Pathogen Capture Using Floating Films

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MITRE Sponsored Research

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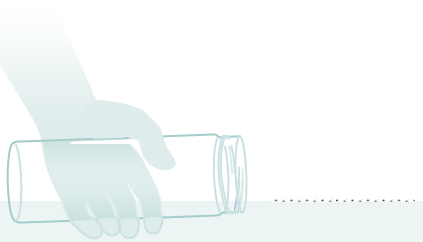
Problem



- Low concentrations of harmful microbes are difficult to detect in large bodies of water.
- We will design and test a novel method of capturing and concentrating pathogens at the water surface.

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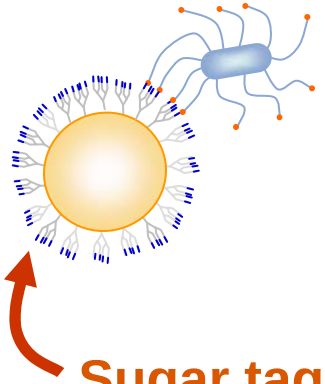
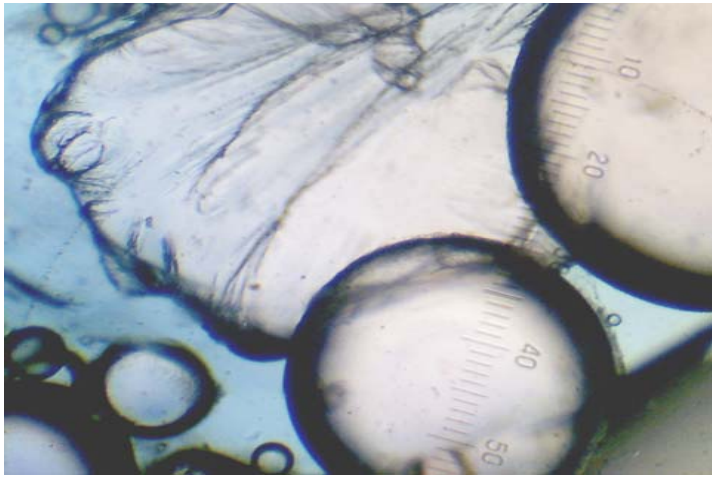
Background



A pathogen must stick to a tissue surface in order to cause an infection.

Sugar tags on animal cell surfaces are often targets of viral and bacterial pathogens.



Bubbles of lipo-glycoprotein film

- Sugar targets can be used to **trap** pathogens.
- Plant and animal tissue fluids contain glycoproteins that can be induced to produce floating biocapture films laced with host-specific sugar targets.

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Objective

- Design and test a prototype film to collect and concentrate specific pathogens
- Provide a low-cost method of rapidly surveying surface waters
  - to facilitate the collection of water samples for analysis
  - to provide early warning of harmful biological contamination

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Activities

- **Optimize and quantify the film's stability and efficiency under different conditions**
  - **Vary micelle size and composition, pathogen concentration, and exposure time**
  - **Experimentally measure sensitivity and selectivity of capture surface**
- **Plan and implement field tests**

