

Evaluation of the Mechanism of Action of a Noble Metal Coating Used for Reducing Microbial Adhesion in Orthopaedic Devices

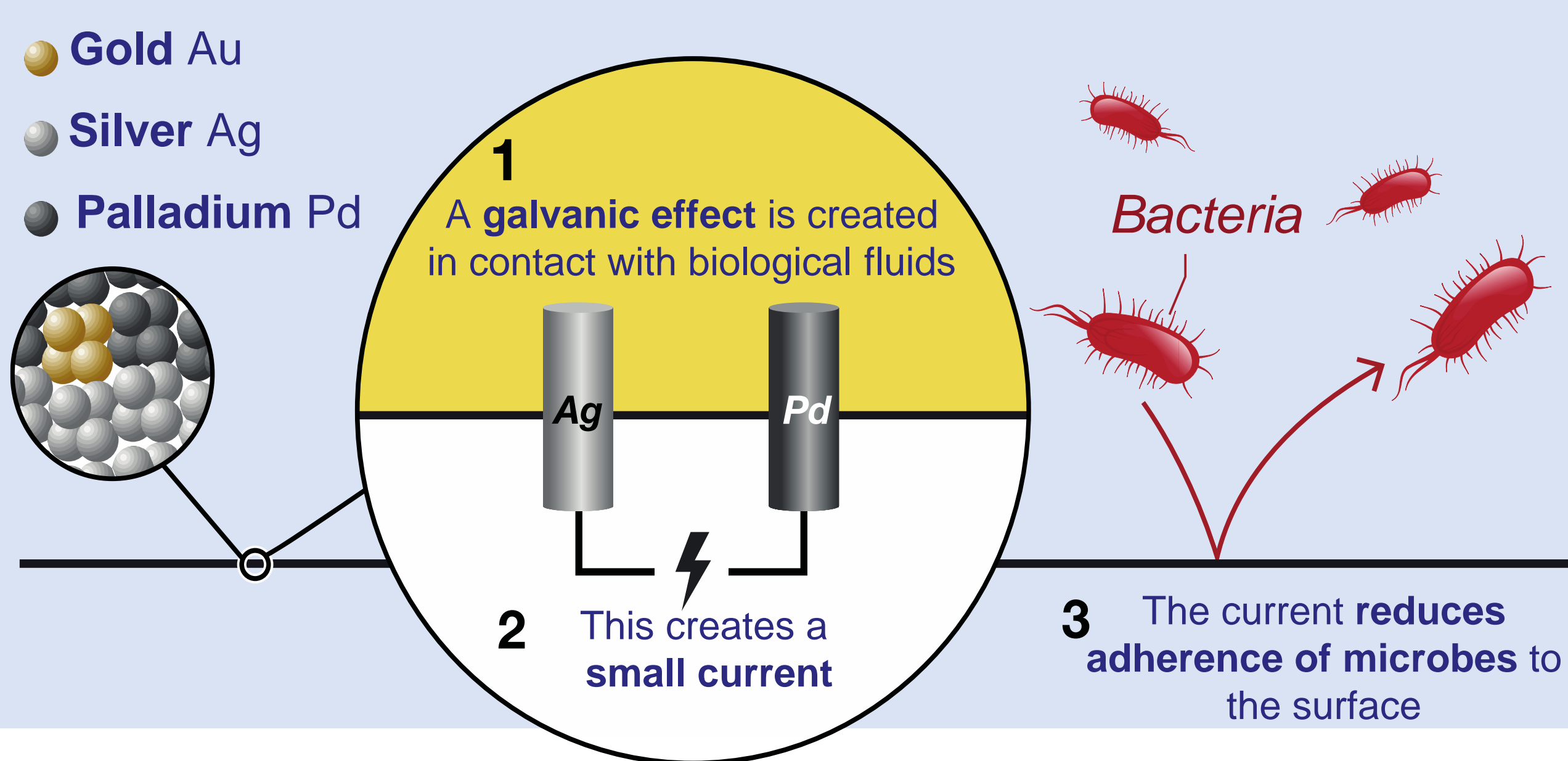
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INTRODUCTION

A noble metal alloy coating* containing silver, gold, and palladium is currently applied to orthopaedic implants and catheters for reducing microbial adhesion and subsequent risk of biofilm formation.



