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Viromes and microbiomes from pig fecal samples: phages and prophages are not vectors of antibiotic resistance genes

Maud Billaud 1,2*, Quentin Lamy-Besnier 1, Julien Lossouarn 1, Elisabeth Moncaut 1, Moira B. Dion 4,5, Sylvain Moineau 4,5,6, Fatoumata Traoré 3, Emmanuelle Le Chatelier 3, Catherine Denis 7, Jordi Estelle 7, Caroline Achard 8, Olivier Zemb 8, Marie-Agnès Petit 1



1. INRAE, AgroParisTech, Micalis Institute, Jouy-en-Josas, France.
2. Pherecydes Pharma, Romainville, France
3. INRAE, MGP, Jouy en Josas, France
4. Université Laval, Quebec City, Quebec, G1V 0A6, Canada

5. Faculté de médecine dentaire, Université Laval, Quebec City, Quebec, G1V 0A6, Canada
6. Felix D'Hérelle Reference Center for Bacterial Viruses, Université Laval, Quebec City, Quebec, G1V 0A6, Canada
7. INRAE, Génétique Animale et Biologie Intégrative, Jouy-en-Josas, France
8. INRAE, Unité Génétique Physiologie et Systèmes d'Élevage, Toulouse, France

Introduction

Understanding the transmission of antibiotic resistance genes (ARGs) is essential as they have important human health implications. It is necessary to identify the animal biotopes where ARGs are present, and if they might be transmitted via mobile genetic elements and then spread into human pathogens.

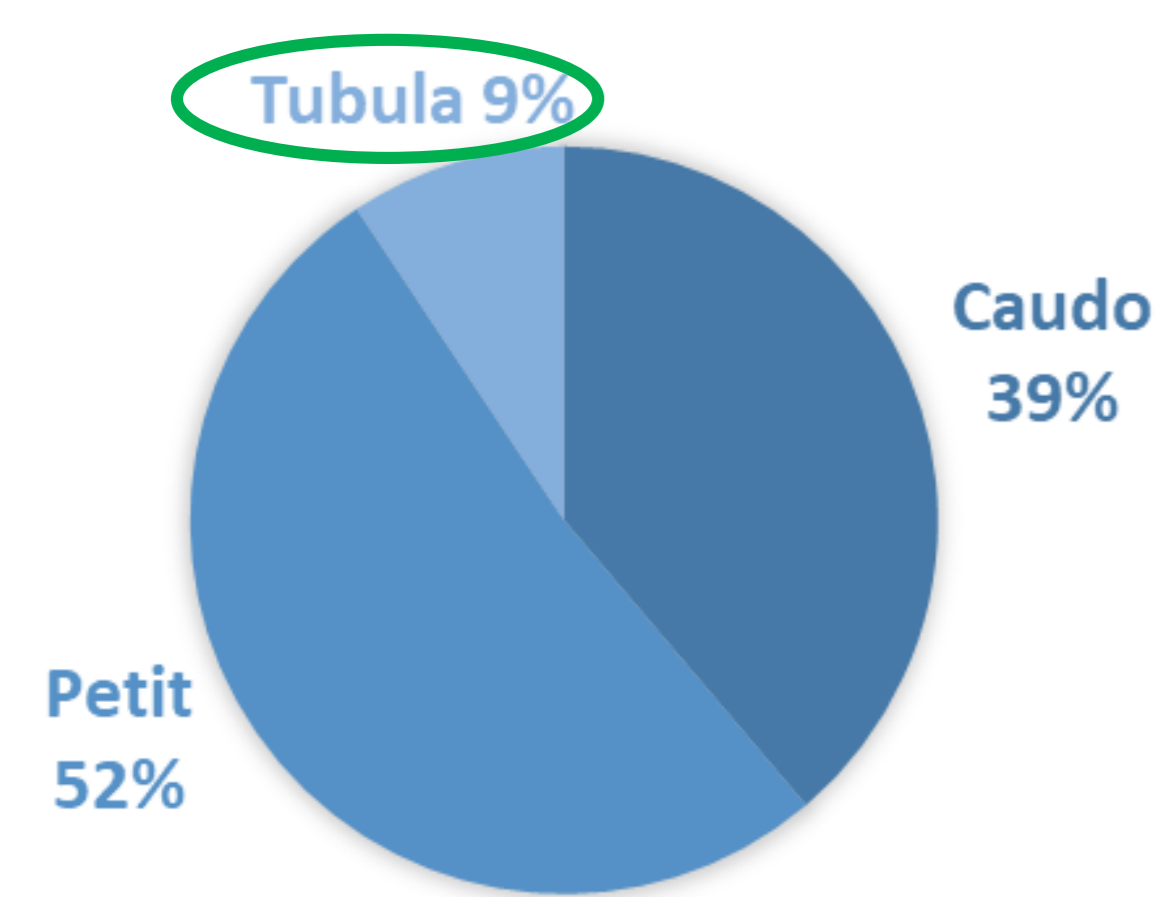
Previous research suggests that ARGs, which can be found in abundance in pig feces, may be encoded by bacteriophages.

