

Design Stage 1 Nanotechnology Brainstorming

Engineering 1282.02H

Spring 2020

Team Y4

C. Wallwey GTA MWF 12:40PM

Date of Submission: 2/24/2020

Brainstorming List:

Disease and Need: Tuberculosis and because it is highly contagious and if it is not detected early enough it will spread to the brain and spine causing more damage to the body. TB is a common disease found in developing countries, and it can be avoided with early detection and antibiotics. A nanotechnology device for this purpose would help solve this issue in developing nations and improve their quality of life.

Analyte: Myobacteria in Tuberculosis

Isolate Blood or whole: Isolate from blood with direct filtration

How will blood be loaded: Syringe with conical tip to inject into device

Steps needed to be taken: Analyzed using spectroscopy to use wavelength to determine the bacterium. Will need to use spectroscopy on lab-studied TB to determine correct wavelength for successful *in-vitro* detection on the chip

Same location or different chamber: Different chambers, move through gravity

Disposable (what is eco impact) or reusable (cleaning): reusable, paper membrane-capillary action to wash it.

Pros and cons of disease: Appear as gram positive and gram negative which could make detection tricky. TB is a disease in developing countries so this device would be useful there.

Disease and Need: Ovarian Cancer and because it is usually detected in its late stages and by then it has a high mortality rate. Most other cancers have an earlier detection system, such as mammograms. But, ovarian cancer is a very severe cancer that has no screening device that is simple to use.

Analyte: Proteins in Blood

Isolate Blood or whole: Whole- **Fibronectin**, Apolipoprotein A1, TIMP3

How will blood be loaded: Insert with syringe with conical tip

Steps needed to be taken: Guided mode Resonance Detection System, sensor coated with antibodies, checking the resonant wavelengths of the coated antibody surface.

Same location or different chamber: Different chamber through Gravity

Disposable or reusable: Likely reusable if washed in the same method as the TB chip, inlets would need to be cleaned and reset

Pros and cons of disease: Need for computer/ screen for optical spectrum analyzer. Need to wash and re-bond sensor after each use to reset

