

**‘Can simple sugars combat bacterial infection?’**

**Chemists and biologists join force’**

Dr Claire Jackson [clj@soton.ac.uk](mailto:clj@soton.ac.uk)

# Cilia defend our lungs

**Photron**

500 fps

Start

Date : 2013/1/24

FASTCAM MC2-500

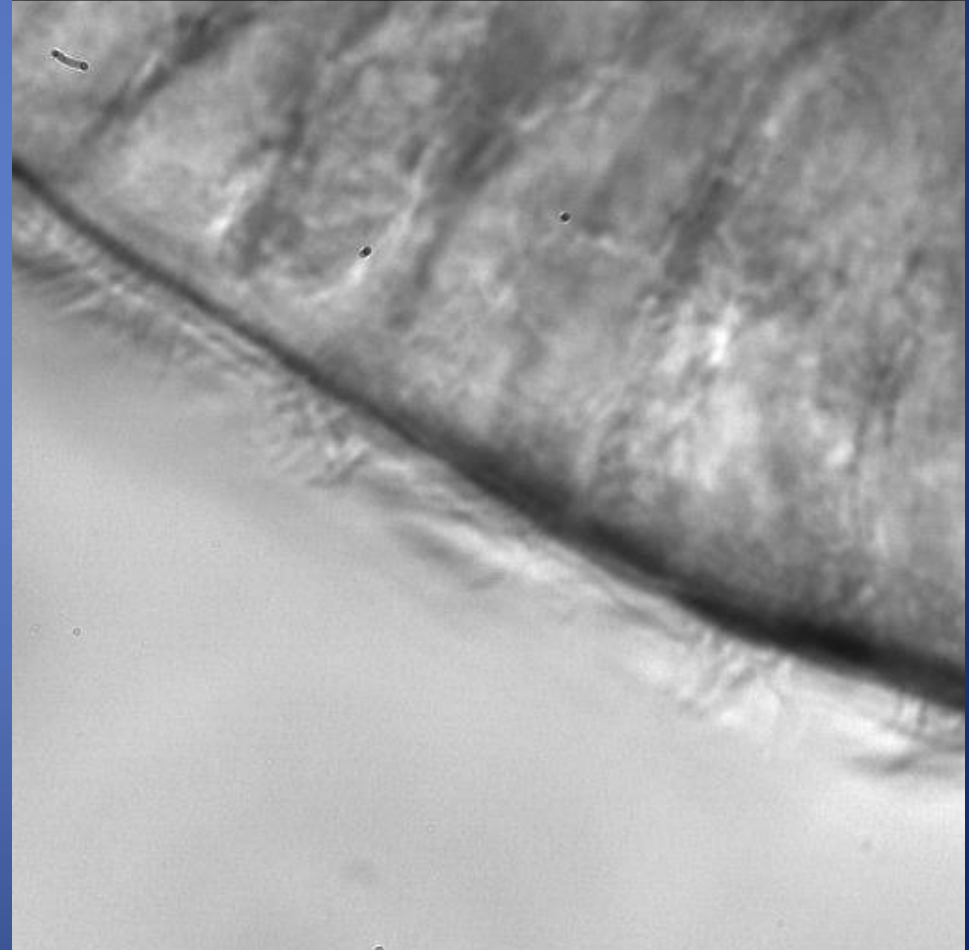
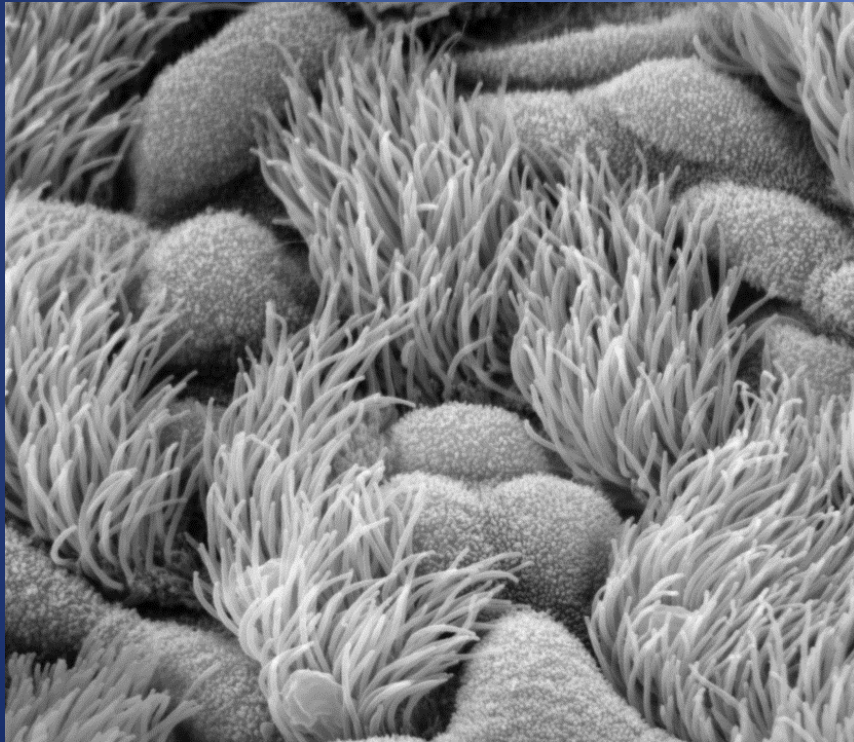
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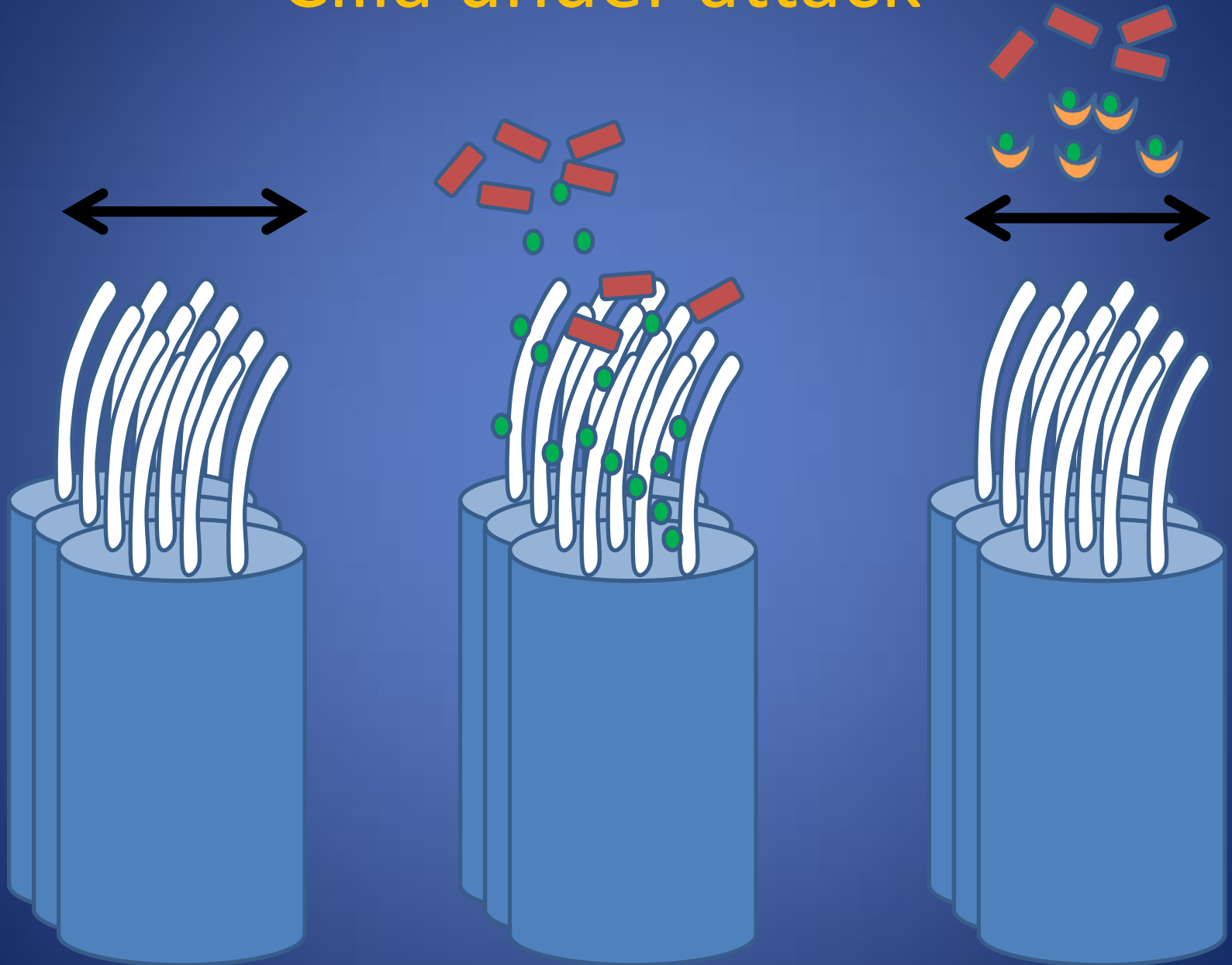
