Component	Purpose	Cost	Sourcing Link
Temperature Subsystem			
FIT0845	Heater	3.66	Digikey
DFR0198	Temperature sensing	10.78	Digikey
SRSZ-05VDC-SH	Relay	4.91	Home Hardware
Heater mount (Onyx material)	Isolate heater from other components	1.45	3D printed
Resistor (1 kΩ)	Pull-up for DFR0198	*included in a kit	
Power Management			
USB-C PD/USB-A QC trigger board	Provide 5V power from power brick	1.98	Link
8-port 200W multi-charger*	Adapts wall socket power to USB-C PD or USB-A QC	21.7 (3.1 per bioreactor)	Link
USB A-C or C-C cable	Connect trigger board to multi-charger	1.82 (A-C) or 1.26 (C-C)	Link: A-C Link: C-C
USB-C PD/USB-A QC trigger board, for Arduino power module	Provide 9V power from power brick to 7 Arduino Nanos	1.98 (0.28 per bioreactor)	Link
USB C-C cable, for Arduino power module	Connect trigger board to multi-charter	1.26 (0.18 per bioreactor)	Link
Pumps Subsystem			
Peristaltic pump with tubing	Peristaltic pump with motor and tubing to pump liquid in and out of the bioreactor	$24.95	Link
Transistor (TIP142)	Transistor to allow low power PWM signal to power high power motor	$6.98	Link
Diode (1N5819) *Not s8050 as shown	Protects Arduino and transistor from	*included in a kit	Link

Component	Purpose	Cost	Sourcing Link
Temperature Subsystem			
FIT0845	Heater	3.66	Digikey
DFR0198	Temperature sensing	10.78	Digikey
SRSZ-05VDC-SH	Relay	4.91	Home Hardware
in circuit diagram below	voltage spike		
6x 18 gauge dispensing needles	Dispense liquid into bioreactor	$11.88	Amazon
6x barb - luer lock adapters	Connect tubing to dispensing needles	$2.58	Amazon
Arduino Nano	Microcontroller to produce PWM signal and run code	$8	Link
Resistor (2.2 kΩ)	Limits current from Arduino to transistor	*included in above kit	
Power Supply (5V)	Powers pump motor separately from Arduino		
Data + Controls			
USB Hub	Connect multiple Arduinos to a single port on laptop to read and write data from and to th5 em	$1 5.5	Link
Additional Circuitry Components			
Protoboard (70x90mm)	Substrate for circuitry	C$2.05	Amazon
2-pin female header	Jumper connection	C$0.32	Amazon
3-pin female header	Jumper connection	C$0.35	Amazon
2x 8-pin female header	Jumper connection	C$0.90	Amazon
3.5mm 2-position	Heater connection	C$1.70	Amazon

Component	Purpose	Cost	Sourcing Link
Temperature Subsystem			
FIT0845	Heater	3.66	Digikey
DFR0198	Temperature sensing	10.78	Digikey
SRSZ-05VDC-SH	Relay	4.91	Home Hardware
screw terminal			
Prerequisite Components			
3D printer			
Gorilla Glue			
Soldering iron			
Solder			
Wire cutter			
Arduino IDE			
Python	Software development for the dashboard	C$0.0	Link