

Isolation and Characterization of Three Bacteriophages Targeting *Acinetobacter baumannii* AB5075

Tenly Hansen, M.S.B.S. '24 | Carolyn Schroeder, M.S. | Michael Carruthers, Ph.D.
Department of Microbiology and Immunology | College of Osteopathic Medicine

Background

- ***Acinetobacter baumannii***
 - Responsible for 90% of all reported *Acinetobacter* infections in humans¹
 - Primarily associated with nosocomial infections in immunocompromised patients
 - Accounts for 20% of infections across ICUs worldwide, with a mortality rate greater than 50%²
 - Common clinical manifestations:
 - Urinary tract, respiratory tract, gastrointestinal tract, wound, and bloodstream infections³
 - Carbapenem-resistant *A. baumannii* is classified as a critical priority pathogen²
 - Pan-drug resistant strains have been isolated
- **Bacteriophages**
 - Viruses that infect bacteria and archaea
 - Most abundant organisms on Earth (10^{31})
- **Phage Therapy**
 - Use of lytic bacteriophages to selectively target and kill pathogenic bacteria causing infection
 - Promising advantages include:
 - High host specificity⁴, low toxicity⁴, auto-dosing⁵, and biofilm disruption⁶
 - Only 184 phages targeting *A. baumannii* with publicly available genome sequences

Phage Morphological Assessment

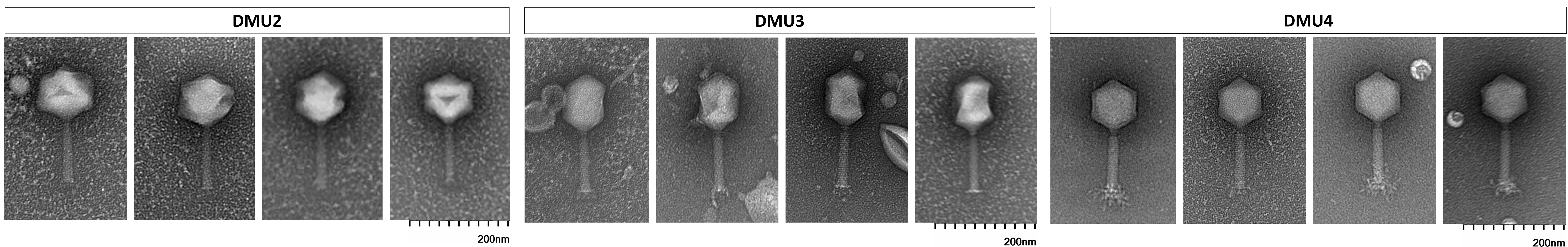


Figure 2: Representative TEM micrographs of phages DMU2, DMU3, and DMU4 stained with 1% uranyl formate. DMU2, DMU3, and DMU4 exhibit myophage morphologies (i.e., icosahedral heads and contractile tails).

