Understanding Nature

To Develop Sustainable Nano-Composite Materials

University of Kent

Robert Barker

Who am I?

Degree & MSc in Chemistry

UNIVERSITY OF BATH

PhD in Surface Science

ISIS

Neutron Scientist

NEUTRONS FOR SCIENCE®

Surface Analysis Technique Developer

NIMA TECHNOLOGY

Surface & Food Chemistry

TASSIMO

Grew up in South London

Visiting Researcher

Institut Pasteur

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ILL NEUTRONS FOR SCIENCE®

Since January 2016

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Lecturer in Physics

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What do we do?

PHYSICS

CHEMISTRY

BIOLOGY

ENGINEERING

What do we do?

IN THE REAL WORLD THERE AREN'T CLEAR DIVISIONS

WE ALL WORK TOGETHER TO SOLVE PROBLEMS

G

What do we do?

PHYSICS

CHEMISTRY

BIOLOGY

ENGINEERING

Interfacial Technologies Group

Rob Barker - 01/03/2019

University of Ke

Group

3D Printed Devices

Flow Alignment

Oil Microfluidics

Multispectral Imaging

Surface Bio-Manipulation

Bio-Lubrication

Confined Surfaces

Interfacial Technologies Group

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ed Surfaces

Next Gen. Confined and Sheared

University of Kent

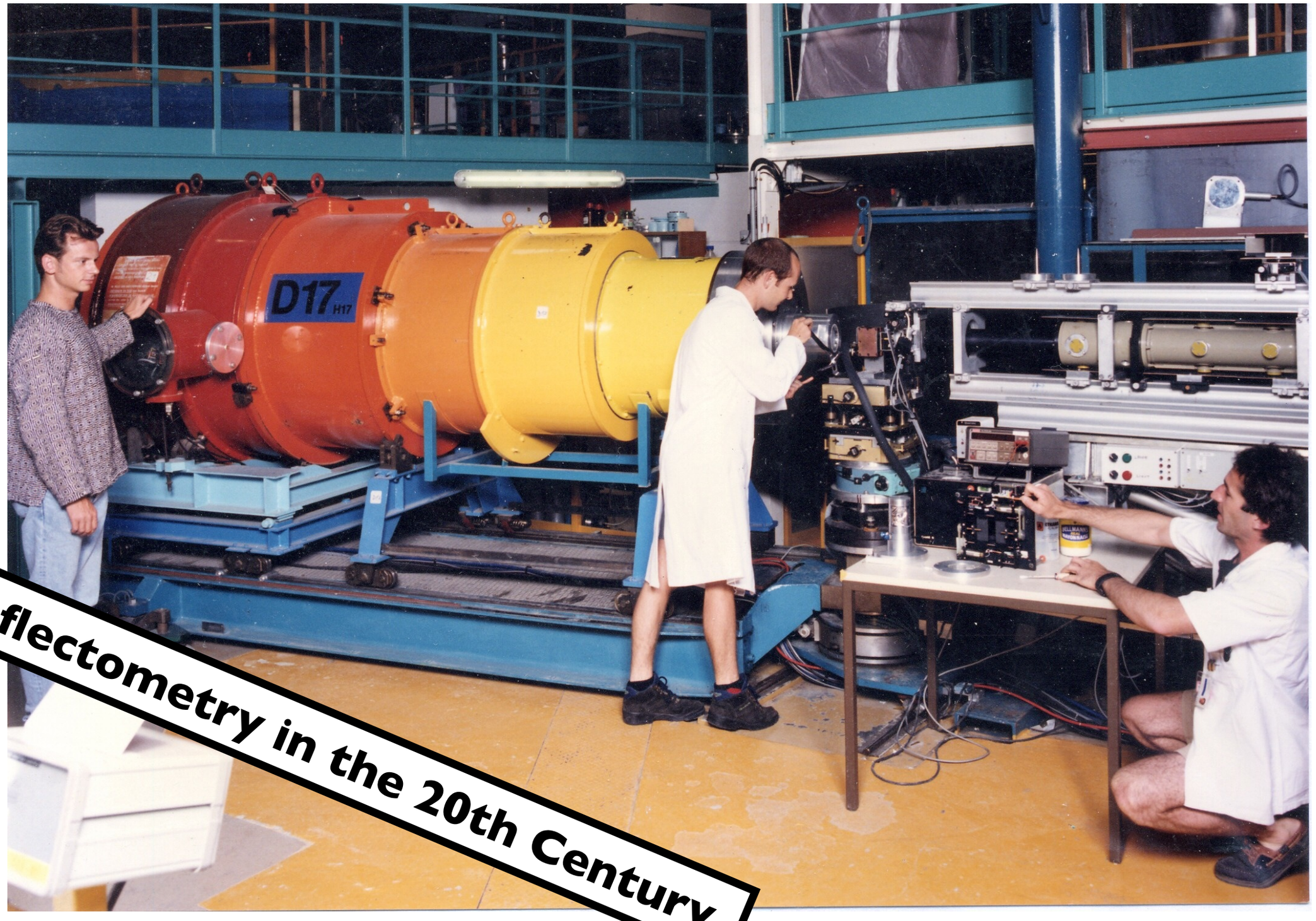
Neutrons as a Probe for Buried Interfaces

NEUTRONS FOR SCIENCE®

Science & Technology Facilities Council
ISIS

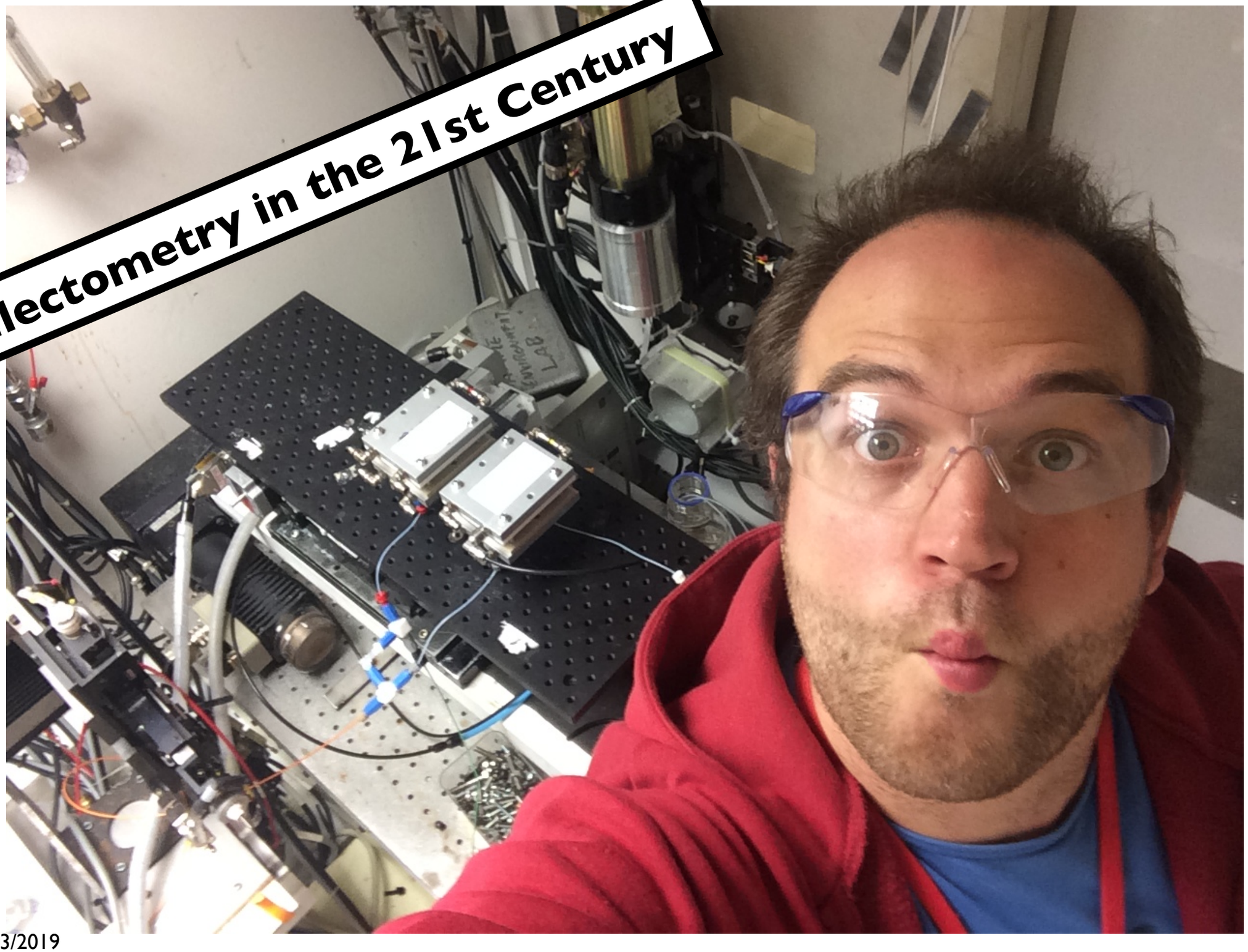
Rob Barker - 01/03/2019

Neutrons as a Probe for Buried Interfaces

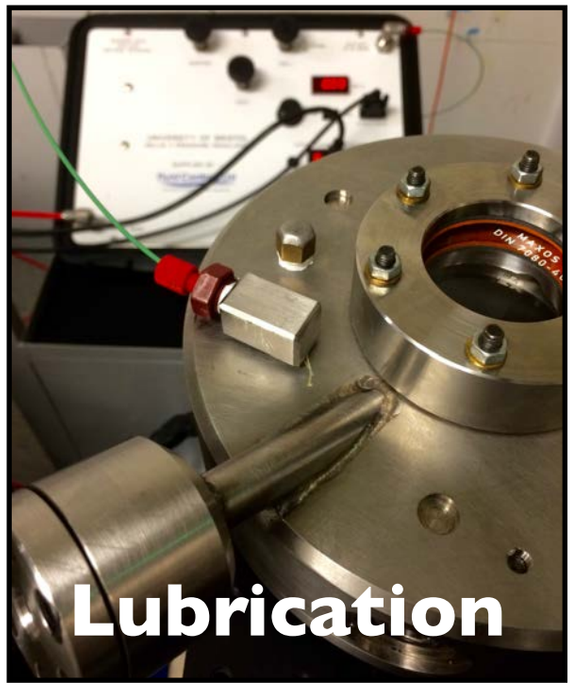


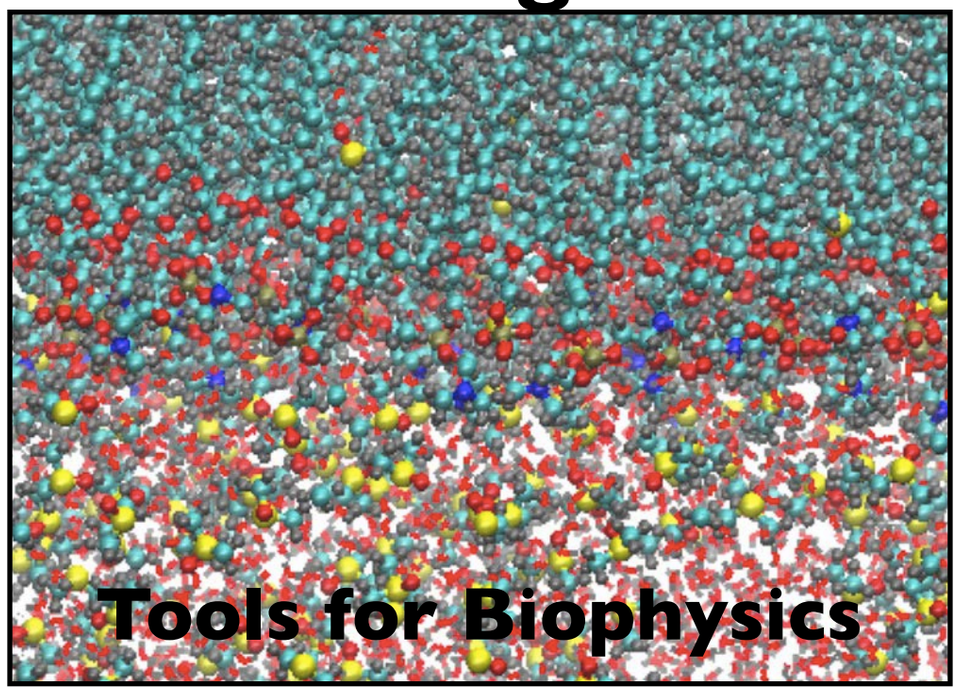
Reflectometry in the 20th Century

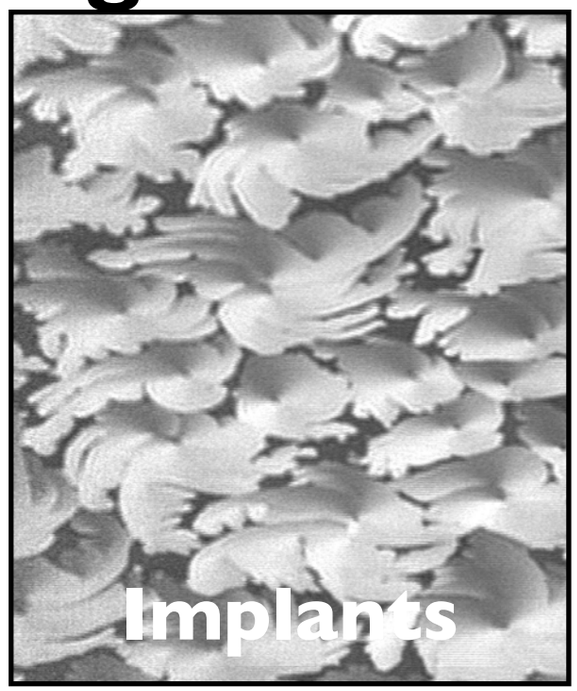
Neutrons as a Probe for Buried Interfaces

