

Welcome to Biomedical Engineering!



**BIOMEDICAL
ENGINEERING**

**Dr. Stephanie Willerth
Director of the Biomedical Engineering
Undergraduate Program**

Email: willerth@uvic.ca

University of Victoria

Wednesday August 26th, 2020



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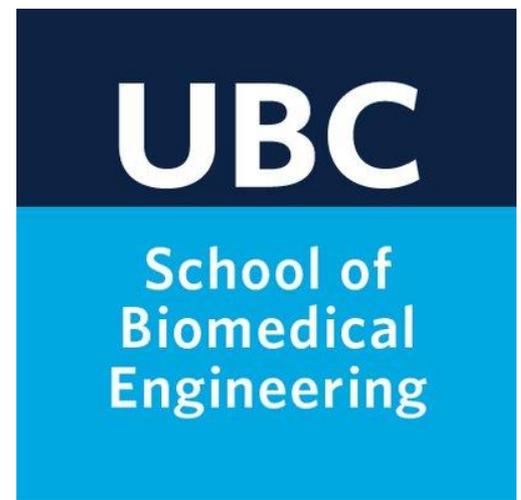
CONGRATULATIONS!

**Yes – I know COVID-19
made everything weird.**



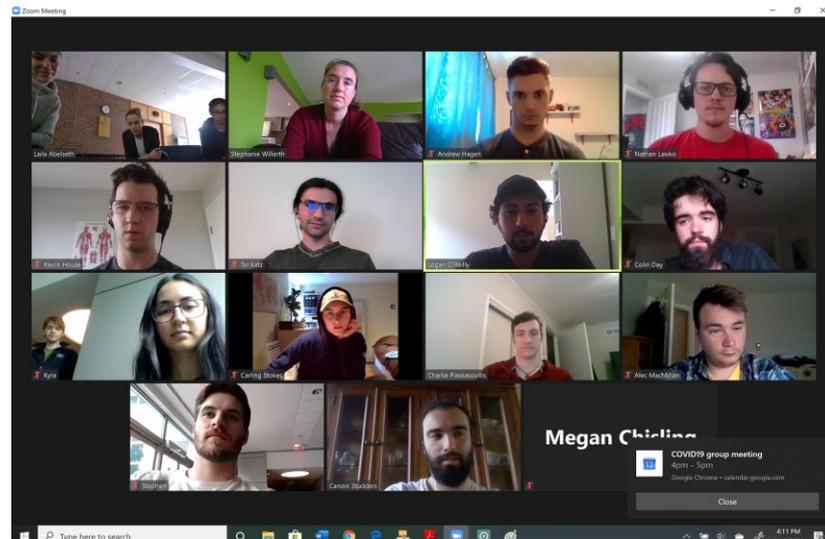
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Dr. Stephanie Willerth (@DrWillerth)



The University of Victoria's Biomedical Engineering Response to COVID19

- We have 14 co-ops and a project manager working on projects related to COVID19 for summer
 - Logan O'Reilly
 - Alec MacMillan
 - Carson Studders
 - Kyra Teetzen
 - Colin Day
 - Megan Chisling
 - Asses Kaur
 - Kim Arklie
 - Nathan Lawko
 - Charlie Plaskasovitis
 - Carling Stokes
 - Kevin House
 - Andrew Hagen
 - Tal Katz

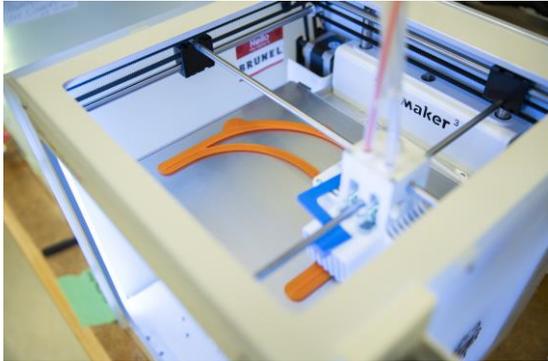


My amazing team

- Laila Abelseth – usually runs UVic’s Centre for Biomedical Research and is now my point person for this project
- James Tyrwhitt-Drake – UVic alum with expertise in 3D printing
- Dmitri Karaman – works in my lab and is TA ing my 3D printing course
- Stephen Bradley – Project Manager for our COVID19 response
- Ian Fraser – UVic Mechanical Engineering Lab Assistant