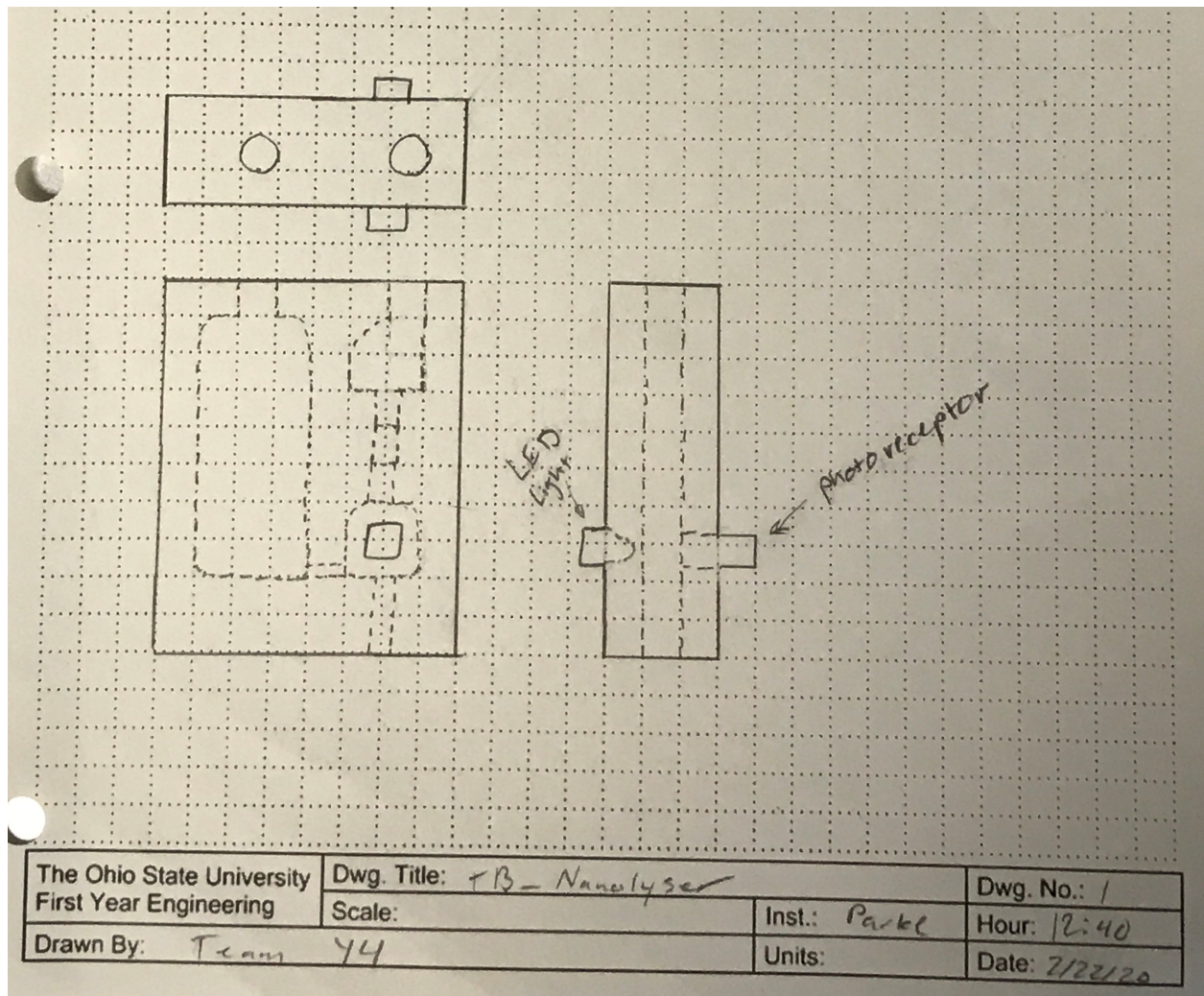
Blood Sample Processing Algorithms:

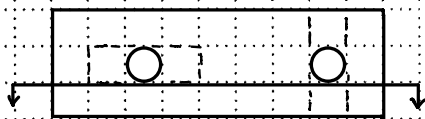
- Tuberculosis
 - a. Insert Blood sample
 - i. Use a syringe with a conical tip to inject the blood sample into the Nano device
 - b. Filtration
 - i. Screening through a semipermeable membrane or filter paper using capillary action
 - c. Small chamber with water with colloidal suspension with gold nanoparticles

- i. This would test the blood for the pathogen in question and produce a proper reaction
 - d. Observe color change, and remove
- Ovarian Cancer
 - a. Insert blood sample
 - i. Using syringe with conical tip to inject blood sample
 - b. Chamber that is lined with antibodies that bind to proteins on pathogen
 - i. Will covalently bond when protein is present
 - c. Monitor for resonance changes/peaks using an optical spectrum analyzer
 - d. Change in peaks will identify presence of ovarian cancer protein biomarker

Sketches:

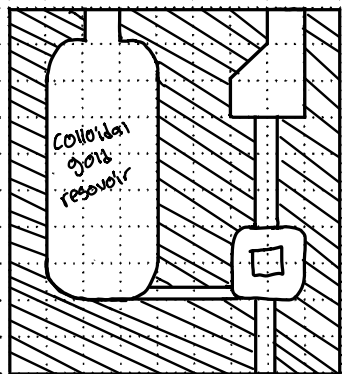
TB-





Colloidal gold
suspension inlet

Blood sample
inlet



LED,
photoreceptor
assembly

Outlet
hole

The Ohio State University
First Year Engineering

Dwg. Title: Nanolyser-TB

Scale:

Inst.:

Dwg. No.: 2

Hour: 12:40

Drawn By: Team Y4

Units:

Date: 2.25.20

Ovarian Cancer-