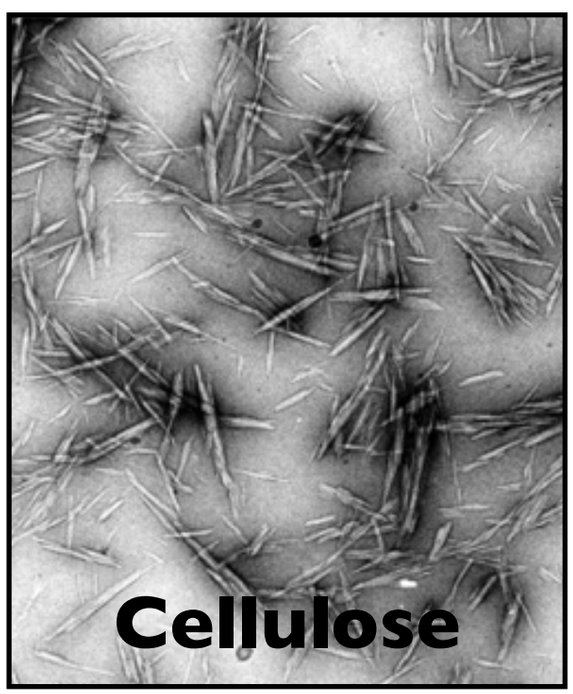


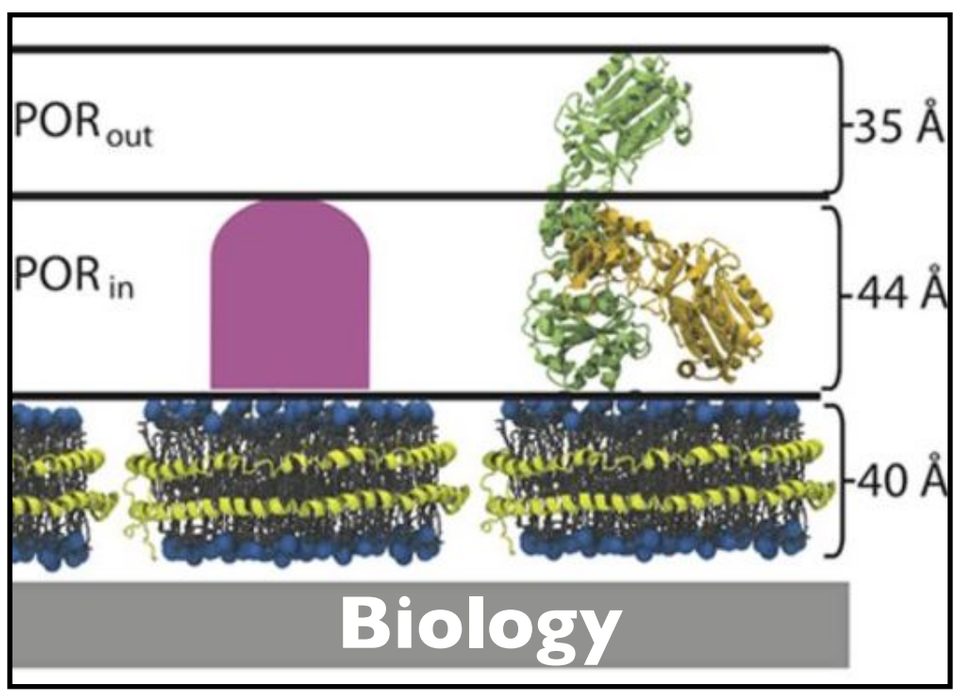
Neutron Scattering Applied to a Number of Chemical & Biological Challenges

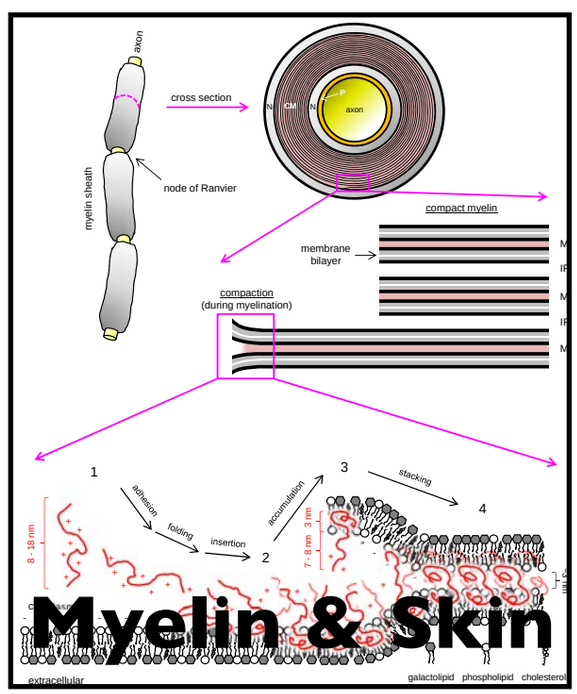












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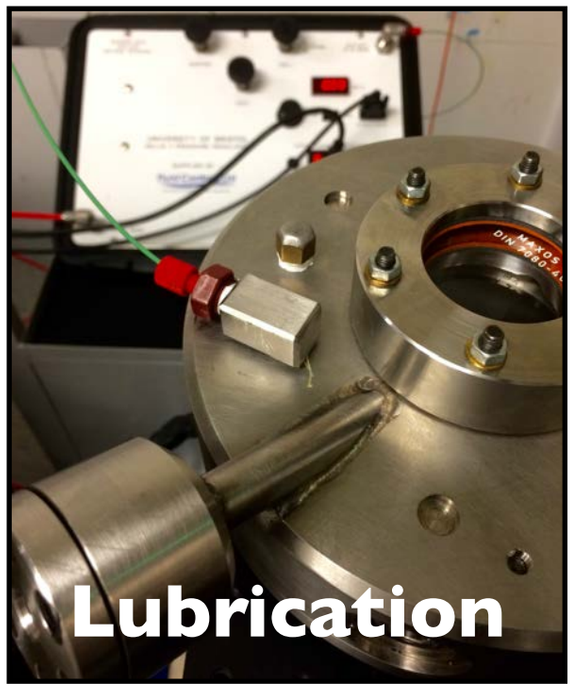

