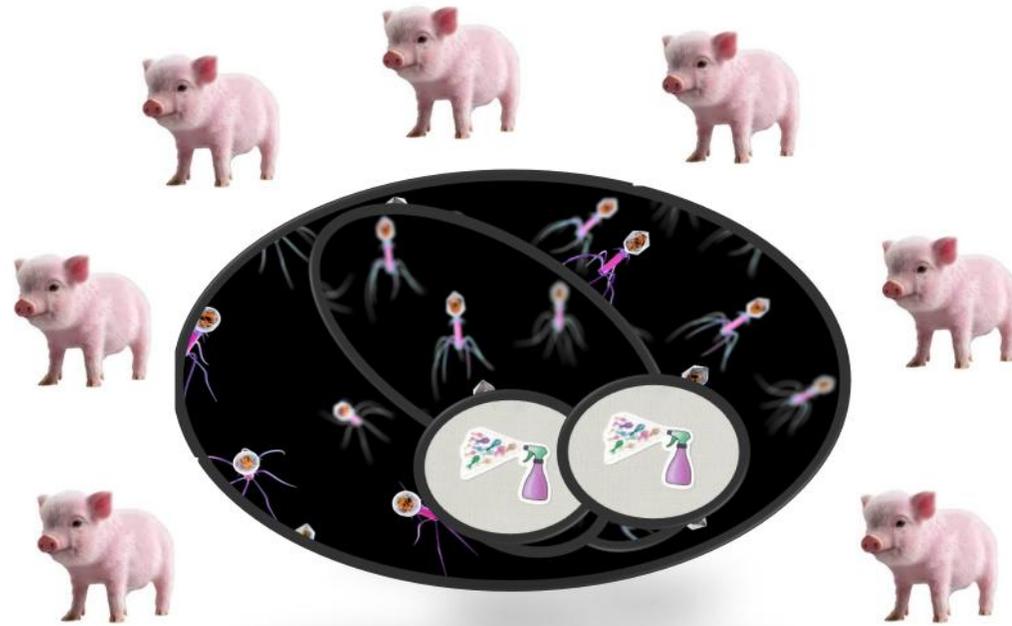


# Systematic characterization of four novel Twort-group bacteriophages infecting *Staphylococcus hyicus*



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# Background

- 🌍 7th largest producer worldwide
- 📦 2.09 million metric tons
- 🌾 4th largest agricultural sector
- 👩 7,000 farms | 31,000 jobs
- 📍 **Quebec:** 31% of Canada's hog population