In this study, 14 pig fecal samples from 14 different farms with various antibiotic usage were analysed.

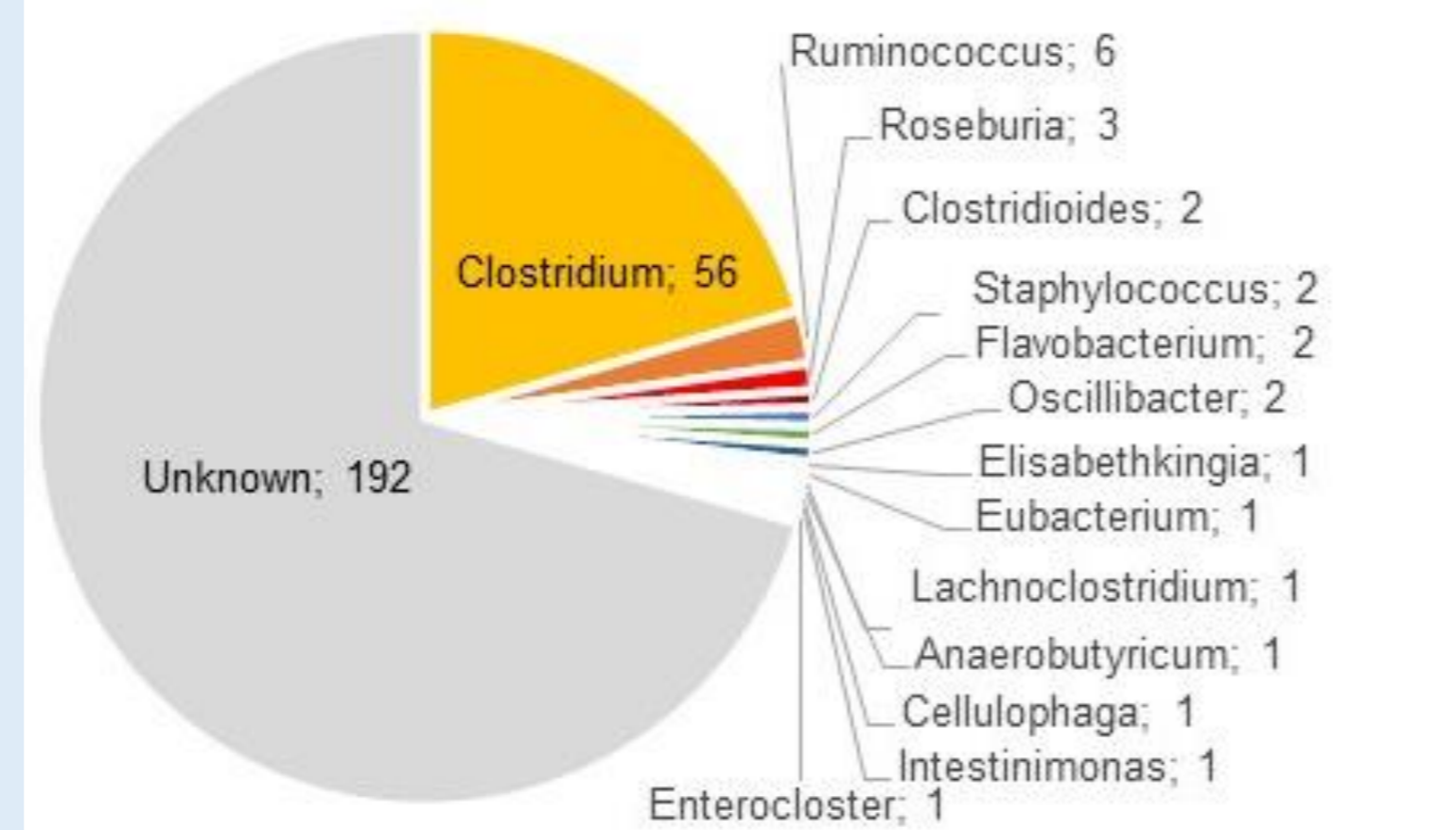
➤ What do pig viral contigs contain?