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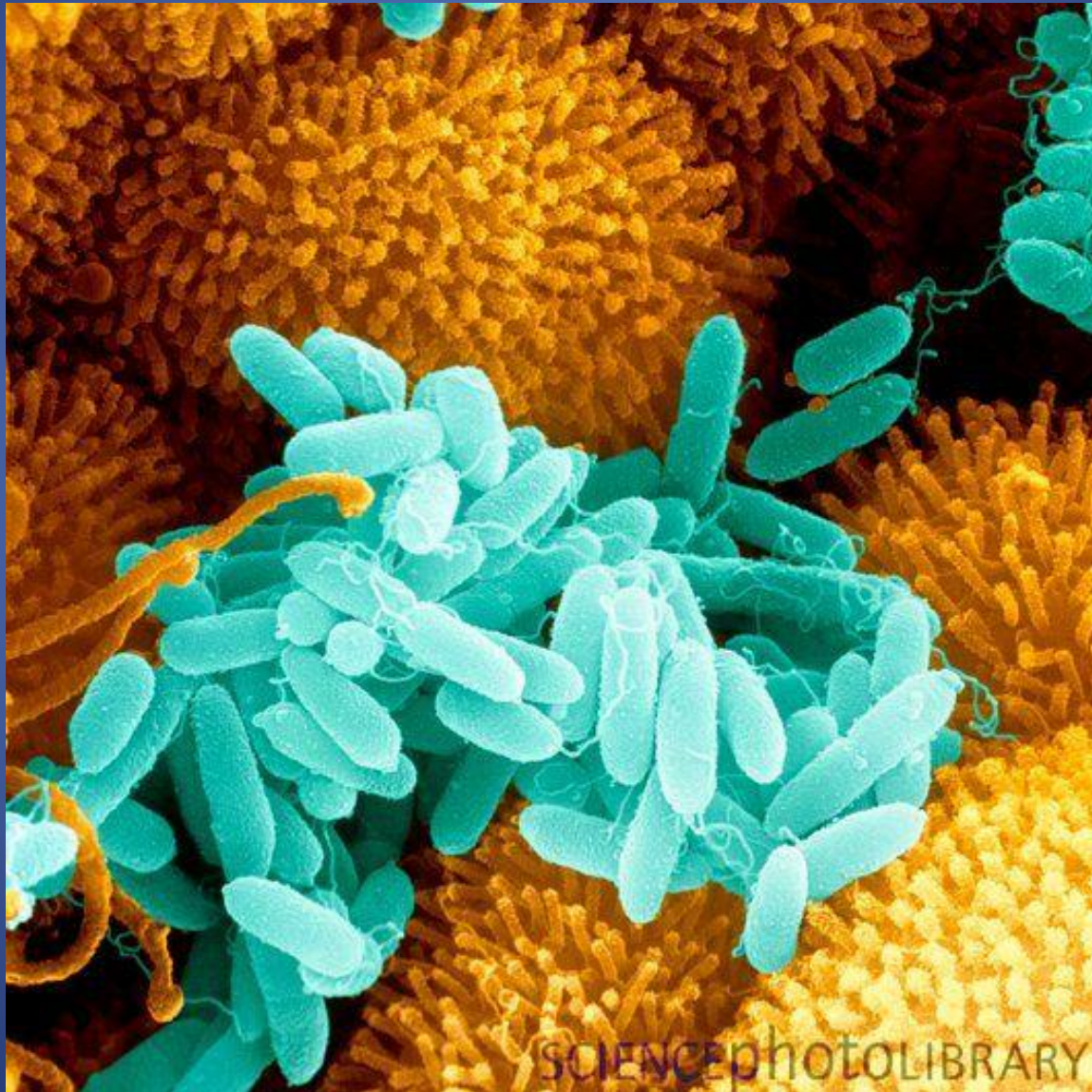
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# Cilia under attack