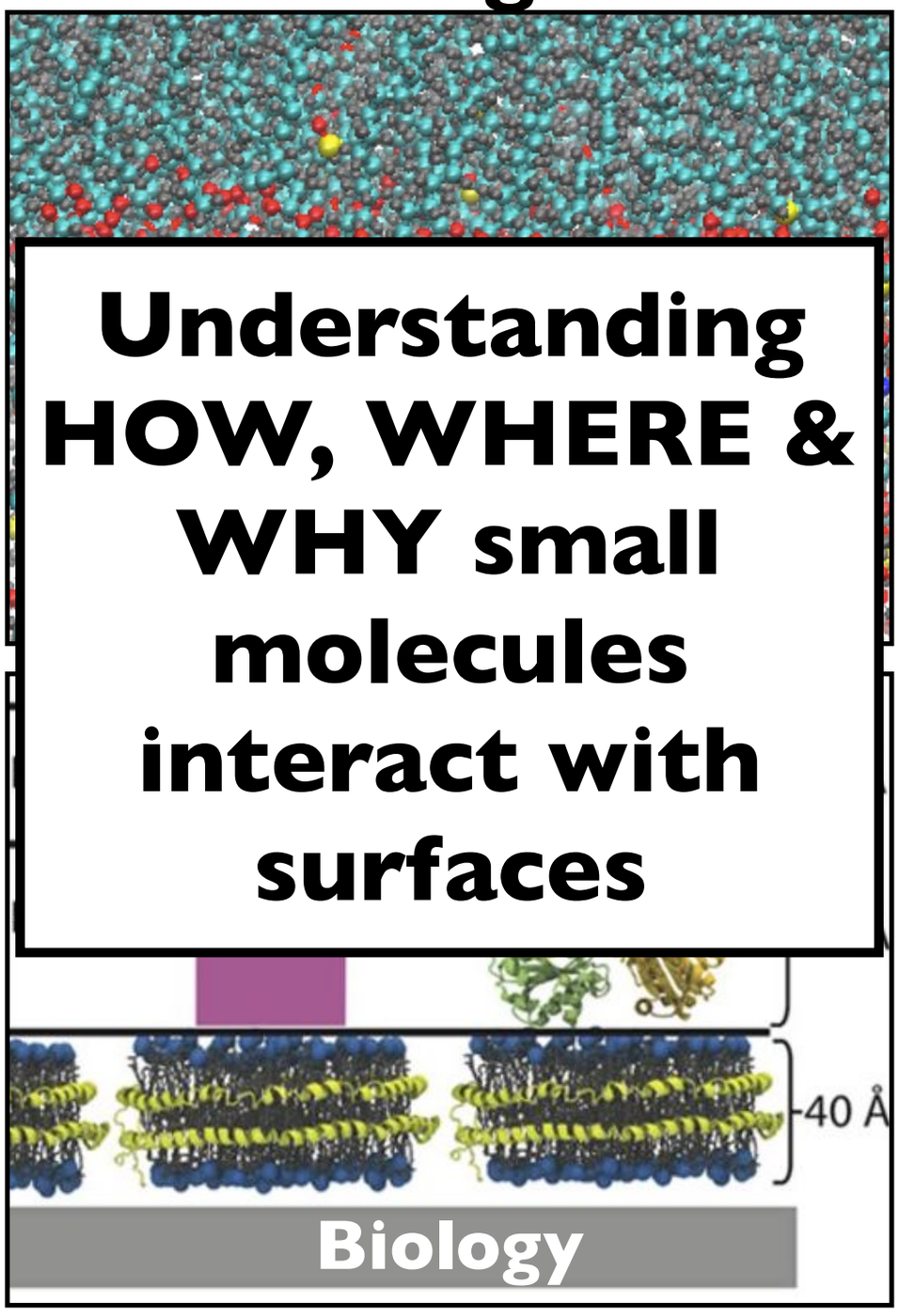

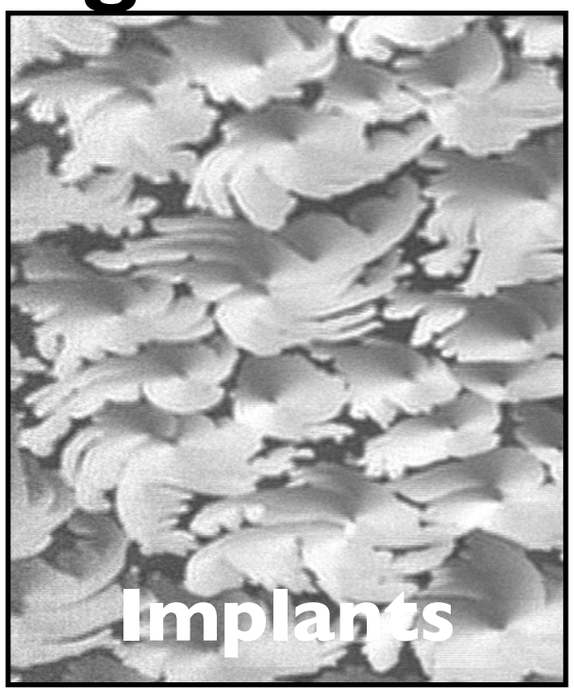

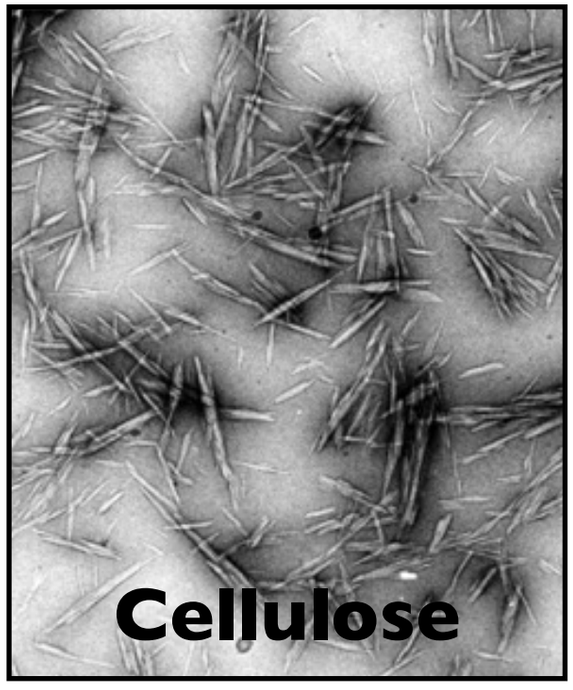

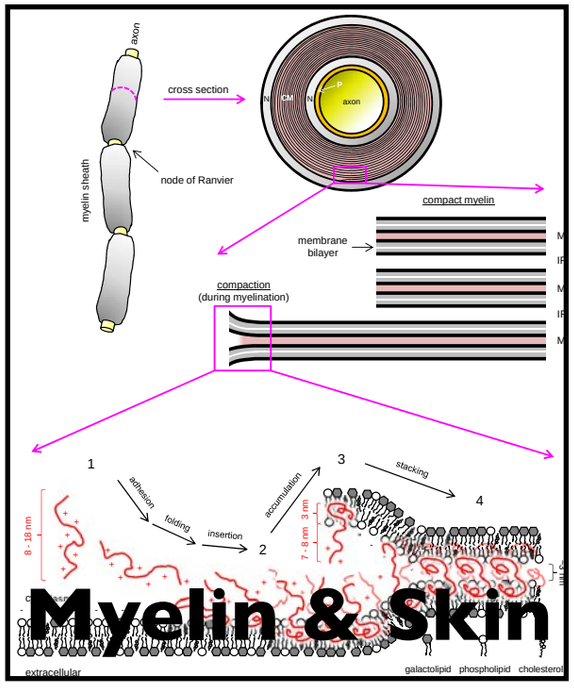

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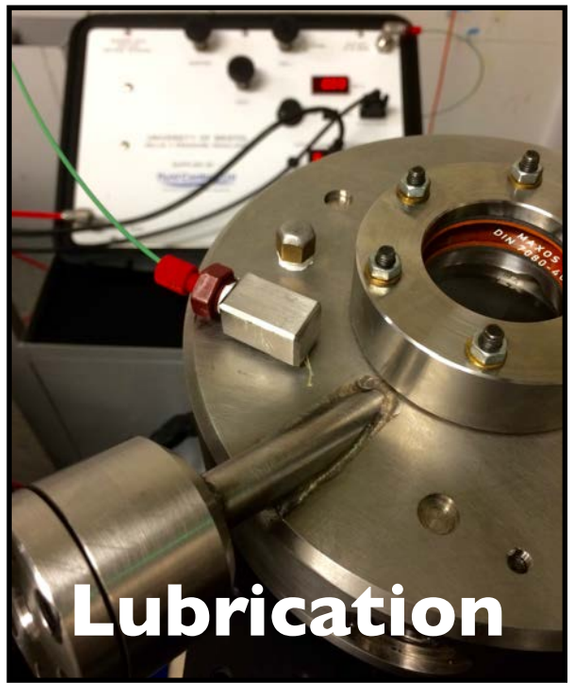

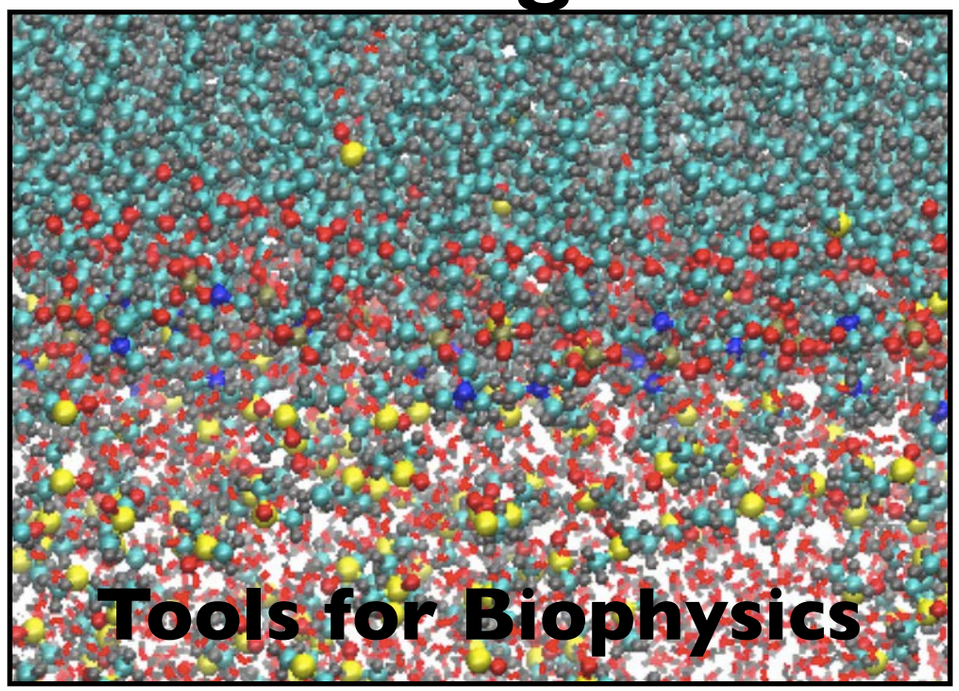

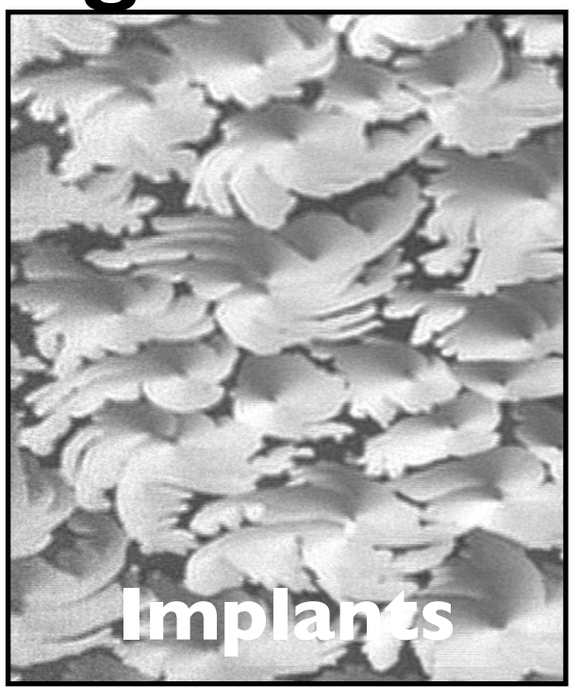

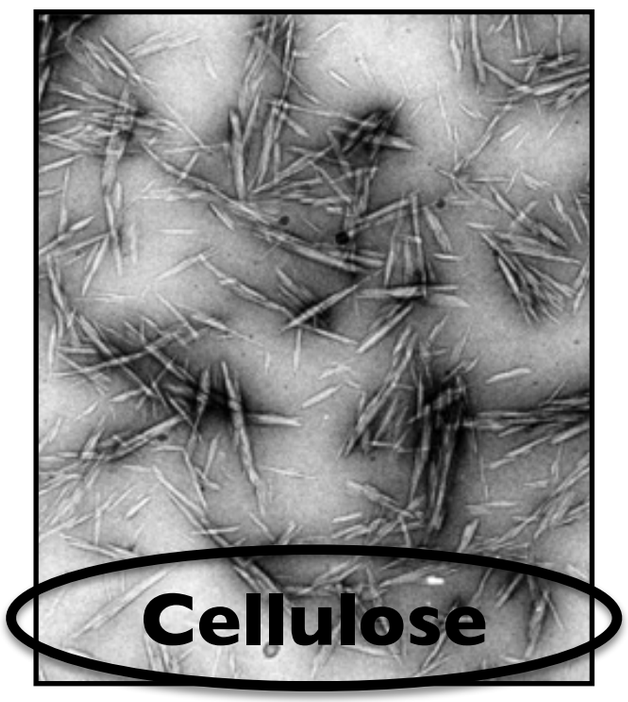

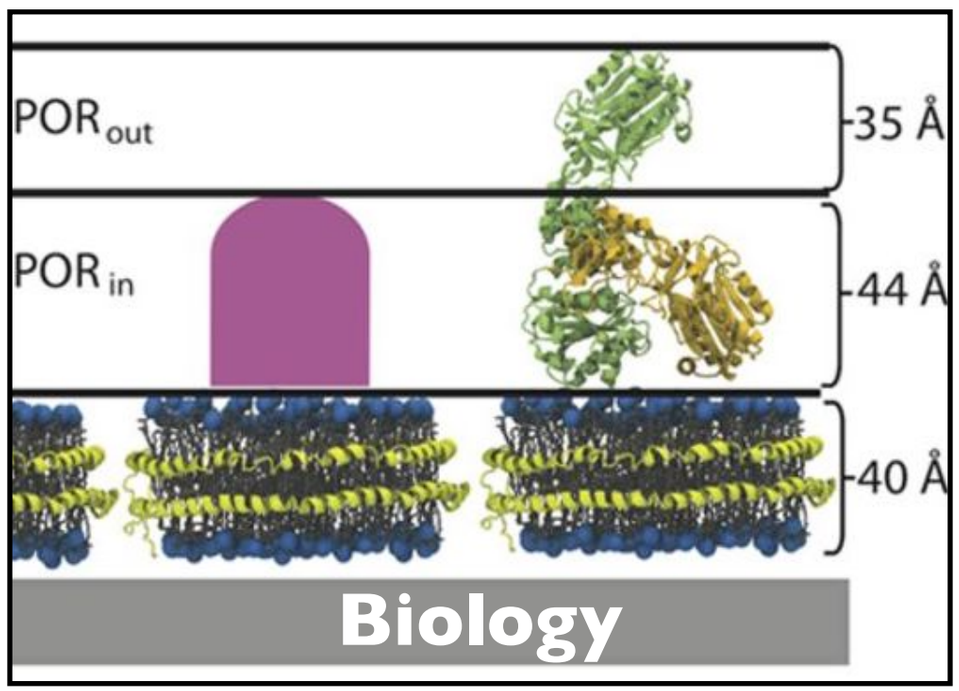

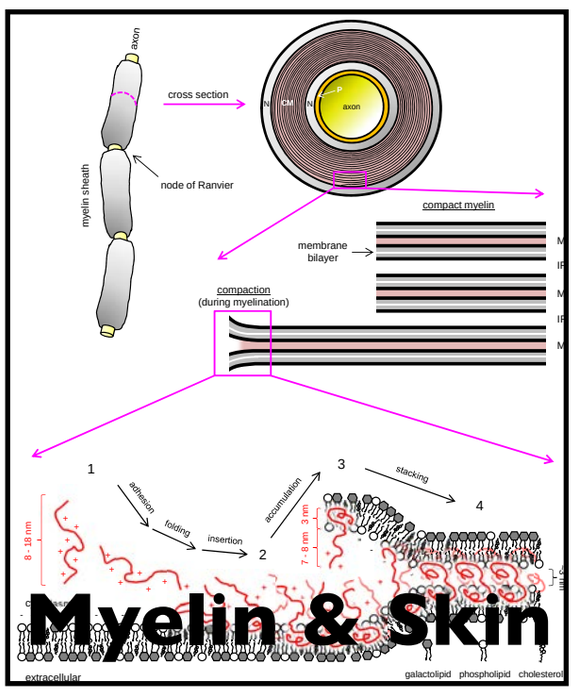

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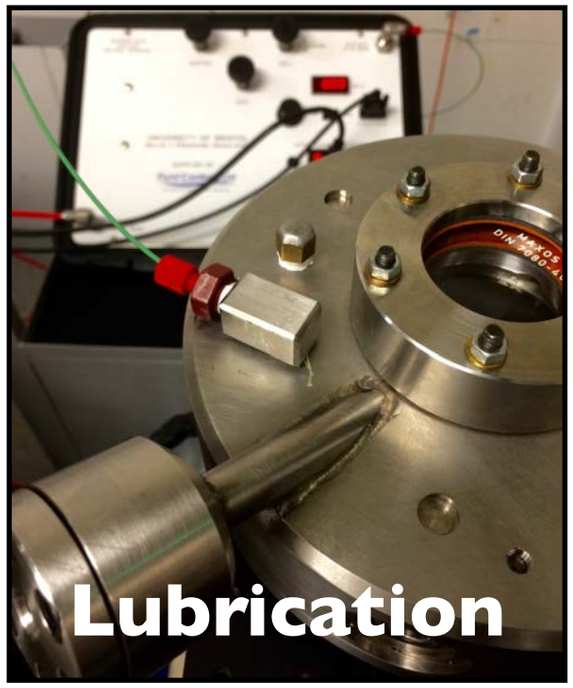
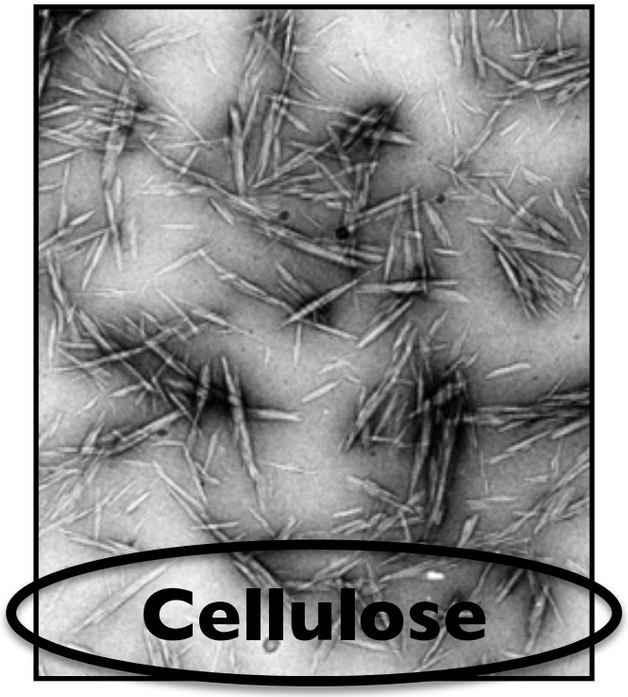
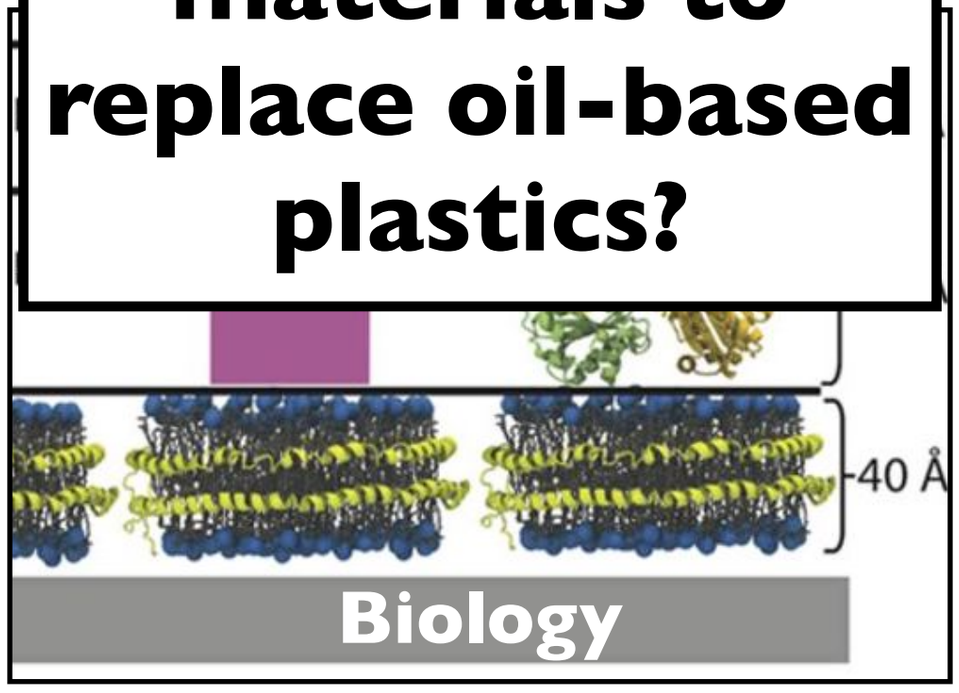