Pigs gut viromes are rich in Tubulavirales

1691 PHAGE CONTIGS > 100 RPKM

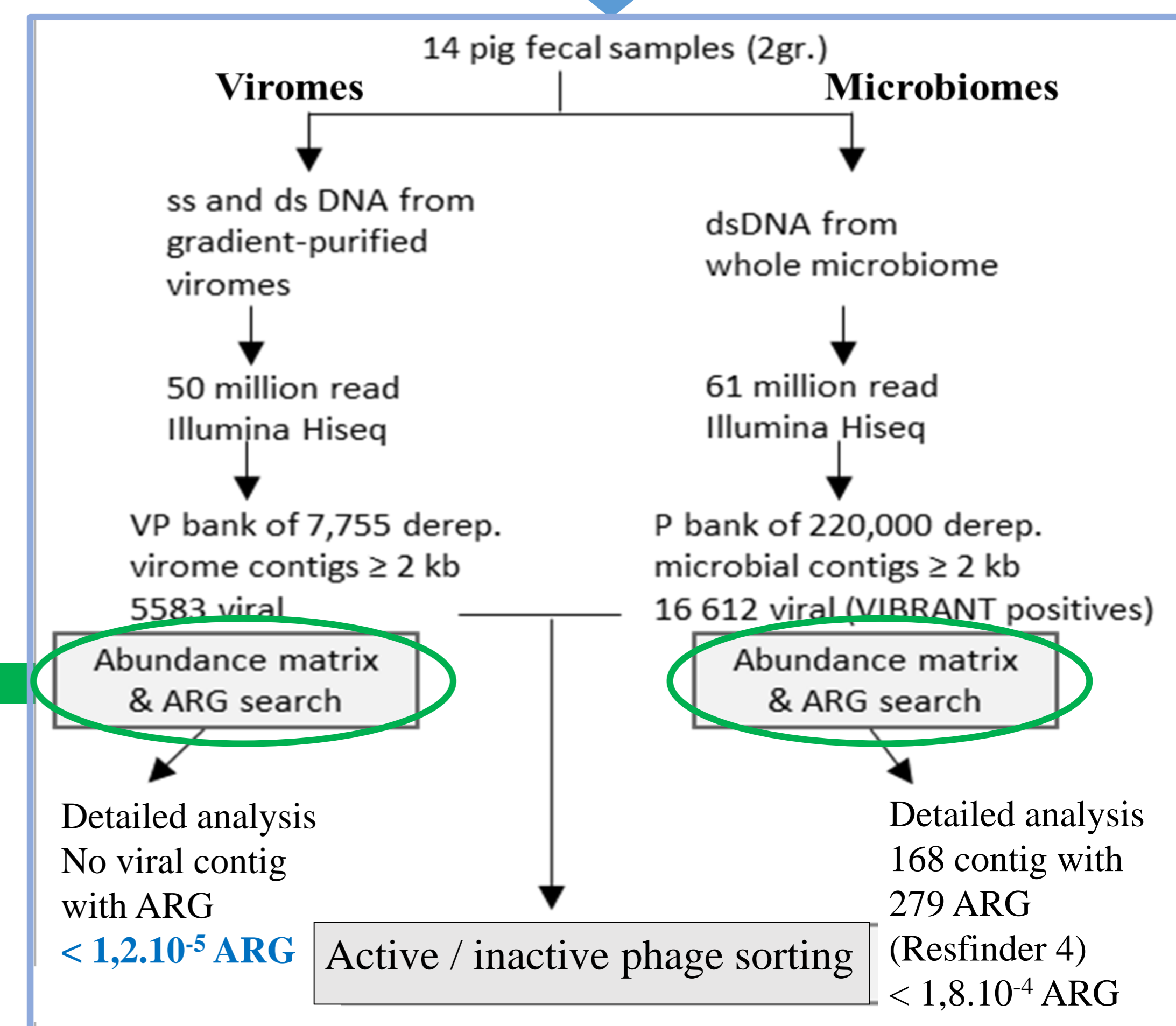


Predicted hosts of Tubulavirales



➤ In pig viromes, most Tubulavirales hosts are Gram + bacteria.