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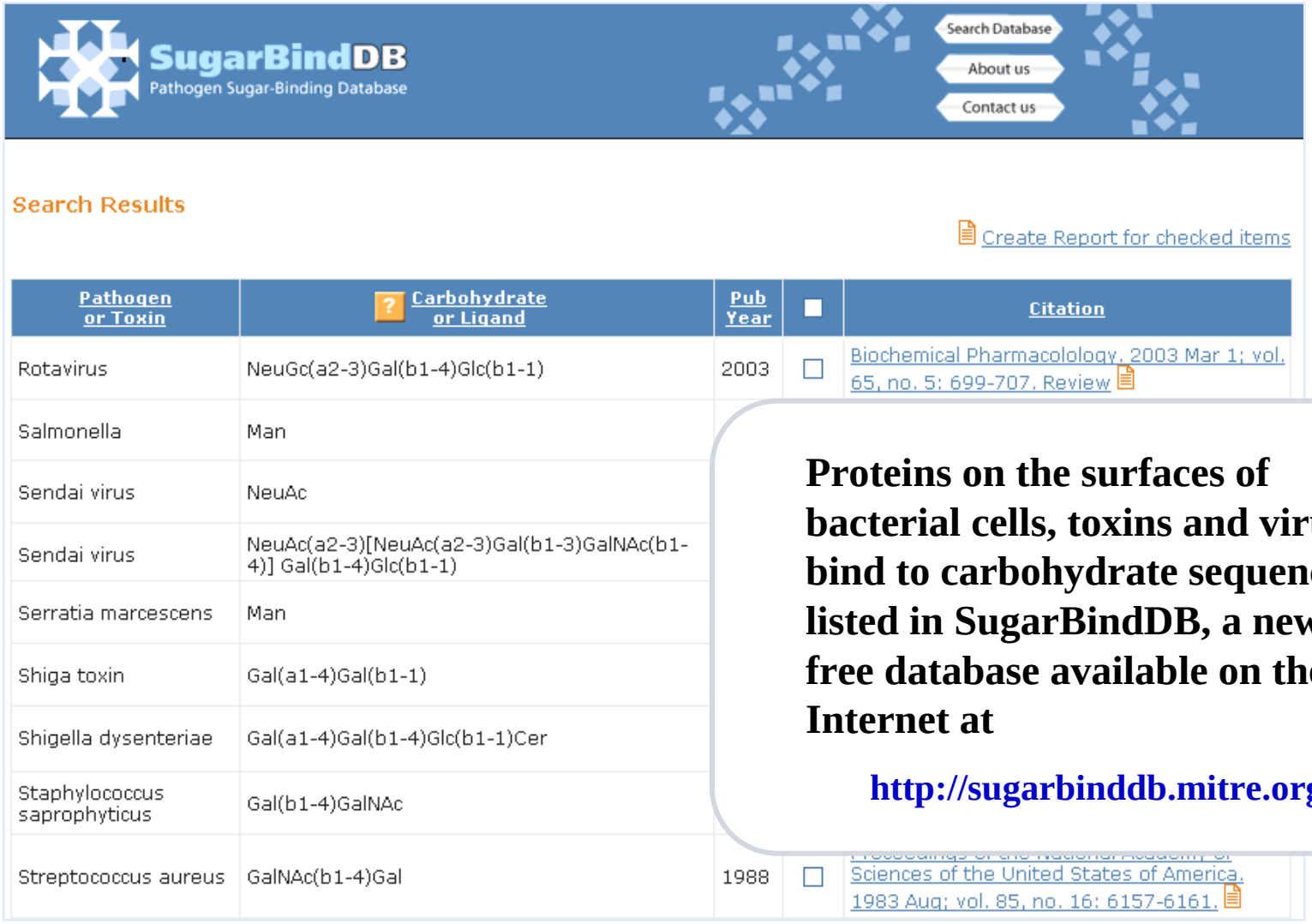
Highlight



Proteins on the surfaces of bacterial cells, toxins and viruses bind to carbohydrate sequences listed in SugarBindDB, a new, free database available on the Internet at

