


 BACTERIAL PATHOGENESIS

On the move

George Marshall

A study in *Proceedings of the National Academy of Sciences USA* has provided some new clues that should help solve the longstanding problem of how *Helicobacter pylori* moves through the gastric mucus.

H. pylori can survive in the acidic environment of the stomach by producing urease: this hydrolyses the urea that is present to produce ammonia, which increases the pH in the area surrounding the bacteria to neutral. Another key to the survival of *H. pylori* is its ability to swim through the mucus layer that lines the stomach and thereby access the underlying layer of epithelial cells. Celli and colleagues began to investigate this process by looking *in vitro* at the effect of *H. pylori* on mucin, the principal glycoprotein component of mucus.

Previous work had shown that when the pH is ≤ 4 the viscoelasticity of mucin is high and it forms a gel, whereas at higher pH the viscoelasticity is reduced and mucin forms a polymer solution. In the presence of *H. pylori*, porcine gastric mucin (PGM) underwent the transition from gel to solution form and the pH increased from pH 4 to \sim pH 7. Analysis of the trajectory of *H. pylori* movement showed that the bacteria can swim freely in PGM solution, whereas in PGM gel bacterial movement was greatly reduced. Finally, Celli *et al.* used two-photon fluorescence imaging to analyse the motility of *H. pylori* in PGM at pH 2 and in the presence of urea. They found that as the urea present was hydrolysed, the pH increased from acidic to neutral, the PGM

underwent a concomitant transition from gel to solution and there was a corresponding increase in *H. pylori* movement.

These results suggest that two of the key virulence factors of *H. pylori* — urease production and motility — are inextricably linked. The production of urease increases the pH, which in turn converts the viscoelastic mucin gel to a solution, allowing *H. pylori* to move freely and, therefore, to reach the protective environs of the gastric epithelium.

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ORIGINAL RESEARCH PAPER Celli, J. P. *et al.* *Helicobacter pylori* moves through mucus by reducing mucin viscoelasticity. *Proc. Natl Acad. Sci. USA* 11 Aug 2009 (doi: 10.1073/pnas.0903438106)