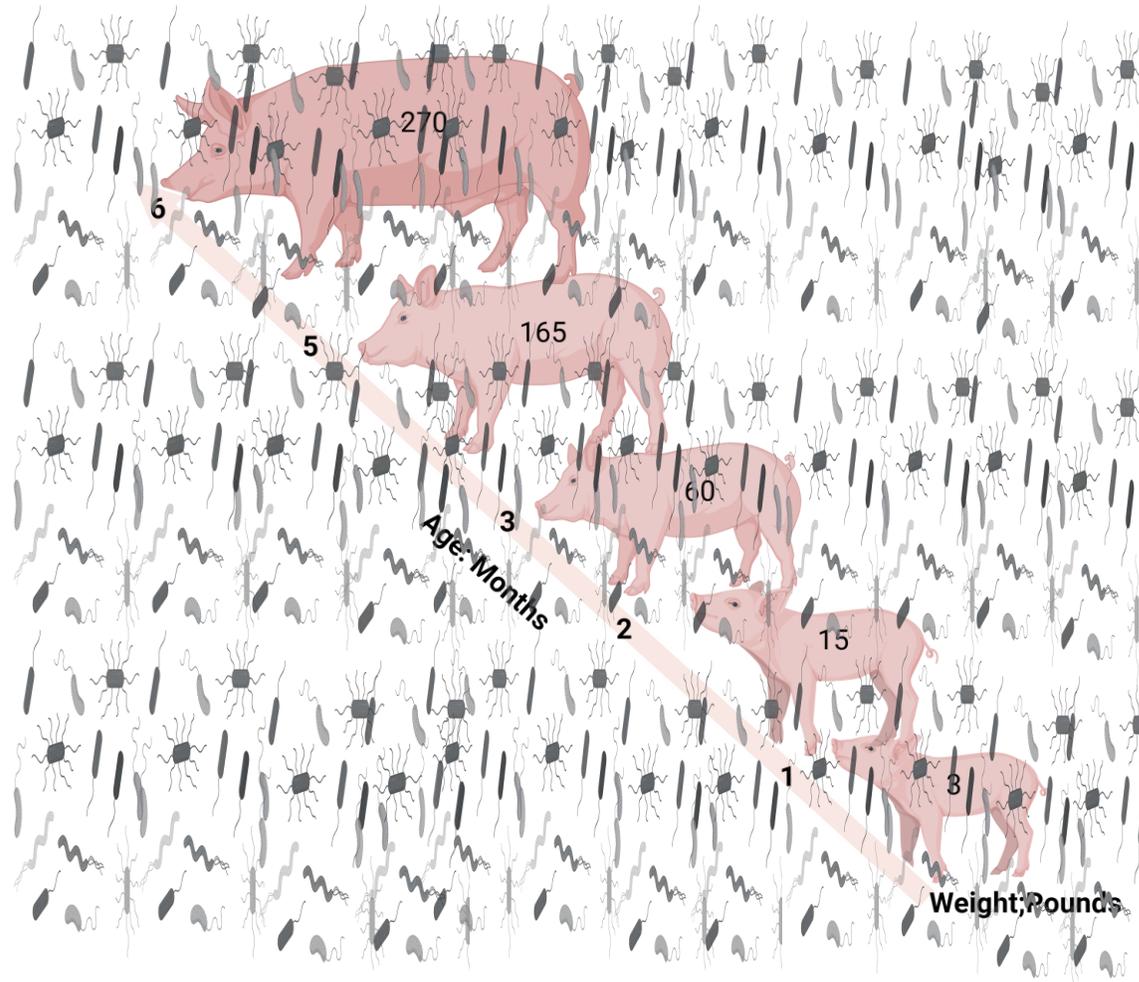


Quebec  
[Pi detection Dataset > Overview](#)

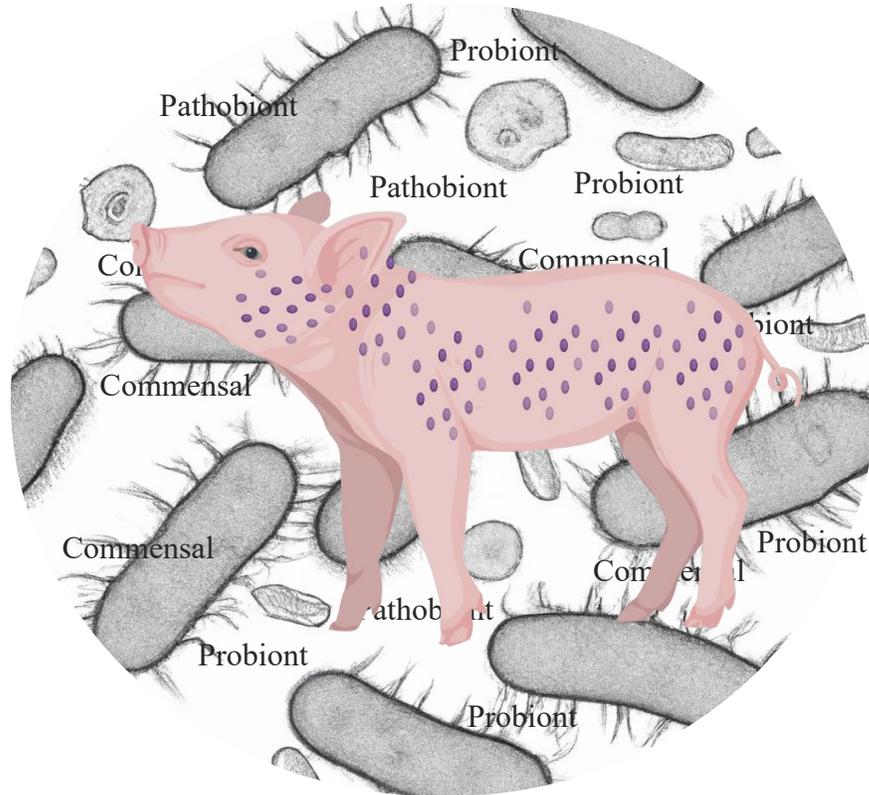
1. <https://www.canadaaction.ca/canadian-pork-farming-facts>

2. <https://agriculture.canada.ca/en/sector/animal-industry/red-meat-and-livestock-market-information/hogs-pork>

