Faculty of Science and Health

FACULTY RESEARCH COMMITTEE

Undergraduate Summer Research Internship Scheme 2017

Project Title: Pass the parcel: how do drug resistance genes on plasmids transfer between bacteria?

Principal Investigator: Dr. Tim Downing, Lecturer in Genomics

School/Research Centre: School of Biotechnology, Dublin City University.

Project Description

Aims and details

Infectious disease outbreaks are driven by drug resistant bacteria. Genes driving this antimicrobial resistance (AMR) are transferred between pathogenic bacteria and "natural" (commensal) microbiome species in the human gut like a game of "pass the parcel". Exactly how these genes are donated to and from microbiomes remains unclear. DNA elements called plasmids have sets of these AMR genes and are exchanged as a unit between bacterial cells. AMR genes in bacteria are often on plasmids lacking cell-cell transfer machinery, so these mix with other plasmids so they can move between cells. Additionally, transposable elements ("jumping genes") transmit AMR genes between plasmids and chromosomes. You will examine these processes in bacteria and microbiome genomes isolated from the human gut. You will test for recent gene exchange between pathogenic *Escherichia coli* and Human Microbiome Project genomes to link key plasmids with disease-associated genes. We hypothesise that microbiomes act as AMR gene carriers and thus promote AMR in pathogenic bacteria. Your work will provide new ideas on how genes get transferred between species in the human gut.

Potential Candidates:

This project suits a motivated student interested working at the interface between molecular, computational and infection biology. The project involves skills such as DNA sequence comparison, visualising genomic data and evolutionary analyses: appropriate training in sequence alignments, genome visualisation and examining large datasets will be provided. You will learn about bacterial evolution, genome analysis and how to explore big data. You will work in the Infection Genomics lab at DCU with two PhD students and a Bioinformatics Technician. To facilitate this work twinning molecular with computational methods, we have a high-performance computer server. At the end of the project, you will be able to perform sequence alignments between genomes, interpret the effects of genes on antibiotic resistance, and investigate their evolutionary innovations. Learning about these techniques is applicable to a range of problems involving bioinformatics or biomedical research on genomic data.