Lubrication

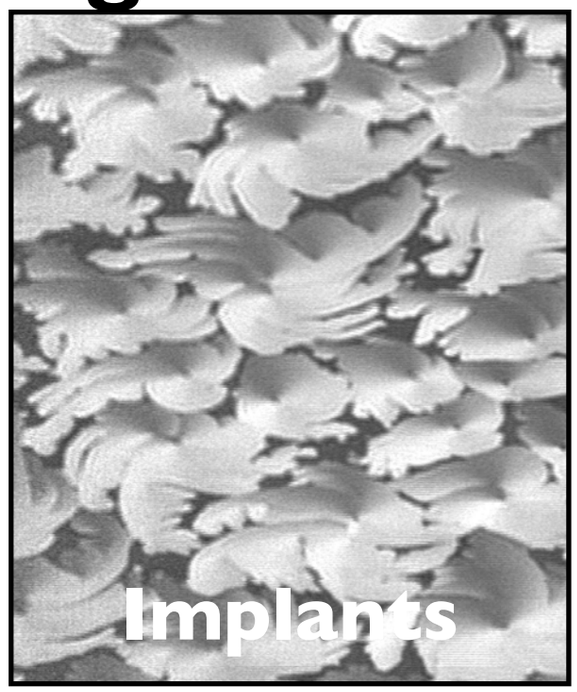


Cellulose

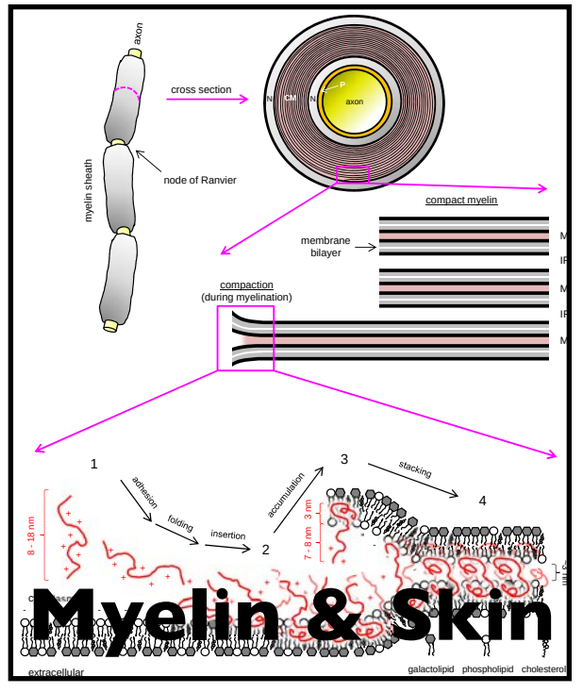
How do we use naturally available materials to replace oil-based plastics?



Biology

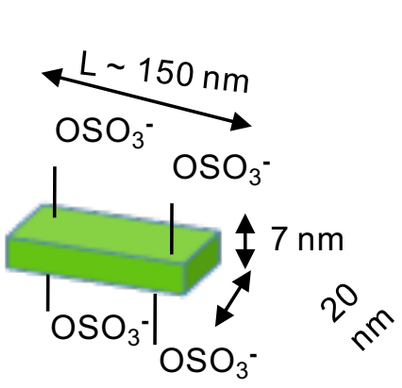


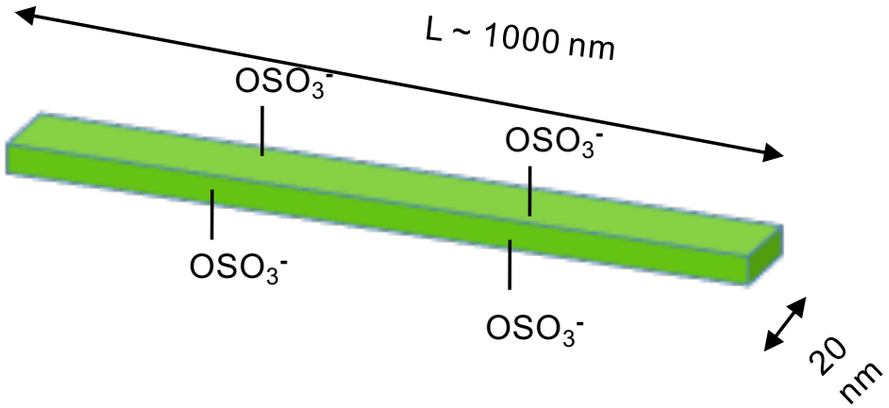
Implants

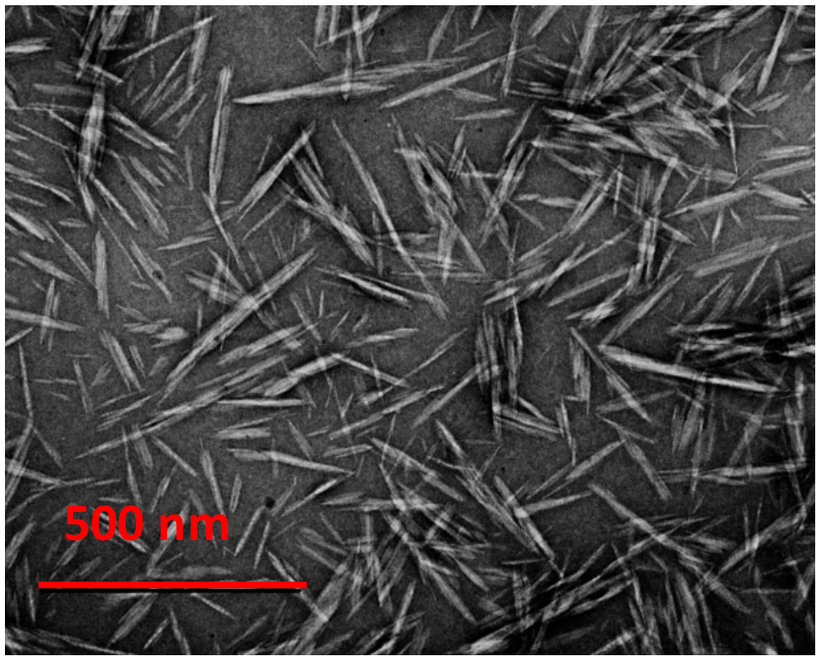


Myelin & Skin

Cellulose Nanocrystals Extracted From Natural Waste

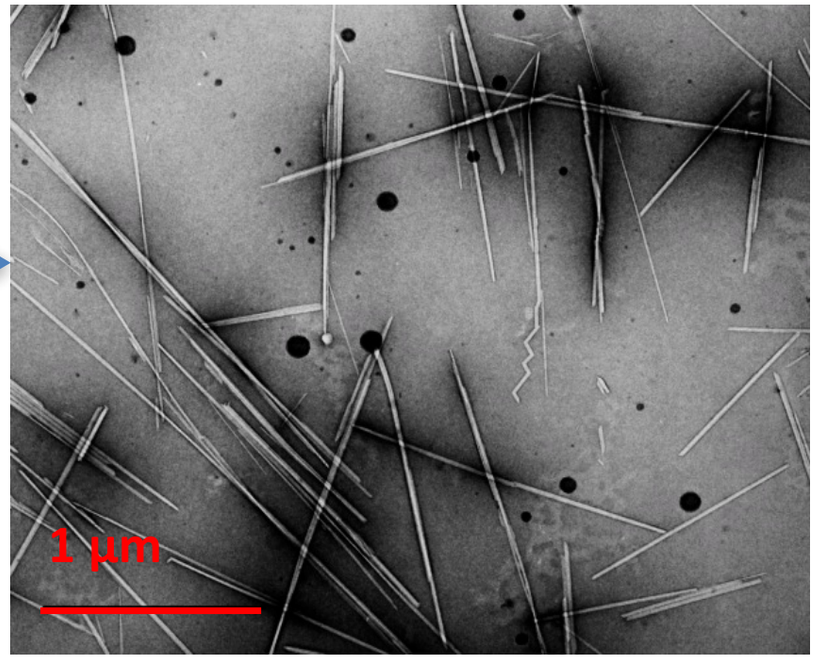






Cotton CNCs (TEM)

Different aspect ration



Tunicate CNCs (TEM)

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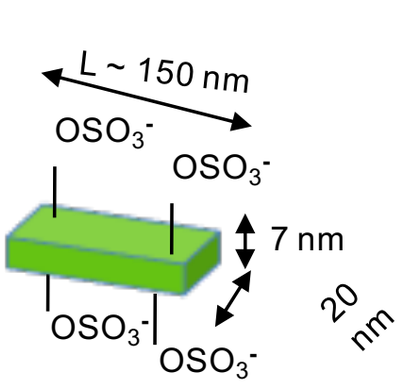

