



# SURE 2017

SUMMER UNDERGRADUATE  
RESEARCH in ENGINEERING

GENERAL INFORMATION SESSION

JAN . 11

PRESENTED BY

CHRISTIN BLOHM-PAPE, STUDENT ADVISOR  
BRECHTJE DE BRUIN, STUDENT ADVISOR

# AGENDA

- Overview of the SURE experience
- Student testimonial
- Application form
- Processing, procedures and selection
- Questions



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# SURE 2017

- The **S**ummer **U**ndergraduate **R**esearch in **E**ngineering Program is made possible by the Faculty's generous donors in support of undergraduate student research.
- Approximately 125 students are accepted to this competitive 16-week program each summer.



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# STUDENT TESTIMONIALS



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A large, crowded exhibition hall with many people looking at posters and displays. The scene is filled with students and faculty members engaged in discussions and presentations. The background shows rows of posters and people moving through the aisles.

**Student Name: SARAH DUBOIS**  
**Department: Chemical Engineering**



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# Microfabrication of a Device for Measurement of Tissue Contractile Forces in High Throughput Screening (HTS)

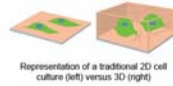
S. Dubois, L. Zhao, C. Moraes

## Introduction

The cost of drug screening has grown exponentially, as only small percentages of potential hits lead to clinically effective products. Emphasis in **High Throughput Screening (HTS)** has shifted from increases in capacity to improvements in quality.

This suggests a need for **more realistic (3-dimensional) HTS-compatible microenvironment** to improve the screening process.

2D vs 3D Cell Cultures	
Flat morphology Monolayer Rigid Surface	Structurally complex Physiologically realistic Diffusion limited



## Objective

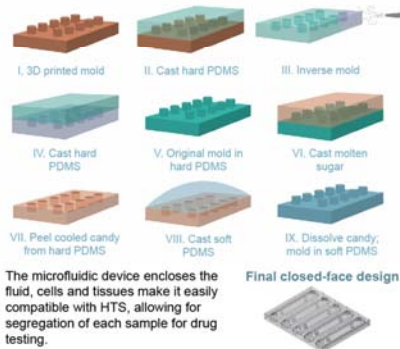
**Fabricate** a 3-dimensional tissue arrays with interact in **mechanically and physiologically realistic culture systems**.

**Characterize** microtissue mechanics through mechanical analysis.

**Evaluate** the **relevance** of microenvironmental parameters on the design of drug discovery.

## Methodology

Super-soft lithography will be used to fabricate the device from soft **polydimethylsiloxane (PDMS)**. The device is a close-faced device to reduce microtissue failure, or slipping from the pillars.

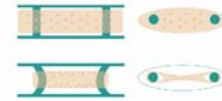


The microfluidic device encloses the fluid, cells and tissues make it easily compatible with HTS, allowing for segregation of each sample for drug testing.

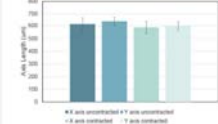
Final closed-face design

## Results

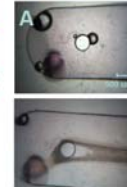
### Hypothesized Contraction of Gel



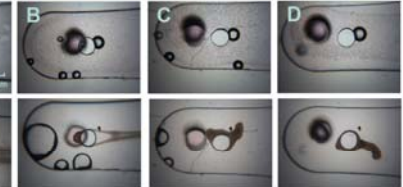
### Analysis of Deformation of Pillar Axis



### Successful Microtissue



### Microtissue Failure



Through image analysis of the contracted and there uncontracted states (A,B,C,D) it was shown that **no significant pillar deformation occurred**.

**Microtissue formation occurred successful and as predicted (A,B)** within 48 of gelation. **Microtissue failure** also occurred (C,D). The rate of failure suggests a need for a more flexible pillar design.

## Conclusion

**Supersoft lithography** was successfully incorporated in the microfabrication of the device. The data collected shows **no significant deformation** of the pillars, nor was any significant deformation of the pillar measured. This suggests a need for a **change in design** to more flexible pillars, however proof of concept was shown through the microtissue formation.

