BACTERIAL PHYSIOLOGY

Stuck on you…

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URLs
Escherichia coli
http://www.ncbi.nlm.nih.gov/sites/entrez?db=genomeprj&cmd=Retrieve&dopt=Overview&list_uids=12319

O157:H7
http://www.ncbi.nlm.nih.gov/sites/entrez?Db=genomeprj&cmd=ShowDetailView&TermToSearch=259

The ability of *Escherichia coli* to adhere to and colonize host tissue is a critical feature of the biology of this ubiquitous microorganism. Results recently reported in *Proceedings of the National Academy of Sciences USA* now reveal the identity of a new microbial factor that potentially contributes to the adherence of *E. coli* to host cells and their subsequent colonization. Furthermore, the production of this factor — termed the *E. coli* common pilus (ECP) — is common to both pathogenic and commensal *E. coli* that colonize the human gut.

Because of its clinical significance, the authors focused their initial characterization of ECP on the potentially fatal food-borne pathogen, enterohaemorrhagic *E. coli* (EHEC) O157:H7. Analysis of the genome of this organism revealed the presence of 16 loci encoding genes that are putatively involved in the biosynthesis of the polymeric adhesive fibres commonly known as 'pili' or 'fimbriae'. Following an ultrastructural investigation of EHEC cells adhering to human epithelial cells, using high-resolution scanning electron microscopy, Rendón *et al.* were able to detect, purify and identify a 21-kDa pilin subunit, the amino-acid sequence of which corresponded to the product of the *yagZ* (renamed *ecpA*) gene — a gene that is present in all *E. coli* genomes sequenced so far. Using antibodies raised against this factor, the authors confirmed the presence of ECP on EHEC cells that adhere to cultured human epithelial cells.

To determine whether the production of ECP is a widespread trait of *E. coli* isolates from various sources, a collection of 169 *ecpA*$^+$ strains was analysed using flow cytometry. ECP production was detected in 71.6% of the strains, including intestinal and extra-intestinal pathogenic strains as well as normal flora *E. coli*. To provide genetic evidence of a role for ECP in host-cell adherence, isogenic *ecpA* mutants of both an EHEC O157:H7 strain and a faecal commensal *E. coli* strain were constructed. Functional analysis of these mutants revealed a significant reduction in adherence to epithelial cells compared with wild-type *E. coli* cells. Finally, the authors sought evidence for the *in vivo* production of ECP by *E. coli* when colonizing human hosts. Analysis of sera, collected from both healthy humans and patients infected with EHEC, revealed the presence of anti-ECP antibodies in all samples, a finding that is suggestive of the ability of commensal and pathogenic *E. coli* to produce ECP in the intestinal environment.

Taken together, this characterization of ECP biology and function indicates a significant role for the pilus in host epithelial cell adherence by pathogenic and non-pathogenic *E. coli*. Interesting avenues of research for the future will include establishing the precise biological role for this factor in the *in vivo* colonization of human gut mucosa, and investigating whether EHEC strains might have adopted a host-cell adherence mechanism to mimic that used by commensal *E. coli* and thus gain an ecological advantage.

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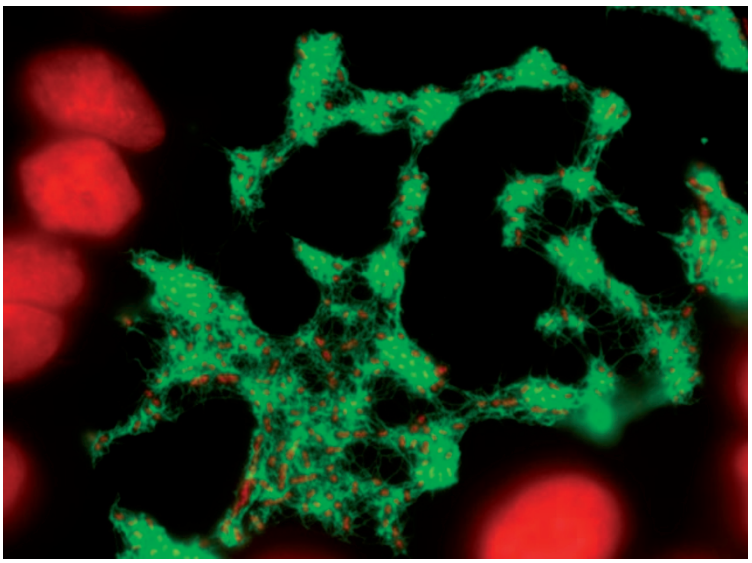
ORIGINAL RESEARCH PAPER Rendón, M. *et al.* Commensal and pathogenic *Escherichia coli* use a common pilus adherence factor for epithelial cell colonization. *Proc. Natl Acad. Sci. USA* **104**, 10637–10642 (2007)
FURTHER READING Kaper, J. B., Nataro J. P. & Mobley H. L. Pathogenic *Escherichia coli*. *Nature Rev. Microbiol.* **2**, 123–140 (2004)



An immunofluorescence image of enterohaemorrhagic *Escherichia coli* (EHEC) O157:H7, producing *E. coli* common pilus (ECP) (green) while adhering to HEp-2 cells. Cellular and bacterial DNA are shown in red. Image kindly provided by Maria A. Rendón, University of Arizona, Tucson, USA.