Integrons are goldmines of anti-phage defense systems

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Abstract

Integrons are genetic platforms that allow bacteria to adapt to different environmental stressors through the acquisition of new genes embedded into cassettes. These systems work by capturing, storing and rearranging cassettes, which ensures the exploration of diverse phenotypic combinations as only the first cassettes of the integron are expressed (1). While integrons are best known for their role in antibiotic resistance, up to several hundred uncharacterised cassettes can be found in large integrons. Given the plasticity of these adaptation on demand platforms, in this work we set out to explore the role of the cassettes present in the *Vibrio cholerae* chromosomal integron as defence systems against phages. Through the overexpression of 88 of these cassettes, we found that 16 displayed anti-phage activity in either *V. cholerae* or *E. coli*. We also showed that these usually silent cassettes can be mobilized and expressed by the integron and thus confer resistance to phages in their natural genetic context. Most of the systems encoded in these cassettes have little or no similarity to previously known ones. Moreover, they exhibit typical features of abortive infection behavior, in which the defense system targets its host cell after detecting the presence of the phage, preventing viral amplification and protecting the rest of the population (2). With these results, we confirm the propensity of integrons to be hotspots for anti-phage systems at a low cost for the cells.

(1) Escudero, Loot, Nivina and Mazel, *Microbiol Spectr*, Mar. 2015

(2) Yen *et al.*, *Nat. Commun.*, Feb. 2017

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Keywords: integrons, bacteriophages, phage defense, recombination