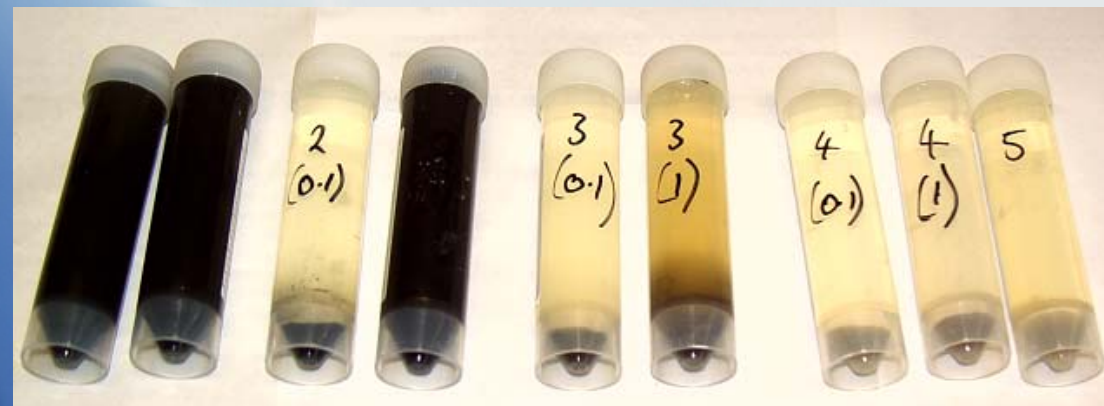
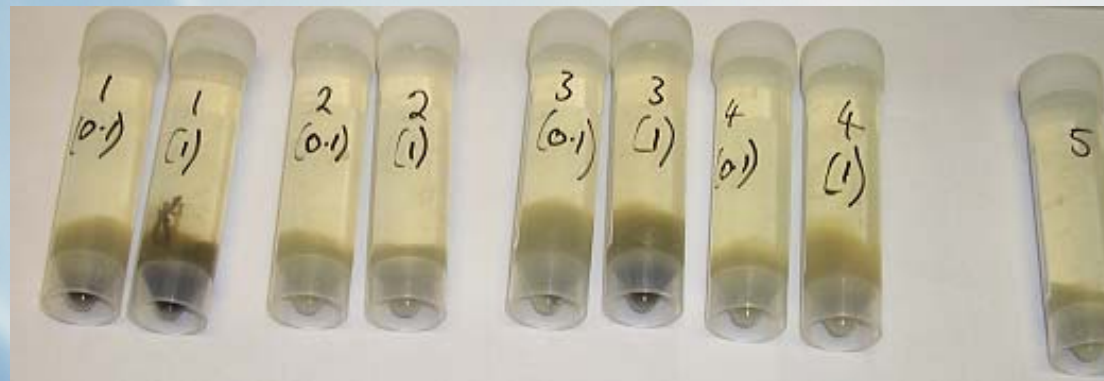




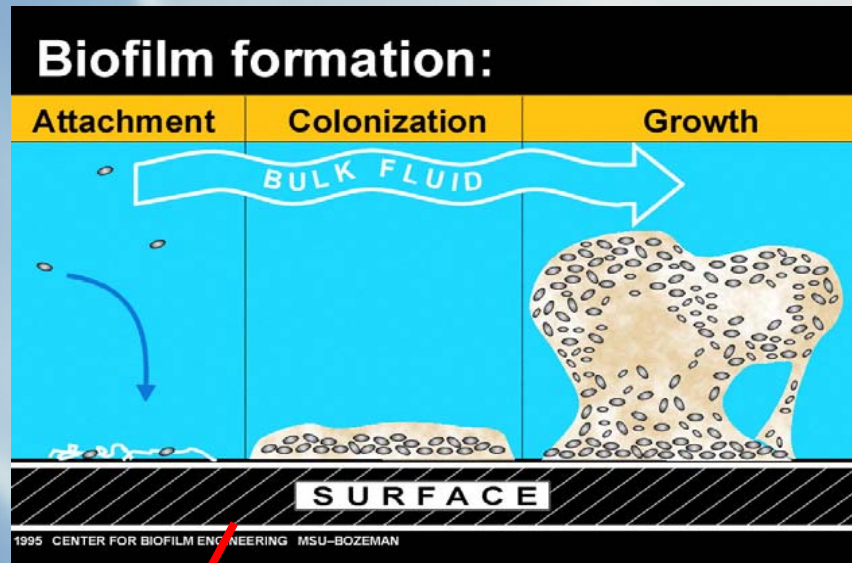
A tale of interdisciplinary research: Material Science meets Microbiology