Isolation of Novel Phages

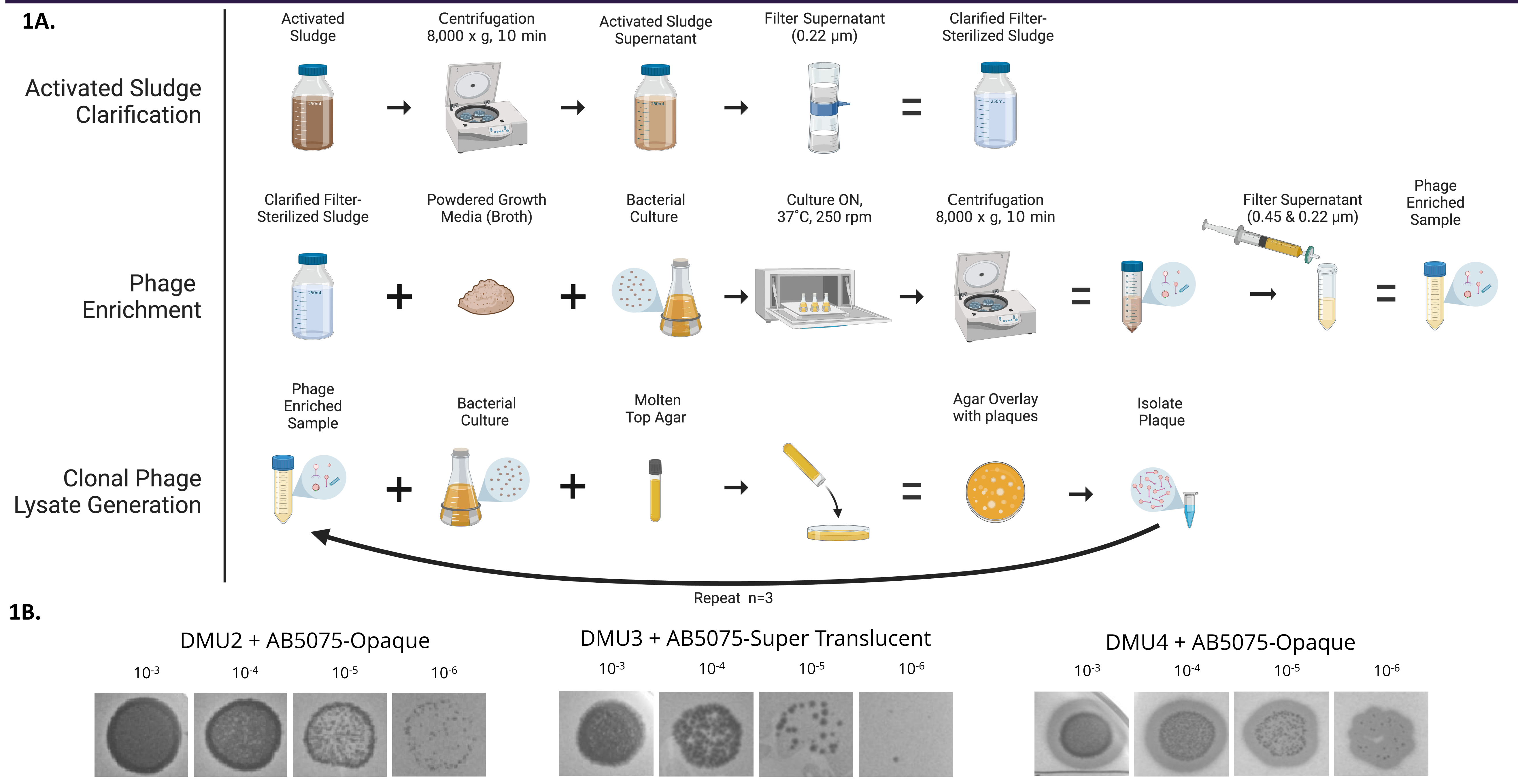


Figure 1A: Isolation of Bacteriophages from Activated Sludge: obtained at the Des Moines Metropolitan Wastewater Reclamation Authority.
Figure 1B: Spot Titrations of *Acinetobacter* Phages: DMU2, DMU3, and DMU4 on soft agar overlays containing *A. baumannii* AB5075 opaque or super translucent morphotypes to assess plaquing.

Conclusions

- Isolated three novel phages that target the model *Acinetobacter baumannii* strain, AB5075
- Each phage exhibits a myophage morphology (icosahedral head, contractile tails) with unique dimensions (data not shown)
- This work advances our research into phages that target *A. baumannii*, adding to a growing collection of phages for potential therapeutic use against this notoriously antibiotic-resistant pathogen

Future Work

- Determine phage host range using a diverse collection of 100 *A. baumannii* clinical isolates
 - Cultured from 2,533 patients across 4 continents by the MRSN from 2001-2017; includes multi- and pan-drug resistant isolates
- Sequence and characterize the genomes of phages
 - Facilitates screening phage genomes for virulence factors, antibiotic resistance genes, and DNA recombination machinery
- Determine phage growth kinetics such as adsorption rate, latency period, and burst size

Acknowledgments

- Larry Hare and Tim Runde at the Des Moines Metropolitan Wastewater Reclamation Authority provided environmental samples
- Tom Moninger at the University of Iowa's Central Microscopy Research Facility performed the staining and imaging of phages

References

1. Boral et al., Ann Clin Microbiol Antimicrob, 2019. 18(1): p. 19
2. Asokan et al., Oman Med J, 2019. 34(3)
3. Falagas, M.E. and P.I. Rafailidis, Crit Care, 2007. 11(3): p.134
4. Skurnik, M., M. Pajunen, and S. Kiljunen, Biotechnol Lett, 2007. 29(7): p. 995-1003
5. Abedon, S.T. and C. Thomas-Abedon, Curr Pharm Biotechnol, 2010. 11(1): p.28-47
6. Azeredo, J., P. Garcia, and Z. Drulis-Kawa. Curr Opin Biotechnol, 2021. 68: p. 251-261