

Implantable Light Source

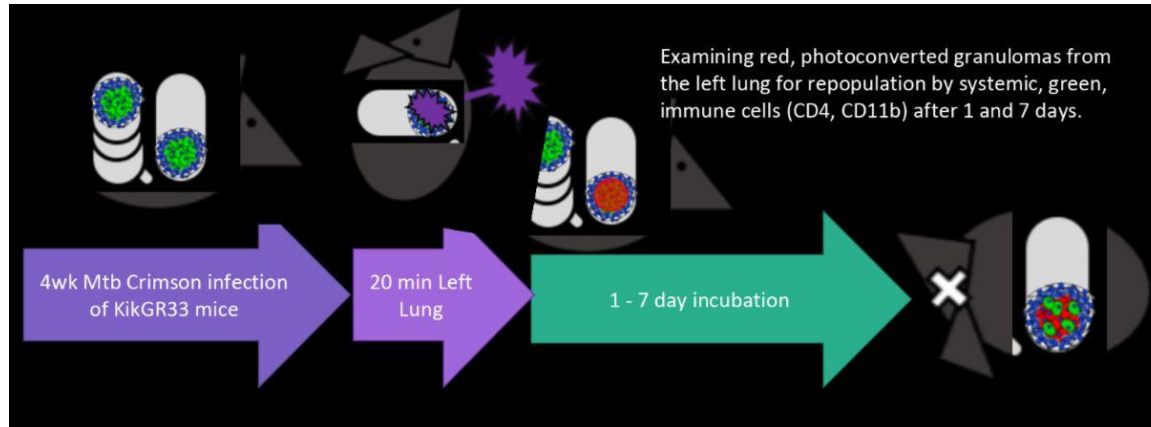
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Cassidy Geddes

Overview

- Background
- Problem Statement
- PDS
- Components
- Design: Disco Bulb
- Design: Bioluminescent Liquid
- Design: Magnetic Fan
- Design: LED Mat
- Design Matrix
- Future Work

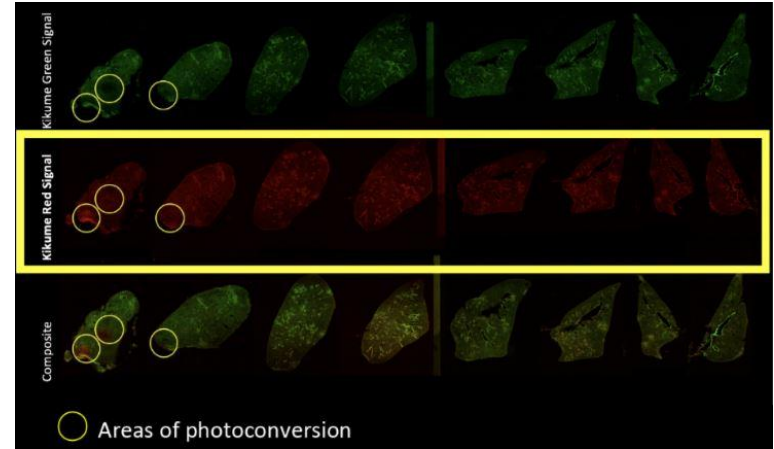
Background

- Dr. Sandor and his team are using fiber optic photoconversion to observe the behavior of immune cells when mice are infected with tuberculosis.
- Fiber optic photoconversion uses 405 nm led lights to change the color of the infected cells to red, which allows them to observe the movement of the immune cells (green) in and out of the infected areas.



Problem Statement

- Current photoconversion methods are not efficient.
 - Not all photoconversion sites can be found
 - Fiber optic light can only reach a small area of the lungs
 - The light is currently administered through a small tube, which makes it hard for the mice to move
- Needs a more efficient method that will photoconvert larger area.

