

DIY Optogenetics

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Materials:

- Power Amplifier
 - Depending on your desired output power, you can choose from one of the below models:
 - Mini-Circuits ZHL-5W-2G-S+ (\$995)
 - Mini-Circuits ZHL-10W-2G+ (\$1295)
 - Mini-Circuits ZHL-30W-252+ (\$2995)
 - Note: Choose the option that includes the heat sink.
 - To power the power amplifier you will require an AC to DC power adapter. Check out the voltage and current requirements of the power amplifier used, and find the adapter that can support those requirements. For example, the adapter for the power amplifier, Mini-Circuits ZHL-5W-2G-S+, can be this one from Amazon.com:
 - http://www.amazon.com/gp/product/B00LUIHZZE?psc=1&redirect=true&ref=oh_aui_detailpage_o03_s00 (about \$10)
- Signal Generator
 - An USB-controlled signal generator is recommended as a low-cost option. You can choose from one of the below models:
 - Vaunix LMS-322D signal generator, .6 – 3.2 GHz with option 003 supporting pulse modulation (\$2536.55)
 - Windfreak Technologies SynthNV (\$599)
 - You might need a USB hub:
 - Vaunix LPH-204B, 4-port high-powered USB hub (\$199)
- Cavity
 - CAD files included on website, can be fabricated at www.3dsystems.com/quickparts (about \$3000)
 - How to tune: use an USB-controlled power sensor as a low-cost option:
 - Mini-Circuits PWR-6GHS (\$695)
- Implant
 - Equipment needed:
 - Soldering Station: Metcal MFR-1100 (about \$400)
 - Iron: 745-SFP-CNL04
 - Hot Plate: Madell QK870
 - Solder Paste: Kester EP256 Lead
 - Microscope: AmScope SM-3TZ-80S
 - Circuits:
 - PCB board: Gerber files included on website
 - Diodes: Skyworks SMS7630
 - 10-pF capacitors: Johanson Technology 250R05L100GV4T

- 10-nF capacitor: Murata GRM033R71A103KA01D
- Blue LED: CREE C470DA2432
- Note: you could purchase the LEDs from distributors such as 35compounds.com
- Epoxy: GC Electronics 10-114

Assembly

- Power Amplifier
 - Attach Power Cables to the terminals on the Power Amplifier
 - Strip rubber from the AC-DC wall adapter and isolate the positive and negative wires, strip that rubber and solder your second set of power cables to these wires, make sure to check the polarity of the wires from the wall adapter
 - Attach connectors to both sets of wires
 - Either connect connectors to each other or switch depending on your preference
- Signal Generator
 - Plug in the USB plug to supply power to the signal generator
 - For Windows: Install the drivers and GUI, following instructions on the CD. Run the GUI and configure the waveform settings to 1.6 Gigahertz at the desired duty cycle.
 - For Mac: Install the drivers and LabVIEW. Program the LabVIEW blocks to generate a 1.6GHz wave at the desired duty cycle
 - Attach output of Signal Generator to Power Amplifier.
- Cavity
 - Follow the video to assemble.
 - Connect the Power Amplifier output to the input of the Cavity Assembly.
 - Follow the video to tune the cavity.
- Implant
 - A step-by-step demonstration in making the implant is included on website.