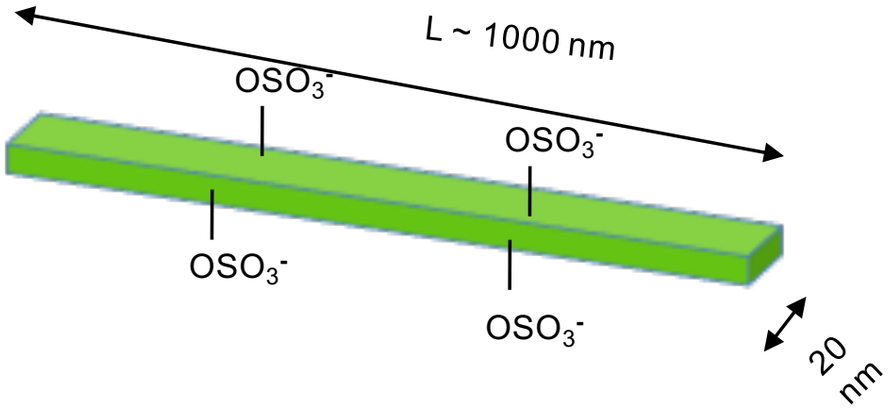

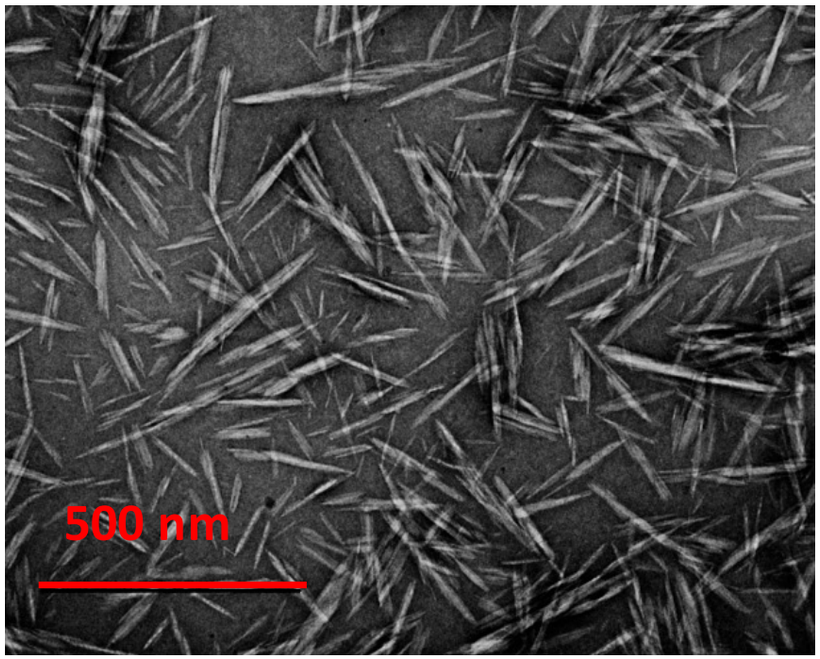

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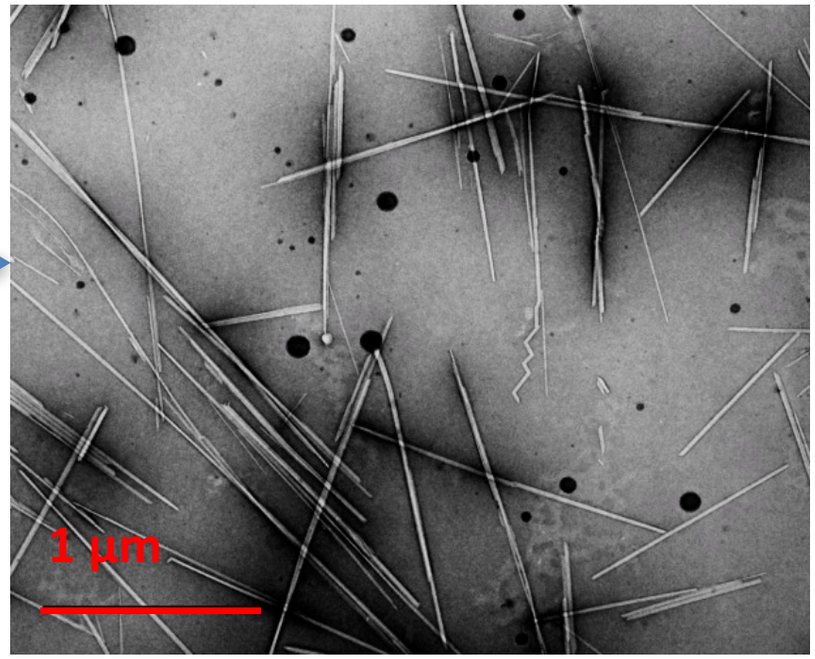

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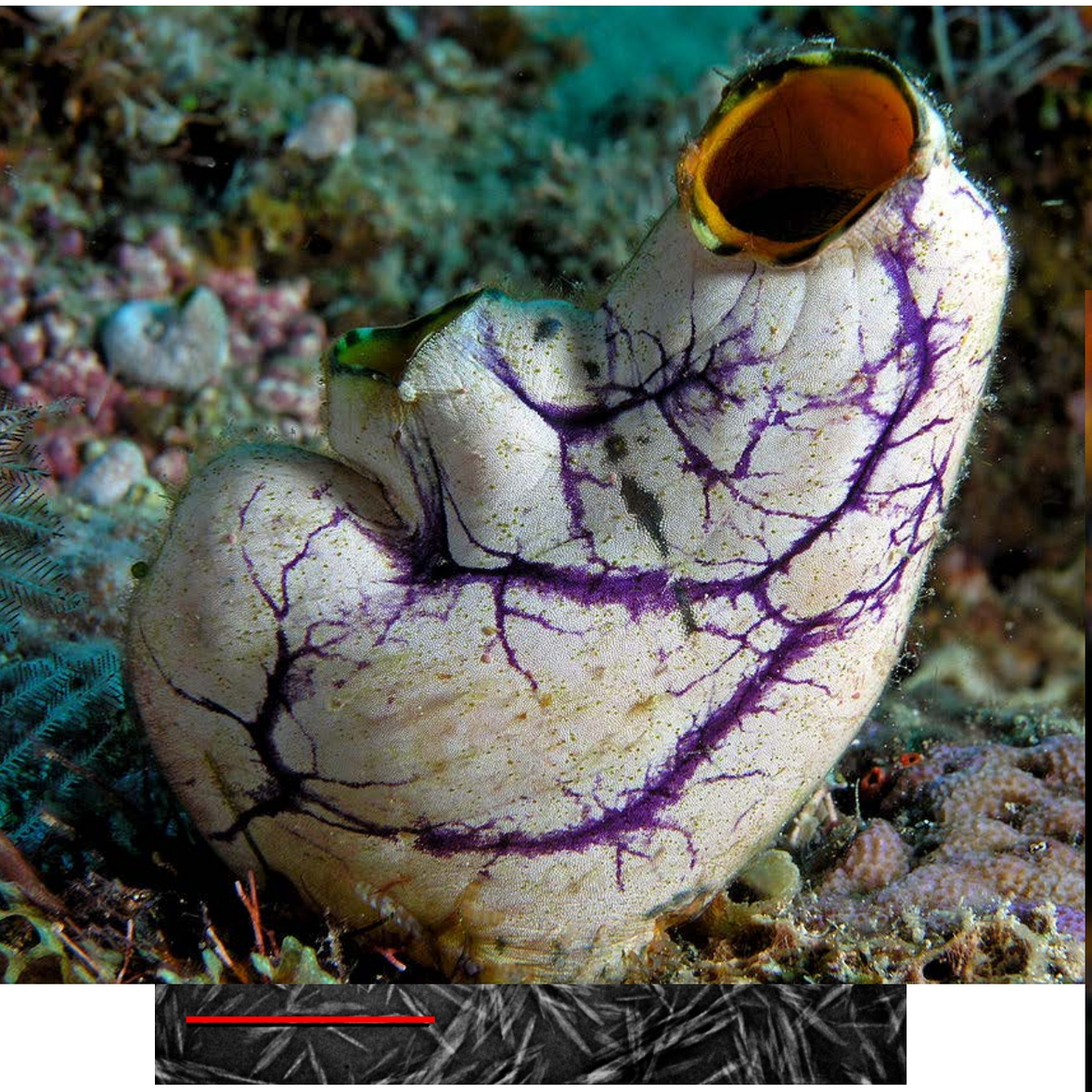

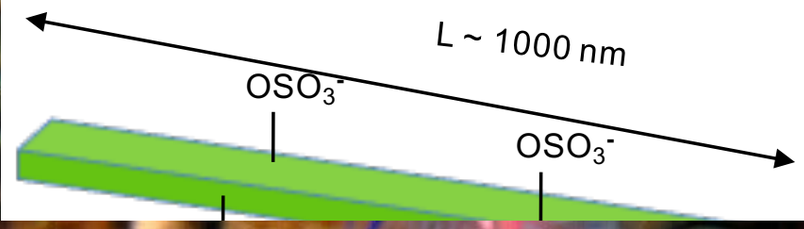

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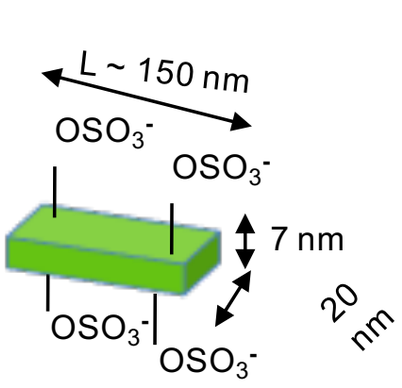

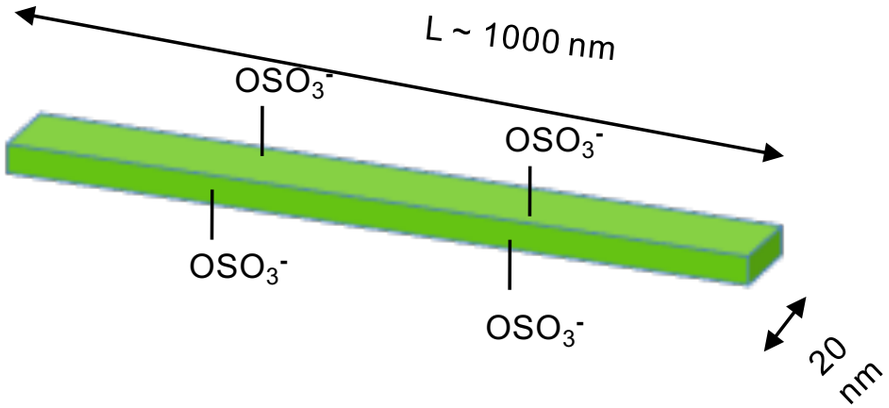

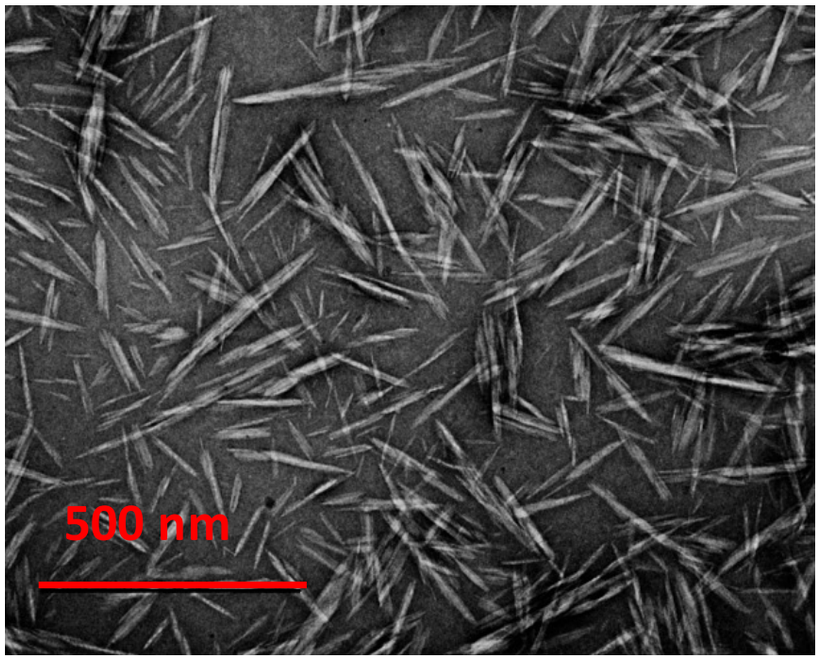

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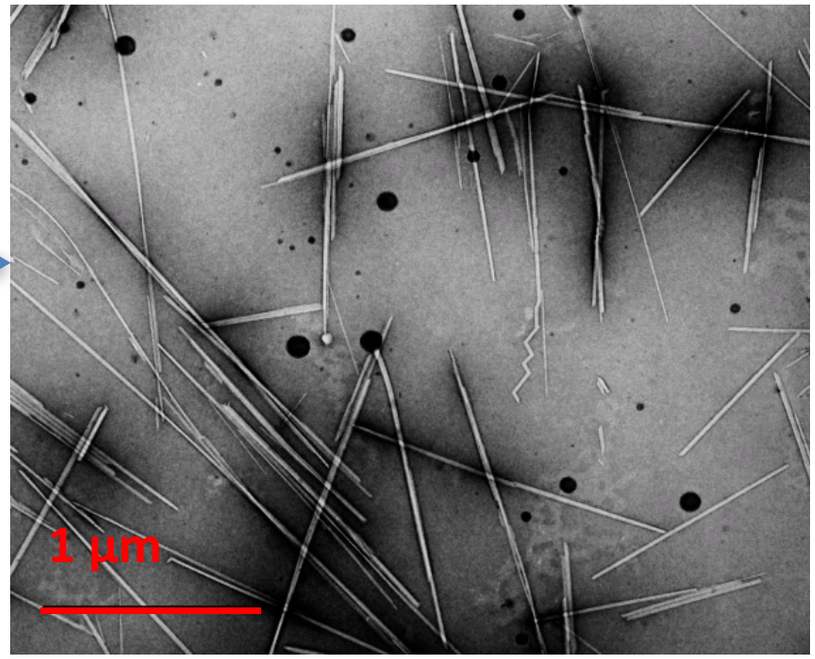

Tunicate CNCs (TEM)

Layer-By-Layer Self Assembly Can Be Used to Make Complex Composite Materials

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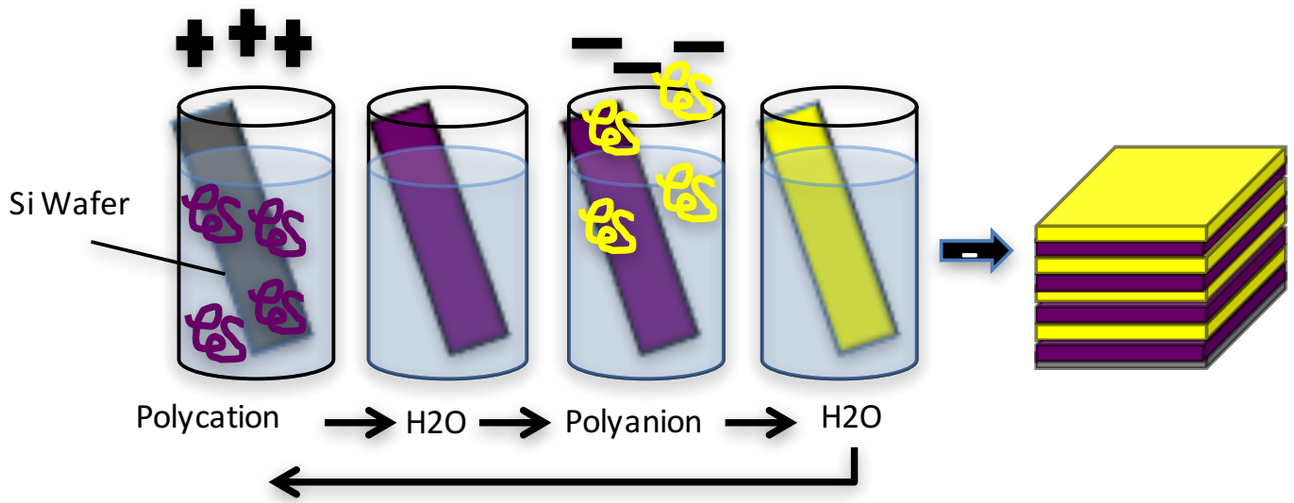
Rob Barker - 01/03/2019