# *Pseudomonas* infection





# *Pseudomonas* burden

A microscopic image of numerous Pseudomonas bacteria, which are rod-shaped and have flagella, set against a dark background.

- Ubiquitous in the environment
  - Opportunistic human pathogen
  - 13 year study of Europe intensive care units
    - 17% *Pseudomonas* +
    - 400,000 patients had hospital-acquired antibiotic resistant strains
- Nathwani et al. *Antimicrob Resist Infect Control* (2014) 3 p.32

# Sugar therapy

## ***Pseudomonas aeruginosa* II Lectin Stops Human Ciliary Beating: Therapeutic Implications of Fucose**

ELIZABETH C. ADAM, BARRY S. MITCHELL, DIETLIND U. SCHUMACHER, GEORGE GRANT,  
and UDO SCHUMACHER

From the Department of Human Morphology, University of Southampton and Ear, Nose and Throat Department, Southampton General Hospital, Southampton; Anglo-European College of Chiropractic, Bournemouth; and the Rowett Research Institute Aberdeen, United Kingdom

AM J RESPIR CRIT CARE MED 1997;155:2102-2104.

*Int. J. Med. Sci.* 2008, 5

371

**International Journal of Medical Sciences**

ISSN 1449-1907 www.medsci.org 2008 5(6):371-376

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Research Paper

## **Inhalation with Fucose and Galactose for Treatment of *Pseudomonas Aeruginosa* in Cystic Fibrosis Patients**

Hans-Peter Hauber<sup>1,2</sup> ✉, Maria Schulz<sup>2</sup>, Almuth Pforte<sup>2</sup>, Dietrich Mack<sup>3</sup>, Peter Zabel<sup>1</sup>, Udo Schumacher<sup>4</sup>

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2. Department of Medicine I, University Hospital Hamburg-Eppendorf, Germany.

3. Department of Microbiology and Immunology, University Hospital Hamburg-Eppendorf, Germany.

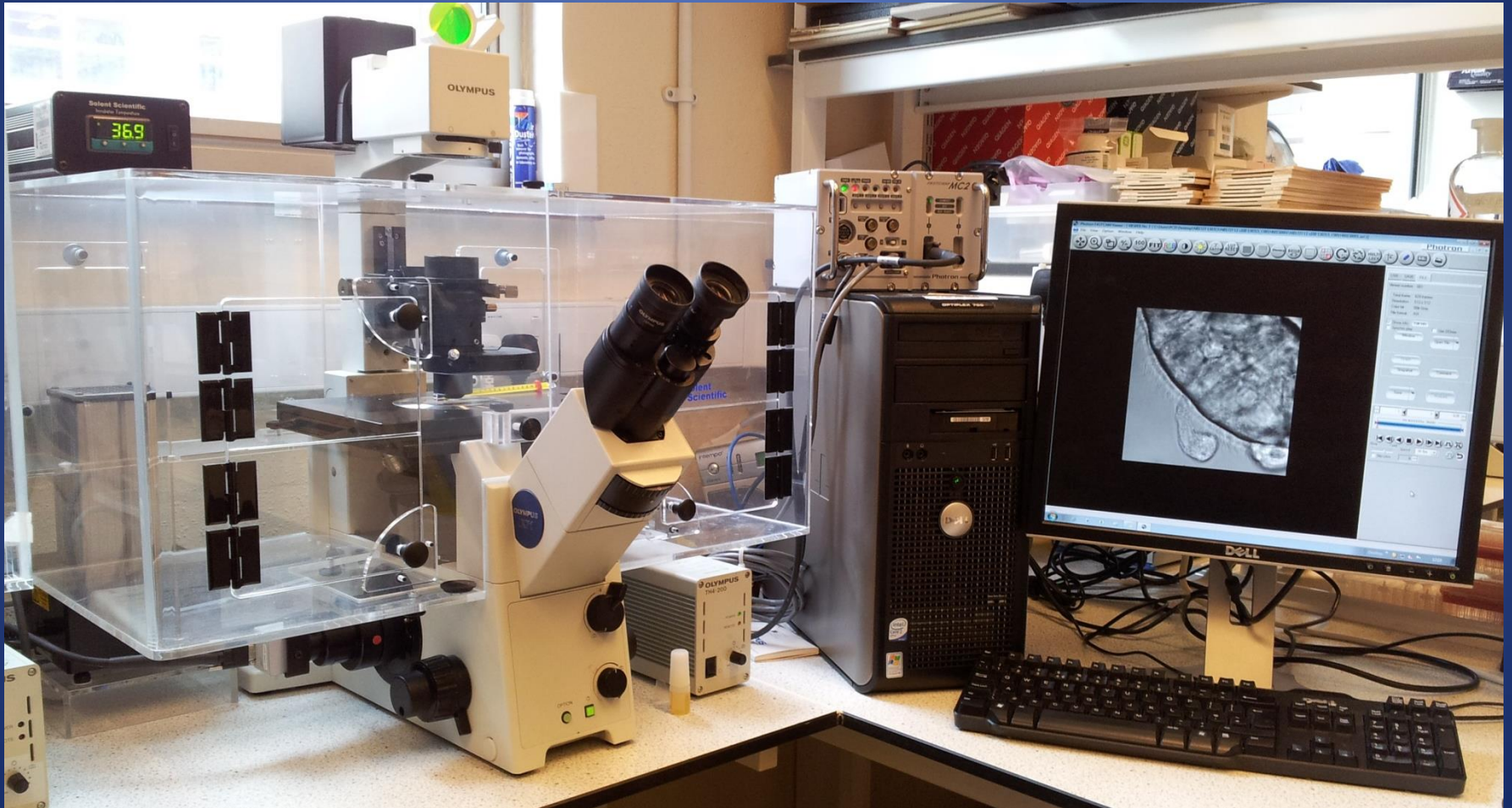
4. Department of Anatomy II: Experimental Morphology, University Hospital Hamburg-Eppendorf, Germany