Tom Smith
Biomedical Research Centre
Sheffield Hallam University

In the beginning were Sulphate (Sulfate)-
reducing bacteria

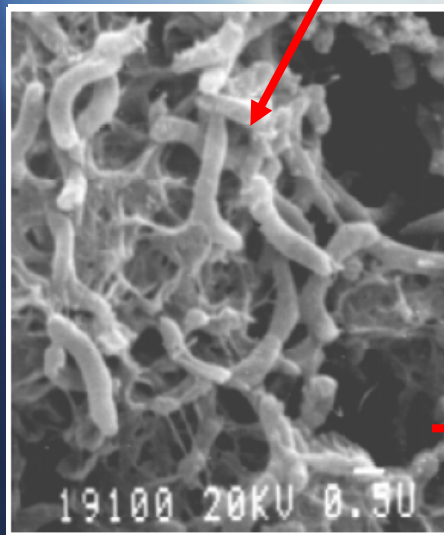


Microbiologically Influenced Corrosion (MIC) (Bacteria & Biofilms)



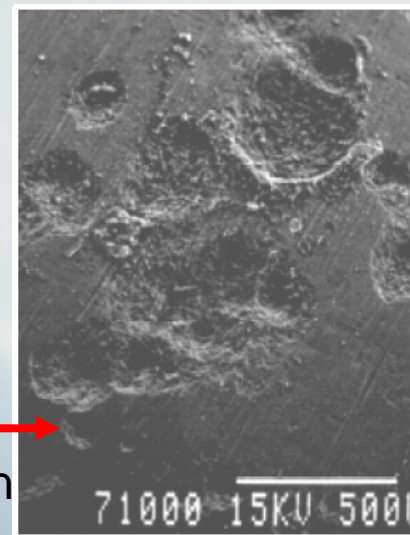
Microorganisms, especially bacteria, colonise surfaces to form **Biofilms**

} Biofilm formation; up to 48hrs depending upon temperature



Colonisation of Sulphate Reducing Bacteria (SRB)

H₂S formation



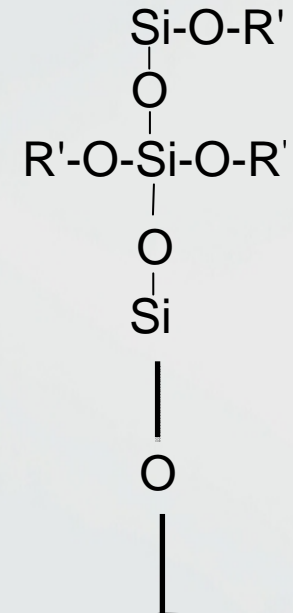
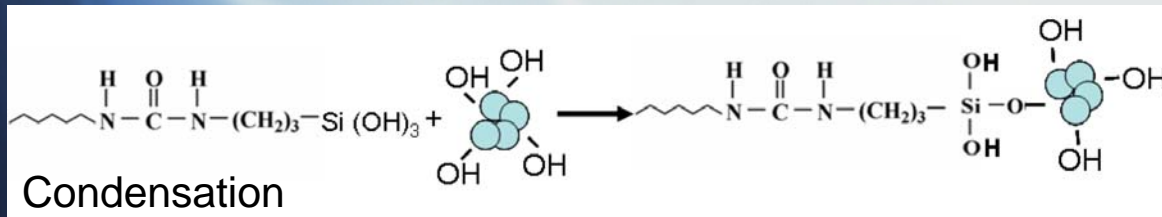
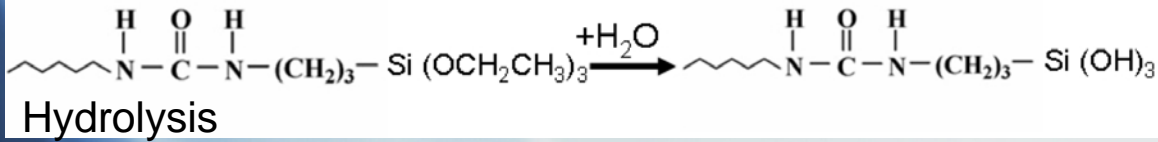
Localised Corrosion (pitting)

