Coliphages are prevalent but mostly uninfectious in the infant gut

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Résumé

A link between one-year old infant gut microbiota and asthma predisposition starts to emerge from several studies (1, 2). Since bacteriophages constitute an important component of the gut microbiome, it is of interest to investigate if they could influence early life microbiota colonization and maturation and whether they play a role in the risk of asthma development. The international joint initiative 'Earlyvir', aims at studying the infant viromes.
Escherichia coli is one of the first bacterial species to colonize the infant's gut. This population is highly abundant (_˜15% of OTU), quite stable during the first month of life, and decreases thereafter (5% at 1 year). This dynamic evolution and the possibility to collect strains from feces, make this specie a good model to start studying the phage-bacteria interactions in the gut.

We used the *E.coli* collection of the COPSAC2010 cohort (3), in which fecal samples of 700 children were collected and a total of 1769 *E.coli* strains were isolated at 1 week (348 isolates), 1 month (467 isolates) and 1 year (954 isolates). We quantified the number of strains containing active temperate phages as well as their level of phage particle production. We find that 62.2% of these *E.coli* strains contain active temperate phages, ie forming plaques on laboratory strains *E.coli* C and MG1655. This percentage evolves over time suggesting two different *E.coli* population dynamics. We also show that during this period, *E.coli* strains containing active prophages are not selected depending on their level of phage production but more probably according to their host spectrum. We next analyzed the capacity of 90 of these phages, to infect 90 COPSAC *E.coli* strains. 79% of *E.coli* strains are resistant to all temperate phages, showing that *E.coli* isolates from the gut possess efficient barriers to protect themselves from temperate phages produced by their neighbours. The genome of twenty temperate phages from *E.coli* strains isolated at 1-year were also sequenced. Sequence analysis showed two main clusters (lambda-like and P2-like) and two minor clusters (Mu-like, P88-like).

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Finally, we studied 153 viromes extracted from fecal samples at 1 year. At least 20% of these viromes contain coliphages and our first results suggest that natural *E.coli* strains are also resistant to these phages.
Therefore, we observe a contrast between high prevalence of coliphages in the infant gut and their low infectivity against residing population. These phages might be useful however to fight against *E.coli* invaders.