Layer-By-Layer Self Assembly Can Be Used to Make Complex Composite Materials



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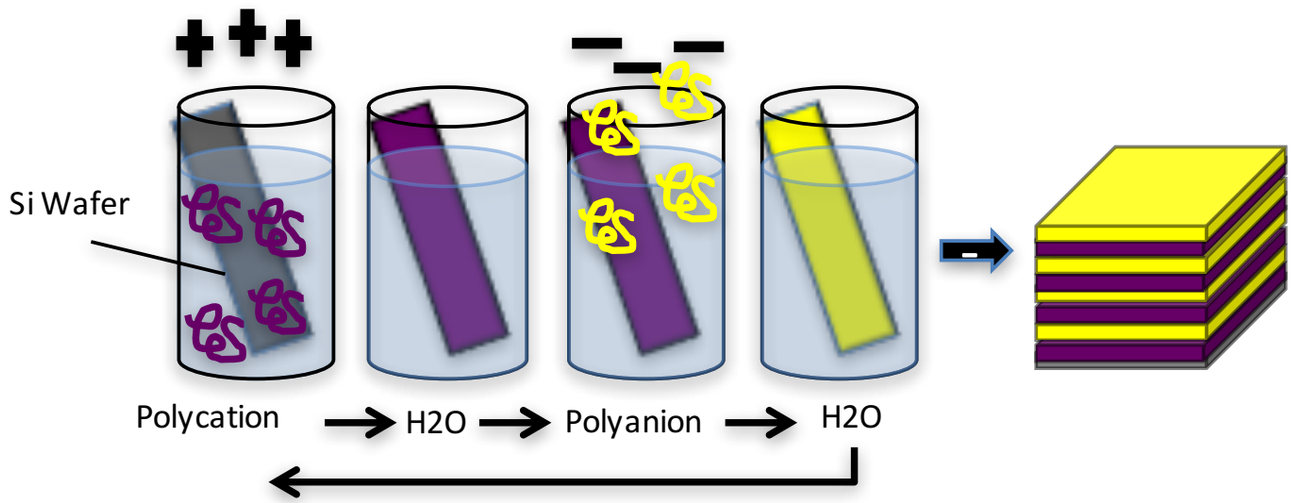

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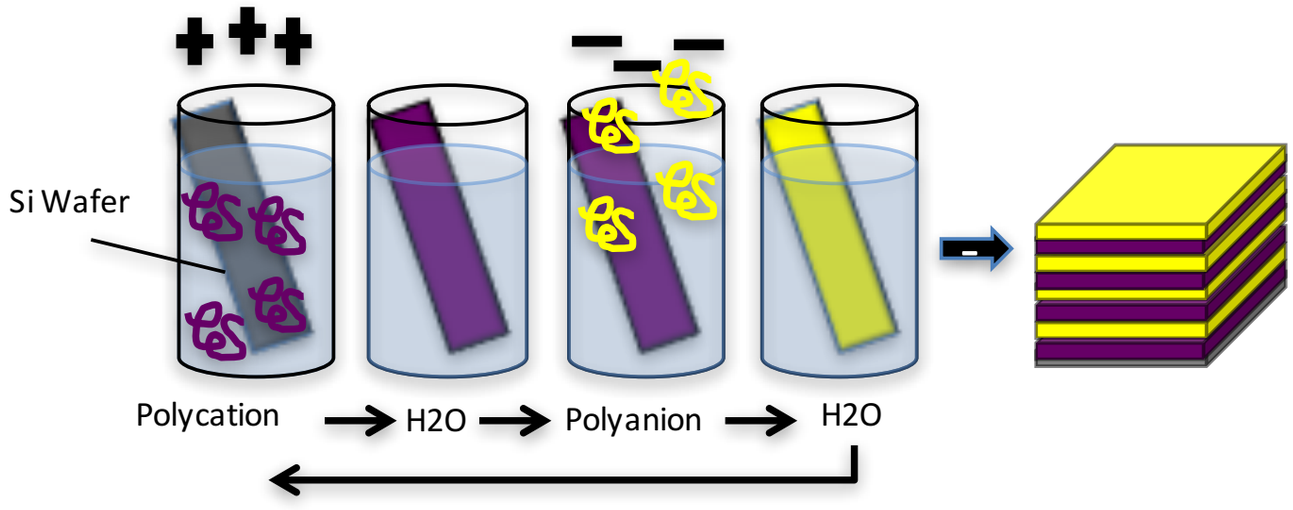
Stratified nanocomposite with controlled architecture in the z direction

Layer-By-Layer Self Assembly Can Be Used to Make Complex Composite Materials

Salt?

Drying Between Layers?



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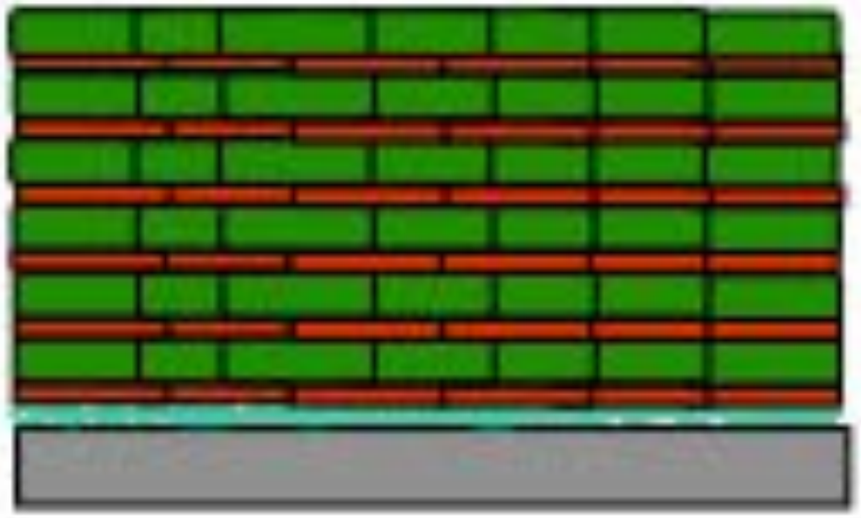
Stratified nanocomposite with controlled architecture in the z direction

By Controlling These Simple Things We Can Control the Properties



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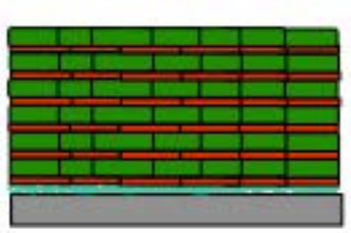

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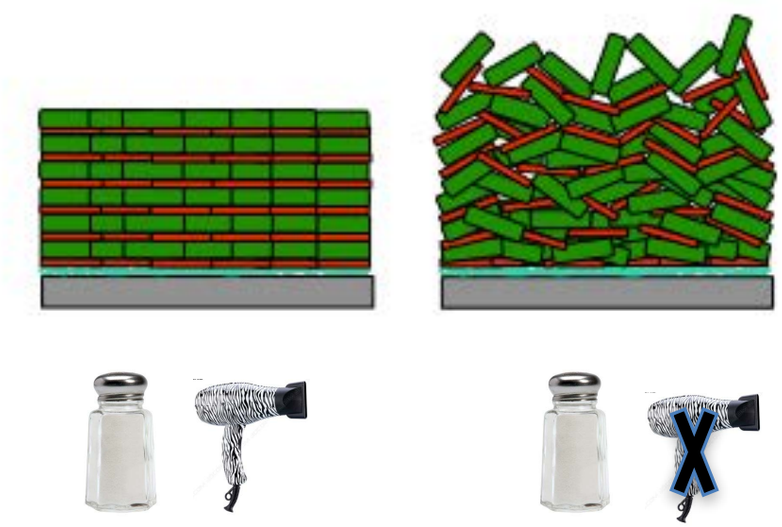

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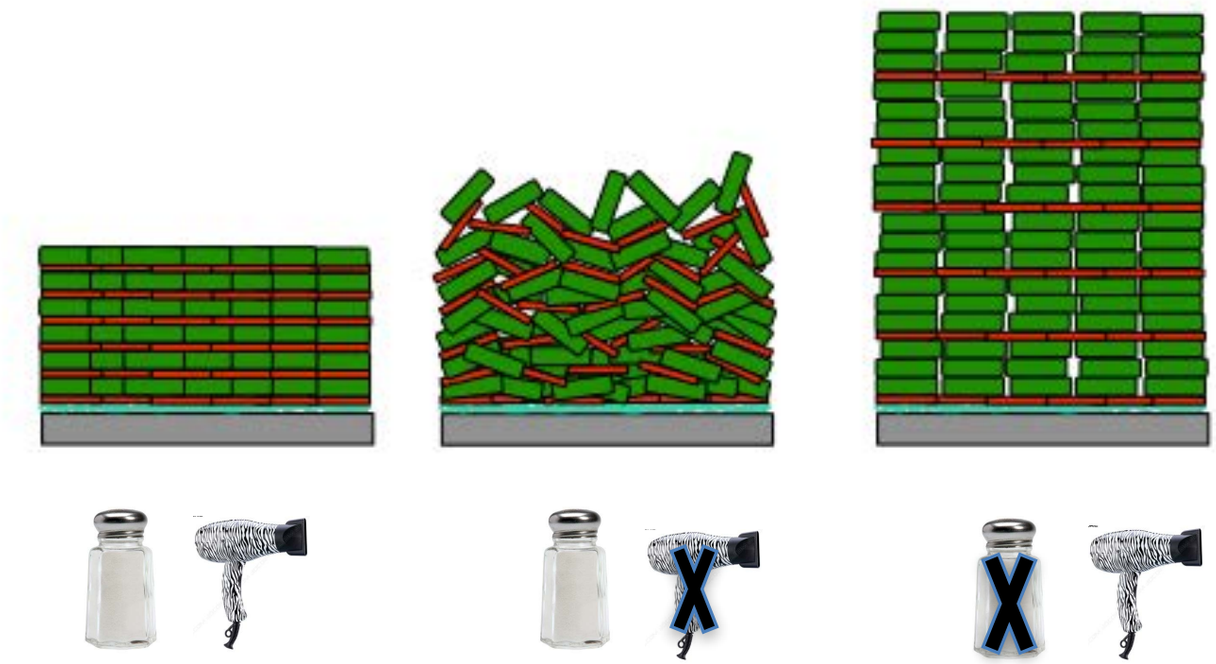

