

Materials List for:

Design and Implementation of an Automated Illuminating, Culturing, and Sampling System for Microbial Optogenetic Applications

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Materials

Name	Company	Catalog Number	Comments
Extensive lab manual	GitHub	NA	An extensive, regularly updated lab manual is available in the "Optogenetic Chemostat Files" GitHub repository (https://github.com/McCleanResearch/Optogenetic-Chemostat-Files). This also includes a description of the microfluidic mold used to generate the representative results.
Fritzing Design Viewer	Fritzing	NA	The free, open-sourced software to view and edit the .fzz type circuit board designs is available at " http://fritzing.org/download/ "
Arduino Uno R3 (Atmega328 - assembled)	Adafruit	50	Microcontroller. 1 required.
Arduino Stackable Header Kit	SparkFun Electronics	10007	Female pin headers for connecting PCB to microcontroller. 1 required.
Adjustable 30W 110V soldering iron - XY-258 110V	Adafruit	180	For making electrical connections to the PCB. 1 required.
Soldering iron stand	Adafruit	150	For making electrical connections to the PCB. 1 required.
Mini Solder spool - 60/40 lead rosin-core solder 0.031" diameter - 100g	Adafruit	145	For making electrical connections to the PCB. 1 required.
0.1 μ F capacitor	SparkFun Electronics	COM-08375	Stabilizes voltage in PCB. 1 required.
10 μ F capacitor	SparkFun Electronics	COM-00523	Stabilizes voltage in PCB. 1 required.
MAX7219CNG LED Matrix/Digit Display Driver - MAX7219	Maxim	MAX7219CNG	LED driver. 1 required.
8 pin IC Socket	Mouser Electronics	575-144308	16 required. These will be stacked on top of each other to support the culture vessel above the LED matrix.
24 Pin IC socket	Mouser Electronics	535-24-3518-10	Optional. Use this to reversibly attach the MAXIM 7219CNG driver to the PCB.
Digital multimeter	Adafruit	2034	For troubleshooting electronics. 1 required.
Break Away Headers - 40-pin Male (Long Centered, PTH, 0.1")	SparkFun Electronics	PRT-12693	Male pin headers for connected LED matrix to printed circuit board. Ends can be trimmed with wire cutters. 1 set required.

Flush diagonal wire cutters	Adafruit	152	For trimming long pin headers and cutting power cables. 1 required.
Premium Female/Female Jumper Wires - 40 x 12" (300mm)	Adafruit	793	Wire ribbon for connecting breadboard to LED matrix. Can be connected end-to-end with male pin-headers to be longer. 1 required.
Half-size breadboard	Adafruit	64	The LED matrix will connect to this and the culturing vessel will rest above it.
Miniature 8x8 Blue LED Matrix	Adafruit	956	Light source. Dominant wavelength is 470nm (blue). 1 required. Alternative miniature LED matrices from the same vendor are available with dominant wavelengths: 624 nm (red), 588 nm (yellow), 525 nm (green), 572 nm (yellow-green), and white.
Stackable header-3 pin	SparkFun Electronics	13875	8 required.
Resistor Kit - 1/4W (500 total)	SparkFun Electronics	10969	For electronics. 1 required.
IRL520N MOSFET	International Rectifier	IRL520N	Voltage regulating switch for controlling DC current. 4 required.
Hook-Up Wire - Assortment (Solid Core, 22 AWG)	SparkFun Electronics	PRT 11367	Wire for electronics. 1 required.
5V 2A (2000mA) switching power supply - UL Listed	Adafruit	276	Power supply for the heating pad and Arduino. 2 required.
12 VDC 1000mA regulated switching power adapter - UL listed	Adafruit	798	For peristaltic pumps. 2 required.
Electric Heating Pad - 10cm x 5cm	Adafruit	1481	For heating the bioreactor. 1 required.
Low flow variable flow peristaltic pump	Fisher Scientific	13-876-1	For pumping media. 1 required
Medium flow variable flow peristaltic pump	Fisher Scientific	13-876-2	For pumping culture. 1 required.
9 VDC 1000mA regulated switching power adapter - UL listed	Adafruit	63	For microcontroller power supply. Order 1.
High Temp Waterproof DS18B20 Digital temperature sensor + extras	Adafruit	642	Thermometer for the bioreactor. 1 required.
Micromanager	Micromanager	NA	The free, open-sourced microscope control software is available at " https://micromanager.org/wiki/Download_Micro-Manager_Latest_Release "
FIJI	ImageJ	NA	The free, open-sourced image analysis software is available at " http://fiji.sc/ "
Arduino Integrated Development Environment	Arduino	NA	The free, open-sourced IDE is available at " https://www.arduino.cc/en/Main/Software "
Custom code	GitHub	NA	The custom microcontroller code and "Bioreactor Controller" plugin are available in the "Optogenetic Chemostat Files" GitHub repository (https://github.com/McCleanResearch/Optogenetic-Chemostat-Files).
USB Cable A to B - 6 Foot	SparkFun Electronics	CAB-00512	Used to download data to microcontroller. 1 required.

