Cell Lysis

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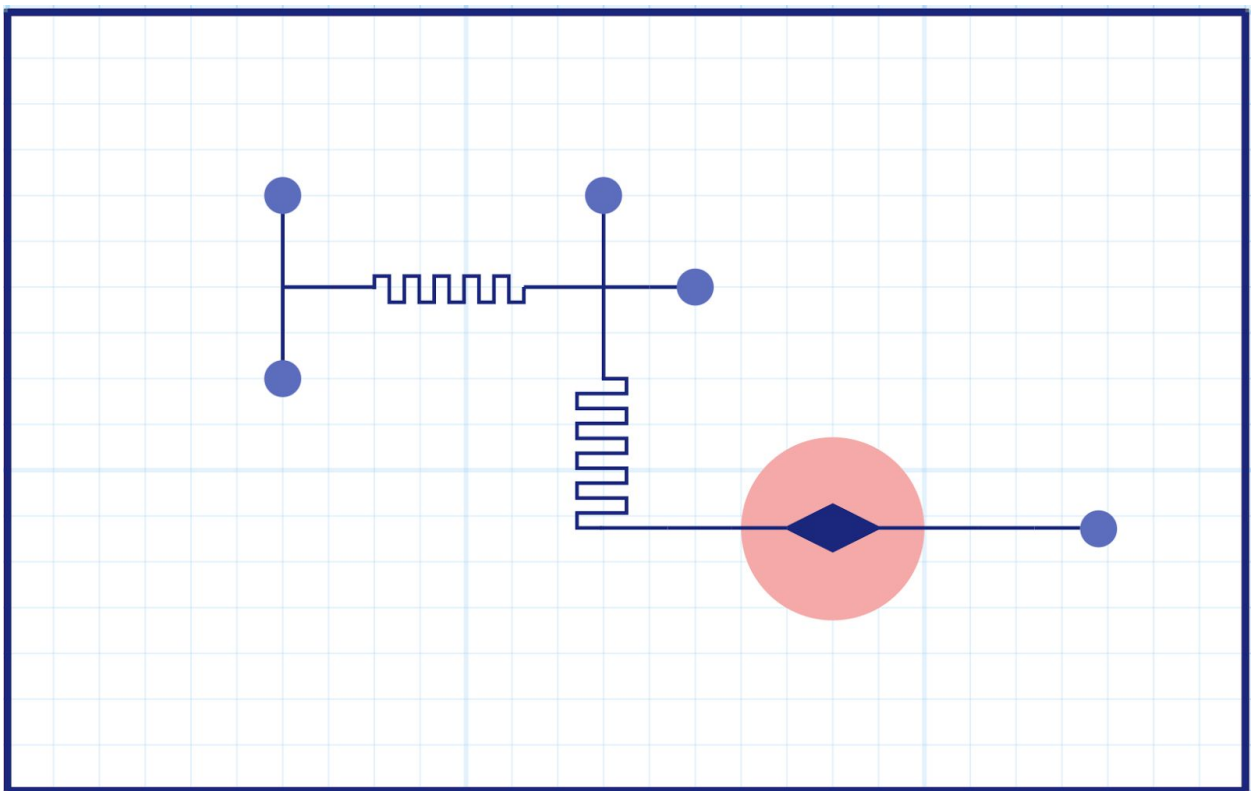
Overview