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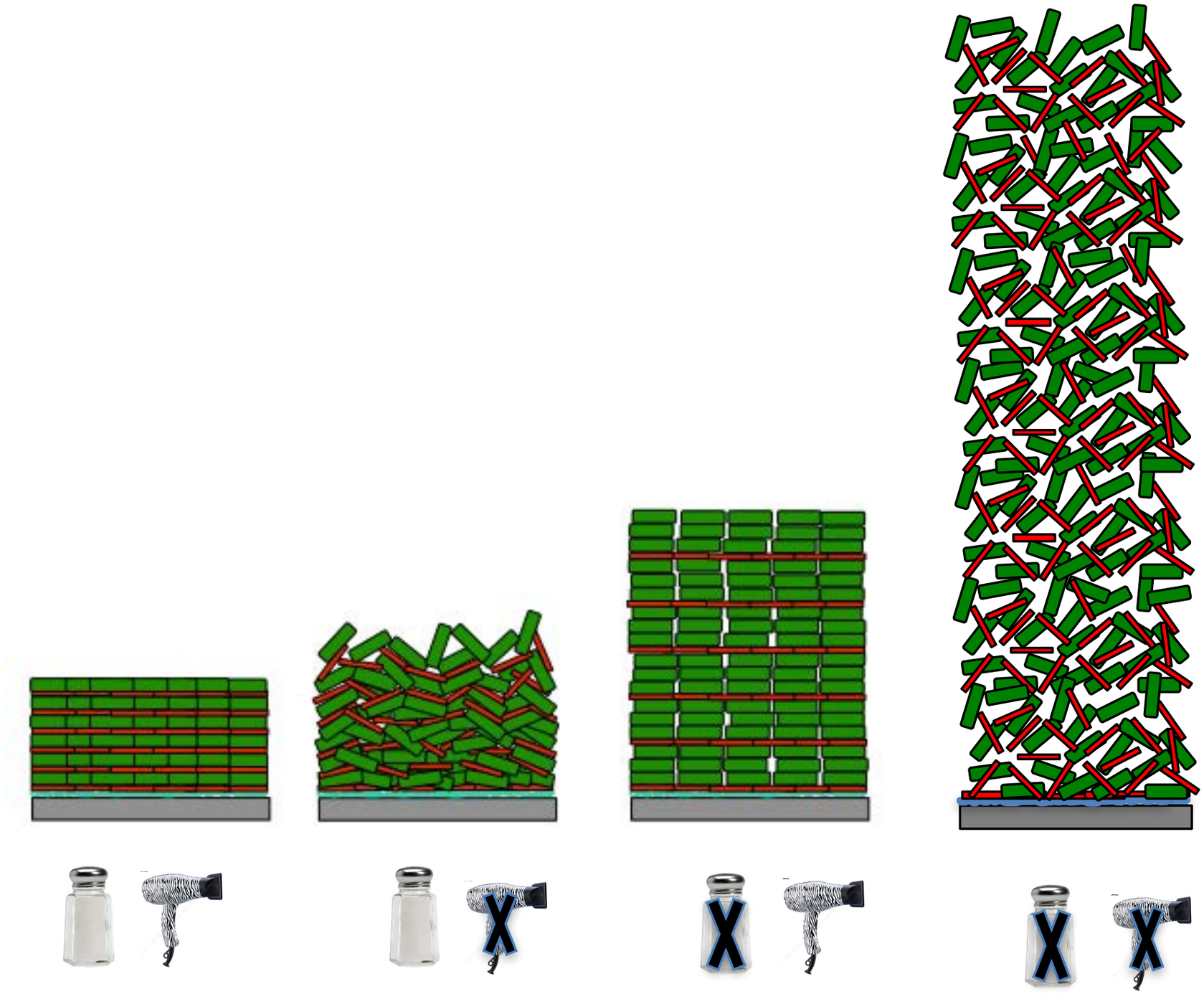
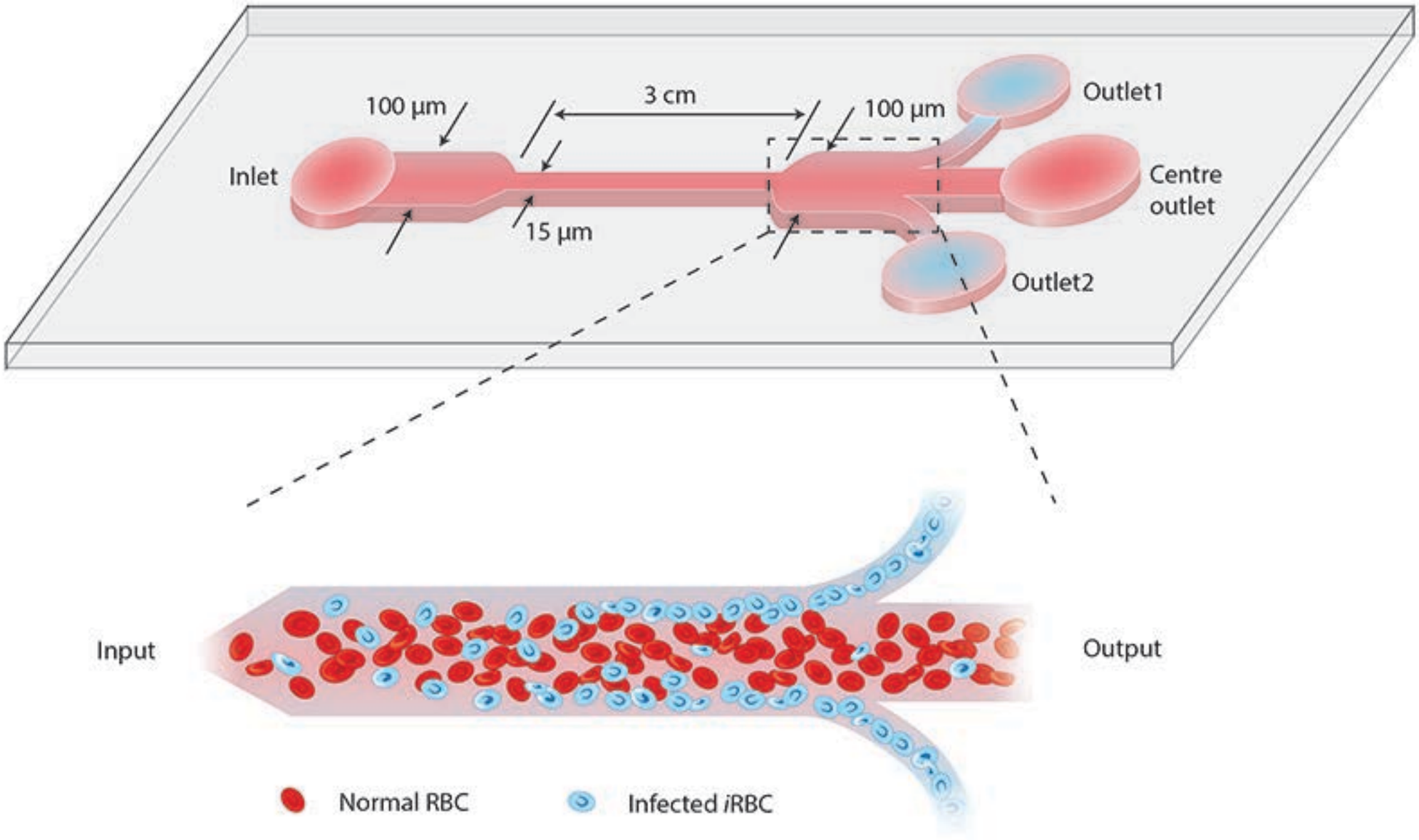


Using Flow to Control Surfaces



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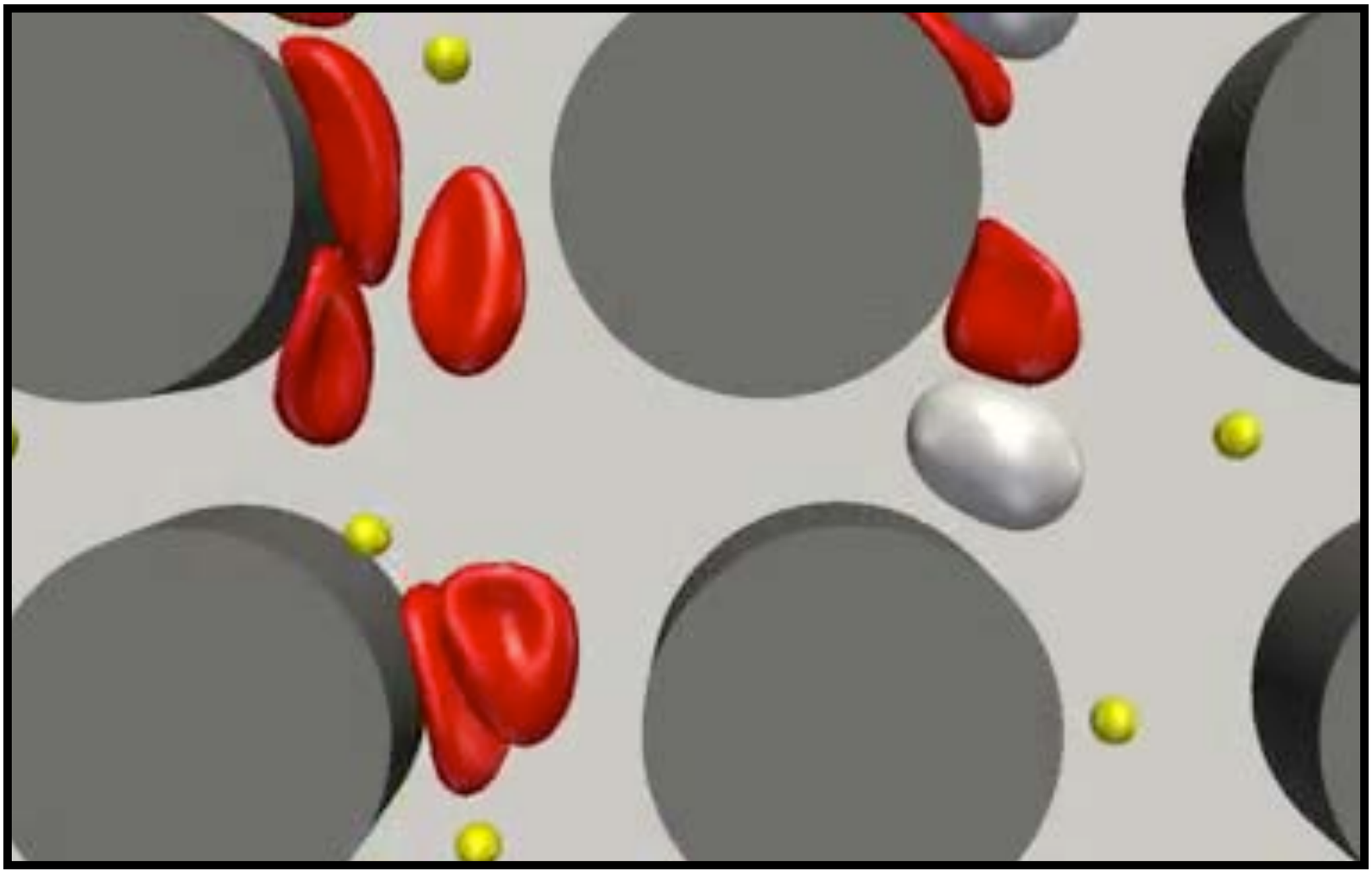