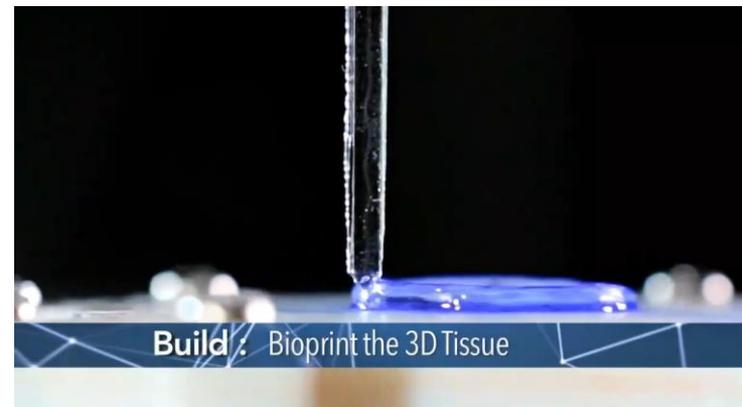
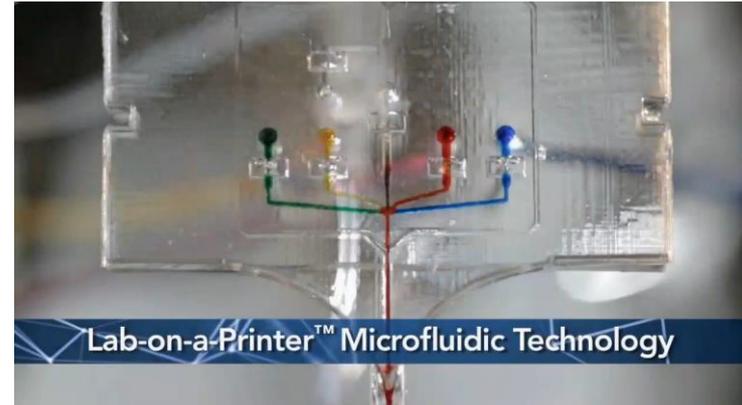
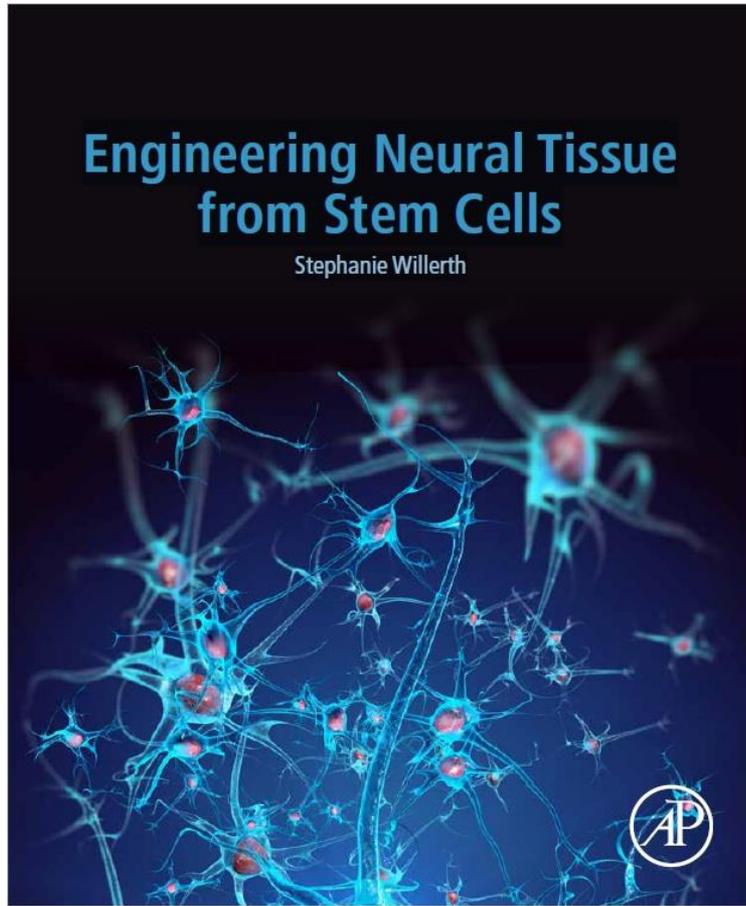
3D printing face shields for use at Island Health