Until now, *Proprionibacterium* phage B5 was the only Gram+ infecting Tubulavirales

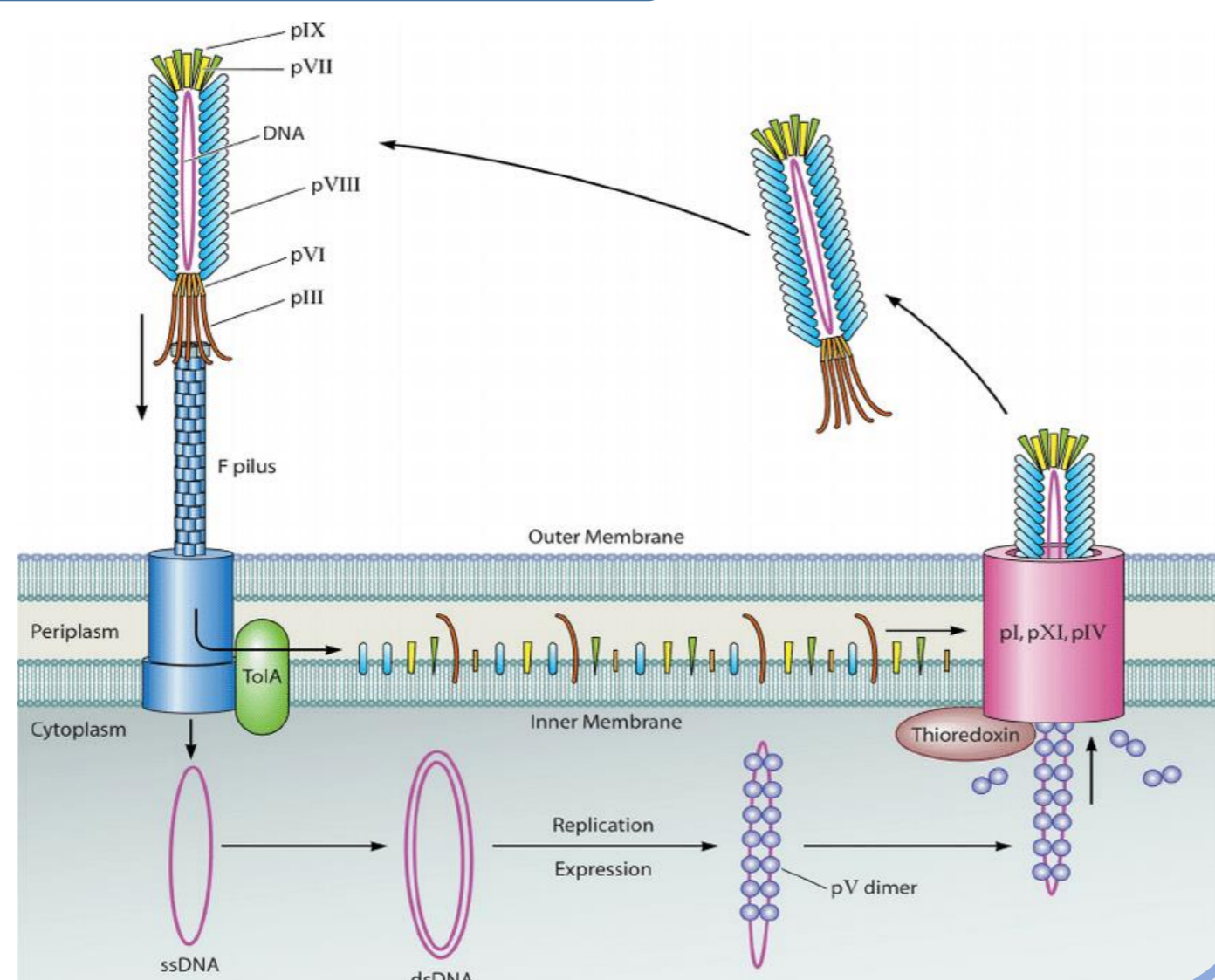


Tubulavirales: the Order of filamentous phages

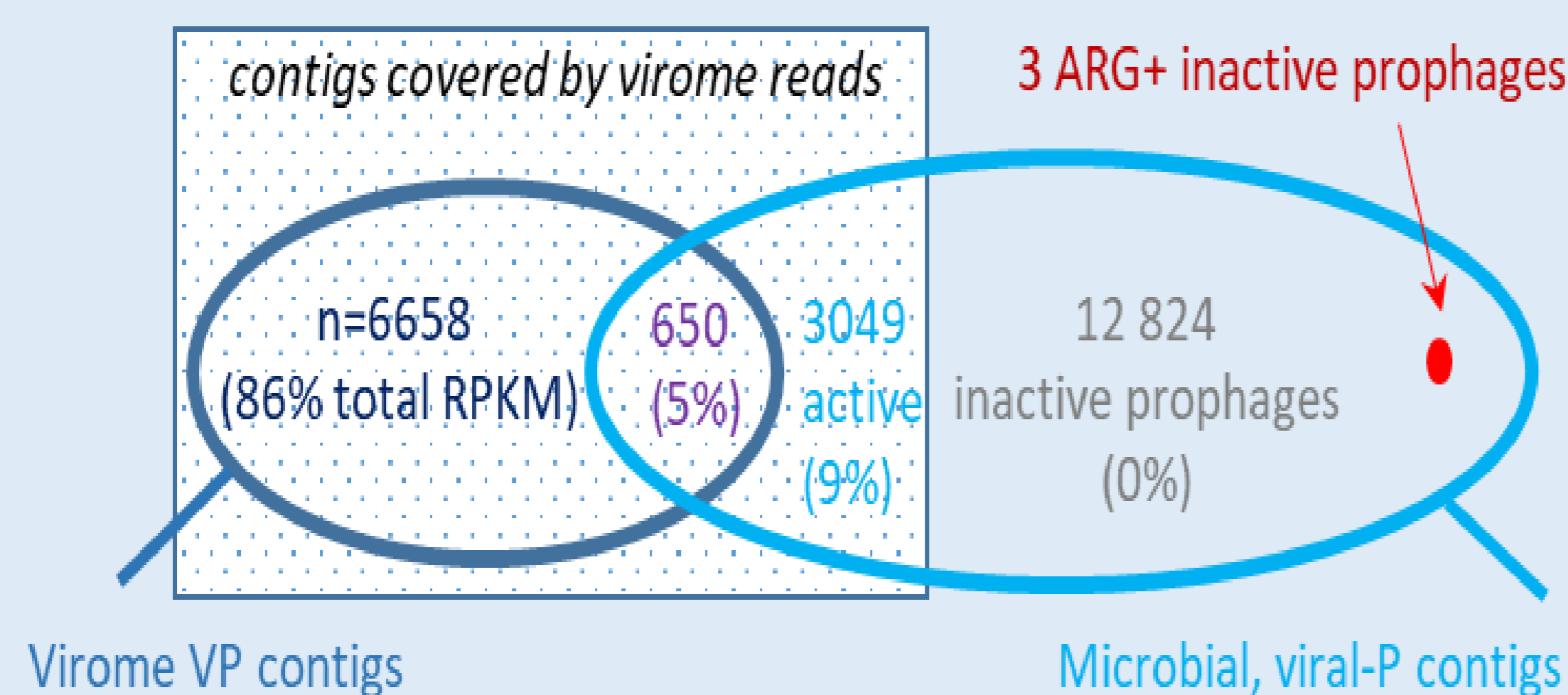
Filamentous phages have a chronic cycle.

During chronic infection, phages, in their episomal form, produce continuous virions that are secreted from the bacterium without lysing it: the virion is assembled at the level of the internal membrane of the host cell, where it is covered by its protein "coat" as it is secreted.