## References

- [1] Legend W, et al. *Proc. Natl Acad Sci* (2009)
- [2] Moraes C, et al. *Lab on a Chip* (2015)
- [3] Adams & Bostan. *Health Econ* (2010)
- [4] Zhao, et al. *Adv Mater* (2013)
- [5] Moraes C, et al. *Ann. Biomed. Eng* (2012)

## Future Work

### Pillar Dimensions

- Increased length or decreased diameter will allow for greater deflection
- Increase distance of injection site to reduce interaction

### Mechanical Stretching

- Mount on a cyclic stretching platform
- Characterize the general rigidity of tissue as well as contractile force

### Comparative testing

- Test against traditional 2D culture
- Evaluate relevance of microenvironment

## Acknowledgements

Moraes Lab Group

Thank you to Selina Liu for 3D printing.



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# PROJECTS/ABSTRACTS

<http://www.mcgill.ca/engineering/current-students/undergraduate/research>



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# Am I eligible to apply?

- Full-time students (including international)
- at least Year 1
- CGPA of 3.0 or higher
- Available for 16-week period between May-August

**Eligibility:** see General Information and FAQ at  
<http://www.mcgill.ca/engineering/current-students/undergraduate/research>



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# How do I apply?

- Abstracts & Online Student Application are available at:  
<http://www.mcgill.ca/engineering/current-students/undergraduate/research>
- Contact Professor (email/ office hours) to discuss.
- After discussion with supervising professor, complete Online Application form, print and submit with Transcript of Record to your selected supervisor.
- **Definite match:** Should a professor and a student come to an agreement that they wish to work only with each other, then the student should be encouraged to apply only for one project and the professor to rank only one student.



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# IMPORTANT NOTES

- Maximum of **3 applications** per student
- Deadline to apply: **Friday, January 27, 2017**  
(Deadline to submit copy of online application & transcript to professor)
- Awards announced after February 20, 2017.
- **Only those selected will be contacted.**
- Second round matches throughout March



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# ONLINE APPLICATION FORM

**Application form available (under “Application”)**

**at: <http://www.mcgill.ca/engineering/current-students/undergraduate/research>**



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**URL:** <https://surveys.mcgill.ca/limesurvey/index.php?sid=19171&lang=en>



### SURE 2017 Student Application Form

**SURE 2017 - Summer Undergraduate Research in Engineering**

(For application to SURE and NSERC-USRA opportunities)

**Application Form:**

**1** application form **per project**

**Maximum 3** applications **per student**

After clicking Submit, **PRINT** a copy, **sign**, attach **Official Transcript** and **submit to your intended SURE supervisor(s)**.

#### Basic Information

Family Name

Given Name



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# NEW in 2017

- **NEW!** SURE program will now be recorded on students' transcripts.
- Specific courses (FACC 351-354 – SURE Experience) will be added to offer students an official record of their participation in the SURE program.
- Courses cannot be added retroactively for SURE participations in previous years.



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# SURE EVENTS

1. Orientation – May 4<sup>th</sup>
2. Engineering at Work Seminar – June 1<sup>st</sup>
3. Poster Design Workshop - July 6<sup>th</sup>
4. Poster Presentation Fair - August 10<sup>th</sup>



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# VACATION

- All SURE participants are expected to attend all SURE events.
- For those that cannot attend an event due to extenuating circumstances, please notify us at [sure-info.engineering@mcgill.ca](mailto:sure-info.engineering@mcgill.ca) in advance, include the reason and cc your supervisor.
- Any vacation requests have to be discussed with the supervisor in order to make arrangements.



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# Graduate Studies at McGill

- SURE as experience to later pursue a research Masters, Ph.D.
  - McGill Engineering Undergraduate Student Masters Award (MEUSMA)
    - Valued at \$17,500+ for two years of research Masters study at McGill in the Faculty of Engineering
    - To qualify: CGPA 3.5+, participation in SURE or other qualifying undergraduate research experiences
- More information: [graduatestudies.engineering@mcgill.ca](mailto:graduatestudies.engineering@mcgill.ca)



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# International SURE 2017

- **International SURE Travel Stipend**, funded in part by a generous donation by the Antje Graupe Pryor Foundation (for research in Europe)
- Schull Yang International Experience Awards (for research outside of Canada)
- Limited number of stipends are available to students who are accepted to an international research project at another university.
- Application form available March 1<sup>st</sup> - March 31<sup>st</sup>:  
<http://www.mcgill.ca/engineering/current-students/undergraduate/research/sure-international>



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# QUESTIONS?

Email: [SURE-Info.Engineering@mcgill.ca](mailto:SURE-Info.Engineering@mcgill.ca)

In Person: Engineering Student Centre, FDA 22



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