Evolutionary escape of Escherichia coli from bacterial predator Bdellovibrio bacteriovorus

Subham Mridha[1], Sarah-Luise Loose[1], Ove Mattmann[1], Rolf Kümmerli[2], and Simona Huwiler[*1]

[1]Department of Plant and Microbial Biology, University of Zurich – Suisse
[2]Department of Quantitative Biomedicine, University of Zurich – Suisse

Résumé

Bdellovibrio bacteriovorus is a predatory bacterium which attaches, kills, invades and then feeds on other gram-negative bacteria. To use this predator as 'living antibiotics' to kill antibiotic resistant bacterial pathogens and to better understand its impact on microbial populations, it is essential to determine whether a bacterial prey could develop resistance to *B. bacteriovorus.* To address if and how fast bacterial prey resistance arises and determine its potential genetic determinants, we performed an experimental prey evolution study. We exposed *Escherichia coli* as prey intermittently to predator *B. bacteriovorus* in alternate cycles, involving a predation phase where prey was exposed to different predation pressures, followed by a recovery phase, where surviving prey was grown in absence of the predator. After the experimental prey evolution, we compared the growth of evolved prey lineages versus the ancestor. We found evidence for media adaptation under no-, partial resistance under low-, and strong resistance under high-predation pressure respectively. We found that prey lineages which evolved without predation pressure were susceptible to predation, suggesting that resistance adaptations are specific to predation and not media. When comparing the growth rate of evolved prey lineages to ancestor in the absence of predator, we observed a trade-off between resistance and fitness. To investigate the genetic basis of resistance, we sequenced the genomes of evolved prey lineages and compared them to the ancestor prey. We identified resistance mutations primarily associated with the outer membrane. *E. coli* gene knockout mutants confirmed that a small subset of genes was mainly responsible for the resistant phenotypes. Altogether our study reveals predation resistance is associated with outer membrane changes in prey, generating valuable insights into microbial prey-predator interactions.

Mots-Clés: predation, resistance, predatory bacteria

[*]Intervenant