AIM

The aim of this study was to investigate the applicability to the noble metal alloy coating of various mechanisms of action that are typically associated with anti-adhesive and antimicrobial coatings.

METHODS

Galvanic Effect

- Electric Force Microscopy
- PeakForce Tunnelling AFM

Microbial adhesion

- Ahearn test – quantification of surface bound microbes after dynamic incubation with microbes

Microbial Inhibition

- Zone of Inhibition (Zoi) according to ASTM E2149-10

Antimicrobial silver

- Silver release by immersion test (ISO10993-15)
- Ahearn and Zoi test on silver resistant *E.coli* (w/pMG101)

Change in pH

- pH testing of fluid localised to the surface
- pH testing of bulk solution surrounding the surface (results not shown)

Bacterial morphology and membrane integrity

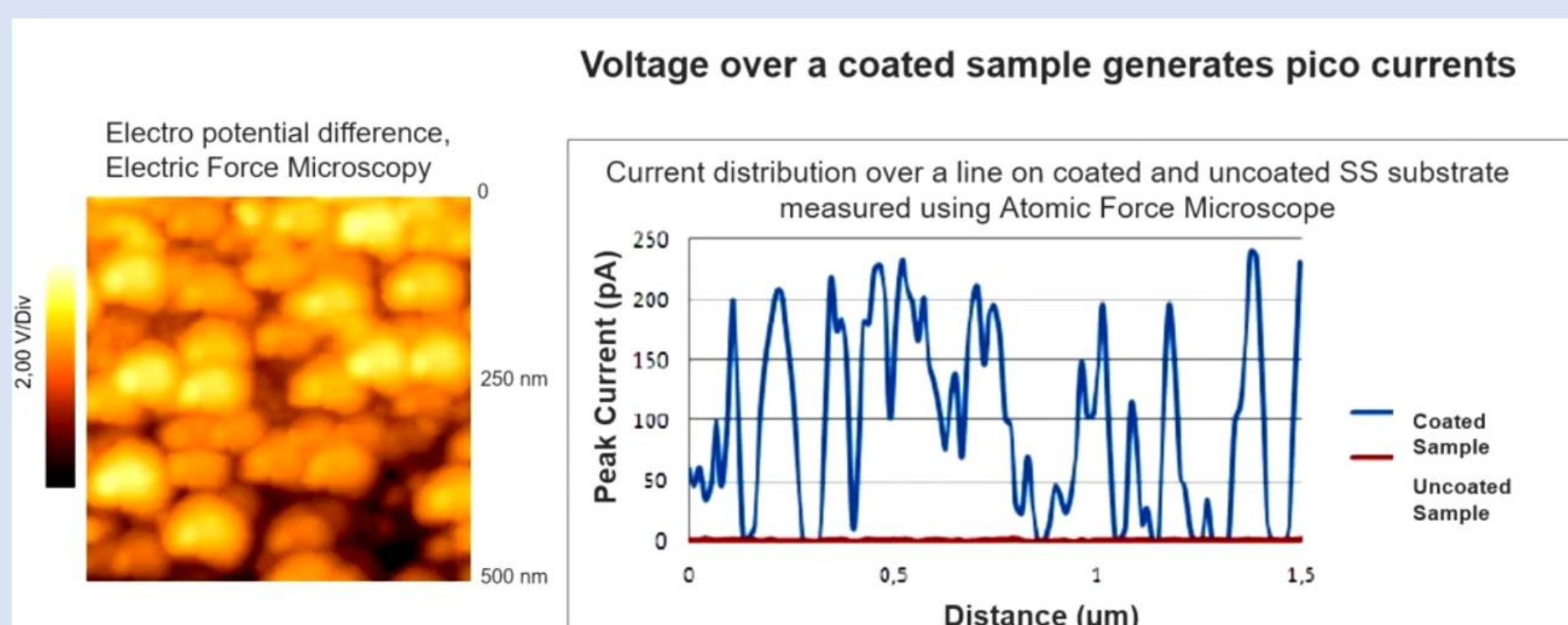
- SEM analysis of bacteria
- Membrane Permeability assay (results not shown)