Consequences of MIC



Sol gel chemistry

Precursor $\text{Si}(\text{OC}_2\text{H}_5)_3 = \text{Si-O-R}'$, where $\text{R}' = \text{C}_2\text{H}_5$

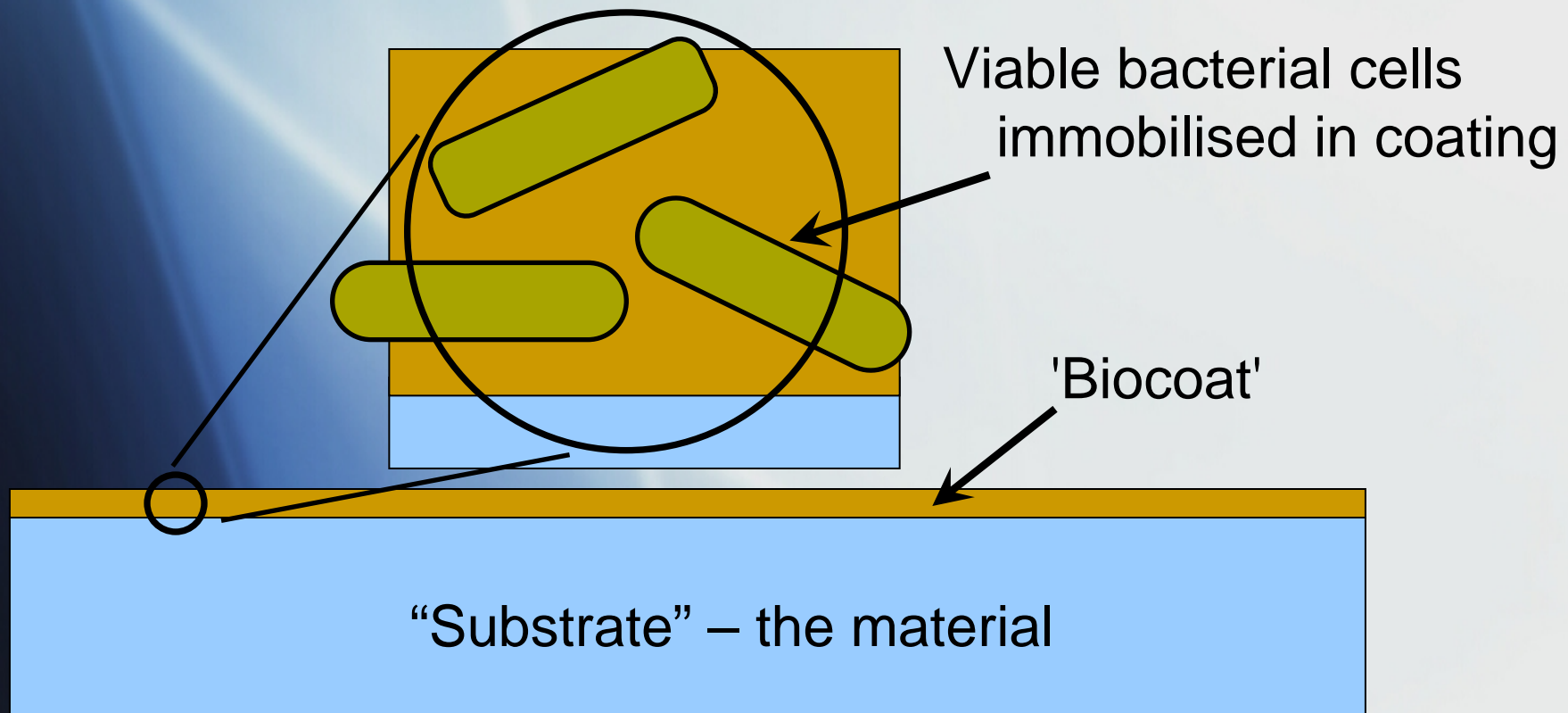


Metal "substrate"

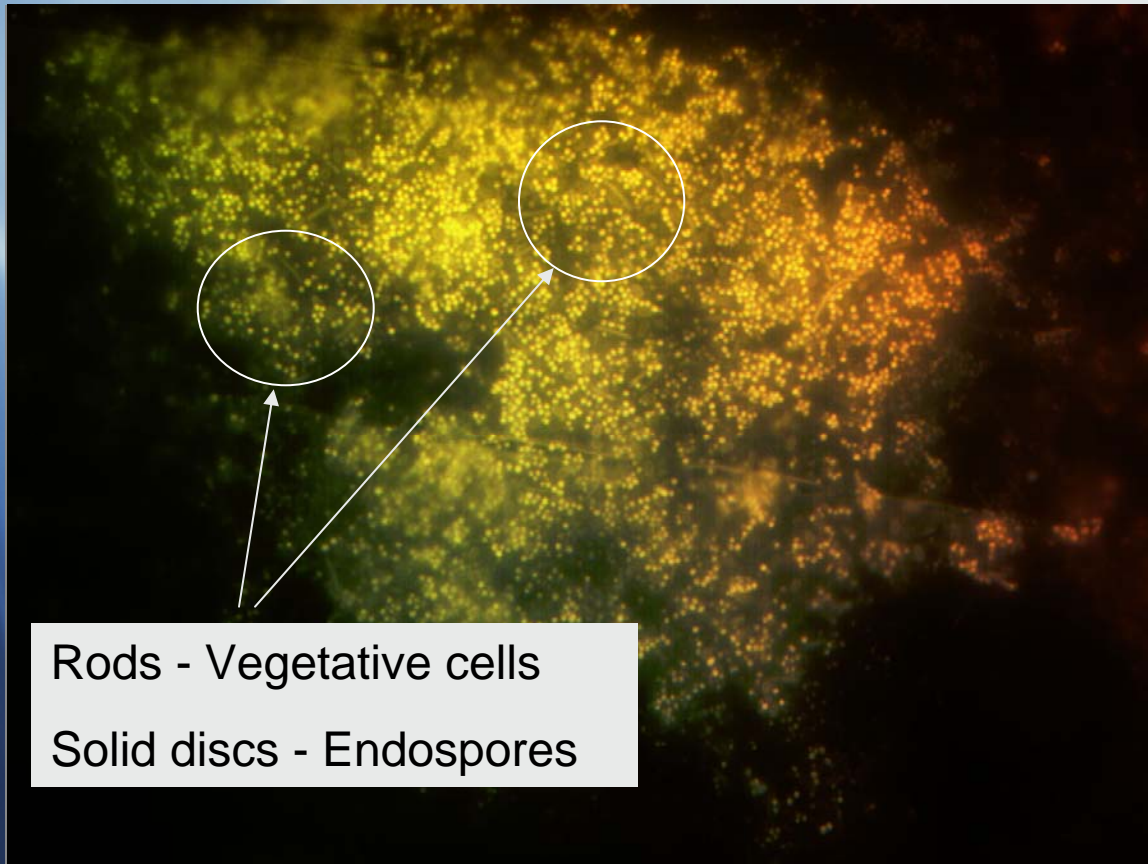
'Bacterial-active' sol-gel coatings

Anti-'microbial induced corrosion' (MIC) coating

- Combination of anti-corrosion sol-gel coating and protective bacteria.
- Uniform distribution of protective bacteria fixed on the surface

