The mcr-1 gene was first detected several years ago in E. coli strains isolated from pigs being raised near Shanghai and, by 2014, was being found in pigs and chickens from four nearby provinces. More worrying, it also was detected among patients with either E. coli or K. pneumoniae infections in hospitals in Guangdong and Zhejiang provinces. “Because of the relatively low proportion of positive samples taken from humans compared with animals, it is likely that mcr-1-mediated colistin resistance originated in animals and subsequently spread to humans,” Shen says. “China is not the only country to use colistin in farming, but there are many countries, including in Europe, that use polymyxins in agriculture, and therefore the responsibility to acknowledge and address the use of antibiotics across human and veterinary sectors must be also global.”

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NEW FROM ASM

Enterococcal Plasmid Wars: Cycling from Harmless to Virulence, then Back

Shannon Weiman

Transposons are largely responsible for the Dr.-Jekyll to-Mr.-Hyde switching that enables the enterococci to range from innocuous gut inhabitants to virulent, antibiotic-resistant pathogens—and then back again, according to several researchers who spoke during the 2015 ICAAC meeting held in San Diego last September. Those transposons can mobilize large genomic regions carrying multiple virulence, antibiotic resistance, and metabolic genes, thereby contributing to the rampant spread of resistance and pathogenicity among clinically concerning strains such as vancomycin-resistant enterococci (VRE).

“The success of Enterococcus faecium and E. faecalis, evolving as multidrug-resistant nosocomial pathogens and leading hospital pathogens worldwide, is associated with their promiscuous nature in acquiring new genetic elements, including antimicrobial resistance genes encoded by mobile genetic elements,” says Guido Werner of the Robert Koch Institute in Berlin, Germany. Tn1546 is the main transposon that mobilizes vancomycin resistance genes, which may be marooned on large pathogenicity islands within “megaplasmids,” he says. These oversized, multifunctional plasmids confer survival advantages as they move rather freely among commensal bacteria and opportunistic pathogens, creating a dangerous ecology within the gut. One scenario raising fresh concerns is the shuttling of vancomycin resistance genes into Staphylococcus aureus, leading to more than a dozen confirmed cases of VRSA in the United States, he notes.

Antibiotics can help to drive transposon-mediated genetic transfers, according to Barbara Murray of the University of Texas Health Science Center in Houston. Referring to research by Kathryn Beabout of Rice University and her collaborators, Murray says that exposure to tigecycline, a tetracycline derivative, triggers Tn916 mobilization in E. faecalis, increasing transfer of the TetM resistance gene 1,000-fold. Thus, antibiotics not only select for resistant bacteria, but also accelerate transfers of...
MINITOPIC
Recent High-Tech Developments in Synthetic Biology and Other Realms of Microbiology

Recent developments in synthetic biology or in other high-technology areas involving microbiology include the following:

- Two recently developed synthetic gene circuits, called deadman and passcode, efficiently can control or kill genetically engineered cells of *Escherichia coli* containing them, according to James Collins of Massachusetts Institute of Technology, in Cambridge, Mass., and his collaborators. The former needs an external chemical to prevent a continuously expressed toxin from killing the cell, while the latter uses hybrid transcription factors to control host cells. Details appeared 7 December 2015 in *Nature Chemical Biology* (doi:10.1038/nchembio.1979).
- A molecular confinement mechanism that separates guide RNA from the Cas9 protein that inserts an artificial sequence into a targeted gene can prevent CRISPR-based gene drives from operating in the wild, according to George Church, Keven Esvelt, and their collaborators at Harvard University and Harvard Medical School in Cambridge and Boston, Mass., respectively. Details appeared 16 November 2015 in *Nature Biotechnology* (doi:10.1038/nbt.3412).
- Ribonuclease H powers a rolling, DNA-based motor that is built onto a 1-μm-sized glass sphere, and that moves 1,000 times faster and is more stable than other two- or multi-legged synthetic nanomotors, according to Khalid Salaïta of Emory University in Atlanta, Ga., and his collaborators. Details appeared 14 December 2015 in *Nature Nanotechnology* (doi:10.1038/nnano.2015.259).
- A prototype device that couples acoustic tweezers with reusable microfluidic platforms can soon be used to sort cells to determine how they respond to drug candidates or, instead, for diagnosing various infectious diseases, according to Tony Jun Huang of Pennsylvania State University in University Park and his collaborators. Details appeared 28 October 2015 in *Lab on a Chip* (doi:10.1039/C5LC01049G).
- Properly harnessed, electricity provides an effective way for killing bacteria, and it works best when it is releasing low but constant amounts of hydrogen peroxide in the immediate vicinity of the targeted microorganisms, including those in biofilms, according to Sujala T. Sultana, Haluk Beyenal, and their collaborators at Washington State University, Pullman. Details appeared 14 October 2015 in *Nature Scientific Reports* (doi:10.1038/srep14908).
- A new mass-spectral imaging system enables scientists to map the contents of cells in three dimensions on a nanoscale, according to Carmen Menoni, Dean Crick, and their collaborators at Colorado State University in Fort Collins. Details appeared 14 December 2015 in *Optics & Photonics News* (http://www.osa-opn.org/home/articles/volume_26/december_2015/).

RESEARCH ADVANCES
By Consuming Glycine, Gut Microbiota Control Glutathione Synthesis

Carol Potera

The gut microbiota in mice consumes glycine, one of three amino acids needed by host animals to make the powerful antioxidant peptide glutathione, according to Adil Mardinoglu at the Royal Institute of Technology in Stockholm and Chalmers University of Technology, Gothenburg, both in Sweden, and his collaborators in Sweden and Denmark. He calls this...