

INVESTIGATING THE TRANSMISSION ROUTE OF *Aedes japonicus japonicus* SUBSPECIES



THE COLLEGE OF
WOOSTER

KELVIN NANA KWAU ANSAH

I.S. Advisor: Dr. Ferdinand Nanfack-Minkeu

PROGRAM IN BIOCHEMISTRY AND MOLECULAR BIOLOGY

BACKGROUND

- Insect-specific viruses (ISVs) are characterized by their inability to infect and reproduce in vertebrates.
- There has been an increase in ISV metagenomic analysis due to their demonstrated potential for controlling mosquito populations and arboviruses.
- *Aedes japonicus narnavirus* (AJNV) is an insect-specific virus that belongs to the Narnaviridae family and its host is the *Aedes japonicus japonicus* species.

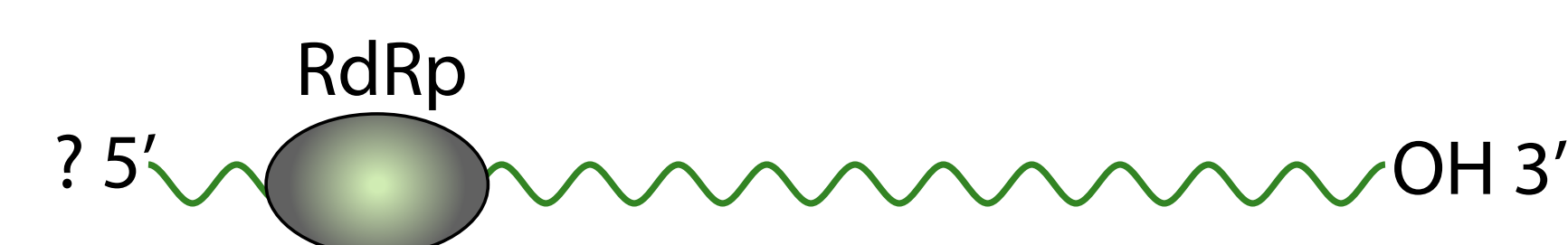


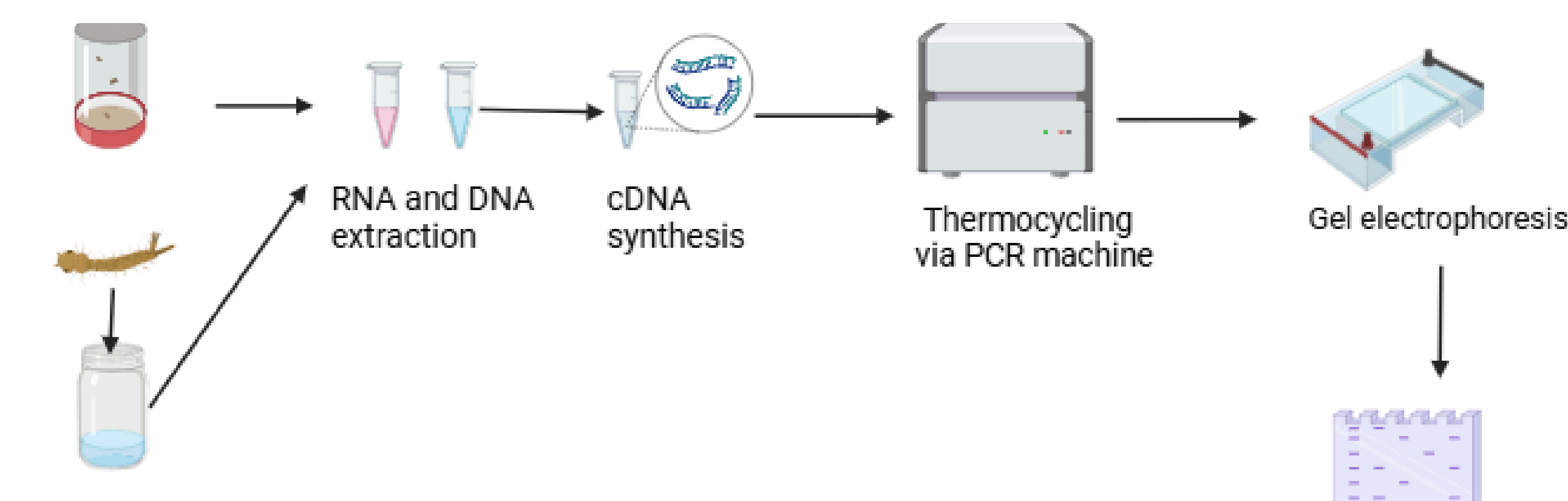
Figure 1: Figure showing the virion structure of a narnavirus. The structure shows a naked virus with no structural proteins and RNA-dependent RNA polymerase (RdRp) associated with the viral genome (viralzone.net).