Transformation

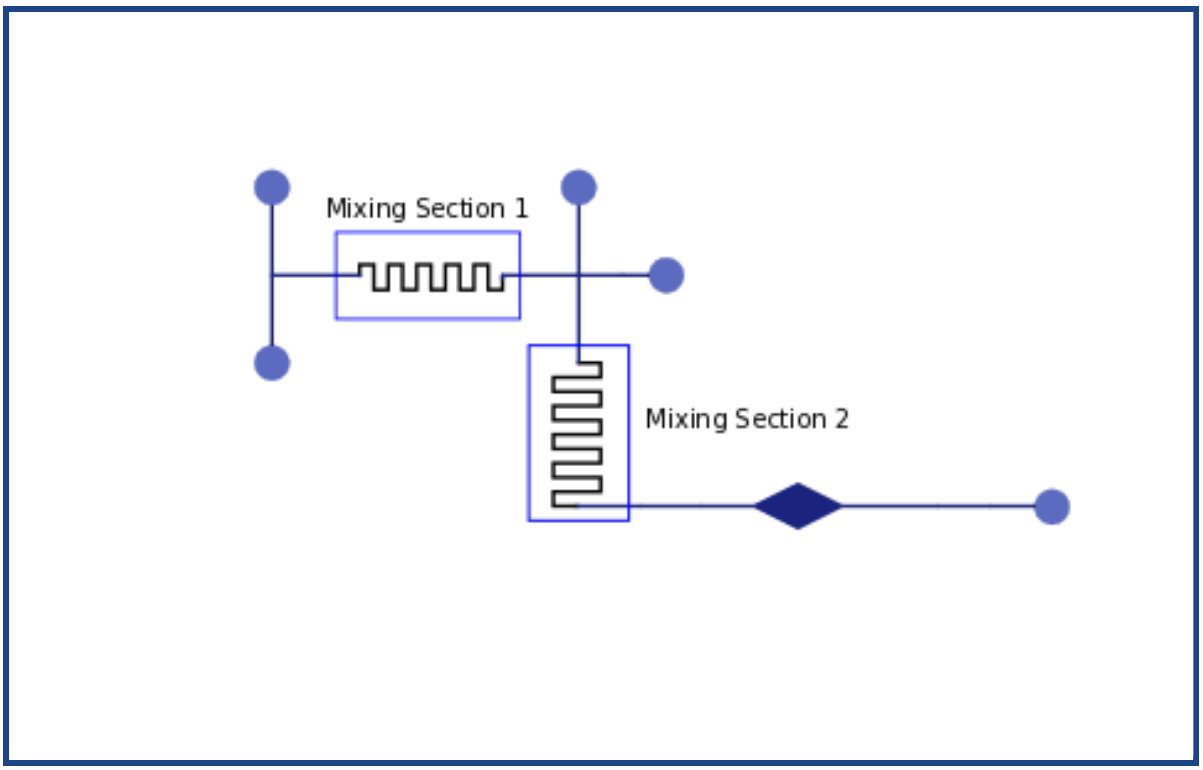
Designed by Dylan Samperi
Date Completed: 10/5/2017

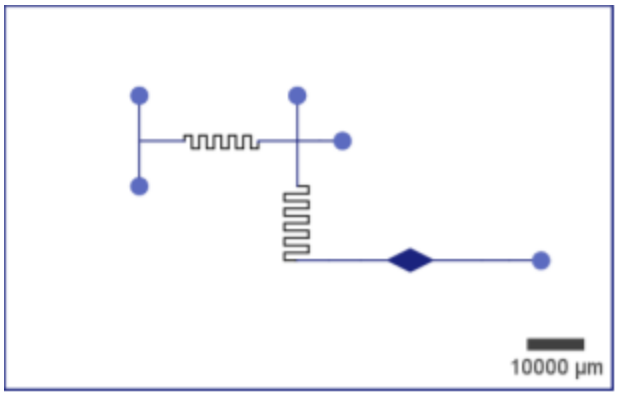


Cell lysis is a commonly used protocol in synthetic biology. It can be performed through a variety of different methods, however we had focused on chemical cellular lysis. Cell Lysis is used to extract and isolate DNA from a specific type of cell. This is an extremely important step in building genetic circuits in order to utilize specific coding regions in a cell's DNA. Chemical cell lysis involves introducing cells to a series of buffers in order to degrade the cell's outer membrane and collect the DNA that is released.