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The Willerth Lab: 3D printing neural tissues using a novel bioprinting system



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BME Vision Statement

- Our program prepares graduates for work with the biomedical community and industry, with healthcare professionals, medical doctors, bio-scientists, and engineers.
- The program will train biomedical engineers in the application of biological and medical science discoveries to the design, development and application of practical technologies needed for human healthcare, medicine and society.



Info from: uvic.ca/annualreview



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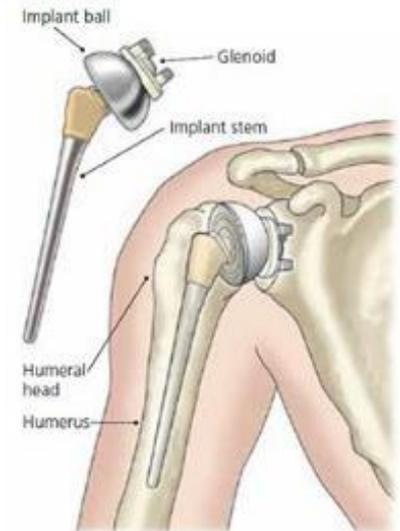
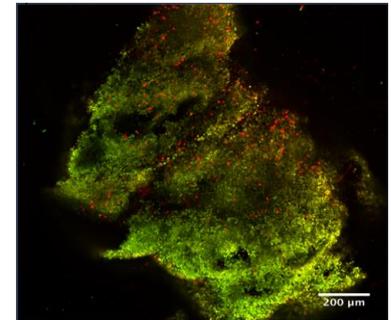
Our Undergraduate Program in Biomedical Engineering

- Four mandatory co-operative work terms, providing students with valuable in-the-field work experience prior to graduation. Co-op allows students to develop practical skills, and networks our students into the biomedical community.
- Our program exposes students to various areas of specialization
 - biomedical devices, biomaterials and tissue engineering, bioinstrumentation and sensors, and medical imaging through course work, technical projects, co-op work-terms, honors theses, and student design groups.
- Graduates of our program will have the engineering tools and ingenuity for developing novel and effective technology in response to challenges in healthcare and medicine.



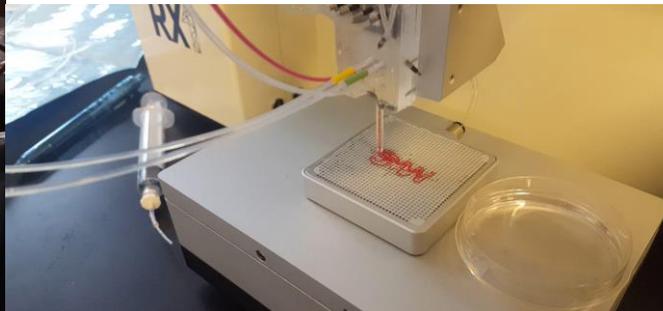
UVic BME Strategic Focus

- Bioinstrumentation and Medical Devices
- Biomaterials and Tissue Engineering
- Biomechanics, Orthotics and Prosthetics
- Medical Imaging



Fast Program Facts

- First accredited program in Western Canada
- Recently we renewed our accreditation for another 3 years
- Our graduates go on to a variety of opportunities, including medical school, graduate school, and industry
- Currently have ~171 students in the program



What makes Biomedical Engineers different?

- More interest in getting in depth science background
- Tend to go to graduate school at higher rates than our other engineering majors
- We are an interdisciplinary and collaborative group of researchers



Overview of BME Curriculum

- First Year (Common):

Year 1 - Term 1A Fall

CSC 111 - Fundamentals of Programming with Eng. Appl.