RESEARCH QUESTION

What is the transmission route, Open Reading Frame (ORF) structure and dissemination type of *Aedes japonicus narnavirus* (AJNV)?

METHODS

RT-PCR



qPCR



PREVALENCE OF AJNV

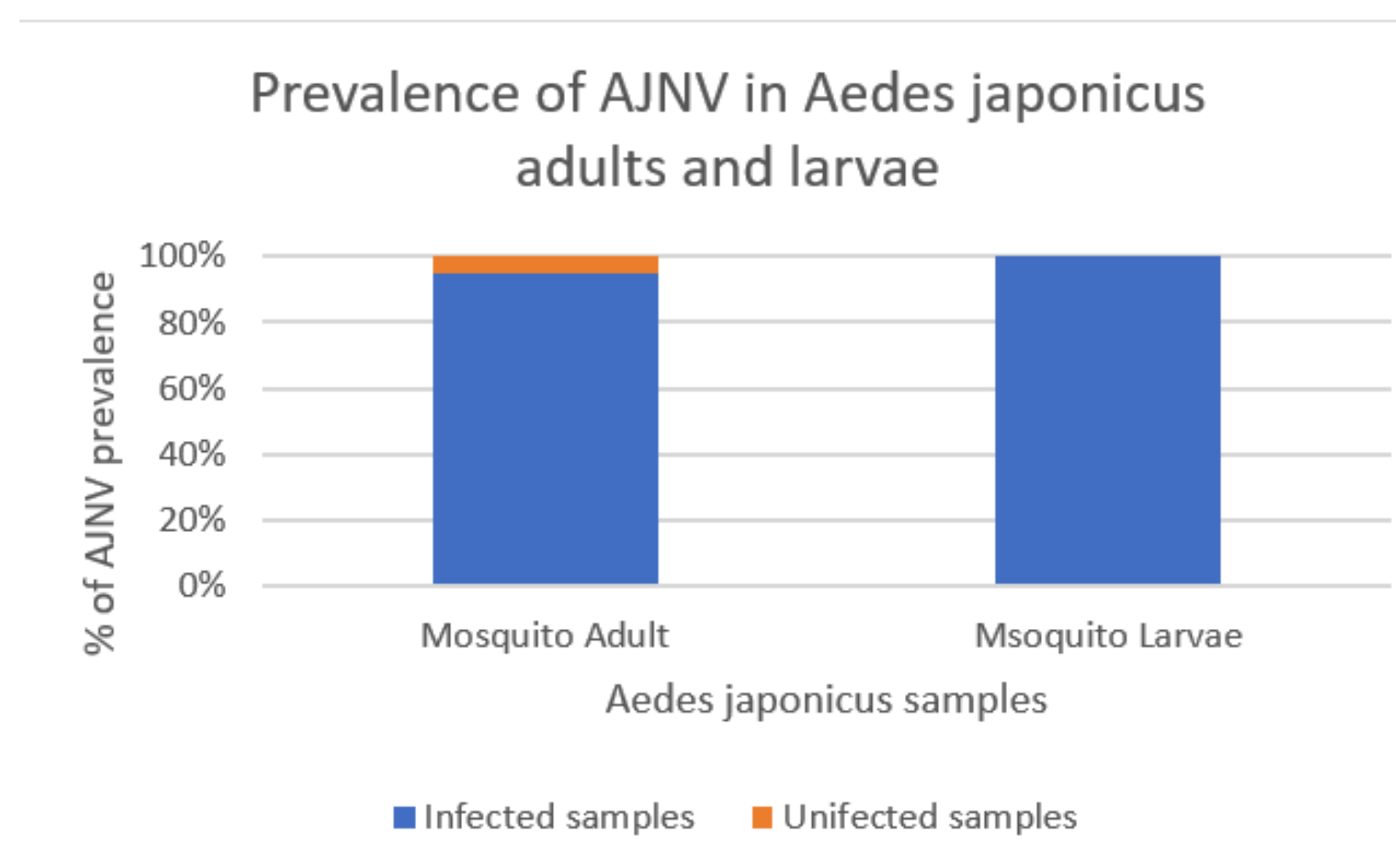


Figure 2: Figure showing AJNV prevalence in Adult and larvae of *Aedes japonicus japonicus* subspecies. The RNA samples of *Aedes* adult mosquitoes (N= 40) and larvae (N = 6) underwent RT-qPCR to determine whether AJNV was present or absent. The figure indicates 98% AJNV prevalence in adult mosquitoes and 100% prevalence in mosquito larvae.