http://sugarbinddb.mitre.org/

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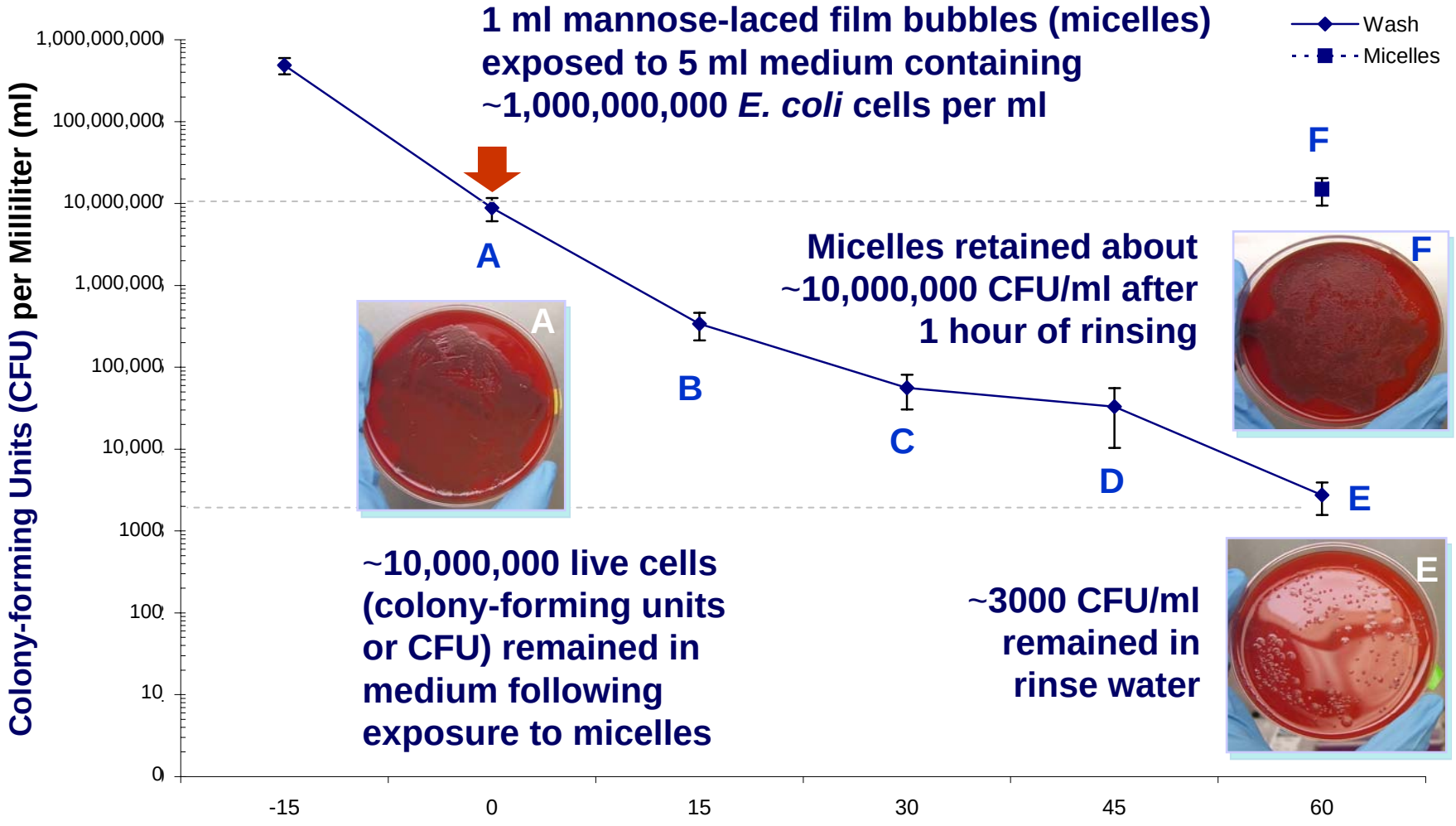
Highlight:

Biocapture Experiment



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Impacts

- **“Designer films” offer an inexpensive means of concentrating pathogens and toxins at the water surface.**
- **The technology will facilitate the collection of water samples for analysis.**
- **MITRE is building a patent portfolio in this area.**

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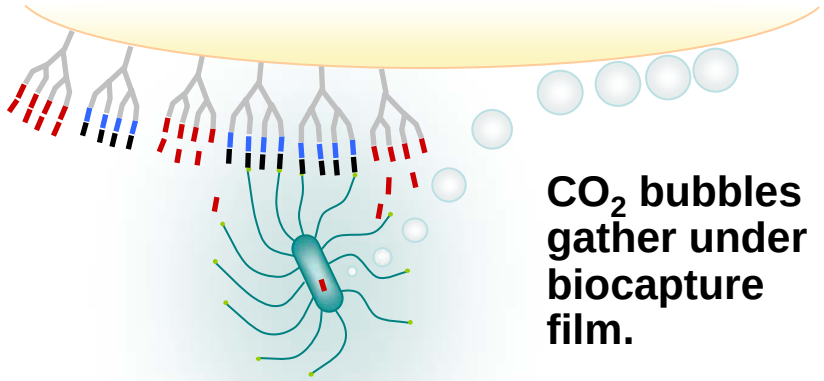
Future Plans

- **Produce a designer film bearing two different sugar strings:**
  - **One to capture**
  - **One to report the production of a species-specific enzyme**
- **Detect release of carbon dioxide**

Bubbles of CO_2 gas are visible on film surfaces.



CO_2 bubbles gather under biocapture film.

Bacteria produce enzymes to break specific carbohydrate linkages, releasing simple sugars that can enter the cell.

When sugars are metabolized, CO_2 gas is released.

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