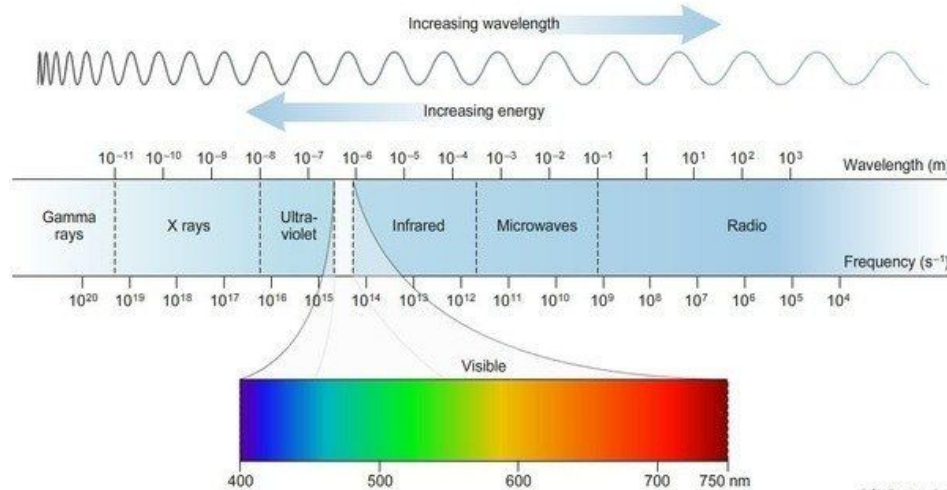


Product Design Specifications (PDS)

- Size
 - Small enough to fit in or on mouse
- Wavelength of Light Source
 - 405nm and 470nm
- Non-Harmful Light
 - No UV light
- Budget



medium.economist.com

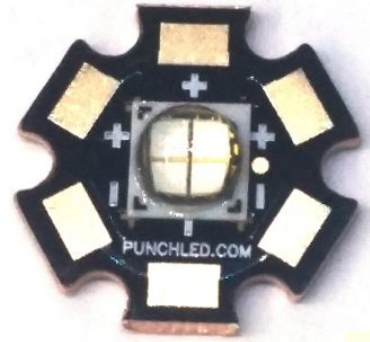


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quora.com

Components

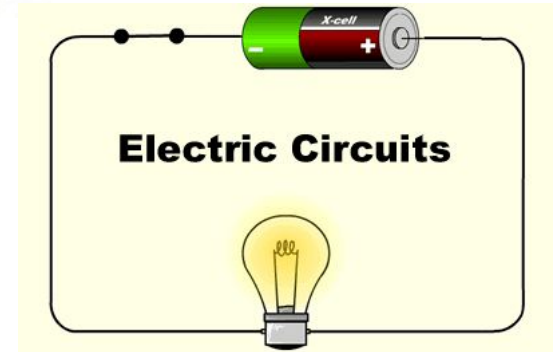
- LED's
 - LED Luxeon Royal Blue
 - Small OLED Display
- Bioinert Biomaterial
 - UHMWPE
 - Aluminum
 - Titanium
- Circuit



