

# How bacteria play pass the parcel—and help each other evade antibiotics

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Form left to right professor James Whisstock, Dr. Daouda Traore, professor Julian Rood and Dr. Vicki Adams. Credit: Monash University

Bacteria are very sneaky in their efforts to develop resistance to antibiotics. Some strains of bacteria package up the genetic instructions for how they defend themselves and cause disease, and pass this information on to neighbouring, naïve, bacteria—essentially gifting their

colleagues with the defences they need to survive against our medical armoury of antibiotics.

If that isn't bad enough, the [information](#) transferred also allows the receiving bacteria to pass on the same information to others, meaning that the ability to resist [antibiotics](#) and produce toxins rapidly spreads from one bacterium to another.

It's a frightening thought.

Scientists at Monash University's Biomedicine Discovery Institute and the ARC Centre of Excellence in Advanced Molecular Imaging, working with the Australian Synchrotron, have answered a key question about how a dangerous bacterium, *Clostridium perfringens*, shares its genetic information.

*C. perfringens* causes more than one million cases of food poisoning every year in the United States and causes the rapidly spreading, fatal condition 'gas gangrene'. It is also an economically important cause of disease in chickens, sheep and cattle.

The team, including Dr. Daouda Traore, Dr. Jess Wisniewski, Dr. Vicki Adams, Professor Julian Rood and Professor James Whisstock discovered information about how a previously unknown gene—called tcpK—functions to help pass the [genetic instructions](#) (DNA) for [antibiotic-resistance](#) from one *C. perfringens* bacterium to another.

These findings were published today in *Nature Communications*.

When they initially identified the new gene the team searched international databases for information about how it might work.

"We couldn't find any clues as to TcpK function anywhere," Dr. Traore

said.

"It's only found in *C. perfringens* and related [disease causing bacteria](#), but is critical for the [bacteria](#) to spread antibiotic resistance," Dr. Adams said.

Firing high energy X-rays generated by the Australian Synchrotron at a TcpK protein crystal, the researchers were able to determine the 3-D molecular structure of the protein.

"Our structural analysis revealed that the molecule resembles a universal DNA binding module called a winged-Helix-turn-Helix. This was the key breakthrough that allowed us to discover that TcpK works by marking the DNA for transfer to another bacterium," Dr. Traore said.

Dr. Traore and his colleagues anticipate that this discovery will facilitate future research aimed at controlling the spread of antibiotic resistance and toxin genes.

**More information:** Daouda A. K. Traore et al, Crystal structure of TcpK in complex with oriT DNA of the antibiotic resistance plasmid pCW3, *Nature Communications* (2018). [DOI: 10.1038/s41467-018-06096-2](#)

Provided by Monash University

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