Introduction Outline

Jennifer Knoop

About Me

- Grew up in Jupiter, Fl
- Math, Science and Engineering program in high school
- Attended the University of Florida and received my degree in Chemical Engineering
- Currently pursing my Ph.D. in Chemical Engineering at the University of Houston

About UH

- The University of Houston was founded in 1927
- Over 300 academic programs and 37,000 students
- Cullen College of Engineering was founded in 1941
- Undergraduate programs in biomedical, chemical, civil, computer, electrical, environmental, industrial, mechanical and petroleum engineering

What is Chemical Engineering?

- The branch of engineering that deals with the application of physical science (e.g., chemistry and physics), and life sciences (e.g., biology, microbiology and biochemistry) with mathematics , to the process of converting raw materials or chemicals into more useful or valuable forms

- Largely involves the design, improvement and maintenance of processes involving chemical or biological transformations for large-scale manufacture

So What Does a Chemical Engineer Do?

Top 10 Chemical Engineering Contributions to Society

1. **Fueling the World's Economies:** The world's $64 trillion economy needs energy to keep it moving. Chemical engineers have made incredible strides in stretching our supplies of fossil fuels. From high-octane gasoline to jet fuel to motor oil, chemical engineers are powering world progress.

2. **Creating Cleaner Energy:** While reducing fossil fuels emissions, chemical engineers are also creating a new generation of clean energy technologies. From the large – the nuclear power plant that powers your home – to the small – the NiMH battery that powers your Prius, chemical engineering is critical to meeting our energy challenges.

3. **Products for Growing Populations:** Chemical engineers have purified our water supply and given us safer, slower-releasing fertilizers. And, with the greening of manufacturing, like improvements in the production of ibuprofen, chemical engineers give us a way to better cope with the headaches of everyday life, without creating headaches for the environment.

List provided by AIChE

Top 10 Chemical Engineering Contributions to Society

4. **Removing Harmful Sulfur from Fuels:** Fill up your car at a gas pump today, and you may cringe. But, the discomfort centers on your wallet and not on any risk to your health. The catalytic converter developed by chemical engineers cleaned up automotive exhaust. Unleaded gas is another chemical engineering innovation that's made life better for children and other living things.

5. **Better Living Through Chemistry:** Like the commercials say, "plastics make it possible." And chemical engineers have made plastics possible. It's easy to call plastics to mind – think bottles, bags, Tupperware. But, to recognize others – Bakelite, pantyhose, Styrofoam – you have to think outside the box. Just like chemical engineers do. That's why some plastics today are made from plants, rather than petroleum.

6. **Stretching Natural Resources:** Chemical engineers make innovative materials... from the synthetic rubber that helped the Allies win World War II...to the thermoplastics on the soles of your athletic shoes...to the Kevlar vests that protect law enforcement and our troops.

List provided by AIChE

Top 10 Chemical Engineering Contributions to Society

7. **Large Scale Production Engineering:** Even if a product was created by a scientist, there's a good chance it was perfected and made practical by a chemical engineer. Your car doesn't rust because chemical engineers figured out how to protect iron and steel. Your laundry detergent is more concentrated, cleans your clothes better, and is friendlier to the environment. And those handy disposable diapers? Thank chemical engineers.

8. **Convenient & Abundant Food:** When popping your favorite ready-to-eat meal in the microwave, don't just thank Chef Boyardee – thank chemical engineers! They're responsible for putting some of your favorite foods into their more available, convenient forms. Think creamy peanut butter, cake mixes, fat-free snacks, pudding cups and beverage bottles.

9. **Healing Diseases & Extending Life:** Chemical engineering has advanced medical science, improving the quality of life and saving millions of lives. They've brought us an abundant supply of penicillin and other wonder drugs, the portable dialysis machine, transdermal patches, new treatments and painless testing for diabetics, non-invasive surgical techniques, and even modern sunscreen...to name a few innovations.

List provided by AIChE

Top 10 Chemical Engineering Contributions to Society

10. **Powering the Personal Computer:** The tools chemical engineers use to improve computers may have long-winded names, but their advances make our gadgets all the more powerful. Divided-wall columns for processing petrochemical fractions that help computers use less energy. Germanium-based silicon chips that help your laptop perform faster. From thin-film liquid crystal displays to software that simulates complex industrial processes, chemical engineers are helping to continue the computer revolution.

List provided by AIChE

So What Do I Do?

