A Novel pH-Regulated, Unusual 603 bp Overlapping Protein Coding Gene \textit{pop} Is Encoded Antisense to \textit{ompA} in \textit{Escherichia coli} O157:H7 (EHEC).

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Abstract

Antisense transcription is well known in bacteria. However, translation of antisense RNAs is typically not considered, as the implied overlapping coding at a DNA locus is assumed to be highly improbable. Therefore, such overlapping genes are systematically excluded in prokaryotic genome annotation. Here we report an exceptional 603 bp long open reading frame completely embedded in antisense to the gene of the outer membrane protein \textit{ompA}. An active $\sigma$\textsuperscript{70} promoter, transcription start site (TSS), Shine-Dalgarno motif and rho-independent terminator were experimentally validated, providing evidence that this open reading frame has all the structural features of a functional gene. Furthermore, ribosomal profiling revealed translation of the mRNA, the protein was detected in Western blots and a pH-dependent phenotype conferred by the protein was shown in competitive overexpression growth experiments of a translationally arrested mutant \textit{versus} wild type. We designate this novel gene \textit{pop} (pH-regulated overlapping protein-coding gene), thus adding another example to the growing list of overlapping, protein coding genes in bacteria.

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KEYWORDS:

EHEC O157:H7; overexpression phenotypes; overlapping gene; pH; protein; ribosomal profiling

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