# Sampling airway epithelium





# High-speed video microscopy





# Cilia movement analysis

**Photron**

FASTCAM-PCI R2 m...

250 fps

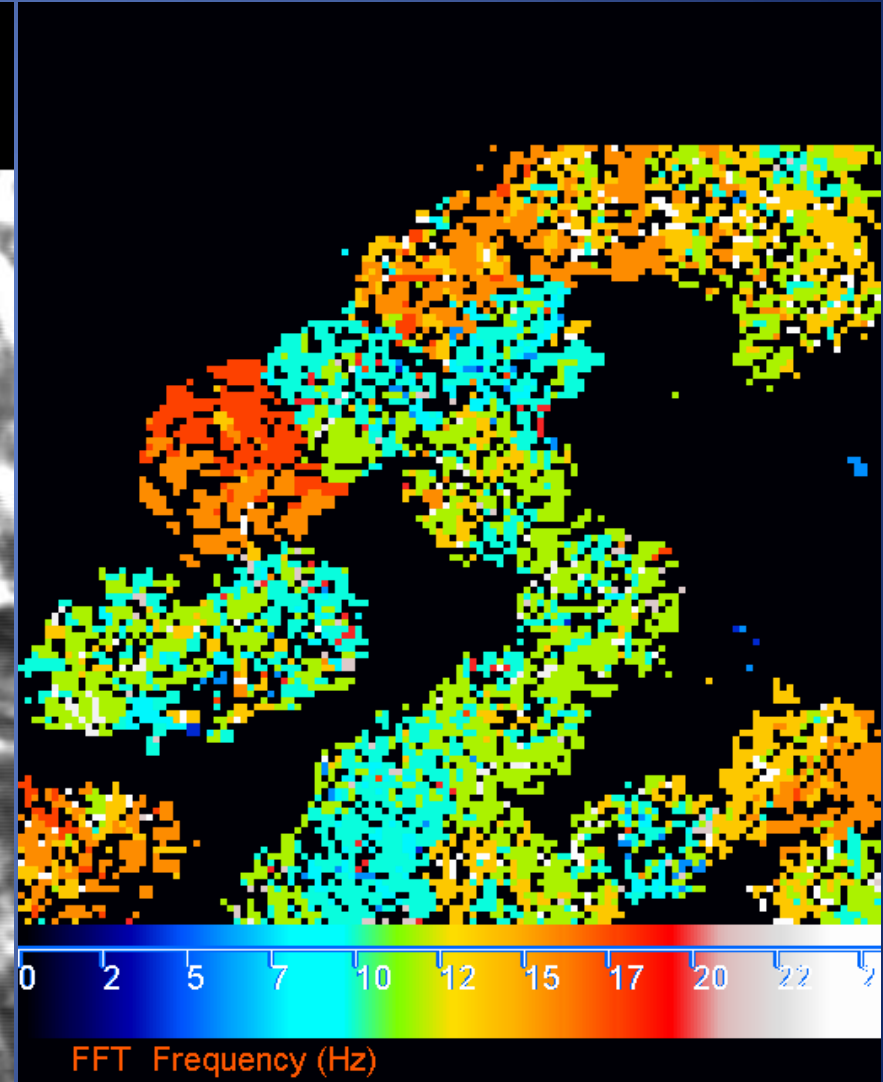
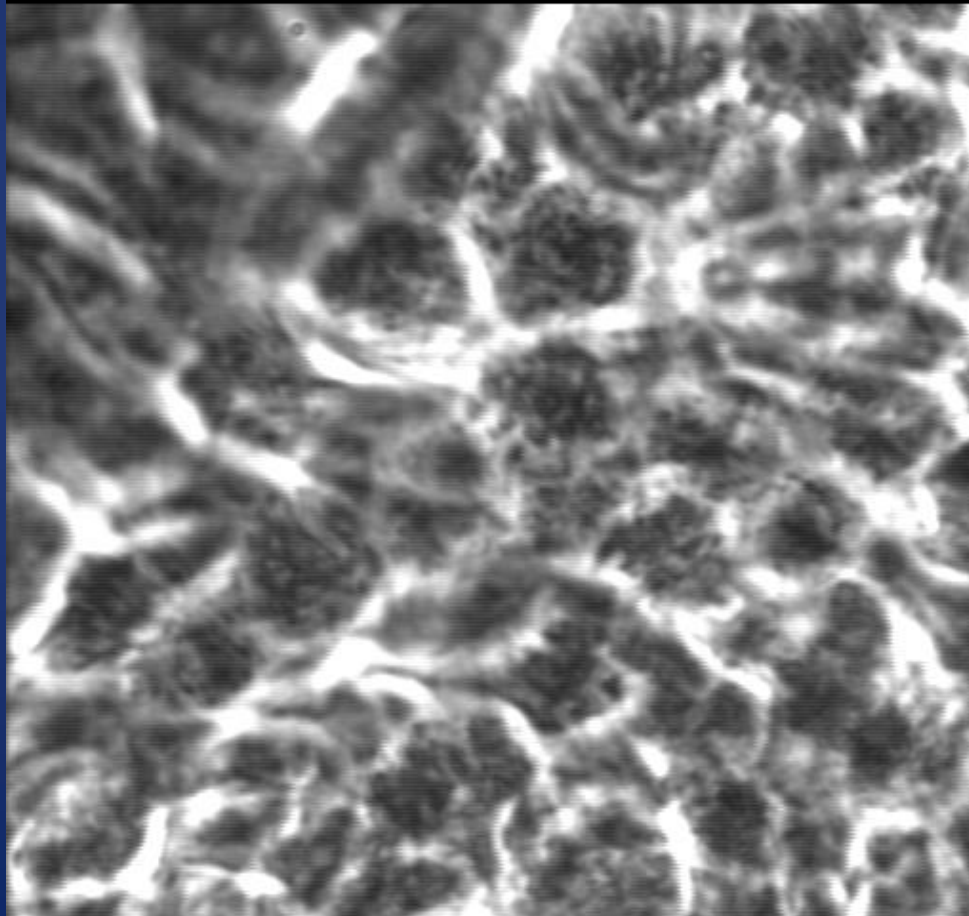
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Start