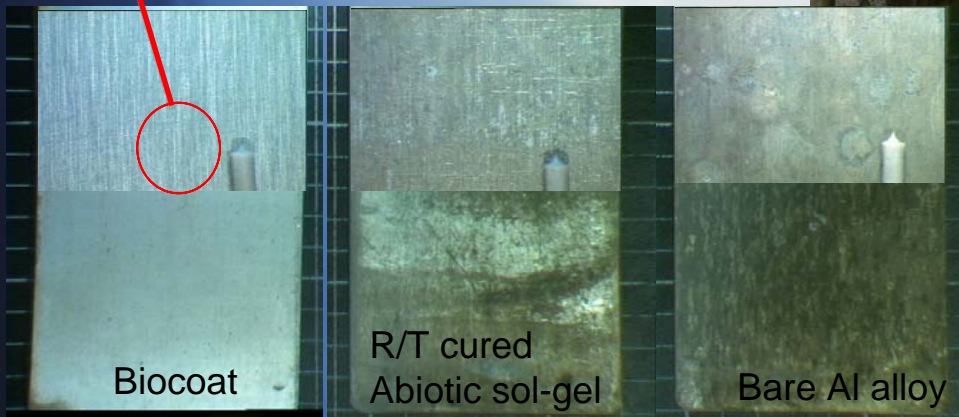


Colonisation of cells within sol-gel coating