# Background



# Background

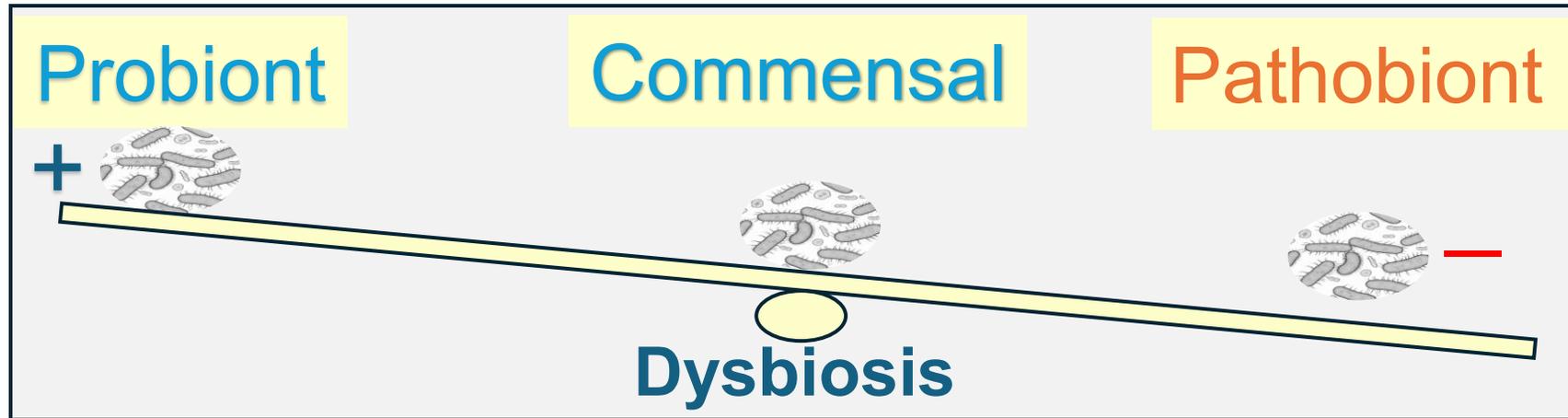
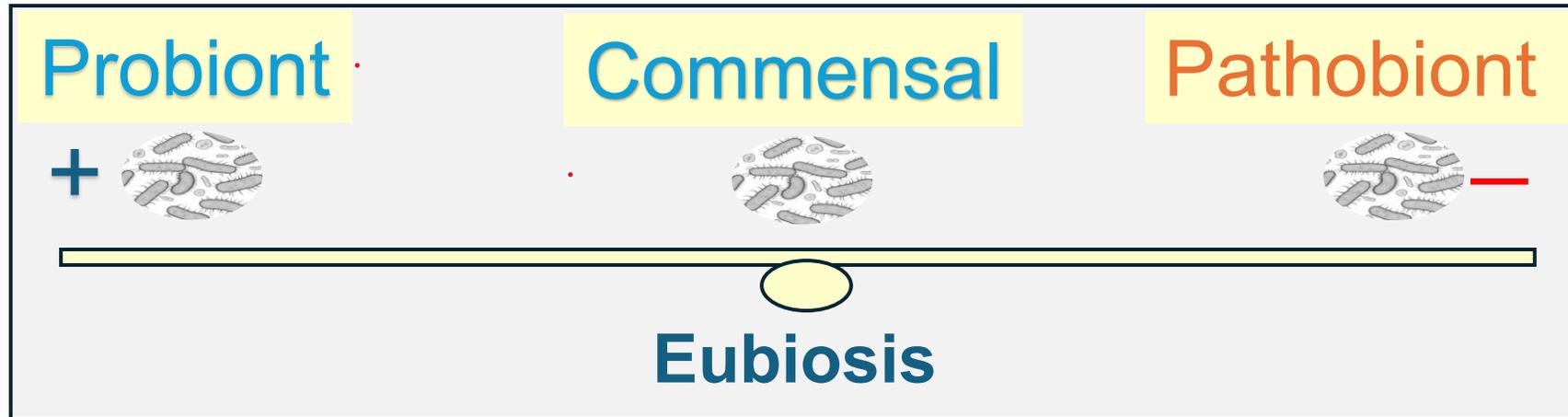


