN INNOVATIONS
- Provides Onsite Testing and Results
- No Laboratory Required
- Use of Simple Optics-based system
- Portable and Low Cost
- Noninvasive

FUTURE WORK
- Select Ammonia Binding-Agent - Winter Quarter
- Finalize specific cuvette design and materials - Winter and Early Spring Quarter
- Device hardware and software design - Spring Quarter

Table 1: Existing *H. pylori* Detection Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Invasiveness</th>
<th>Requires Laboratory</th>
<th>Test Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastrointestinal Tract Biopsy</td>
<td>&gt;95%</td>
<td>&gt;95%</td>
<td>Highly</td>
<td>Yes</td>
<td>High</td>
</tr>
<tr>
<td>Blood Antibody Assay</td>
<td>85%</td>
<td>79%</td>
<td>Minimal</td>
<td>Yes</td>
<td>Low</td>
</tr>
<tr>
<td>Fecal Antigen Test</td>
<td>96%</td>
<td>97%</td>
<td>None</td>
<td>Yes</td>
<td>Low</td>
</tr>
<tr>
<td>Urea Breath Test</td>
<td>95%</td>
<td>96%</td>
<td>None</td>
<td>Yes</td>
<td>High</td>
</tr>
</tbody>
</table>

DETECTION METHOD
1. Light enters a cuvette filled with patient’s exhaled breath (contains ammonia)
2. The photons experience scattering from the cuvette’s medium and absorption from the ammonia
3. The light is recorded from the cuvette and diffusion theory is applied to determine the medium’s optical properties
4. The Beer-Lambert Law is applied to calculate the ammonia concentration from the patient’s breath

FLOW CHART
Patient exhales into solution before urea pill
Ammonia reacts with solution
Solution injected into cuvette
Difference in ammonia levels diagnoses *H. Pylori* presence
Solution measured with instrument

SCHEMATIC

CURRENT RESULTS
Raw Data
Processed Data

Website: https://sites.google.com/site/helicooptics/