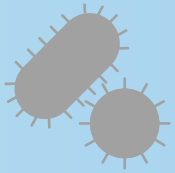
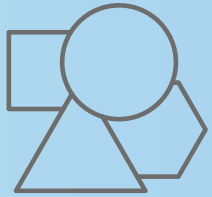
WHAT ARE THE NEXT STEPS?



Cell Types

Collect data for a **wider range of cell types** applicable to cell therapies.



Design Changes

Incorporate **multiple channels** with **distinct geometries**. Enables more effective data collection.

Novel Syringe System

Aid the development of a patented syringe design aimed to greatly **increase cell therapy efficacy**.

TLDR *(Want a summary?)*

We are making injections safer for cells!

Low cell survival during injection causes therapies to fail. We have developed a microfluidic device to test exactly how much shear rate cells can handle.

This helps us find safer limits, leading to more effective and efficient injection systems. This will get more healthy cells where they need to go.

ACKNOWLEDGEMENTS

We would like to thank our supervisor Professor James Moore Jr., as well as Daniel Watson and Raphael Delattre for their guidance and support during our project.

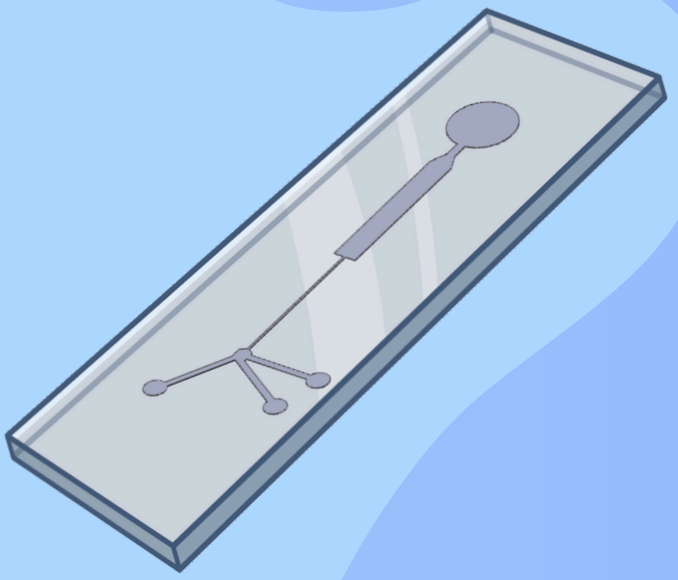
WANT TO LEARN MORE?

You can find more information, CAD files and our final report by simply scanning the QR Code!

Contact Us

Department of Bioengineering
Imperial College London
South Kensington Campus
London SW7 2AZ, United Kingdom
Email: james.moore.jr@imperial.ac.uk

IMPERIAL INSTRUMENTS



SMALL CHANNELS

BIG IMPACT

Designing a microfluidic device to effectively evaluate cell viability under shear rates

IMPERIAL

WHAT'S THE PROBLEM?

Cell therapies are a **revolutionary** way to deliver life saving treatment.

Then why does it have low success rates?

95% of cells end up <u>dead</u> after travelling through the needle.

This is largely due to **high shear rates** - fast fluid layers sliding past each other, which can damage cells.

OVERALL AIM

Determine the critical shear rate of a given cell type

<u>How did we approach this?</u>

- Simulate flow using Matlab
- Design and fabricate microfluidic device
- Assess cell viability
- Quantify results to identify critical shear rate

WHY MICROFLUIDIC DEVICES?

LESS CELL MATERIAL

FINER CONTROL

COST EFFECTIVE

Microfluidic devices allow precise flow control and are able to replicate injection conditions, while using a minimal number of cells.

WHAT HAVE WE ACHIEVED?

Controlled Shear Delivered

Our simulations **accurately guided device design**, exposing cells to **precise** shear rates.

Cells exposed to a relevant shear rate showed **87.3% reduced** viability compared to controls

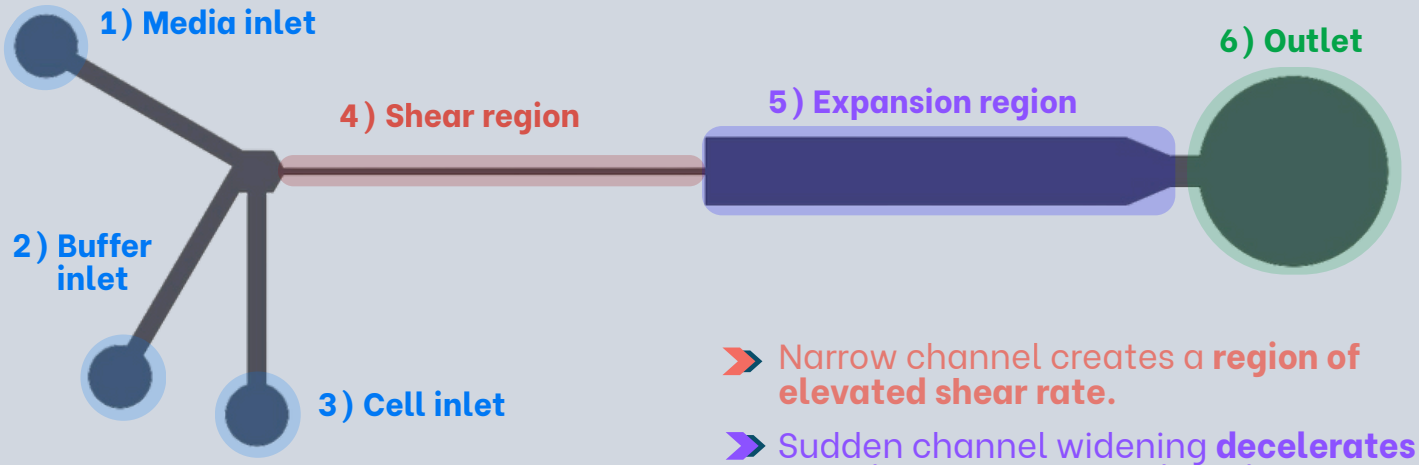
Cell Viability Impact

Validated Research Platform

Created a microfluidic device for **future shear rate research** on different cells types

FINAL DEVICE DESIGN

After many iterations based on **experimental results**, the design converged onto several essential features:



- Advanced flow control enables precise regulation of inlet flow rate, ensuring **efficient use of resources.**
- Narrow channel creates a **region of elevated shear rate.**
- Sudden channel widening **decelerates and disperses cells for imaging.**
- Allows for **excess** fluids and cell material to exit.