**Probiotic**

**Commensal**

**Pathobiont**

# Background

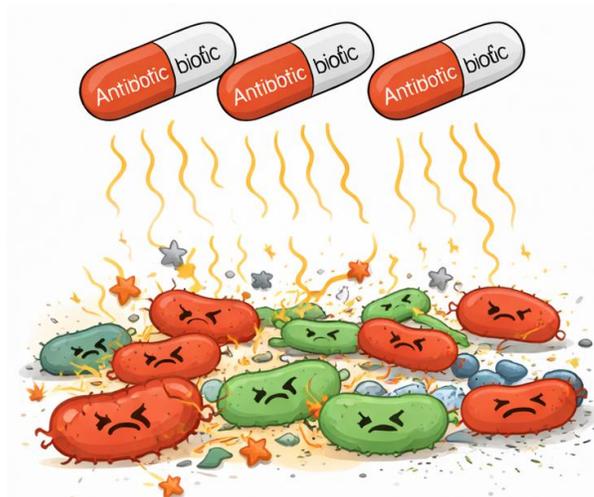


# Preventive Approaches



- Stocking density
- Proper ventilation
- Isolating sick piglet
- **Disinfection of farming facilities**

# Diseases Treatment; Antibiotic

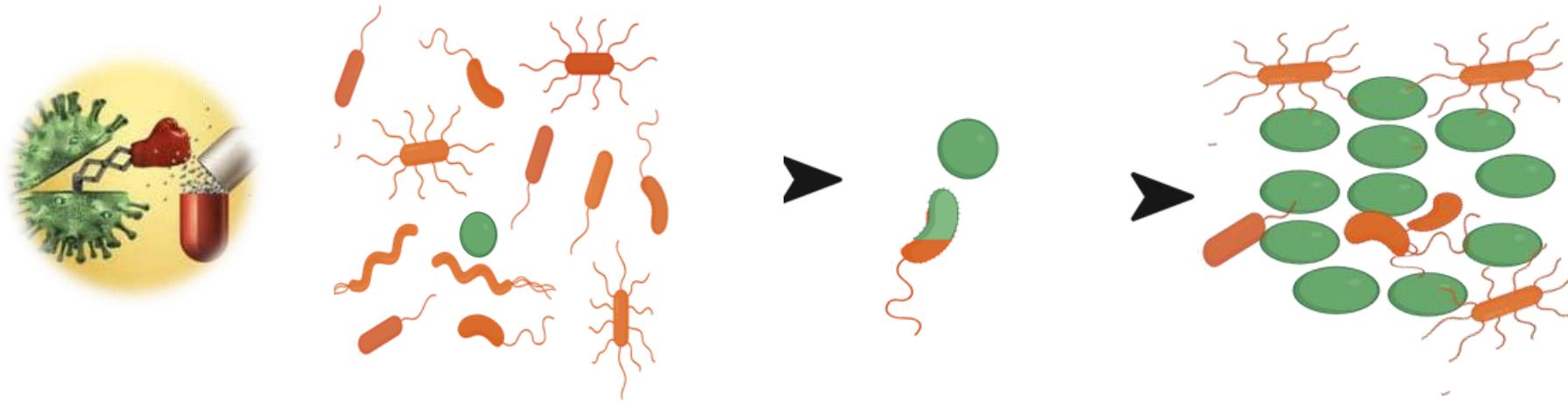


Kills all bacteria



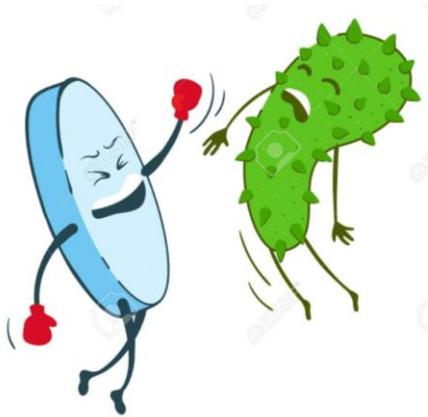
Antibiotic resistance

# Antibiotic Resistance



# Management Approaches

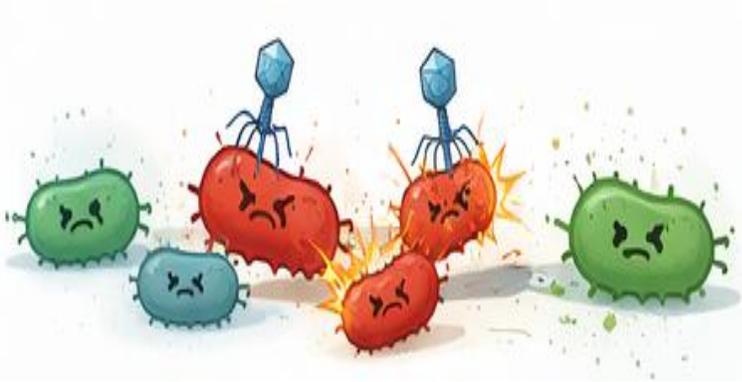
Before Diseases ; Chemical



After Diseases ; Antibiotic



# Bacteriophage



# Bacteriophage



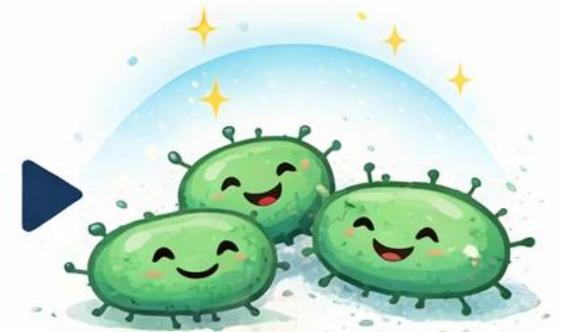
