Faculty of Science and Health

FACULTY RESEARCH COMMITTEE

Undergraduate Summer Research Internship Scheme 2017

Project Title: The antimicrobial effect of nanomaterials.

Principal Investigator: Assist. Prof Konstantinos Gkrintzalis

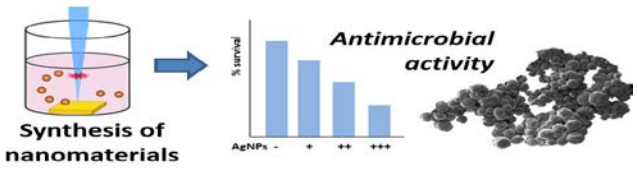
School/Research Centre: School of Biotechnology

Project Description

The antimicrobial effect of nanomaterials

Engineered nanomaterials and, in particular metallic nanoparticles, are increasingly present in several products in daily life, mainly due to their promising applications in agriculture, healthcare, engineering and drug delivery. There is an increasing number of nanomaterials exhibiting significant antimicrobial activity, which highlights their use in healthcare as potential bactericidal agents. The bactericidal action of nanomaterials is measured as bacterial growth inhibition upon exposure to them (Figure 1). Till this day, culturing and bacterial growth inhibition are performed in large volumes which results in increasing time and costs for experimentation. Miniaturisation of culturing and growth inhibition testing would result in significant benefits considering savings in time, cost and efficiency of the experiments.

Figure 1. Synthesis of nanomaterials and impact on antimicrobial activity.



In this project you will use a series of nanomaterials (gold, silver, carbon, silica, zinc oxide) synthesized in the School of Biotechnology. Initially, you will establish a miniaturised approach for bacterial growth by exploring different volumes and vessels. Following, you will test the antimicrobial activity of nanomaterials. In the next phase having decided the optimum working conditions you will further characterise the impact of nanomaterials on bacterial physiology using biochemical approaches.

The novelty of this study is firstly the generation of a novel method for testing growth inhibition and secondly the testing of nanomaterials not only in suspension but also on coated biopolymer surfaces which will introduce novel applications of the generated results towards developing antimicrobial nano-surfaces. You will identify how key parameters such as size, charge and metal composition affect the antimicrobial activity of nanomaterials in an effort to design better functionalised nanoparticles.

During this internship, you will receive training over all angles of this project. You will benefit by developing a novel culturing approach and introduce your innovative ideas and critical thinking in this trajectory. You will obtain specific skills such as culturing of bacteria, experience with nanomaterials and assessment of their antimicrobial activities, as well as practice in statistical analysis and scientific writing.

The project will be divided into the following work packages.

Week	Task
1-2	Training to work under good laboratory practice. Training for the methods employed.
3-4	Development and optimisation of a culturing and test protocol based on previous results.
5-6	Determination of dose response growth inhibition curves and decision over the working concentrations.
7-9	Determination of markers of oxidative stress and other biochemical parameters.
10	The student will generate a final report and present the results in a publishable format.