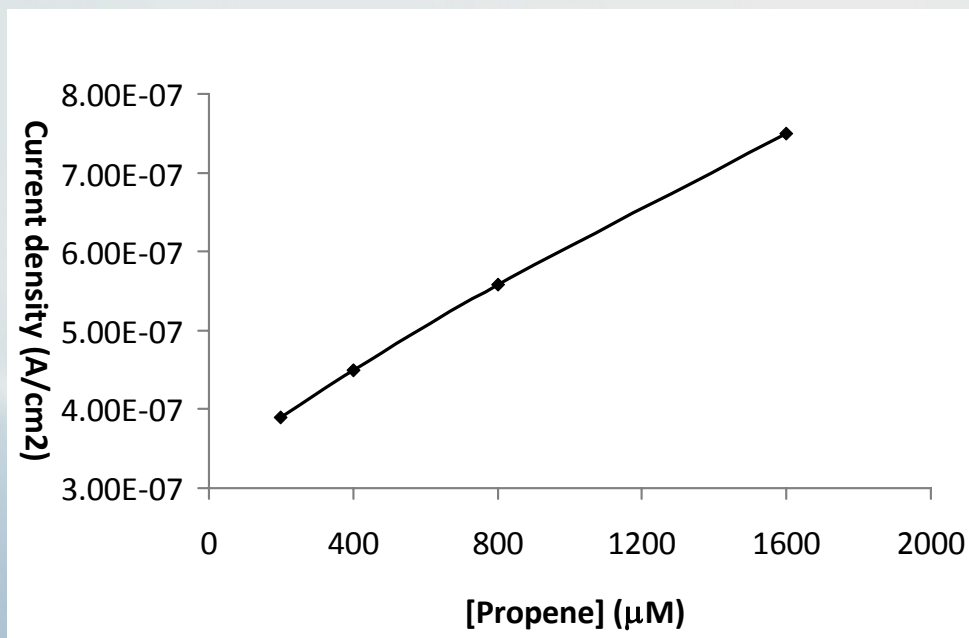
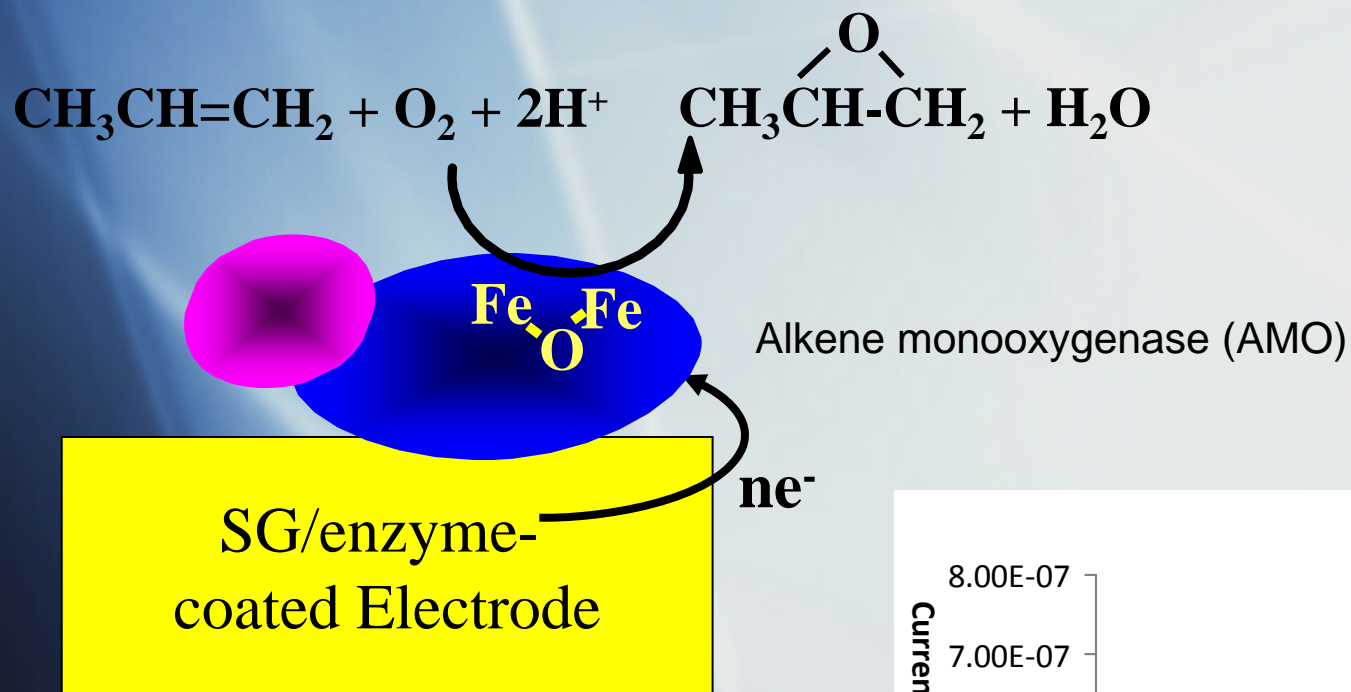


