Bilirubin Phototherapy Device

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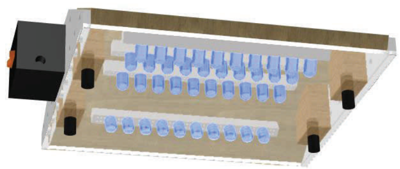

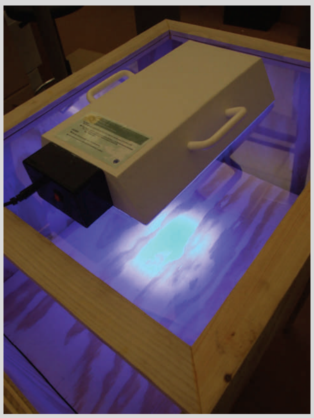

Global Health Challenge

Neonatal jaundice is the yellowing of the skin due to the accumulation of the toxic substance bilirubin in fatty tissues under the skin. Approximately 60 to 80% of newborns have neonatal jaundice. If untreated, high levels of bilirubin can lead to brain damage and even in some cases, death. The most common way to treat neonatal jaundice in developed countries is to phototherapy. By exposing skin to light with a wavelength of 430-490 nm and an irradiance of at least 30 uW/cm^2/nm, bilirubin molecules are broken up and pass through the body, thus lowering the total serum bilirubin concentration to a safe level. In developing countries, phototherapy treatment is limited by high equipment costs and maintenance. Our challenge was to develop an effective, inexpensive, and easy to maintain phototherapy device to treat neonatal jaundice at the Queen Elizabeth Hospital in Blantyre, Malawi.

Appropriate Solution

Frank Ko, Nick Ripp, Sarah Wulf for BIOE 451: Bioengineering Senior Design have developed an inexpensive bilirubin phototherapy device that uses LEDs as s light source and an innovative design to deliver the light in an effective manner, with an irradiance of over 30 uW/cm^2/nm and a wavelength of 470 nm. LEDs meet the requirements of our device because they are inexpensive, have a long lifespan, and are easy to replace if necessary. The device uses 4 rows of 10 10mm 470 nm LEDs all connected in parallel to ensure that the array stays lit even if one light goes out. The LEDs are mounted on breadboards, which makes it easy to replace a bulb if necessary. The lights are arranged on three angled panels to provide concentrated light and increases the surface area the light covers. An AC adapter outputs 4.5 VDC to the circuit, through a 1 ohm 25 W resistor that limits the current to 25 mA per LED. The device is designed to work with wall power, but can be adapted in future developments to work with battery power or solar power. Dr. Cabrera-Meza from Texas Children's Hospital and Dr. Maria Oden from Rice University served as mentors in the development of this solution.

Current Status

Through Beyond Traditional Borders, several phototherapy devices will be sent to Blantyre, Malawi for initial field testing. Future adaptations to the device such as solar or battery power may be implemented in order to assist other developing areas that would benefit from a bilirubin phototherapy device.

BEYOND TRADITIONAL BORDERS

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An initiative for the advancement of appropriate, high-value innovations in global health biotechnology

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