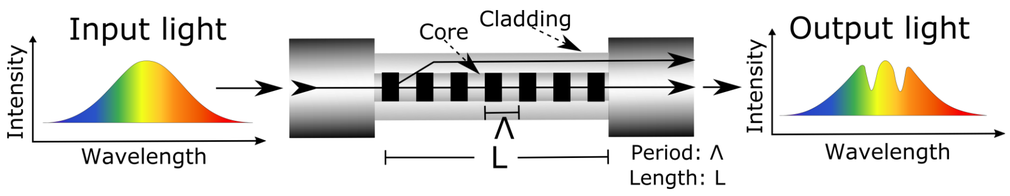
# A Fibre Optic Long Period Grating Immunosensor for *Campylobacter jejuni* with Enhanced Sensitivity by Bacterial Staining

## Introduction

Campylobacteriosis is one of the most reported bacterial infections and can be fatal for children and the elderly. The economic cost of treating the infection has increased to £100 million annually in the UK [1].

A selective immunosensor based on an antibody coated long period grating (LPG) is demonstrated and means to enhance its sensitivity explored.

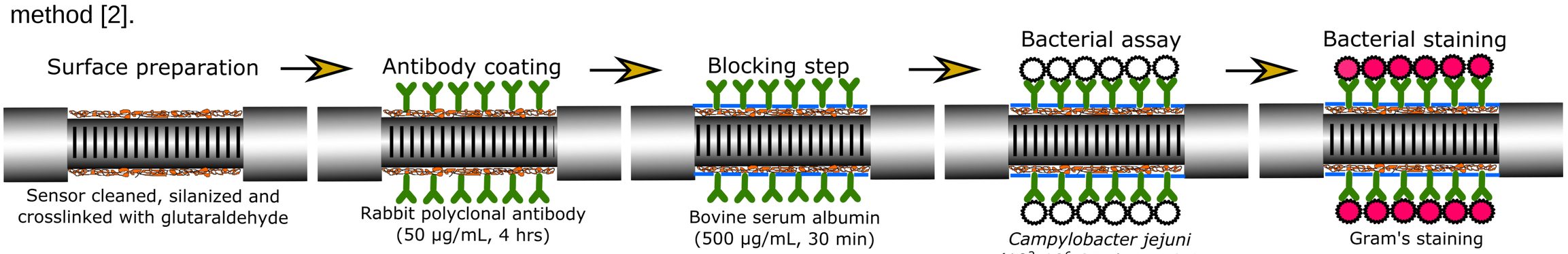



Schematic of LPG operation.

## Method

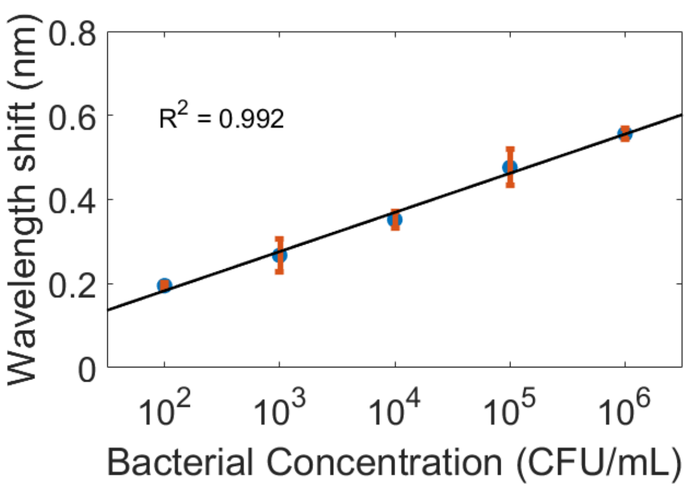
An LPG of length 4 cm and period 112.6 μm, selected to provide high sensitivity was fabricated in single mode B-Ge co-doped optical fibre (cut off wavelength 627 nm) with the point by point method [2].

The optical fibre was cleaned, silanized and chemically prepared for the later covalent attachment of antibodies. It was mounted in a reaction container within a chamber maintained at 25°C.

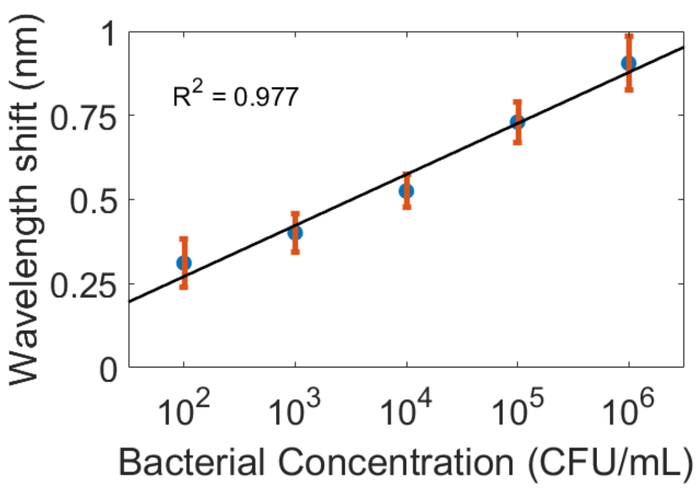



Schematic of LPG operation.