Immersion in
nutrient broth
for 1 hour

Original concept - Biocoat



Sol-gel immobilised enzymes as electrochemical biosensors



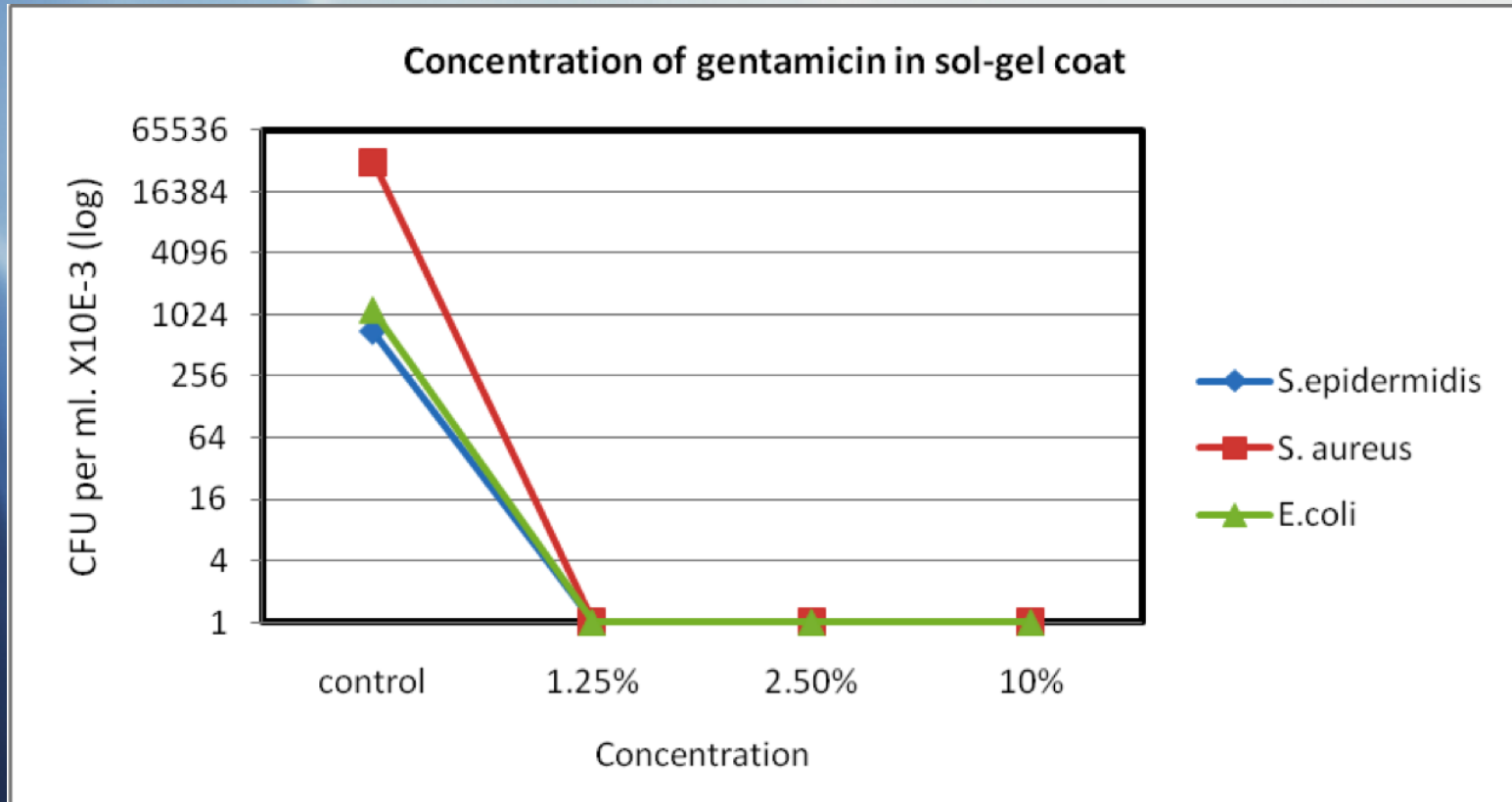
Controlled-release antibiotic coatings for orthopaedic prostheses