My Ph.D. Research

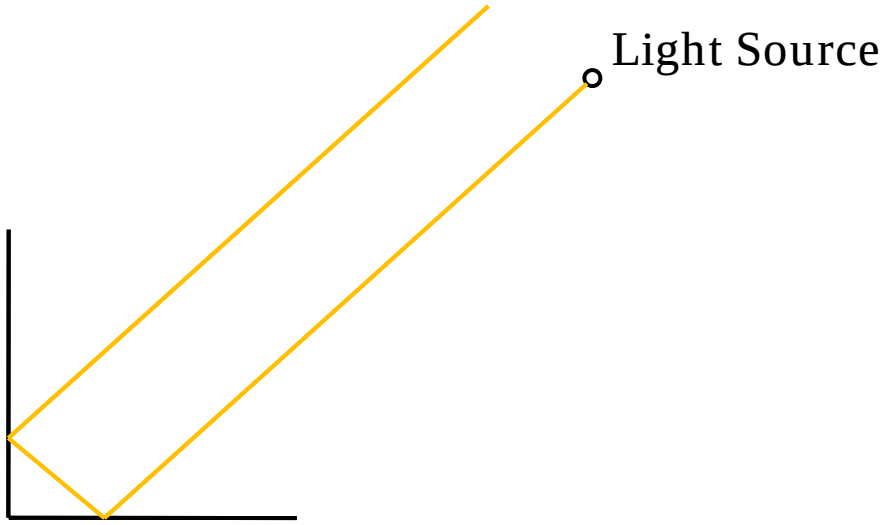
- The long-term goal of my project is to develop a rapid, ultrasensitive and novel multi-agent diagnostic platform for the detection of National Institute of Allergy and Infectious Diseases (NIAID) Category A, B and C agents

- What does that mean?...We are creating a diagnostic that can quickly detect bioterrorism agents and emerging diseases such as: *Yersinia pestis* (plague), *Francisella tularensis* (tularemia), Rift Valley Fever, *Bacillus anthracis* (anthrax), Filoviruses (ebola), Influenza and more

My Ph.D. Research

- The diagnostic platform is based on micro-retroreflectors

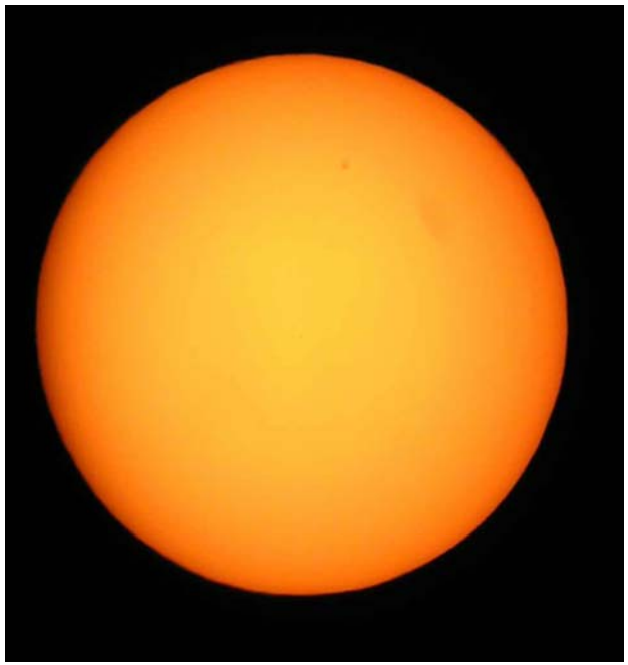
- Retroreflectors reflect light back to the source and are highly detectable



http://www.hyviz.com/hyvis/other.htm

My Ph.D. Research

- The detection principle is similar to an eclipse, where you can't see the moon until it passes in front of the sun. When there is nothing there the signal is bright, but when the target is present the light is blocked.

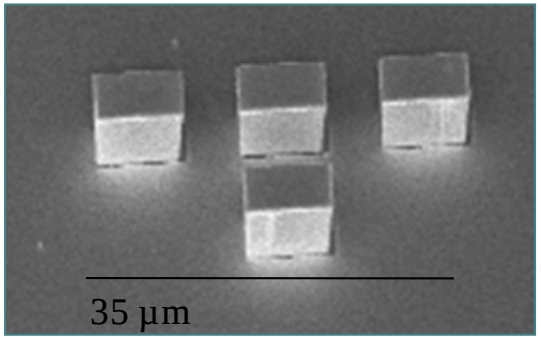


Moon passes in front of the sun

Solar eclipse April 8, 2005, by: Ken Miller (http://www.raftermranch.com/Solar%20Eclipse%20040805/solar_eclipse_april_8.htm - accessed 02-28-08)

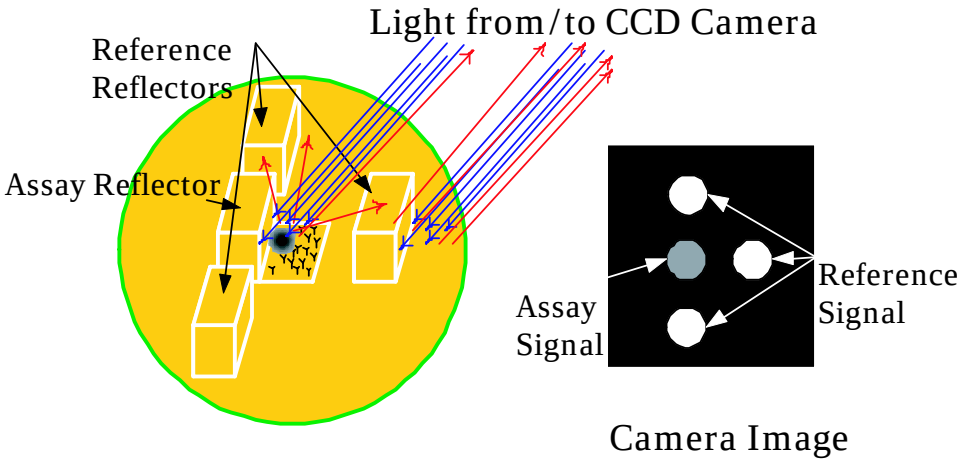
My Ph.D. Research

- The micro-retroreflectors are lithographically fabricated on silicon wafers (like computer chip features