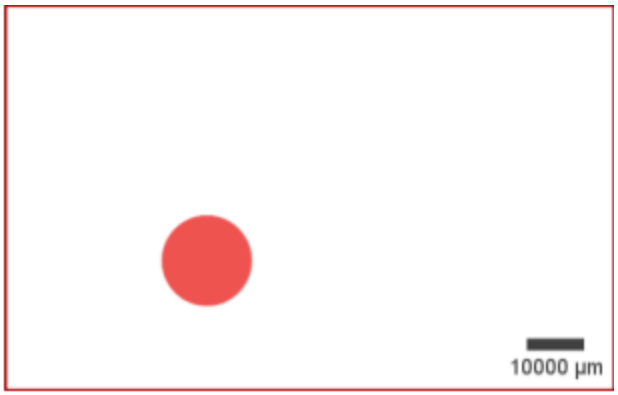
This microfluidic chip is designed to perform chemical cell lysis. Suspended cells and an lysing buffer would be mixed inside the cell. This mixture of buffer and cells would be then mixed with a neutralization buffer to prevent DNA degradation. The mixture would then move to the diamond chamber where the DNA binds magnetic particles. Lastly, an elution buffer would be input and to clean and release the DNA from the magnetic particles.

Chip Design



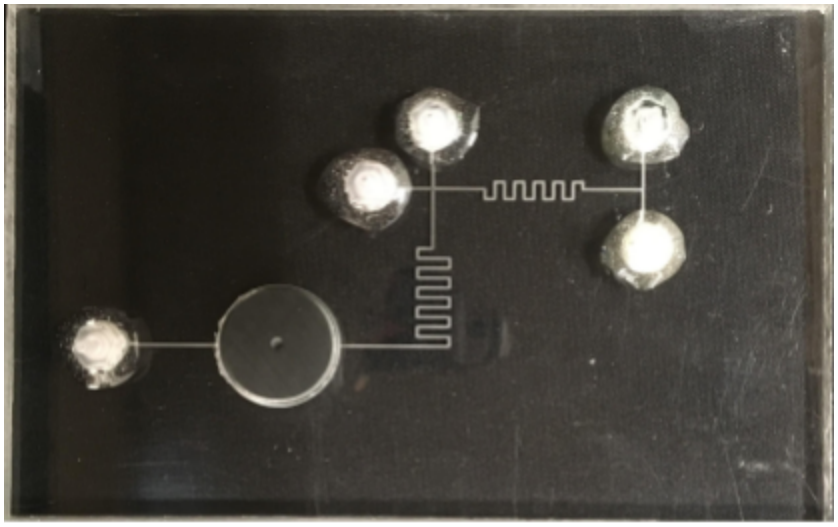


Flow Layer



Control Layer

Milling Guidelines



Flow Layer

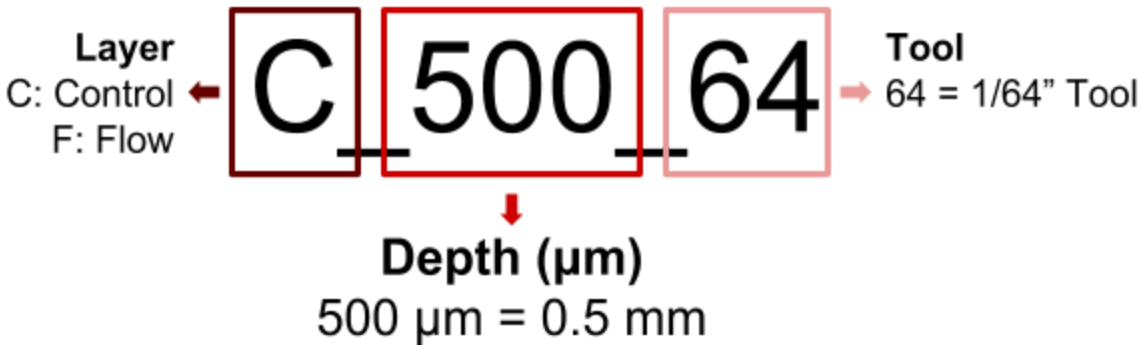
Milling Guidelines

For a comprehensive guide to milling click here. For a list of tool parameters click here.

Notes

1. This chip should be milled on thick polycarbonate (5.00mm < $Z_{Polycarbonate}$).
2. This chip requires thin PDMS (0.24mm < Z_{PDMS} < 0.26mm)

All the required SVGs for milling this chip are provided in the ZIP file. The layer, depth, and tool required for each SVG is listed in the file name. Below is a key describing how to read an SVG file name:



Milling Instructions

Mill the layers in the order they are listed with the correct depths and using the correct tools.