ENGR 110 - Design and Communication I

ENGR 130 - Introduction to Professional Practice

MATH 100 - Calculus I

MATH 110 - Matrix Algebra for Engineers

PHYS 110 - Introductory Physics I

Year 1 - Term 1B Spring

CHEM 150 - Engineering Chemistry

ENGR 120 - Design and Communication I

ENGR 141 - Engineering Mechanics

MATH 101 - Calculus II

PHYS 111 - Introductory Physics II



BME Curriculum

- Second Year:

Year 2 - Term 2A Fall
BME 200 - Molecular and Cellular Physiology for Engineers
CHEM 231 - Introductory Organic Chemistry
CSC 116 - Fund. of Programming with Engineering Applic. II
ECE 250 - Linear Circuits I
MATH 200 - Calculus III
MECH 240 - Thermodynamics

Year 2 - Term 2B Summer
BME 201 - Quantitative Human Physiology
ELEC 216 - Electricity and Magnetism
MATH 204 - Calculus IV
MECH 220 - Mechanics of Solids I
ECE 260 - Continuous Time Signals and Systems
MECH 242 - Dynamics

RED – BME Specific Courses



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How will BME200 work in Fall?

Labs will be in person, but don't worry if you are not in Victoria. We will pair you with a group and you will get to make the labs up at a later date!



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BME Curriculum

- Third Year:

Year 3 - Term 3A Spring
BME 320 - Engineering Materials with BME Applications
<i>BME 350 - Biomedical Engineering Design</i>
One of : ECE 330 - Electronic Circuits ECE 365 - Applied Electronics and Electrical Machines
MECH 345 - Mechanics of Fluids
Electrical Stream: Two of: ECE 300, ECE 310, ECE 320, ECE 340, MECH 320
Mechanical Stream: Both: MECH 320, MECH 335
Year 3 - Term 3B Fall
BME 335 - Biosensors and Instrumentation
ECON 180 - Engineering Economics
STAT 260 - Introduction to Probability and Statistics I
Electrical Stream: ECE 360 One of: ECE 350, ECE 370, ECE 380, MECH 330, MECH 360, MECH 395
Mechanical Stream: Both: MECH 330, MECH 380
Complementary Studies Elective

RED – BME Specific Courses
Italics – Design course



BME Curriculum

- Fourth Year:

Year 4 - Term 4A Summer
ENGR 297 - Technology and Society
<i>BME 499 - Design Project</i>
Choose 2 of Biological Science: CHEM 232 Organic Chemistry with Biological Applications BIOC 299 Biochemistry for Non-Majors BIOC 300A General Biochemistry I BIOL 360 Cell Biology BIOL 367 Neurobiology: Molecules to Behaviour
Choose 2 of Biomedical Engineering Electives: BME Electives (see next page)
Choose 3 of: Technical Electives

Year 4 - Term 4B Spring
CSC 349A - Numerical Analysis
ENGR 446 - Technical Report
ENGR 498 - Engineering Law

RED – BME Specific Courses
Italics – Design course



BME Curriculum

- Fourth Year: (BME Electives)

Biomedical Engineering Technical Elective Courses	
BME 401A - Microfluidics	
BME 401B - Bioprinting - 3D Printing Body Parts	(NEW 2018)
BME 401C - Human Factors Eng. for Medical Devices	(NEW 2019)
BME 403 - Medical Image Processing	
BME 434 - Biophotonics	
BME 481 - Biomaterials and Tissue Engineering	
MECH 483 - Mechanics and Energy Conversion in Living Cells	
PHYS 432 - Medical Physics	
BME 450D - Introduction to Musculoskeletal Biomechanics	
<i>BME490 or BME498 – Technical Project/Honors Thesis</i>	

RED – BME Specific Courses

Italics – Design course



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Examples of our innovative teaching

- BME401B: 3D bioprinting – Printing human body parts
- We currently have 3 bioprinters that are core BME equipment