INTRAHOST DISSEMINATION OF AJNV

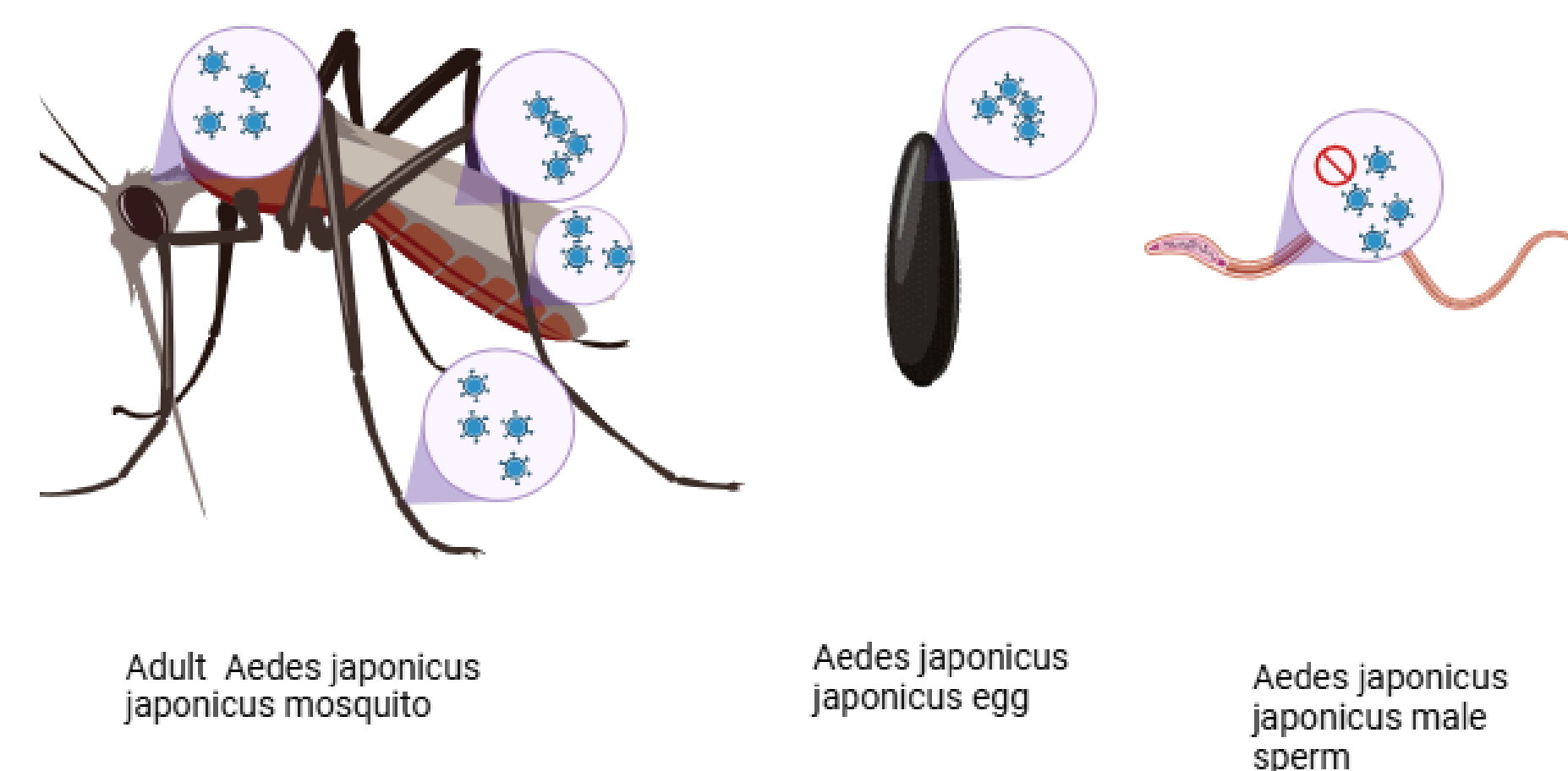


Figure 3: Figure showing AJNV dissemination in *Aedes japonicus japonicus* species. The figure showed that AJNV was not present in the host mosquito's male sperm but had disseminated into the mosquito egg, head, abdomen, leg, and wing (biorender.com)