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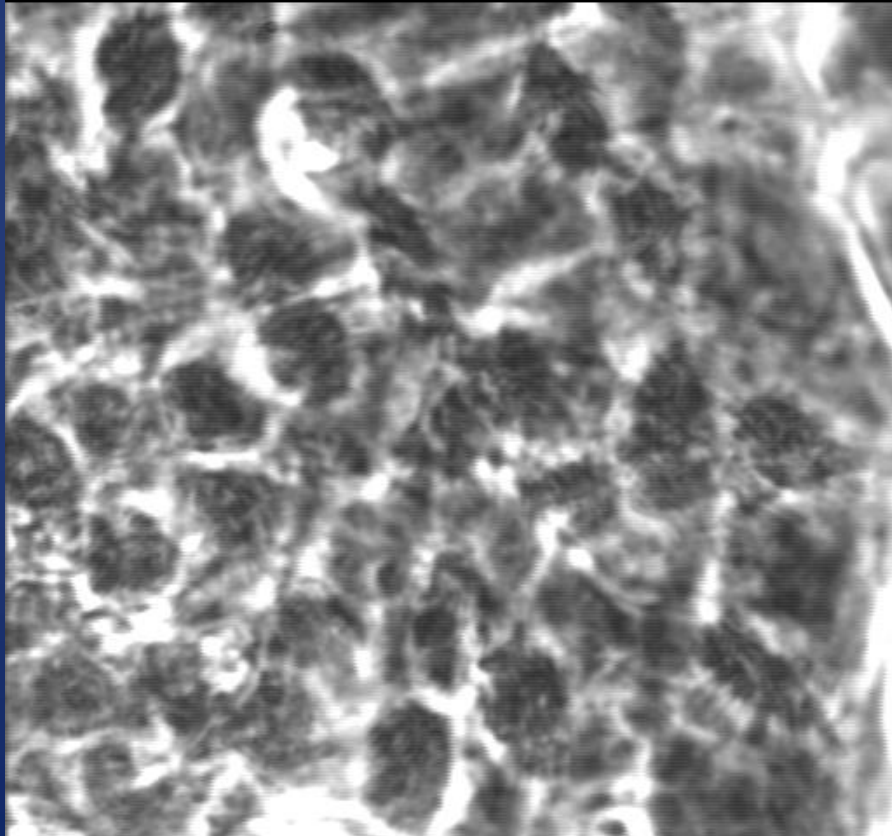


# *Pseudomonas* lectin stops cilia

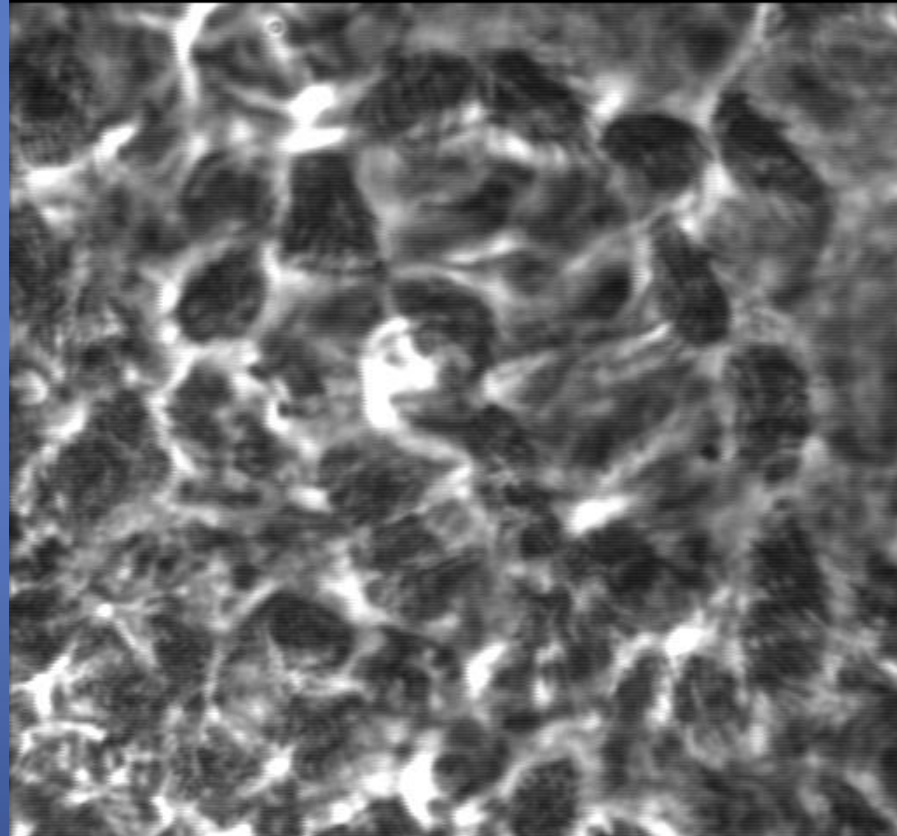
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+ Lectin 1h

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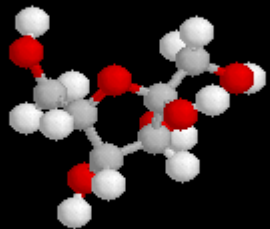
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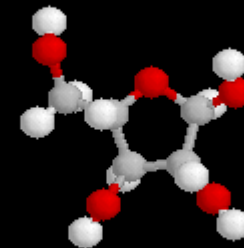