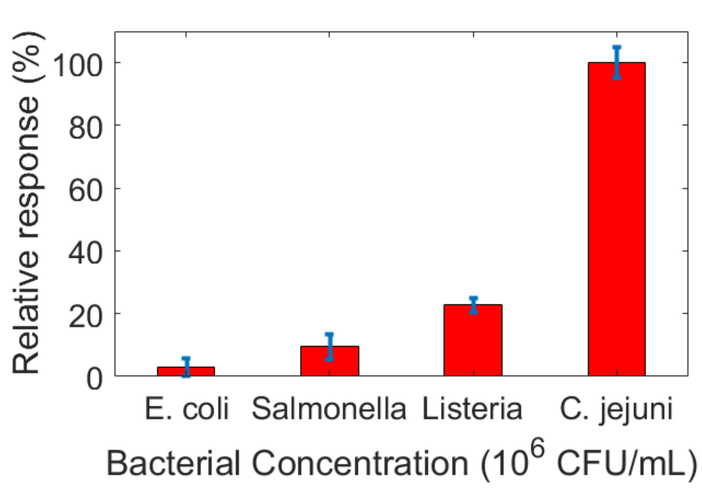
## Results



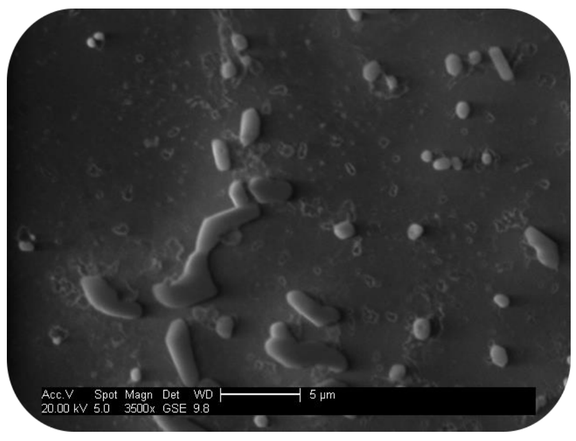

Response of the sensor to concentrations of *C. jejuni* from $10^2$ to $10^6$ CFU/mL. The covalent attachment of antibodies onto the surface results in enhancement of the response (~2 times) than achieved using adsorption [3]. The error bars in all graphs represent the standard deviation of triplicates.




Response of the sensor to bacterial staining, which was increased ~1.5 times compared with the direct assay.



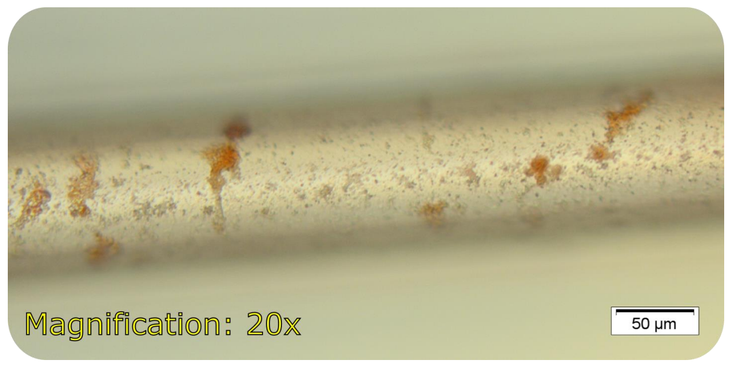

Response of the sensor to different species of bacteria: *Escherichia coli*, *Salmonella typhimurium* and *Listeria monocytogenes*.




ESEM image showing bacterial attachment onto the surface of the sensor.

## Conclusions

The fabrication of an immunosensor for *C. jejuni* detection has been achieved. The sensitivity of the immunosensor was enhanced by staining the bacteria, allowing detection of concentrations as low as $10^2$ CFU/mL, matching the reported limits of detection of other optical platforms such as SPR [4]. The sensor showed good selectivity.




Optical image of the surface of the sensor with stained *C. jejuni*. Gram-negative bacteria display a pinkish red tone.


**References**

[1] Tam, C. C. & O'Brien, S. J., PLoS One, **11**, 1, 2016.
[2] Wong, R. Y. N. et al., Appl. Opt. **53**, 21, 2014.
[3] Romero, A. et al., Proc. IEEE Sensors, 1-3, 2017.
[4] Masdor, N. et al., Chemosensors, **5**, 16, 2017.



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