Deciphering the aerosol survival of respiratory pathogens

Supervisory team:
Main supervisor: Dr Darryl Hill (University of Bristol)
Second supervisor: Prof Andrew Preston (University of Bath)
Prof Jonathan Reid (University of Bristol)

Collaborators: Dr Barry Atkinson (UKHSA Porton Down)

Host institution: University of Bristol

Project description:
Respiratory infections in which bacteria are spread from person-to-person via the air cause significant health, social and economic harms. Aerosol particles containing microbes are exhaled when an infected individual breathes, speaks, coughs and sneezes. Transmission occurs when these infected droplets are inhaled by others. Despite the importance and high incidence of respiratory infections, very little is known about the factors that determine the infectiousness of these airborne bacteria. This is largely because it is difficult to study them in tiny droplets (aerosols), which are an environment unlike any other, that cannot be replicated in other experimental systems. In this project, we aim to understand the fundamental biology of how environmental factors such as heat and humidity affect bacterial survival in aerosol droplets and how bacteria adapt to the unique aerosol environment. To do this we will use cutting edge technology that enables us to study individual bacteria suspended in aerosol droplets. We will also measure how those bacteria adapt under these same conditions through changes in gene expression profiles leading to phenotypic changes. Learning how bacteria are able to survive during transmission will help lead us towards new ways to intervene, through informing environmental controls (e.g. temperature and humidity controls), vaccine design and even design of indoor spaces (e.g. occupancy levels and positioning).

This project spans several different disciplines. The student will be trained in biophysics as it pertains to measuring the aerosol droplet composition and stresses, molecular microbiology, including working with pathogenic organisms, and microbial genomics including gene expression profiling and the bioinformatics approaches involved in analysing RNAseq and proteomics data. The student will benefit from the combined expertise in these areas of the Bristol and Bath supervisors and will collaborate with the Biosafety unit at UKHSA Porton Down involved in understanding the airborne spread of infectious viruses.

Our aim as the SWBio DTP is to support students from a range of backgrounds and circumstances. Where needed, we will work with you to take into consideration reasonable project adaptations (for example to support caring responsibilities, disabilities, other significant personal circumstances) as well as flexible working and part-time study requests, to enable greater access to a PhD. All our supervisors support us with this aim, so please feel comfortable in discussing further with the listed PhD project supervisor to see what is feasible.