ROS

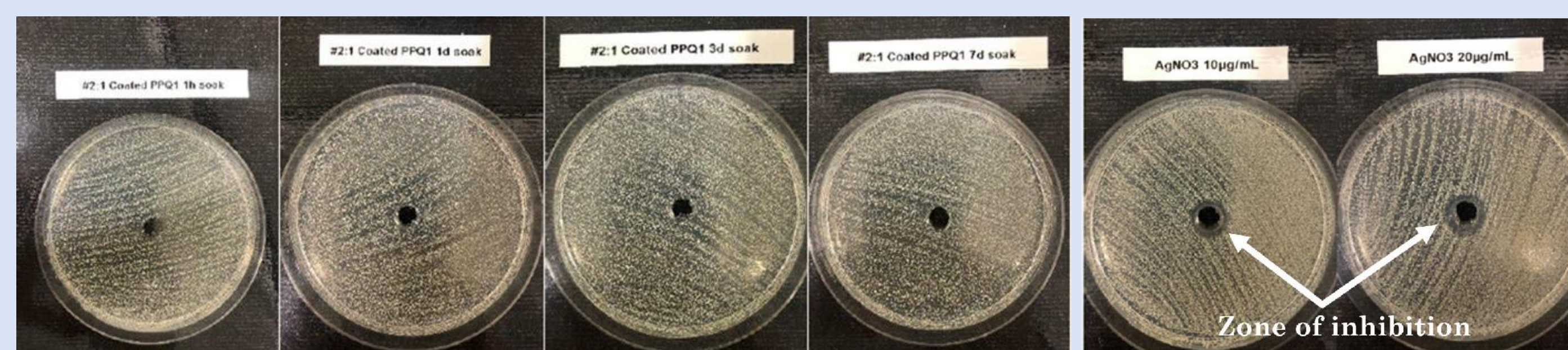
- DCFDA fluorescence assay

RESULTS

Galvanic Effect



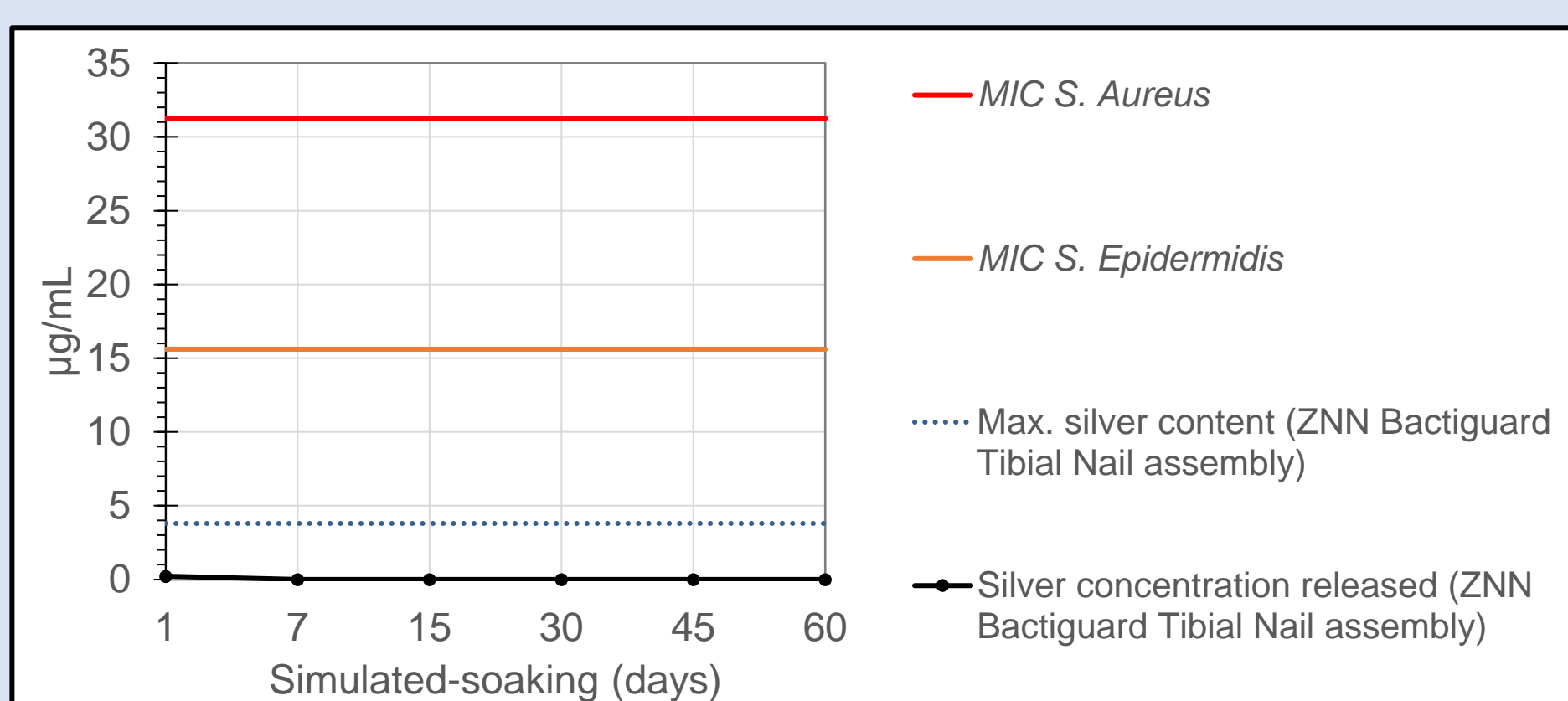
Zone of Inhibition Test



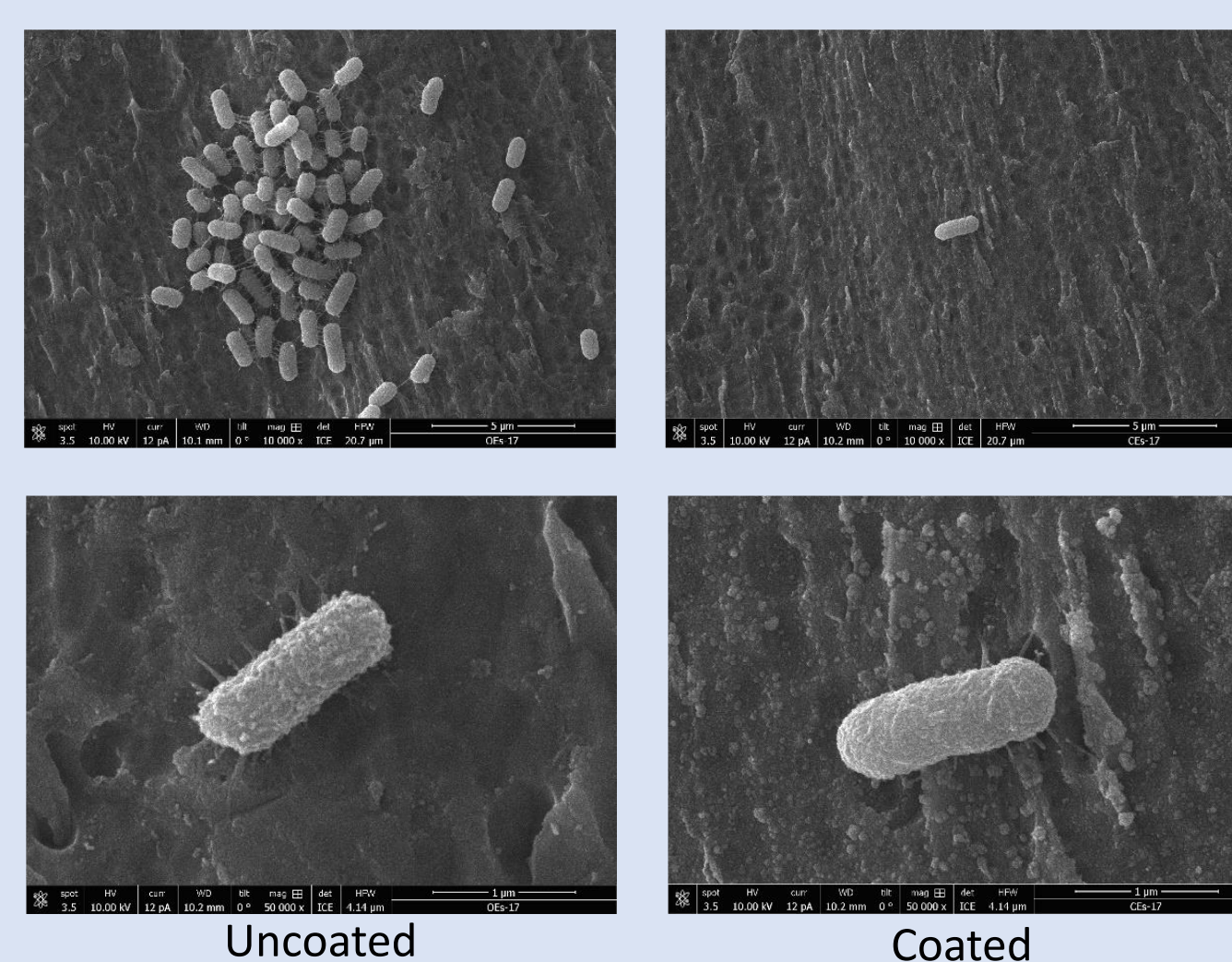
Microbial Adhesion Test

Microbial Strain	% reduction in adhesion
<i>S.aureus</i>	84%
MRSA	77%
<i>S.epidermidis</i>	63%
<i>C.acnes</i>	100%
<i>P.aeruginosa</i>	99.997%
<i>C.albicans</i>	79%
Silver resistant <i>E.coli</i> (J53 w/pMG101)	99.973%

