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Research brief

Just a phage it's going through

Antibiotic treatment can worsen enterohaemorrhagic *Escherichia coli* infections. Until now, stress-induced stimulation and replication of a phage within the bacterial genome was thought to lead to the production of sufficient amounts of Shiga toxin to cause severe disease. New findings show this not to be the case. By testing bacterial and viral mutants in a mouse model of the disease, researchers saw that an induction signal (such as that from antibiotics) was indeed essential for lethal disease but, unexpectedly, that sufficient Shiga toxin could be produced without viral replication. The next steps in this research are to unpick the mechanisms behind toxin production and hunt for treatment targets.

Don't let it fester

To better understand how virulence and antimicrobial resistance emerges in community-acquired, methicillin-resistant *Staphylococcus aureus* infections, scientists studied a continuing outbreak in an enclosed religious group in Brooklyn (NY, USA). Through high-resolution genetic analyses of the bacteria, they found two sequential developments that enabled the strain to persist: first, the emergence of a unique phage that promoted abscess formation and a mutation that promoted colonisation, then the emergence of a unique plasmid that conferred drug resistance. The findings show the need for immediate interruption of bacterial circulation within such high-risk groups to stop the development and spread of stubborn infections into hospitals or the general public.

A *Candida* explanation of dementia?

Fungal infections that cause allergic airway disease or sepsis have been linked with an increased risk of dementia in later life. To study this potential association, researchers

experimentally infected mice with *Candida albicans*. Mice infected with *C albicans* had impaired spatial memory compared with uninfected control mice. Further study showed that the fungus crossed the blood-brain barrier and, once in the brain, activated microglia and a neuro-inflammatory response. Around the fungus-induced granulomas, they noted the accumulation of amyloid proteins—molecules typically found in the plaques characteristic of Alzheimer's disease. The researchers want to assess the role that fungal infections could have in other neuro-degenerative diseases.

Insights into cholera in Yemen

Amid the fighting and famine, Yemen is in the grips of one of the largest cholera outbreaks in history. The most recent wave of the epidemic, which began in April, 2017, has affected more than a million people and killed more than 2500. Scientists did whole-genome analysis of 42 samples collected in the country and compared them with a collection of 1000 global samples. Their findings showed that the *Vibrio cholerae* strain that is causing the outbreak is the Ogawa serotype, which was first seen in south Asia in 2012 and circulated in eastern Africa in 2013–14. Encouragingly, the strain circulating in Yemen seems to be susceptible to antibiotic treatment.

A headache for infection control

Findings from an experiment in mice suggest that common pain medication can worsen the severity of *Clostridium difficile* infection. Only 20% of mice given a pre-infection dose of the non-steroidal anti-inflammatory indometacin survived to the end of a 1-week observation period after experimental *C difficile* infection versus 80% of control mice not given pain medication. Cellular and genetic analyses showed that the drug disturbed the mice's gut microflora

and the production of the immune hormone prostaglandin. It also seemed to weaken epithelial cell junctions. The researchers posit that, given their similar mechanisms of action, other pain relief drugs such as ibuprofen and aspirin could have similar effects on infection.

Opioids and pneumonia

Prescription opioids are associated with severe pneumonia in people with and without HIV. So say the findings from a nested case-control study of 4246 people with community-acquired pneumonia and 21 146 controls in a registry of people who receive care through the Veterans Health Administration in the USA. People with HIV were susceptible to pneumonia even at low doses and with opioids with low immunosuppressive properties. Opioids can suppress the immune system by, for instance, suppressing the urge to cough and reducing respiration and mucus secretion. The researchers suggest that physicians should encourage all opioid-requiring patients, especially those with HIV, to be vaccinated against pneumonia.

Lassa fever detective work

A spike in the number of Lassa fever cases in Nigeria last year piqued concerns of an outbreak of a new, more virulent strain of the virus. Instead of relying only on the usual epidemiological door-knocking detective work of tracking cases and tracing outbreak origins, researchers used mobile sequencing technology (MinION; Oxford Nanopore Technologies, UK) to assess samples from 120 patients. They detected no evidence of a new, more virulent strain or of person-to-person transmission, identifying instead rodent contamination of food as the main source. Use of such technology can help allocate public health resources for swift and effective responses to this and future outbreaks.

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For more on **Shiga toxin** see *PLoS Pathog* 2019; **15**: e1007494. <http://dx.doi.org/doi.10.1371/journal.ppat.1007494>.

For more on **evolution of virulence and antimicrobial resistance** see *Proc Natl Acad Sci USA* 2019; published online Jan 11. <http://dx.doi.org/doi.10.1073/pnas.1814265116>

For more on **fungal infection and neurological illness** see *Nat Commun* 2019; **10**: 58. <http://dx.doi.org/doi.10.1038/s41467-018-07991-4>

For more on **cholera in Yemen** see *Nature* 2019; **565**: 230–33. <http://dx.doi.org/doi.10.1038/s41586-018-0818-3>

For more on **pain medication and *C difficile*** see *MBio* 2019; **10**. <http://dx.doi.org/doi.10.1128/mBio.02282-18>

For more on **opioids and pneumonia** see *JAMA Intern Med* 2019; published online Jan 7. <http://dx.doi.org/doi.10.1001/jamainternmed.2018.6101>

For more on the **cause of Lassa fever in Nigeria** see *Science* 2019; **363**: 74–77. <http://dx.doi.org/doi.10.1126/science.aau9343>