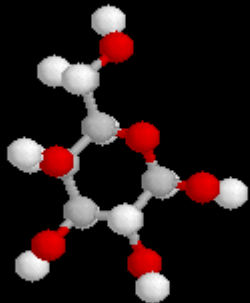
# Sugar - $(\text{CH}_2\text{O})_n$



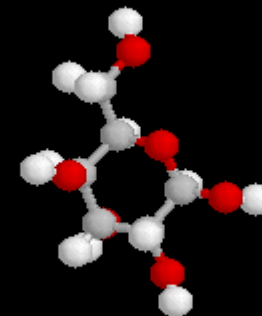
MDL



MDL

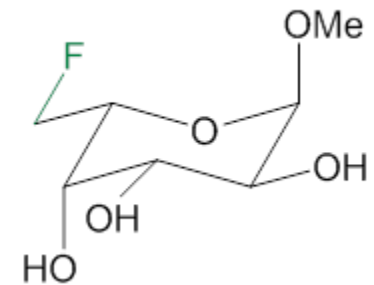
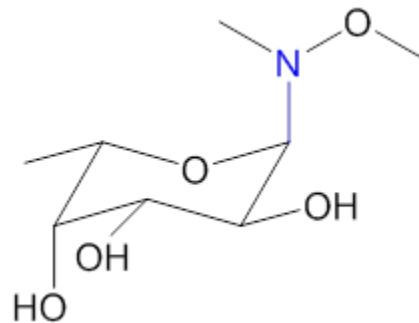
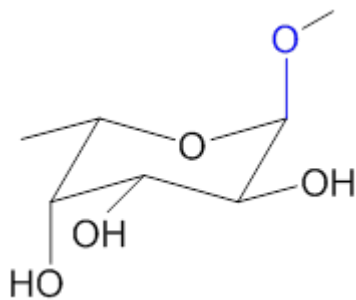
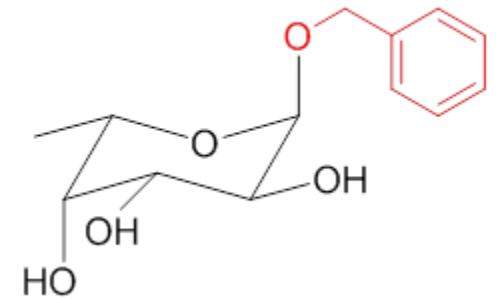
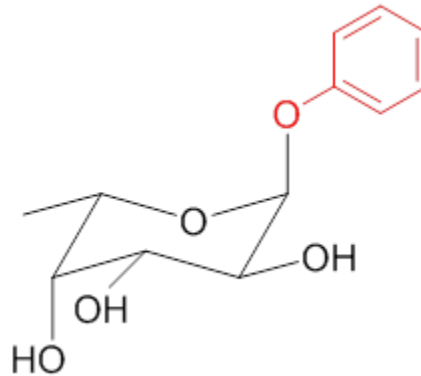
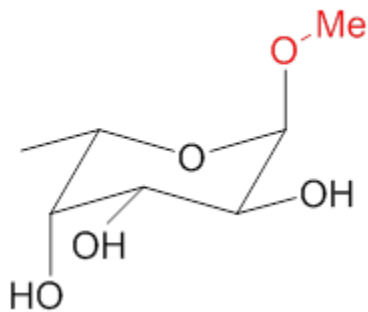


MDL



MDL

# Modified L-fucose



# Modified sugars future directions

- Protect cilia defense
- Prevent bacterial colonisation
- Improve antibiotic efficacy
- Prototype for aerosolised therapy



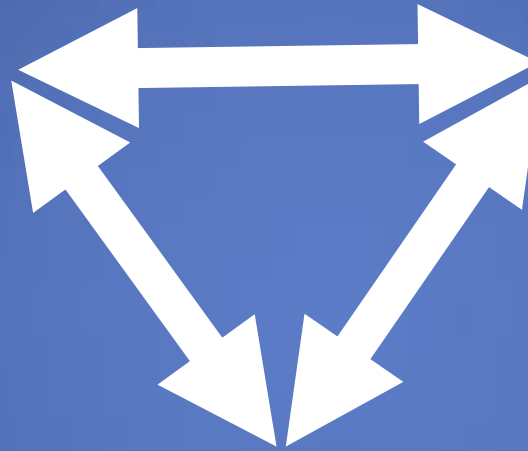
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Mr Rob Szpera

NAMRIP pump priming is funded by EPSRC's Network for Antimicrobial Action 'Bridging the Gap' call (EP/M027260/1).

<http://www.southampton.ac.uk/namrip>