AAC (2012), Johnny X Wang *et al.*

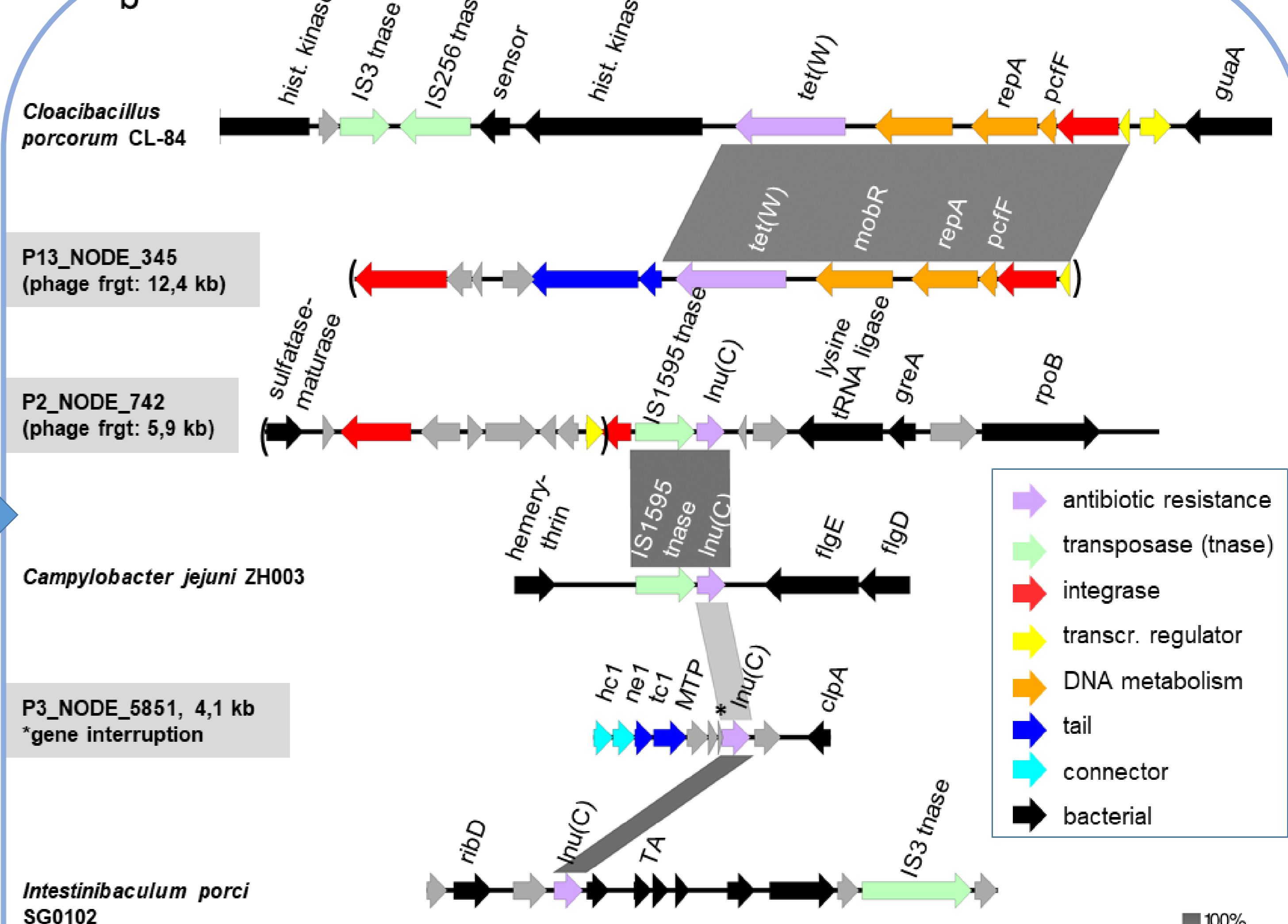


Are there ARGs in the viral contigs ?



No ARG found in the virome fraction
< 0,02% ARG encoded by viral contigs.

b



➤ The 3 ARG-encoding prophage contigs are composite elements with no evidence for intact phage functions

Conclusion

- **Pig viromes are rich in filamentous phages.** The majority of them seem to infect Gram-positive strains.
- **ARGs are rarely encoded by phages:** the probability of finding an ARG in a phage genome is **1000 times lower** than that of finding one in a bacterial genome.
 - ❖ This suggests that phages are not carrying ARGs.
 - ❖ It is important to test their capacity to perform generalized transduction. Indeed, some phages are called "transducers" because they sometimes encapsulate bacterial DNA and transmit it to the bacteria they infect.