Researchers provide new insights into how antibiotic resistance develops

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Researchers at the Quadram Institute on the Norwich Research Park have shown how the development of antibiotic resistance by bacteria can have 'side-effects' for them including affecting their ability to cause disease.

Antibiotic resistance remains one of the greatest challenges to global health with very few new antibiotics and widespread resistance. It has been estimated that tens of millions of people will soon die annually due to antibiotic resistant infections not being treatable.

This new research has the potential to help in the development of new treatments, as well as giving us a better understanding of how resistance arises, and so guide current practices to minimize this.

Led by Dr. Mark Webber, the team developed a model using Salmonella to allow a more realistic simulation of how bacteria grow and are exposed to antibiotics in the real world. The research was funded by the Biotechnology and Biological Sciences Research Council, part of UKRI.

Most bacteria in nature are found in communities known as 'biofilms." These structures are self-formed by bacteria cells in a community held together by a slimy matrix. In biofilms, bacteria are very hard to kill, but little is known about how they might adapt when exposed to antibiotics.

In this work, published today in the journal *npj Biofilms and Microbiomes*, a model for how bacteria in a biofilm respond to antibiotics was developed and results compared with traditional laboratory conditions.

This showed that bacteria in a biofilm can develop antibiotic resistance very rapidly but that when this happened other properties of the bacteria were compromised including their ability to cause disease, or to form a biofilm in the first place.

They also identified some novel mechanisms of antibiotic resistance which have subsequently been seen in isolates from patients. This shows the model can usefully predict how antibiotic resistance can emerge in the real world.

This research paves the way for more studies to understand how antibiotic resistance evolves in real world conditions and can help guide how best to use current antibiotics and inform development of new antibiotics.

Dr. Mark Webber said, "I'm proud of this work as it has been a large effort and it has provided new insight into how bacteria adapt and evolve in different conditions. We are now able to better model and predict how bacteria respond to drugs in the real world."

Lead author Dr. Eleftheria Trampari said, "I hope this model system will now be more widely used and we can understand the consequences for bacteria of developing resistance and use this information to help guide treatments which will minimize risks to human and animal health."

More information: Eleftheria Trampari et al. Exposure of Salmonella biofilms to antibiotic concentrations rapidly selects resistance with collateral tradeoffs, *npj Biofilms and Microbiomes* (2021). DOI: 10.1038/s41522-020-00178-0

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