**1. Find the Target**



**2. Attach**



**3. Inject & Multiply**



**4. Bad Bacteria Destroyed**

# Bacteriophage

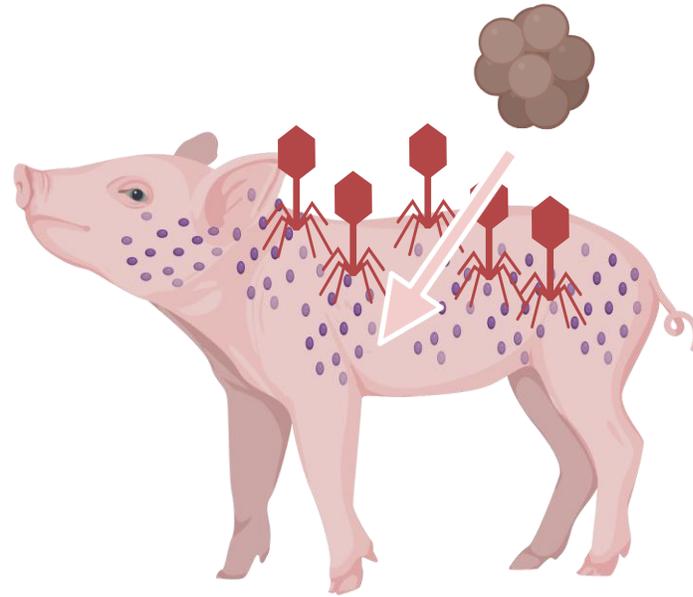


# Exudative Epidermitis (EE)



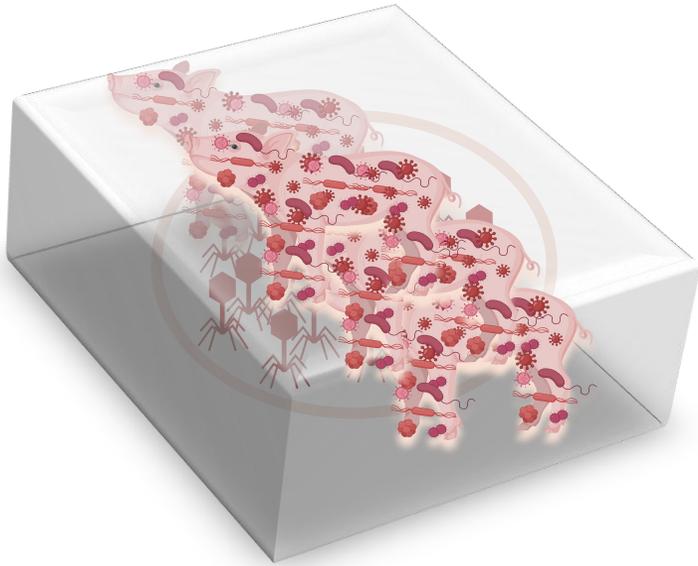
# Exudative Epidermitis (EE)

*Staphylococcus hyicus*



**Bacteriophages**

# General Objectives



**Phage Isolation**



**Analyzed Morphology**



**Genetic Diversity**

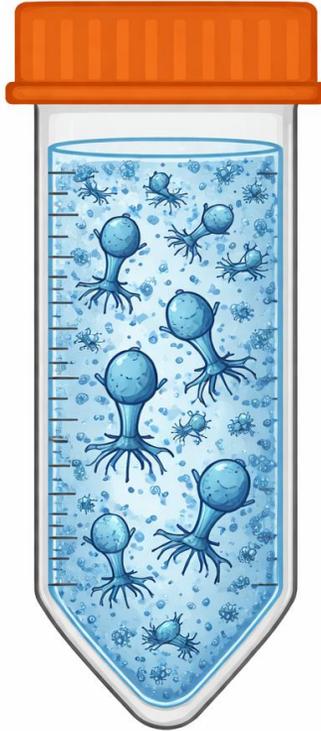


**Host Susceptibility**



**Therapeutic Application**

# Materials and Methods



**Water**



**Manure**



***S. hyicus* Strain**

# Results and Discussion

## Phage Isolation

**Table 1.** Summary of bacteriophages isolation from EE infected swine farm environmental sources using both liquid and solid methods.

