How the microbiome could tackle antibiotic resistant infections in the lungs

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Research into the microbiome could potentially tackle antibiotic resistant infections in the lungs. Credit: Imperial College London

Understanding how microbes contribute to respiratory health and immunity could help tackle drug resistant infections in the lungs, say scientists.

Miriam Moffatt, Professor of Respiratory Genetics at the National Heart and Lung Institute at Imperial College London, presented her work to shed some light on the lung microbiome and the potential to develop new

treatments at a recent Academic Health Science Centre (AHSC) research workshop.

Bacteria in our bodies known as the microbiome play many different roles in maintaining human health. For example, these bacteria act as a first line of defence against potential disease-causing germs. The benefits of healthy gut bacteria are well known but the lungs also have their own ecosystem of microorganisms that could be just as important to our health and immune system.

Maxine Myers caught up with Professor Moffatt to find out more about her research.

Can you explain in more detail about your microbiome research?

I am working with my research partner Bill Cookson, Professor of Genomic Medicine at Imperial College London, on how research into the microbiome could potentially tackle antibiotic resistant infections in the lungs.

Sixteen-million antibiotic prescriptions are given each year to NHS patients to treat lower respiratory tract infections such as pneumonia and bronchitis. However, these prescriptions are a primary driver of antimicrobial resistance (AMR) as they encourage bacteria to gradually evolve to become resistant to the antibiotics.

For example, patients with chronic lung conditions such as cystic fibrosis (CF) have many courses of antibiotics as part of their treatment and over time the bacteria in their lungs have become progressively resistant to a wide range of antibiotics. Several very aggressive superbugs such as Pseudomonas Aeruginosa have been discovered growing in the lungs of

patients with CF around the world.

Why are antibiotic resistant infections so prevalent in the lungs?

Lung infections are very common and often patients are prescribed antibiotics which target a wide range of bacteria rather than the specific bug.

These broad spectrum antibiotics make very little difference to treating the infections but they can disrupt the microbes in the gut leading to a reservoir of antibiotic resistance. The changes in bacteria in the gut can last for a year after the antibiotics are given.

It is also difficult to quickly identify the bacteria causing the lung infection because the laboratory tests needed to do so rely on them growing on agar plates. This process can be time consuming and identifying the bacteria accurately can be difficult. There is a need to develop faster and more accurate diagnostic tests.

How can microbiome research potentially tackle antibiotic resistant infections in the lungs?

In the future it may be possible to replace the bad bugs in the lungs and gut with healthy normal bacteria that resist infections. As yet, we do not know enough about the healthy lung microbiome to do this but we are gradually building up a collection of the good and bad bugs to help our research.

How can patients potentially benefit from your research?

We hope to provide a set of diagnostic tests that will use DNA sequencing to tell us about the members and types of the bugs present in a patient's lungs and how they cause harm. We can then prescribe antibiotics that target specific bacteria, known as narrow-spectrum antibiotics. This can make a big difference to antibiotic prescribing. We also plan to make new kinds of antibiotics that are inhaled only into the lung and do not penetrate into the gut to help in the prevention of AMR.

What other microbiome research are you doing?

We have discovered that the bugs in the lungs of asthmatics are abnormal and asthma sufferers' airways may contain large numbers of bad bacteria that can cause damage. We are capturing and growing these bugs to work out how they cause asthma. Treating the bugs with narrow-spectrum antibiotics or with vaccination, and replacing them with healthy bacteria, are possible future therapies for the disease.

Provided by Imperial College London

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