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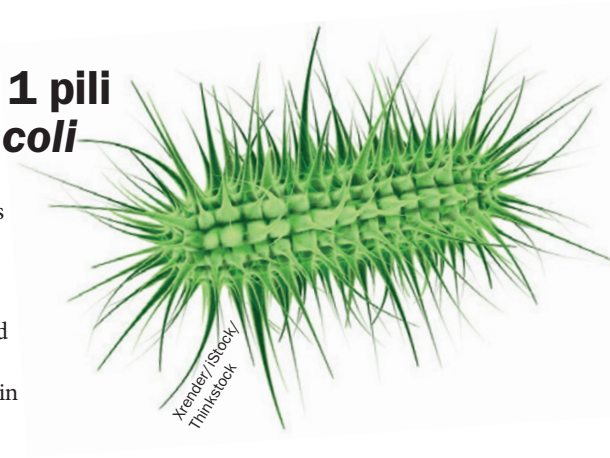
INFECTION

Exposure to human urine decreases type 1 pili expression in uropathogenic *Escherichia coli*



Uropathogenic *Escherichia coli* (UPEC) infections are a major cause of UTIs, and in most UPEC strains, this process is known to be enabled by the expression and functions of type 1 pili. Now, newly published research reveals that human urine is able to inhibit both the function and expression of type 1 pili in their planktonic bacteria, while UPEC that are bound to urothelial cells remain unaffected.

Describing the approach used, lead author Scott Hultgren explains, "the application of established and relatively simple assays to complex questions was a primary theme of the methods used in this paper." Results of initial experiments showed that the prototypical UPEC strain UTI89 had substantially more type 1 pilation when cultured in Luria broth media than in filtered human urine. This effect was found to be mediated by unknown factors in the urine that induced the phase variable type 1 pilus promoter unit, fimS, to stay in the phase OFF orientation, or switch to this orientation, preventing pilus gene expression.

Using a genetic approach, introduction of a loss-of-function mutation in the mannose-binding pocket of FimH resulted in reduced pilation, and this effect was confirmed in another mutated UTI89 strain that produces all type 1 pilus components but not FimH, implying a novel form of type 1 pilus regulation where loss of FimH function affects pili expression by driving the *fimS* promotor towards the OFF state.

In agreement with the findings of genetic studies, growth of UT189 cells under pilus-inducing conditions in the presence of the mannoside ZFH269 again resulted in inhibition of FimH function. "We discovered that both genetic and chemical inhibition of type 1 pilus mediated binding results in bacteria switching to a phase OFF state," concludes Hultgren, who adds "in this work, we demonstrated that growth in the presence of mannosides causes the type 1 promoter phase switch to flip OFF."

Despite the positive findings of this research, Hultgren also reflects on the diversity of bacteria present within the urinary tract: "it is critical to address the impact that multiple niches may have on bacterial physiology, and to take into account the complexity that these different niches introduce into experimental readouts."

Peter Sidaway

Original article Greene, S. E. *et al.* Human urine decreases function and expression of type 1 pili in uropathogenic escherichia coli. *mBio* doi:10.1128/mBio.00820-15