- The structures are coated in gold so they'll be able to reflect light back to the source

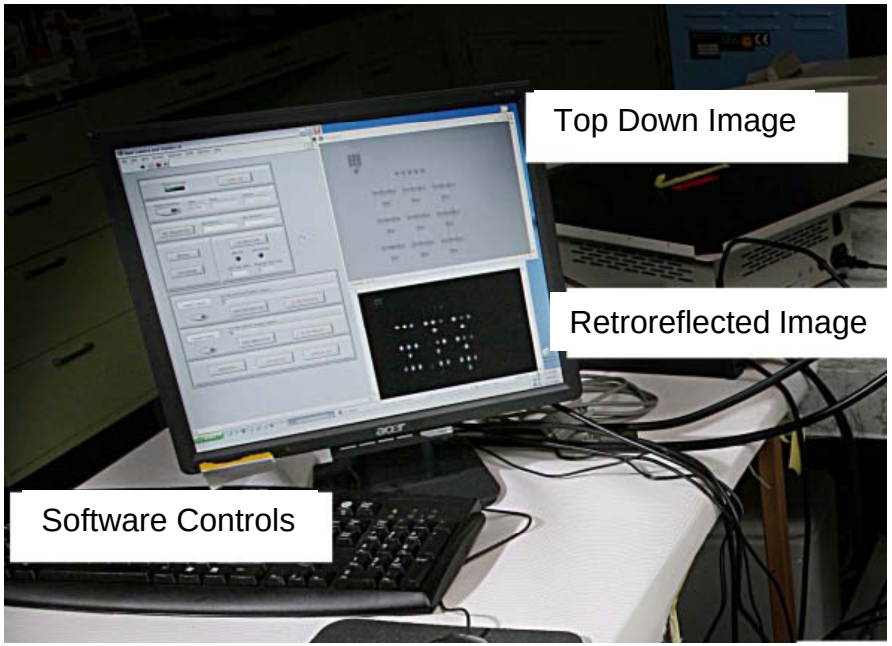
- When the target (bacteria or virus or interest) is present in the sample the light will be blocked



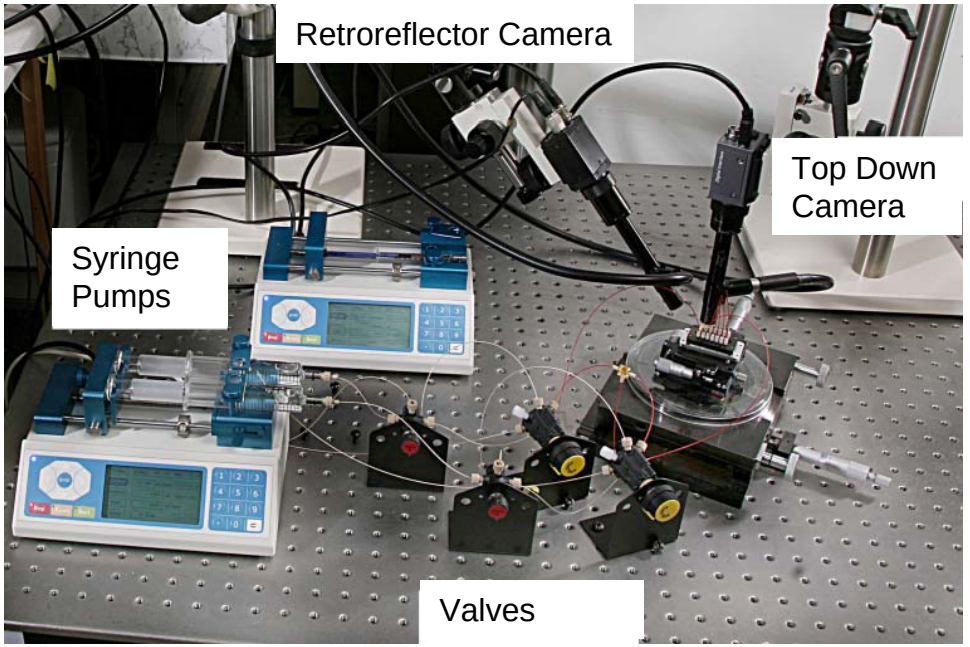
My Ph.D. Research

- Video of target capture and subsequent retroreflector darkening

  http://www.youtube.com/watch?v=IGb_Mxp1X5U



User Interface



Microfluidic Prototype