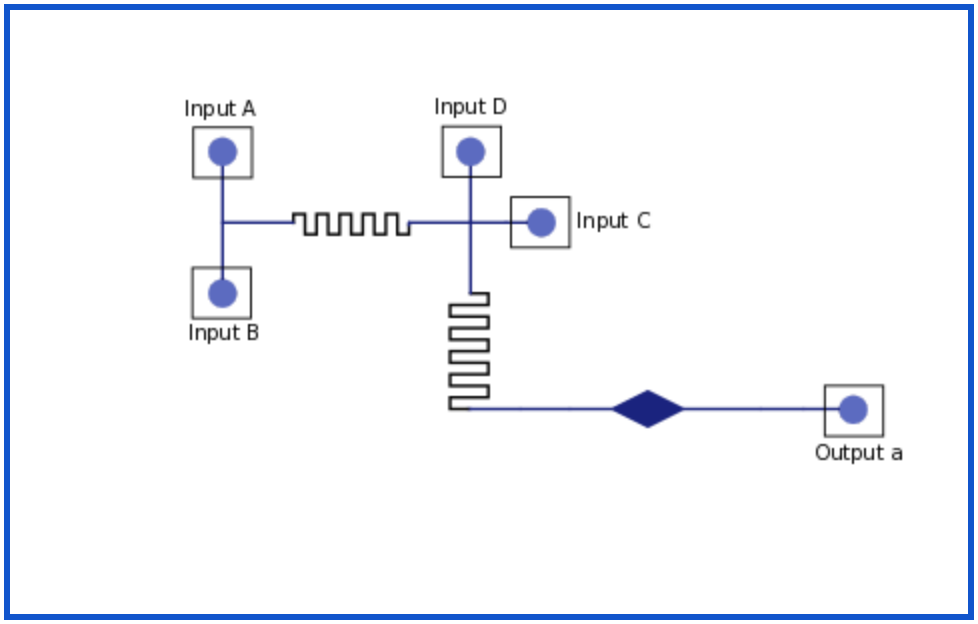
Flow Layer

Order	Layer Name
1.	F_400_64
2.	F_1400_32
3.	F_PORTS_8
4.	Border

Control Layer

Order	Layer Name
1.	C_200_100
2.	Border

Testing Protocol



Flow Layer Setup

Inputs		
Name	**Liquid**	**Flow Rate**
A	Lysing Buffer *Represented by* yellow *colored water*	3.0 mL/hour
B	Suspended Cells *Represented by blue colored water*	3.0 mL/hour
C	Neutralization Buffer *Represented by purple colored water*	6.0 mL/hour
D	Elution Buffer *Represented by* black *colored water*	3.0 mL/hour

Outputs	
Name	**Liquid**
a	Excess Buffer/Cells and DNA

Testing the Chip

Setup

1. Prepare 4 syringes
    a. 1 filled with yellow colored water
    b. 1 filled with blue colored water
    c. 1 filled with purple colored water
    d. 1 filled with black colored water
2. Attach your syringe containing yellow colored water to Input A
3. Attach your syringe containing blue colored water to Input B
4. Attach your syringe containing purple colored water to Input C
5. Attach your syringe containing black colored water to Input D
6. Attach your waste output tubing to Outputs a; this liquid will be excess fluid or fluid containing DNA

Running the chip

7. Begin by flowing both yellow and blue colored water into your chip at a flow rate of 3.0mL/hour
8. Once the yellow and blue colored water is mixed in mixing section one flow purple colored water into your chip at a flow rate of 6.0mL/hour
9. Allow colored water mixture to flow through mixing section 2 and pass over diamond reaction chamber until all suspended cells have been input
10. Replace output tubing with fresh section of tube
11. Flow black colored water at a flow rate of 3.0mL/hour
12. Collect dispensed fluid in your designated receptacle

Cleaning the Chip

13. Disconnect your output tubing carefully and dispose of all liquid waste in the correct receptacle
14. Disconnect all other syringes
15. Clean the chip following the water and oil cleaning protocol listed here
16. Store your chip as detailed in the cleaning protocol