Phage 	Source	Host	1st amplification		2nd amplification		Titer (PFU/mL)
			Liquid lysis	Solid lysis	Liquid lysis	Solid lysis	
vB_ShyM_BQE1	Water	SC392	+	+	+	+	$1.0 \times 10^{10}$
vB_ShyM_BQE4	Water	SC361	+	+	+	+	$4.7 \times 10^8$
vB_ShyM_BQE7	Water	SC386	+	+	+	+	$4.1 \times 10^8$
vB_ShyM_BQL4	Manure from pit	SC361	-	+	+	+	$1.14 \times 10^9$

Higher efficiency

# Materials and Methods

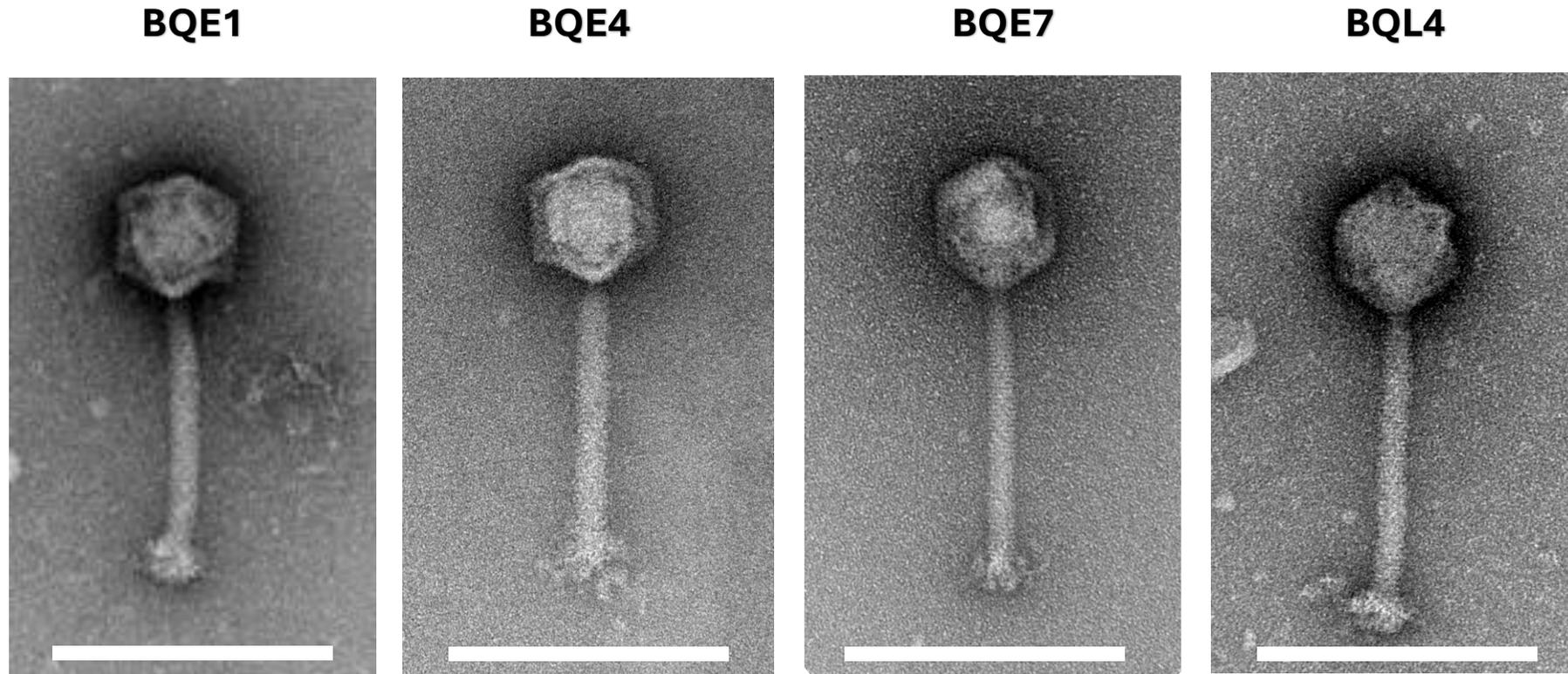
## Transmission Electron Microscopy (TEM)