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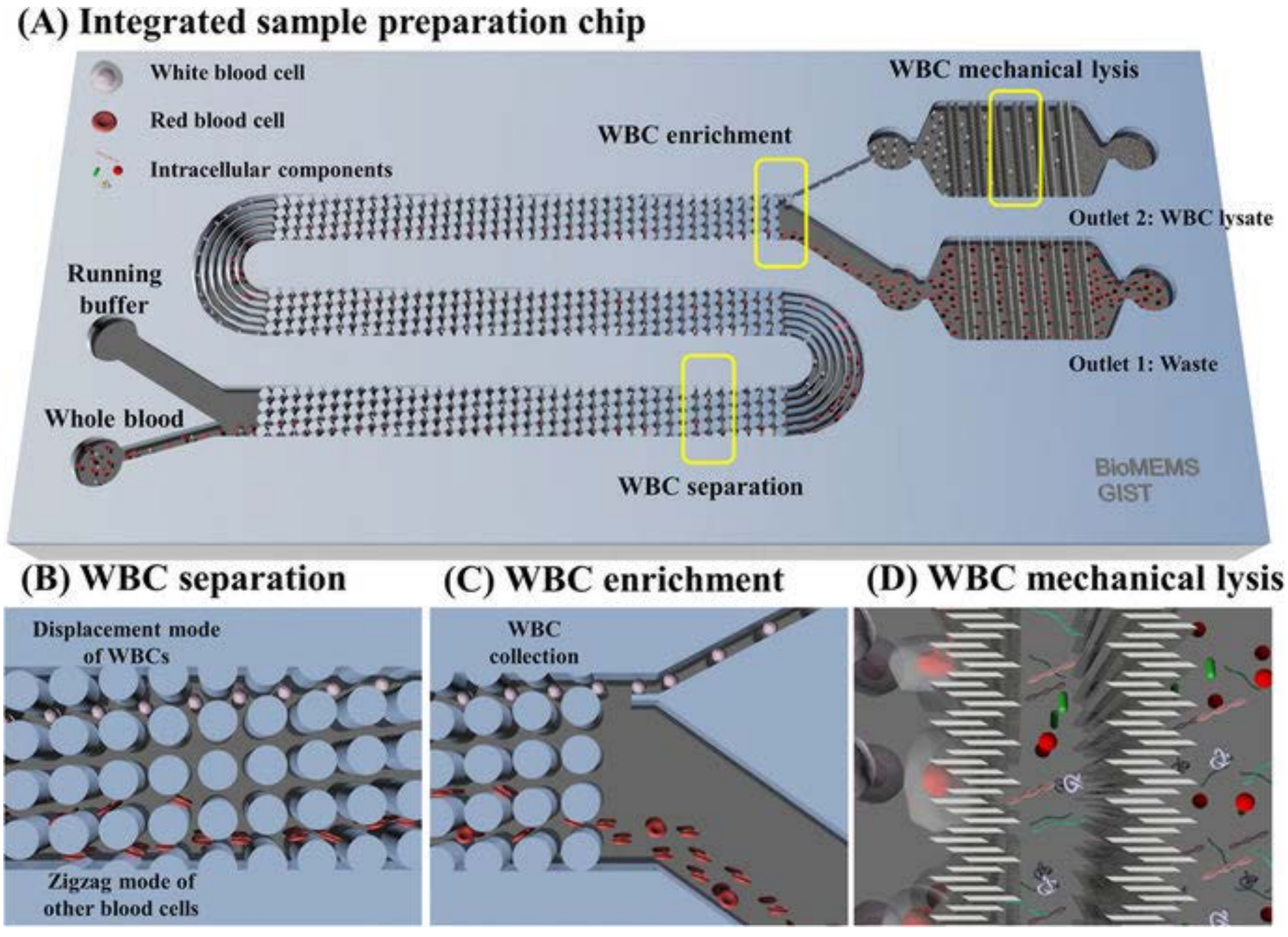
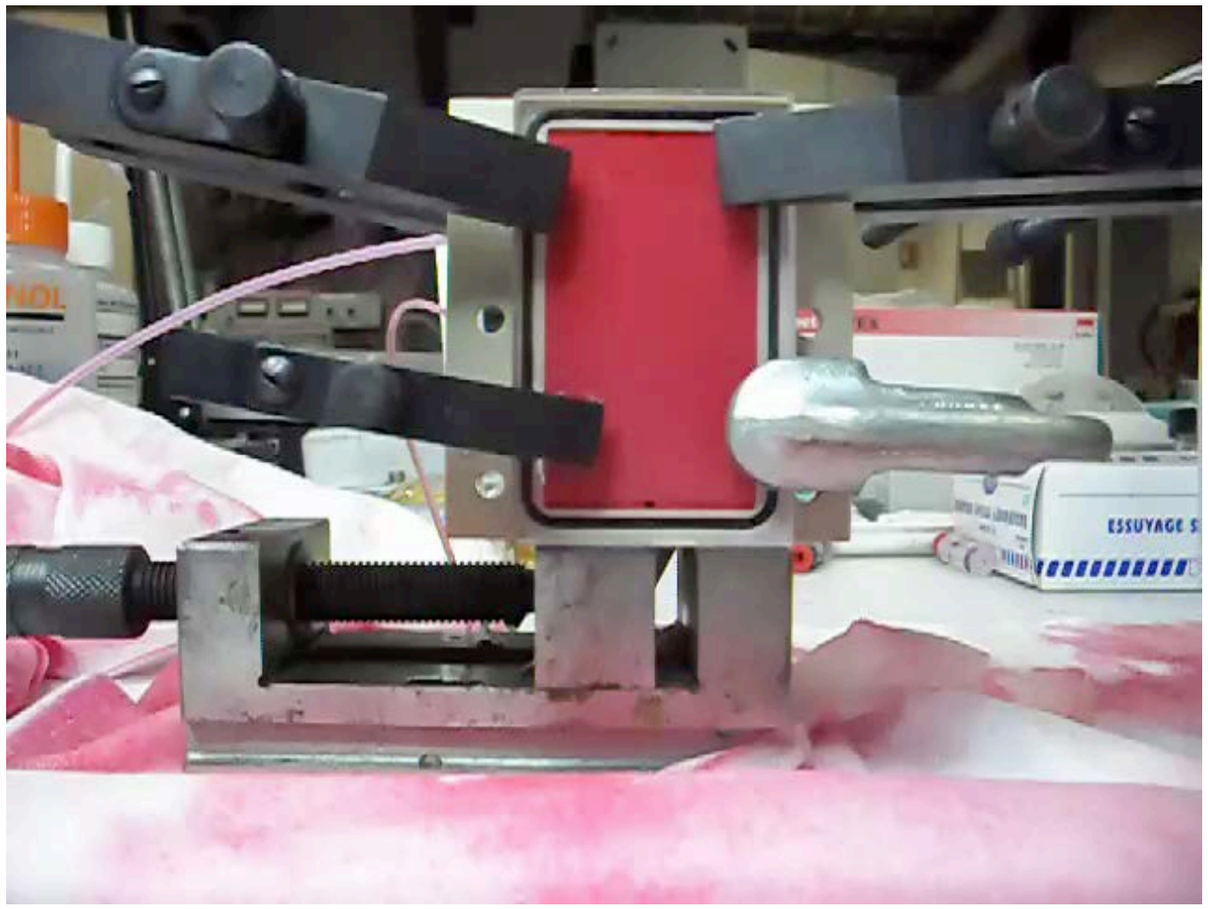
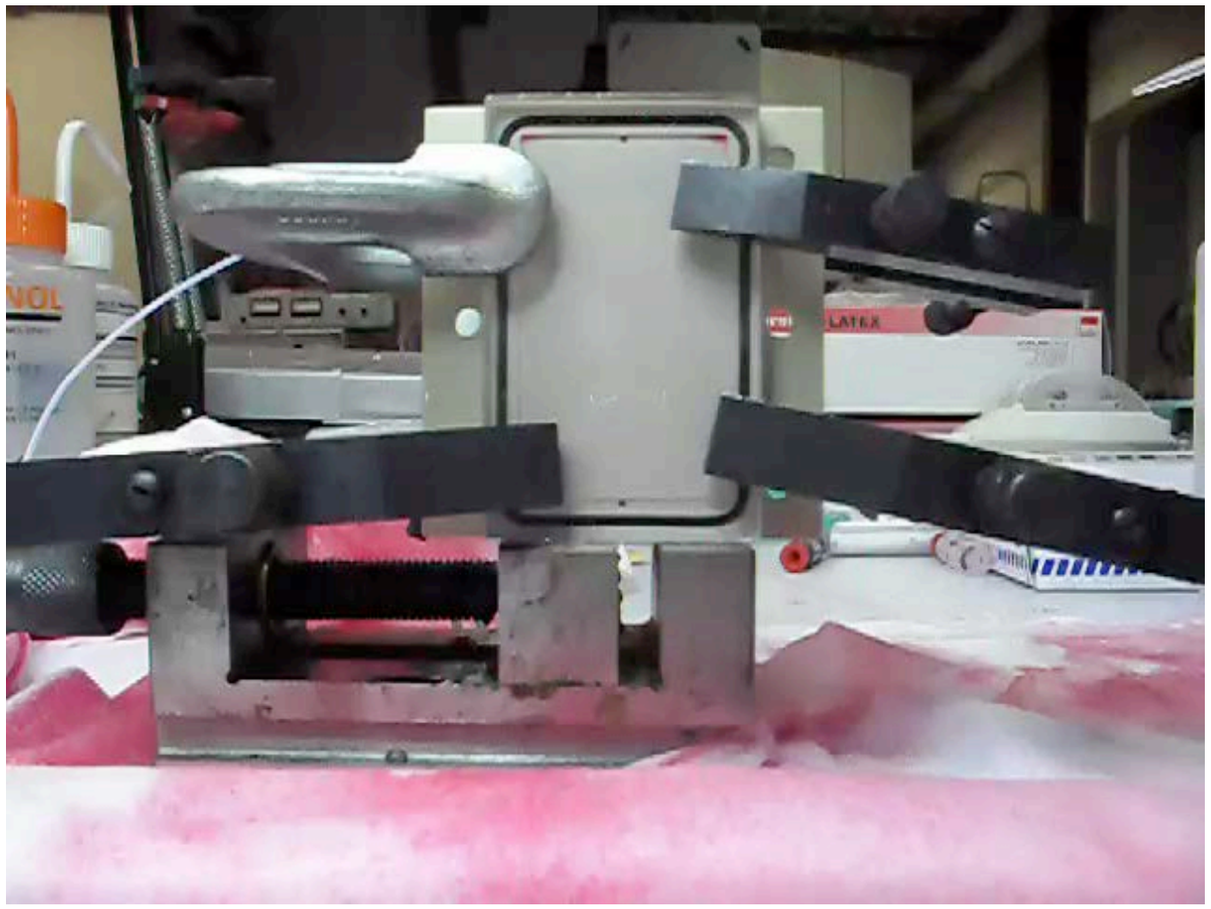


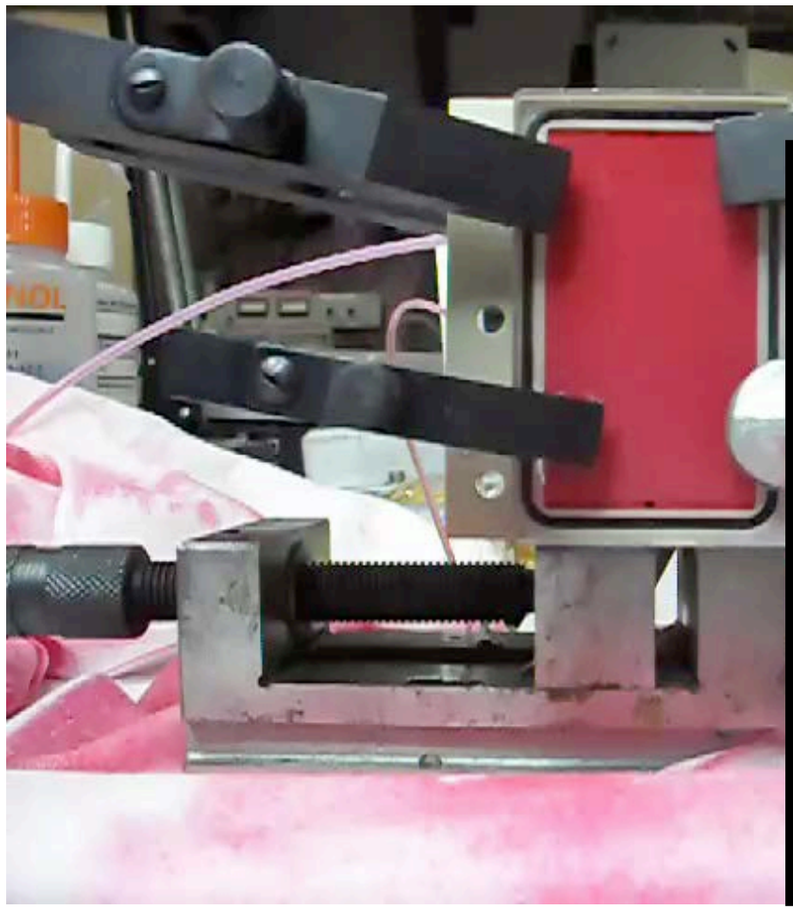
Using Flow to Control Surfaces



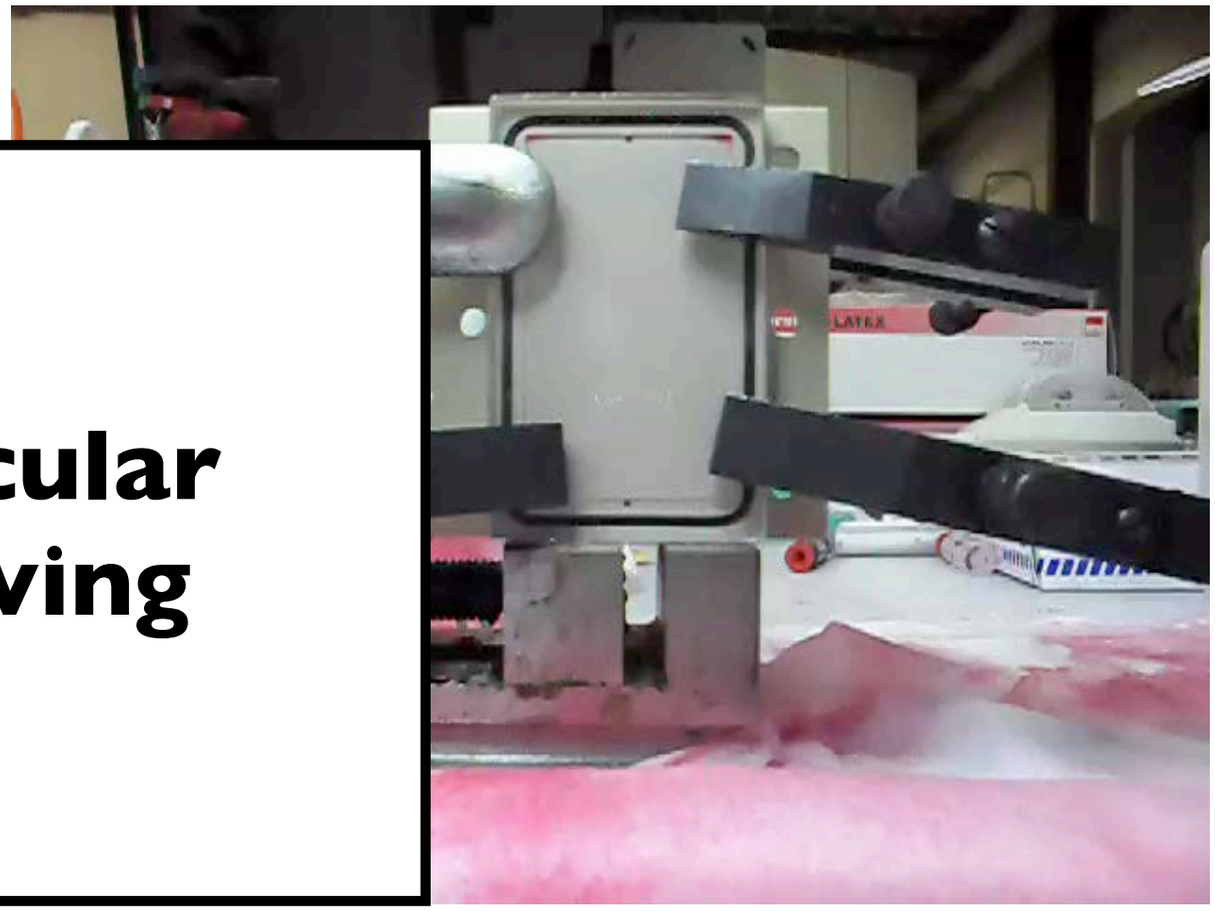


Using flow to align surfaces with cellulose

Using Flow to Control Surfaces



Molecular Weaving



Using flow to align surfaces with cellulose