AMBIGRAMMATIC NATURE OF AJNV

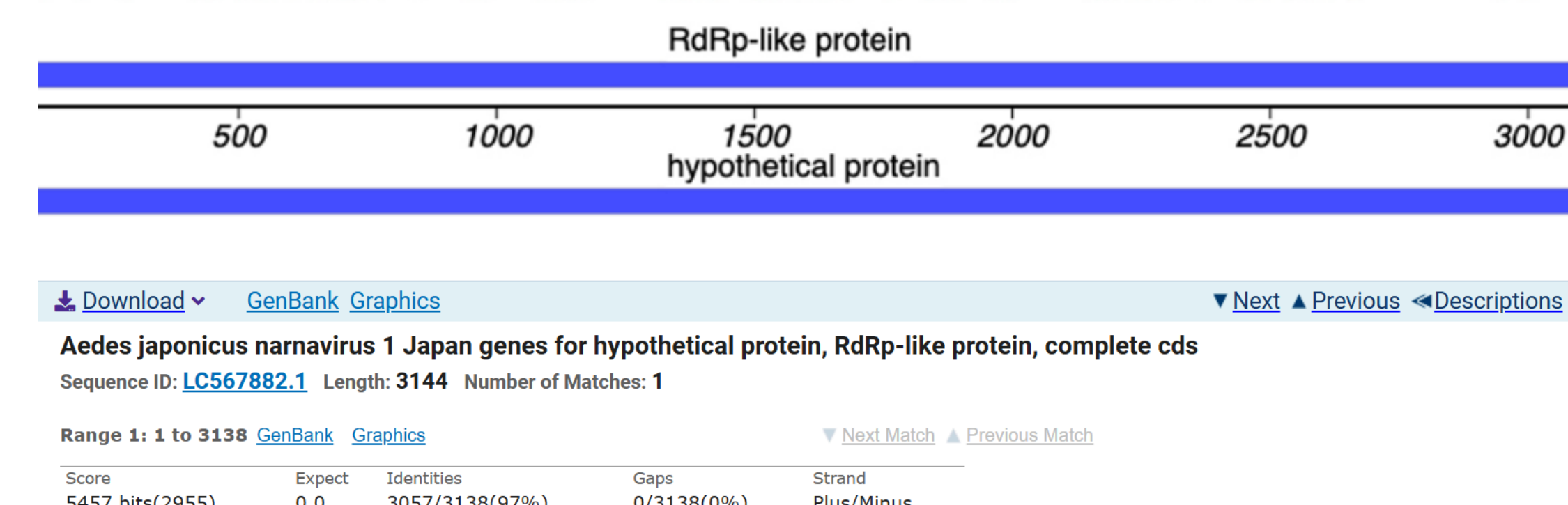


Figure 4: a) Figure showing the assembled genetic code of *Aedes japonicus narnavirus*. The virus is ambigrammatic, meaning it can be read in both directions to produce an RdRp-like protein and possibly another protein (Nanfack-Minkeu et al., 2023). b) Figure presenting blast analysis of the AJNV reverse sequence. This figure indicates that the reverse sequence codes for a potential functional RdRp-like protein