**JEOL 2100 Plus Transmission  
Electron Microscope**

# Results and Discussion

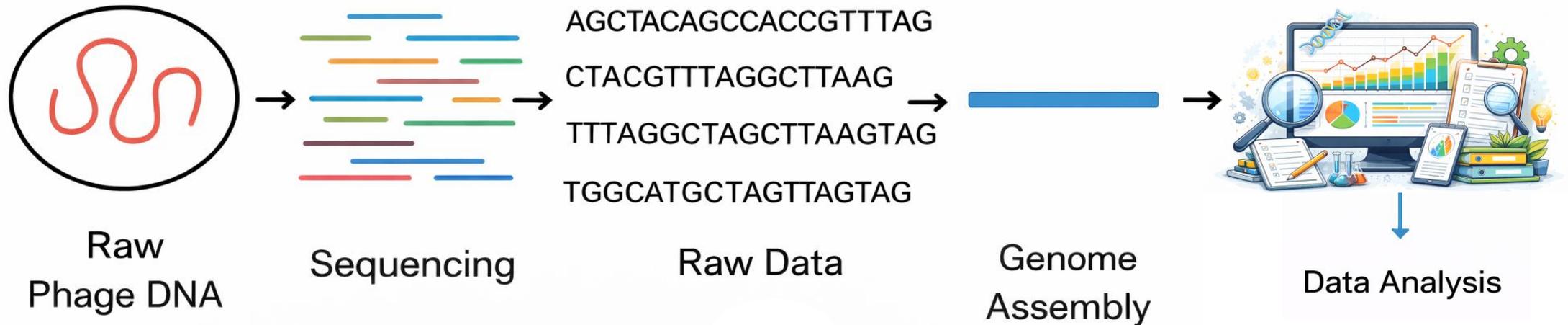
## Phage Morphology



**Figure 1.** TEM Images of Bacteriophages BQE1, BQE4, BQE7, and BQL4, at 200 kV and 50,000 $\times$  magnification (white scale bar: 200 nm).