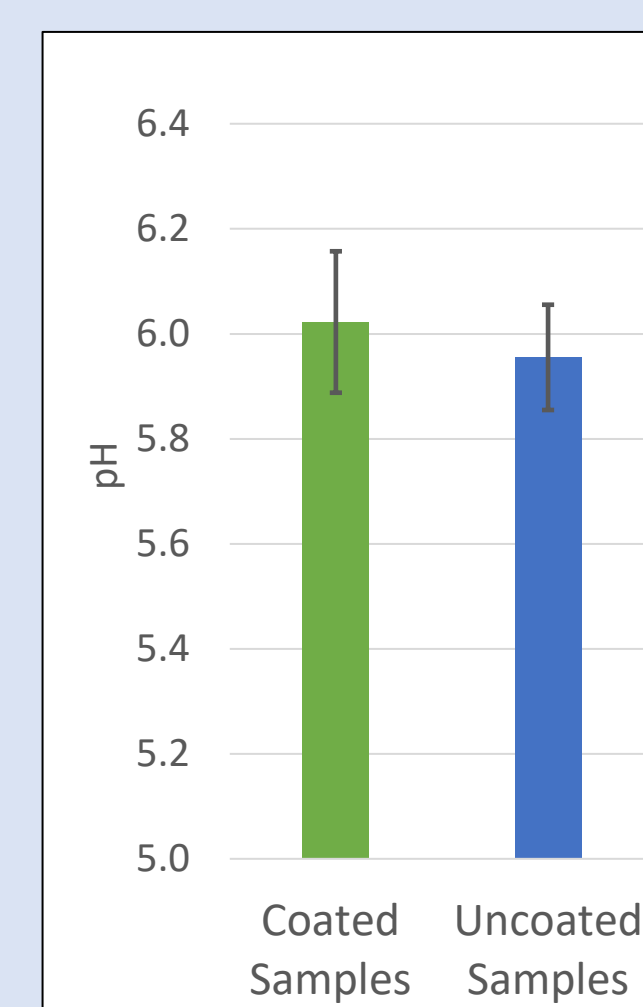
Silver Release by Immersion Test



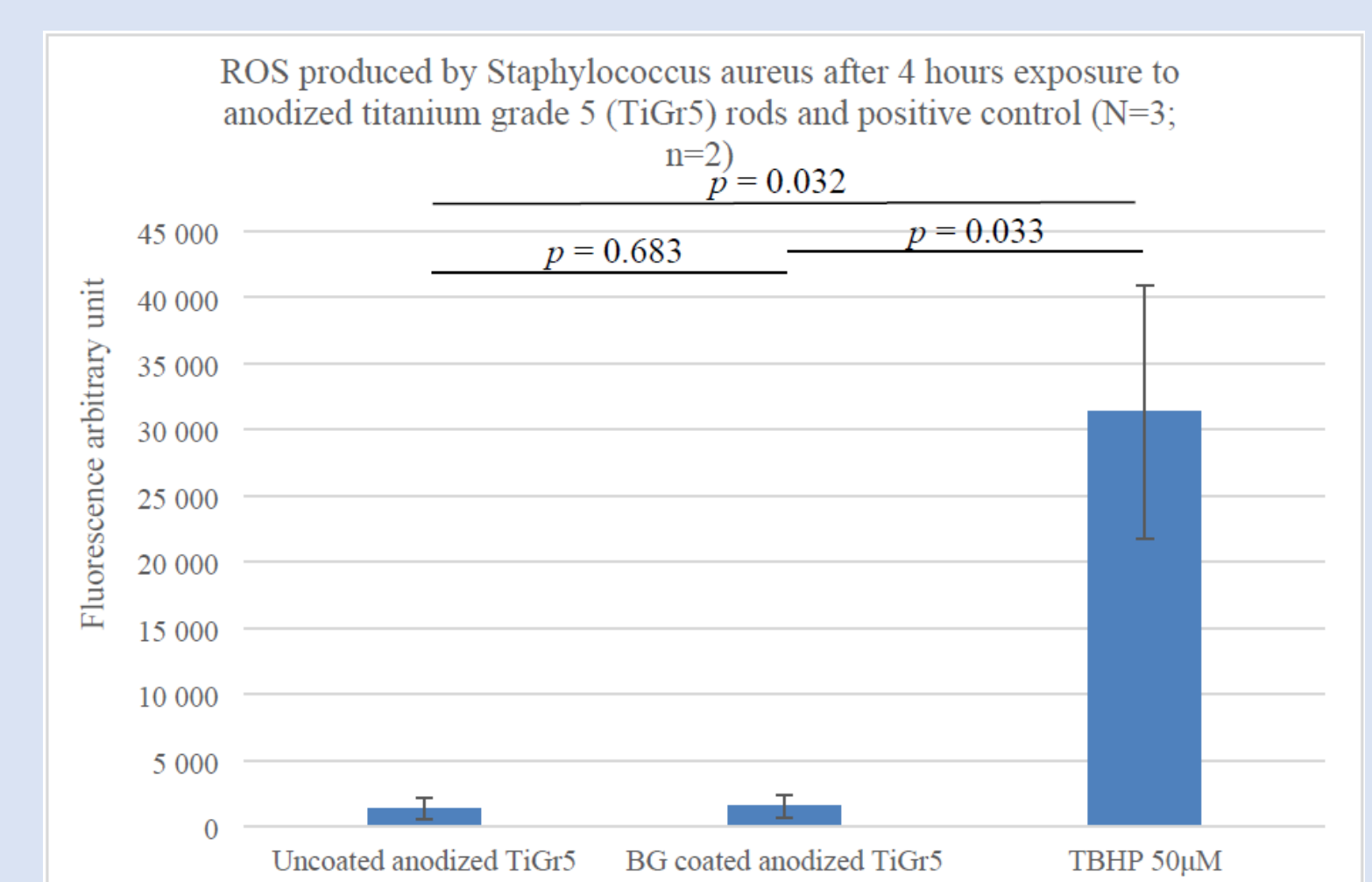
SEM analysis of *E.coli*



Localised pH



ROS Test



CONCLUSION

This study concluded that the noble metal alloy coating has a non-eluting, galvanic mechanism of action that reduces microbial adhesion.