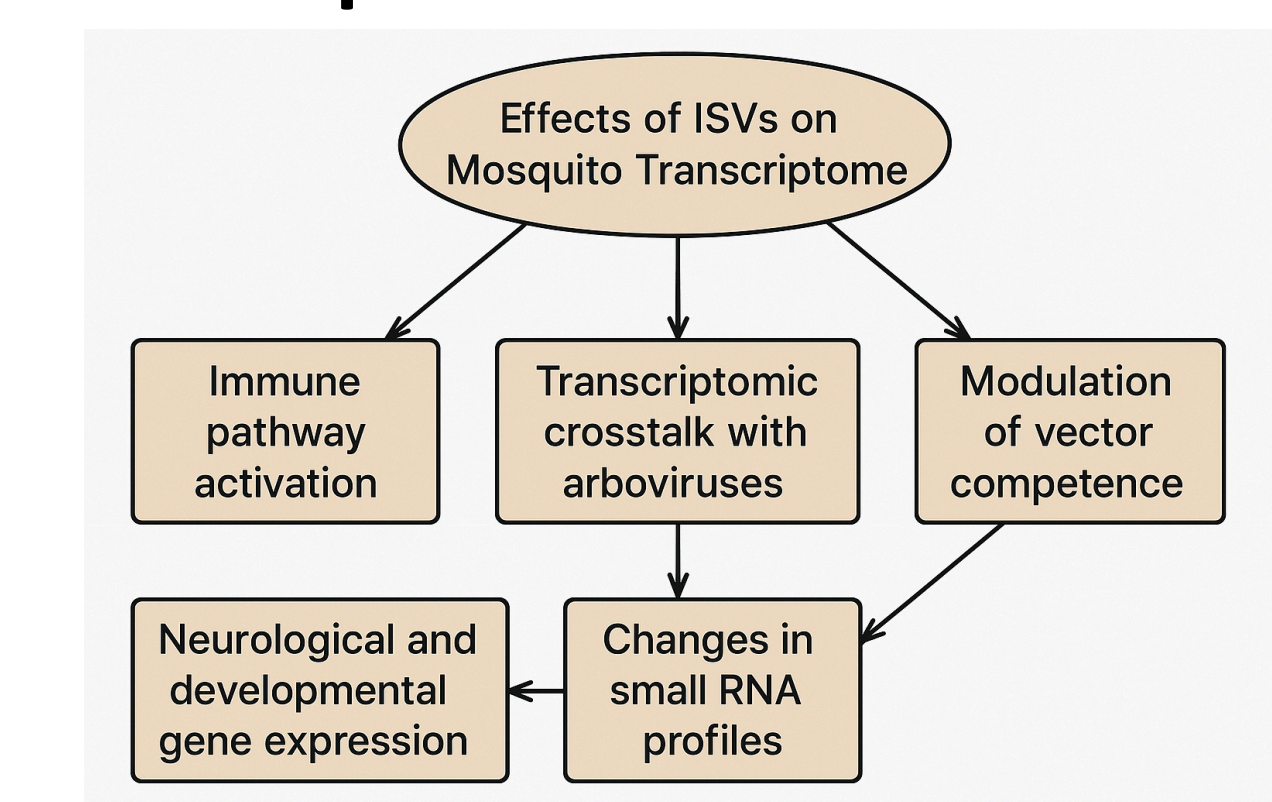
DISCUSSION

- Similar AJNV prevalence in both adults and larvae, as well as further analysis with treated mosquito eggs, revealed a TRANSOVARIAL INTRAEMBRYONIC TRANSMISSION ROUTE.
- As AJNV is restricted to invertebrates, the dissemination of AJNV was determined to be INTRAHOST DISSEMINATION.
- Blastn analysis of the reverse virus sequence showed that it coded for a hypothetical protein, confirming the virus to be AMBIGRAMMATIC.

CONCLUSION AND FUTURE DIRECTIONS

In conclusion, successfully completing the experiment objectives could serve as a starting point for further experiments into the virus's effects on the morphology of the *Aedes japonicus* mosquito population, as well as the potential suppression of arboviral replication rates when present in the same mosquito population.

-Future steps involve investigating effects AJNV effects on host mosquito transcriptome.



ACKNOWLEDGEMENTS

I would like to sincerely thank Dr. Ferdinand Nanfack-Minkeu as well as the College of Wooster Independent fund

REFERENCES

- Carvalho, V. L.; Long, M. T. Perspectives on New Vaccines against Arboviruses Using Insect-Specific Viruses as Platforms. *Vaccines* 2021, 9 (3), 263. <https://doi.org/10.3390/vaccines9030263>
- Kenney, J. L., & Brault, A. C. (2014). The role of environmental, virological, and vector interactions in dictating biological transmission of arthropod-borne viruses by mosquitoes. In *Advances in virus research* (Vol. 89, pp. 39-83). Academic Press. <https://www.sciencedirect.com/science/article/abs/pii/B9780128001721000021>.
- Nanfack-Minkeu, Ferdinand, Alexander Delong, Moses Luri, and Jelmer W. Poelstra. "Invasive *Aedes japonicus* Mosquitoes Dominate the *Aedes* Fauna Collected with Gravid Traps in Wooster, Northeastern Ohio, USA." *Insects* 14, no. 1 (January 6, 2023): 56. <https://doi.org/10.3390/insects14010056>.
- <https://viralzone.expasy.org/303>
- <https://blast.ncbi.nlm.nih.gov/Blast.cgi>