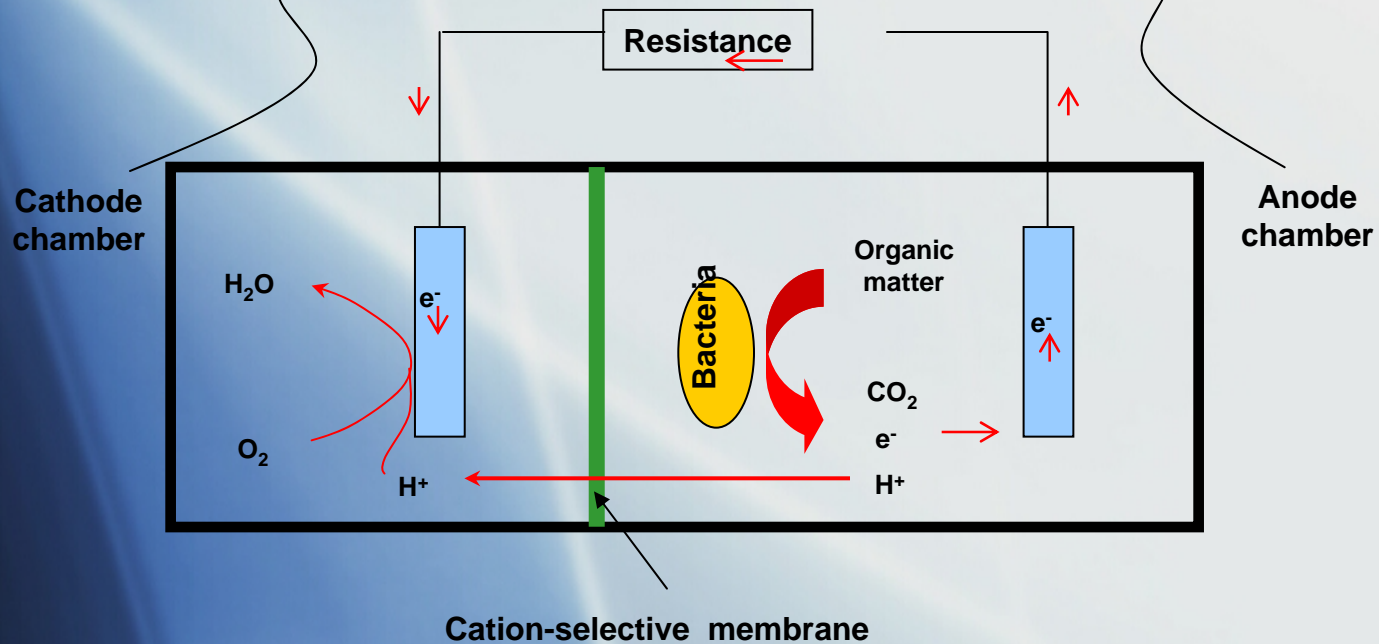
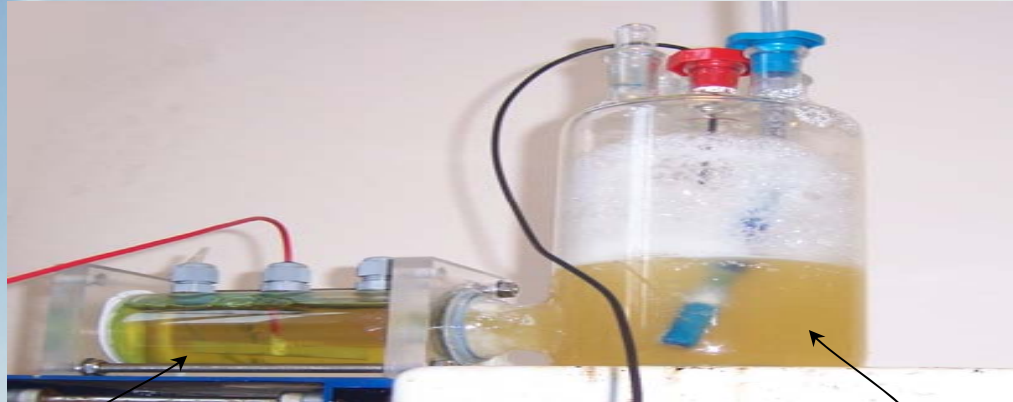
Traditionally implants (e.g. replacement hip and knee joints) are secured with antibiotic-containing cement to reduce post-operative failure due to infection (1%)

We are developing new controlled-release antibiotic coatings to help prevent infection of modern uncemented prostheses

Results - Effect of antibiotic concentration



Microbial Fuel Cell (mediator-less)



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