bioreactorTimecourse_example.csv	GitHub	NA	The advantage of loading LED matrix values from a CSV file is that a program can be called by the plugin to update those values based on image analysis results, and those values can be reloaded to the microcontroller, enabling feed-back control. It is available from the "Optogenetic Chemostat Files" GitHub repository (https://github.com/McCleanResearch/Optogenetic-Chemostat-Files).
Tota-frost gels (diffusion paper)	B&H	B&H # LOFSFTL MFR # T1-72	For LED matrix. 1 required.
Kitting Sheet Crosslink 1/4x12x24in	Grainger, inc	20JL37	Black foam for culturing vessel enclosure. 4 required.
Standard Photodiode Power Sensor, Si, 200 - 1100 nm, 50 mW	Thorlabs	S120VC	For measuring light intensity. 1 required.
Labelling Tape	Fisher Scientific	159015N	For labelling and securing loose components. 1 required.
Compact Power and Energy Meter Console, Digital 4" LCD	Thorlabs	PM100D	For measuring light intensity. 1 required.
100mL GL45 hybridization glass bottle	Bellco Glass, Inc.	(7910-40150)	Bioreactor vessel. 1 required.
Six port assembly	Bellco Glass, Inc.	Custom	For the bioreactor vessel. Tubing Specs: .125" OD x .055"ID. Port A: 1.0" long above cap slug and to bottom of tube. Ports B,C,E,F: 1.0" long above cap slug, 33 mm long below. Port D: 1.0" long above cap slug, 65 mm long below. 1 required. Includes 45 mm diameter polypropylene open top screw cap and a white silicone gasket to ensure a tight seal between the cap and the vessel.
Scotch Magic Tape 3105, 3/4 x 300 Inches, Pack of 3	Amazon	B0009F3P3U	Clear scotch tape. This is available from many other vendors. It is used to cover markings on the culturing vessel and to secure the coverglass with the PDMS channel to the aluminum support frame.
1/16" ID x 3/16" OD x 1/16" Wall Tygon Sanitary Silicone Tubing	United States Plastic Corp.	57288	Tubing. ~25' required.
Cole-Parmer Twistit white rubber stopper, size 10	Cole-Parmer	EW-62992-32	Media flask stopper and effluent flask stopper. 2 required.
2L Laboratory Flask	Pyrex	4980	Media flask and effluent flask. 2 required.
Day pinchcock	Fisher Scientific	5867	For pinching tubes shut. 3 required.
Replacement tubing assembly 1/16" ID	Traceable Products	3372	The peristaltic pumps come with a set of tubes, but they wear out after weeks of use.
Replacement tubing assembly 1/50" ID	Traceable Products	3371	The peristaltic pumps come with a set of tubes, but they wear out after weeks of use.
Male luer with lock ring x 1/16" hose barb, Nylon, 25/pk	Cole-Parmer	EW-45505-00	Connectors. ~10 luers are required.
Male luer with lock ring x 1/8" hose barb, Nylon, 25/pk	Cole-Parmer	EW-45505-04	Connectors. 5 required, one for each rubber stopper hole to fill with tubing.

Female luer x 1/16" hose barb adapter, Nylon, 25/pk	Cole-Parmer	EW-45502-00	Connectors. ~10 luers required.
Female luer x 3/16" hose barb adapter	Cole-Parmer	EW-45502-08	Connectors. ~10 luers required.
Cole-Parmer Luer Accessory, Female Luer Cap, Nylon, 25/Pk	Cole-Parmer	SC-45502-28	
Cole-Parmer Luer Accessory, Male Luer Lock Plug, Nylon, 25/Pk	Cole-Parmer	EW-45505-56	
Microbore PTFE Tubing, 0.022"ID x 0.042"OD, 100 ft/roll	Cole-Parmer	EW-06417-21	Tubing. 1 roll required.
Masterflex platinum-cured silicone tubing, L/S 13, 25 ft	Cole-Parmer	EW-96410-13	Tubing. ~25' required.
3/16" ID x 1/4" OD x 1/32" Wall Tygon Sanitary Silicone Tubing	United States Plastic Corp.	57293	Tubing. ~1' required.
Vacuum filter	Fisher Scientific	974107	Nalgene vacuum filter for sterile filtering media.
Aquel Oxy-Boost 200	Rena Aquatic Supply	AP200	Dual diaphragm adjustable flow air pump for aerating and mixing media. 1 required.
0.2 µm pore syringe filter	Corning International	431229	This ensures that air from the aquarium pump does not contaminate the apparatus. 1 required.
Slygard 184 Silicone Elastomer Kit	Dow Corning	Slygard 184	For microfluidic device. 1 required.
American Safety Razor GEM Scientific Single-Edge Razor Blades	Fisher Scientific	17989000	For cutting tubes and PDMS. 1 blade required.
Harris Uni-Core hole puncher 1.2mm ID	Sigma-Aldrich	WHAWB100028 ALDRICH	For punching inlet/outlet in microfluidic device. 1 required.
Microscope cover glass 22x60-1.5	Fisher Scientific	12-544-G	For microfluidic device. 1 required.
Rectangular aluminum frame with a square window	Custom	Custom	To support the microfluidic channel. Outer dimensions: 3 inches x 1.25 inches. Inner dimensions (cut out portion): 7/8 inches x 7/8 inches Thickness: ~1/32 inches