BME401C: Human Factors and Usability Engineering for Medical Devices

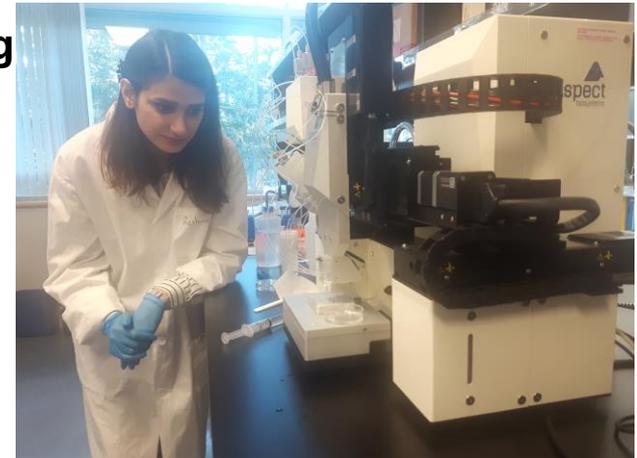


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Looking Forward: Curriculum

- More emphasis on specific/unique BME knowledge:
 - More Elective courses in areas of Strategic Focus
 - Innovative elective being offered with local medical device company Starfish Medical
 - **Addition of laboratory components to existing courses**
 - **Hiring a Canada Research Chair in Assistive Technology**
 - **Hiring an external BME director**
- New Course Pathways:
 - BME Information Systems & Technology
 - BME Regulatory Space
- New Practical Experiential Learning:
 - Work Placements in Hospitals or Clinical settings

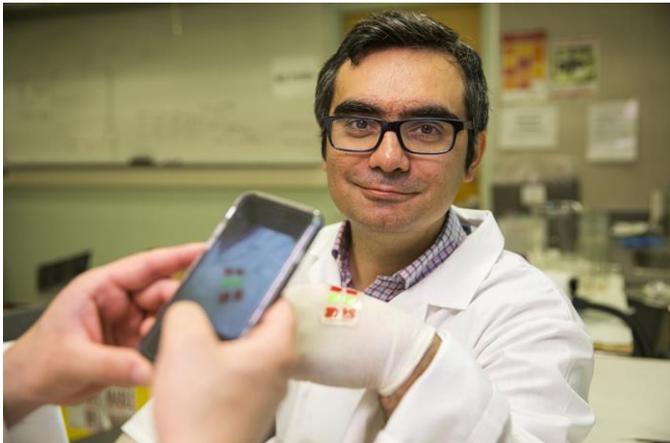


Looking Forward: Resources

- BME specific Faculty to teach BME content
- Equipment to support undergraduate courses
- **Laboratory space for BME undergraduate laboratories**
- Manufacturing resources for 4th year capstone
- Staff to manage BME resources and scheduling



Examples of our research



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BME Research at the University

Our faculty works in areas of specialization such as:

- Biomaterial scaffolds containing stem cells for repair of spinal cord injuries
- Implantable wireless medical devices for monitoring internal physiology
- Prosthetic and orthotic device design and development
- Microfluidic devices and 3D printing of biological tissues
- Nanoscale sensors to screen cells and biofluids for the earliest signs of disease, such as cancer
- Computerized medical image analysis for helping to make diagnosis and therapy planning faster and more accurate



Mechanisms for undergraduates to get involved in research and experiential learning

- **Opportunities to get class credit for doing research in labs and contributing to student teams**
 - Directed studies courses, Honors thesis, Engineering Technical Report
- **Paid opportunities**
 - Work-study positions and co-op terms work terms (NSERC Undergraduate Student Awards/CIHR awards)
- **Nominate students for awards**
 - J.Cura, MITACS, NSERC/CIHR scholarships, BCIC co-op work grants



We are on social media!

- <https://www.facebook.com/UVicBiomedicalEngineering/>
- <https://twitter.com/biomedicaluvic>



Email willerth@uvic.ca and enguoast@uvic.ca to get items posted



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Vancouver Island Life Sciences Group

(www.vils.ca)

- VILS.ca brings together the life-sciences community in Victoria and around the Island:
- Did you know there are over 35 companies and entities in the Victoria and island area working on life sciences innovations?
- Our membership only requires an interest in and enthusiasm for entrepreneurship and innovation in life sciences.
- Our members include biotech, diagnostics, medical devices, pharmaceutical, and software companies; local health authorities; students; secondary education institutions; local government; and more.



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B.C. Regenerative Medicine Initiative

- <http://bcregmed.ca/>



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