# Materials and Methods

## DNA extraction for Genome sequencing



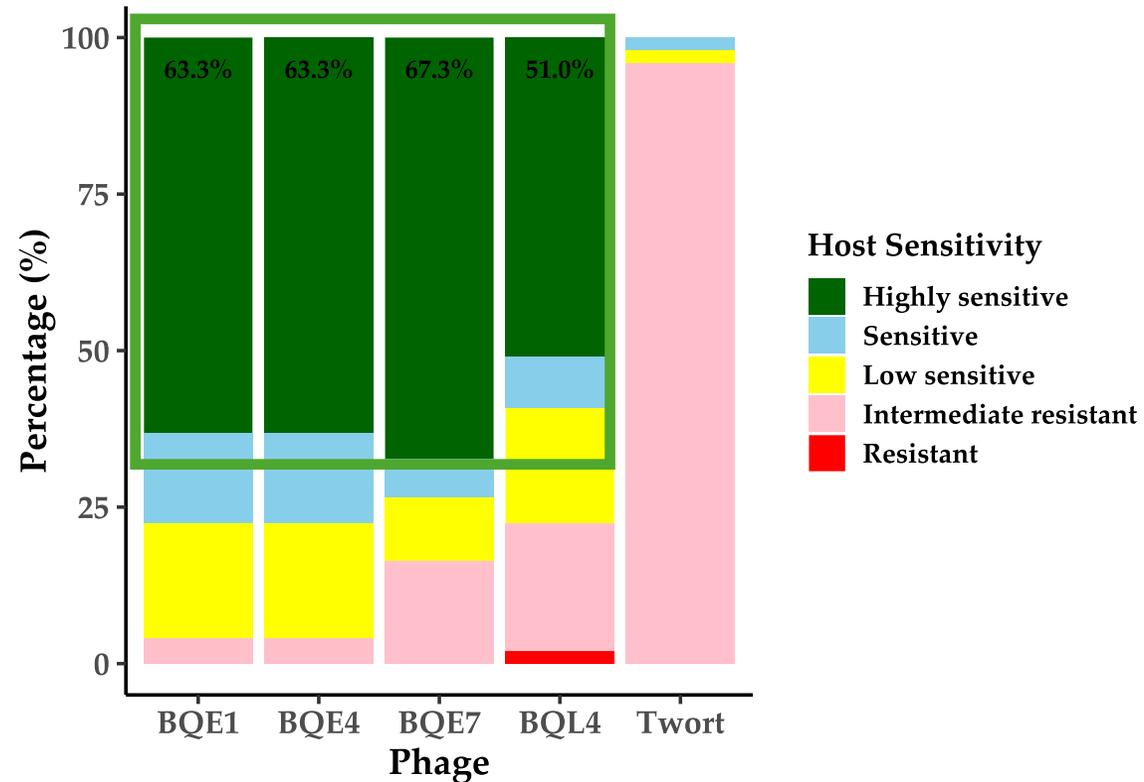
# Results and Discussion



**Figure 2.** Comparison between the phage genomes analysed in present study.

# Results and Discussion

## Host Range



**Figure 3.** Lytic spectrum of the four isolated phages against 49 *S. hyicus* strains

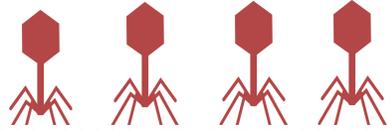
# Results and Discussion

## Phage Stability Test

**Table 2.** Stability of phages BQE7 and BQL4 at room temperature (RT) and 31 °C over 8 days.

Phage	Temperature	Concentration (PFU/mL)				
		Initial (0h)	1day	2 days	4 days	8 Days
BQE7	RT	$2.6 \times 10^9$	$10^9$	$10^9$	$10^9$	$10^9$
BQE7	31 °C	$2.6 \times 10^9$	$10^9$	$10^9$	$10^9$	$10^7$
BQL4	RT	$3.9 \times 10^9$	$10^9$	$10^9$	$10^9$	$10^9$
BQL4	31 °C	$3.9 \times 10^9$	$10^9$	$10^9$	$10^9$	$10^9$

# Conclusion



## ● Phage Therapy ; Suitable



Myovirus morphology



No VFDB / CARD genes



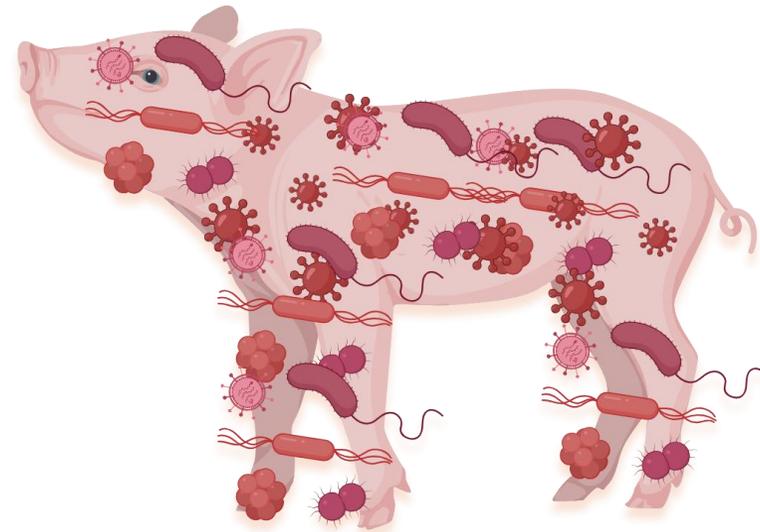
Broad host range



Strong lytic activity



Temperature stability



**Exudative Epidermitis (EE)**

# Future work

## Therapeutic Potential



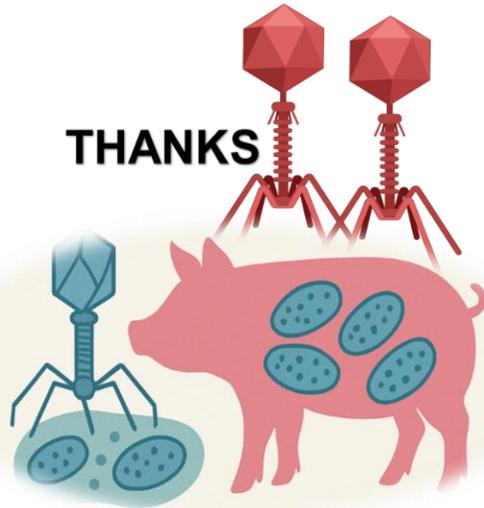
**Phage spray**

# Future work

## Therapeutic Potential



- In vivo validation
- Optimization
- Field application
- **Funding needed**



**Bacterial Strain Providers:**

- Canadian Bovine Mastitis Research Network
- Laboratoire de santé animale of MAPAQ

**Funding:**

- Centre de recherche en infectiologie porcine et aviaire (**CRIPA**)
- Bacteriophage Research Accelerator Fund hosted by Temerty Faculty of Medicine at the University of Toronto.