stevesleds.com



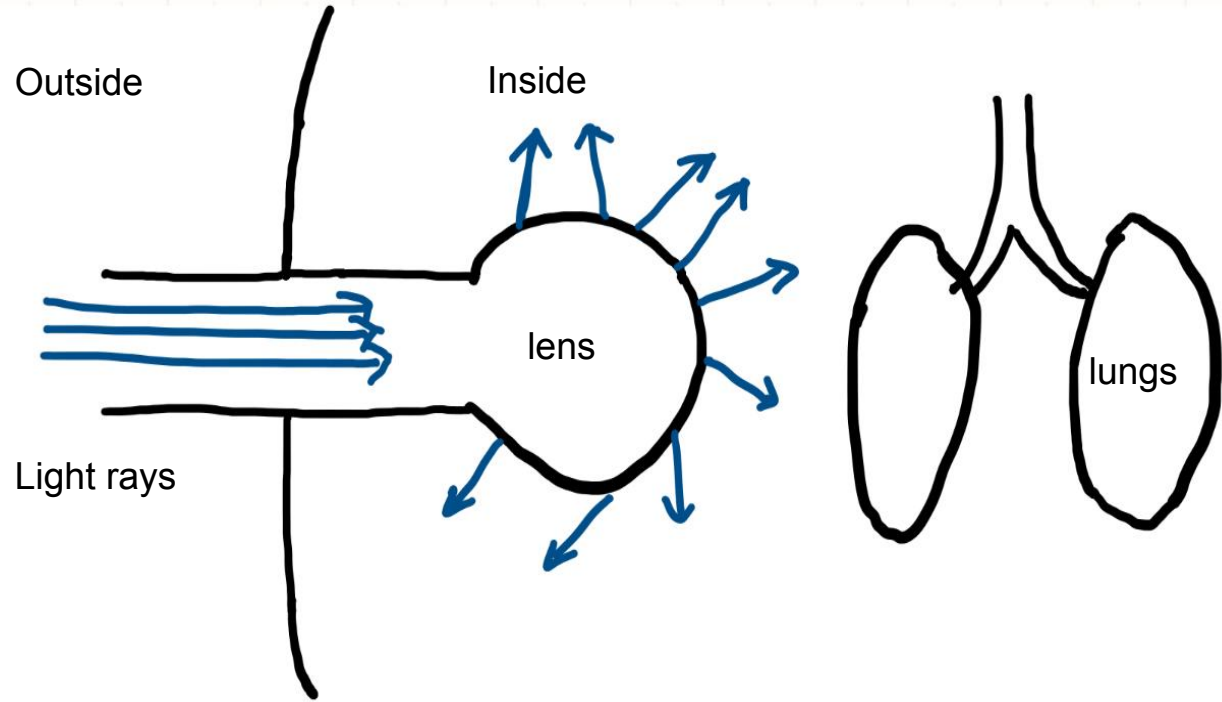
Aluminum



thinglink.com

metalsupermarkets.com

“Disco Bulb”



“Disco Bulb”

Pros

- Minimize the incision size
- Reusability
- Modifiable

Cons

- Manufacture of the lens
- Material selection
- Light intensity

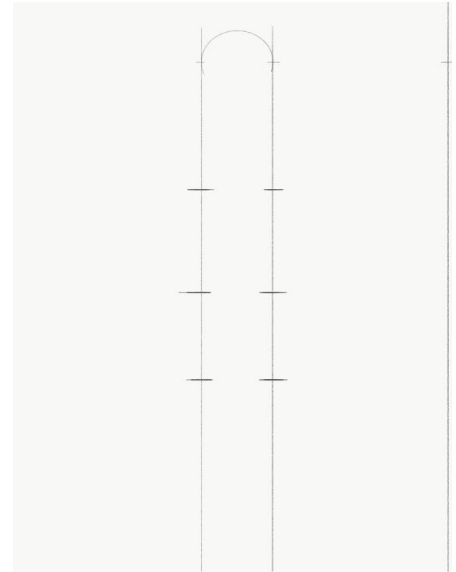
Bioluminescent Liquid

Pros

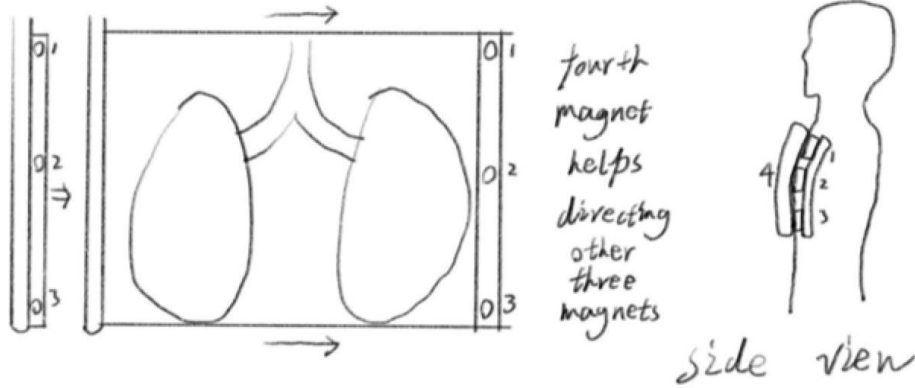
- Easy Operation
- Less damage to the mice
- More temperature control

Cons

- Proper wavelength
- Reusability
- Economic efficiency



Magnetic Fan



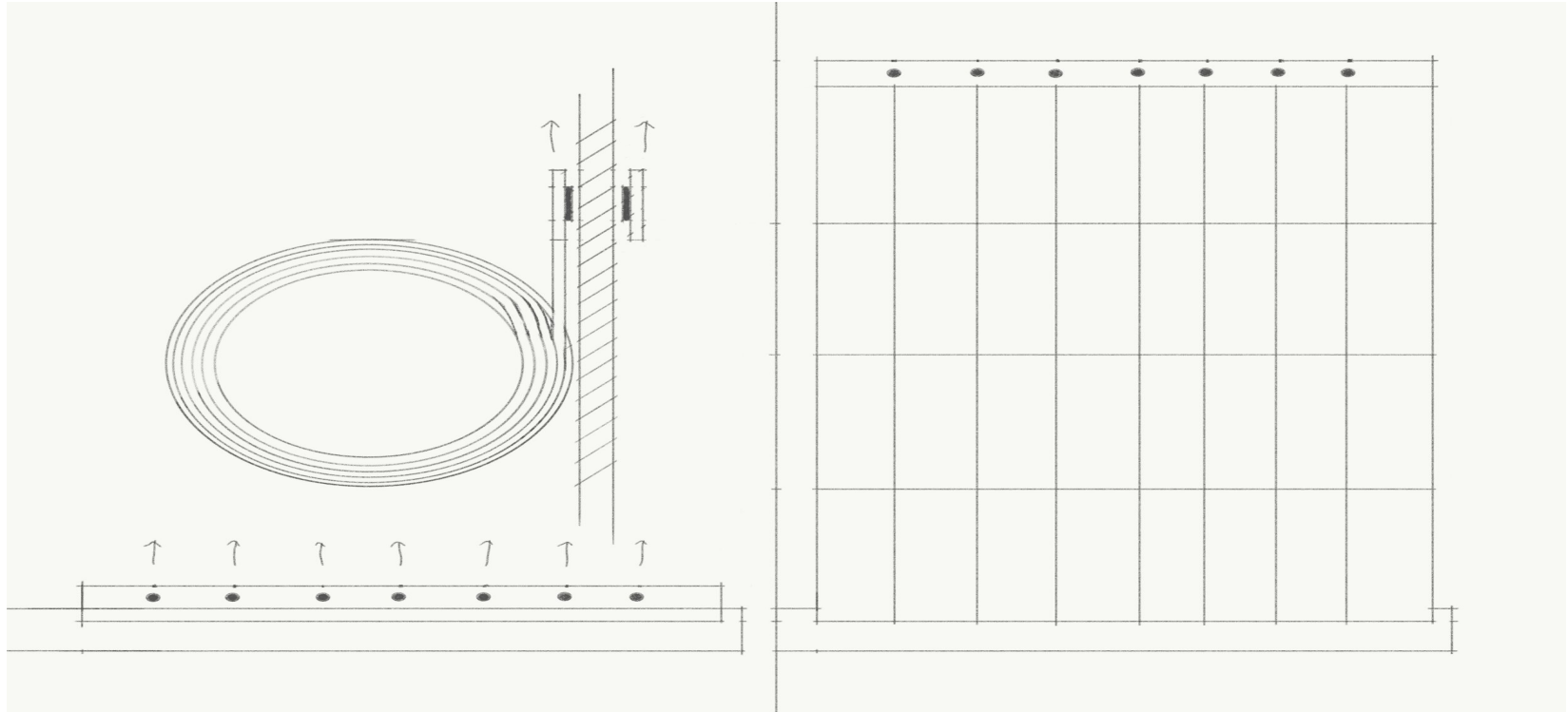
Pros

- The lights can cover a large area
- Less damage during implantation
- Easy manipulation

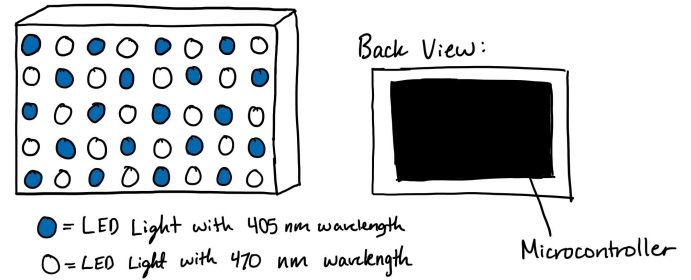
Cons

- Limited space to expand the fan
- Strength of magnetic force
- Size

Magnetic Fan



LED Mat



- Flexible, three dimensional, biocompatible mat
- LED lights will be alternated across the rows and down the columns between the two different wavelengths
- Microcontroller allows device to be automated

Pros

- Allows the client to easily switch between the desired wavelengths
- Flexible material that wraps around mice's skull or ribcage
- Can be easily manipulated to fit other projects of Professor Sandors
- Broad scope of light

Cons

- More invasive
- Size

Design Matrix

Criteria (weight)	Magnetic Fan	Disco Bulb	Bioluminescent Liquid	LED Mat
Cost (5)	4	3	5	4
Safety (20)	6	16	12	16
Size (15)	10.5	12	7.5	10.5
Efficiency (25)	20	17.5	12.5	20
Ease of Use (10)	6	7	8	8
Feasibility (10)	4	7	2	7
Materials (15)	10.5	12	9	12
Total (100)	61	74.5	56	77.5

Future Work

- Finding the correct LEDs
- Programming
- Figuring out Bluetooth/wireless
- Making lighting device small enough

Acknowledgement

Our team would like to thank Dr. Skala for her guidance and thank Dr. Sandor's Lab for providing us the opportunity to work on this project.

Sources

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<https://www.ncbi.nlm.nih.gov/pubmed/28574633> , 2017 [Oct. 3, 2018]
- Dr. Sandor and team

Questions?