



Molecular pathogen surveillance and discovery

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INTRODUCTION

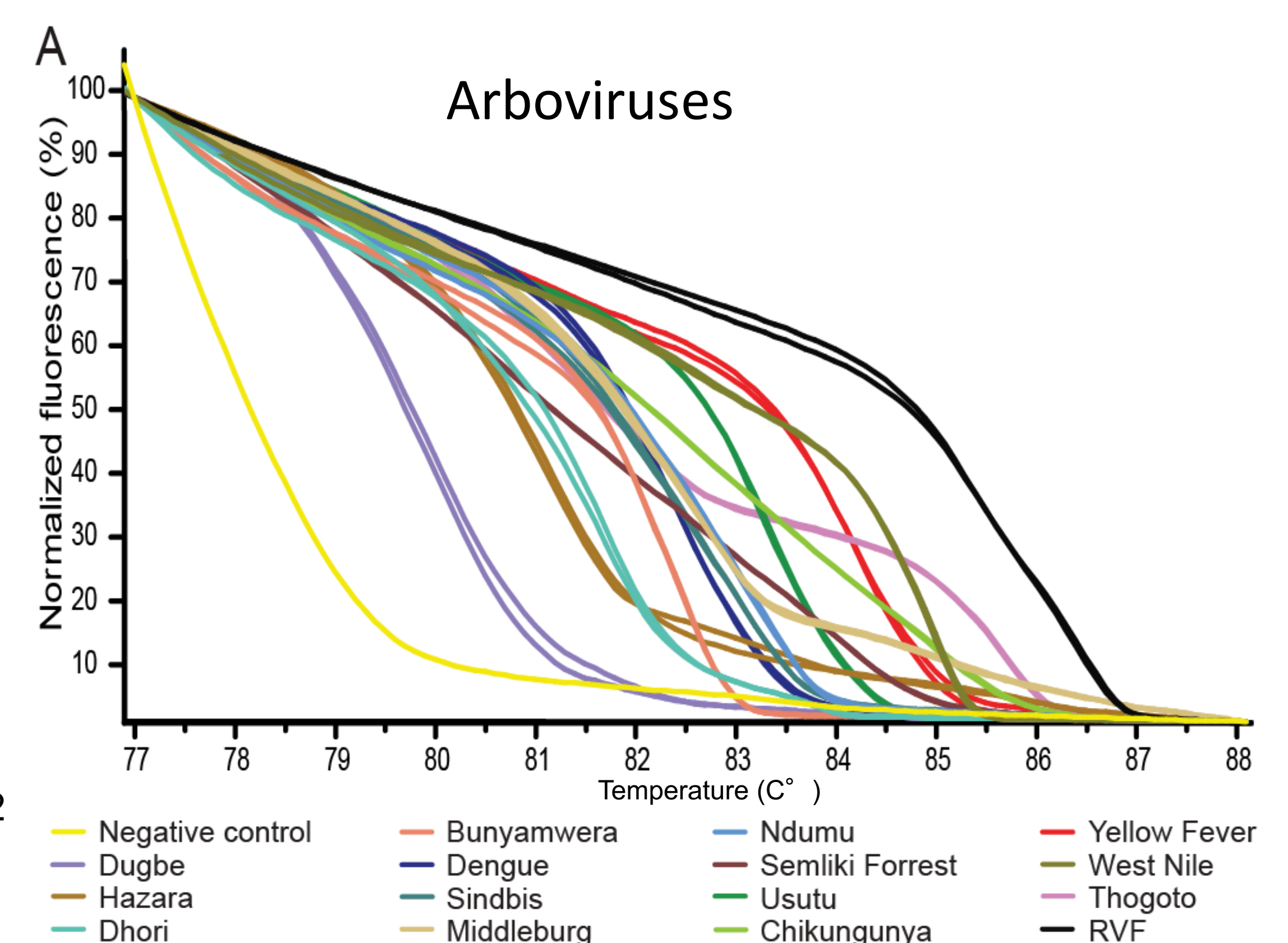
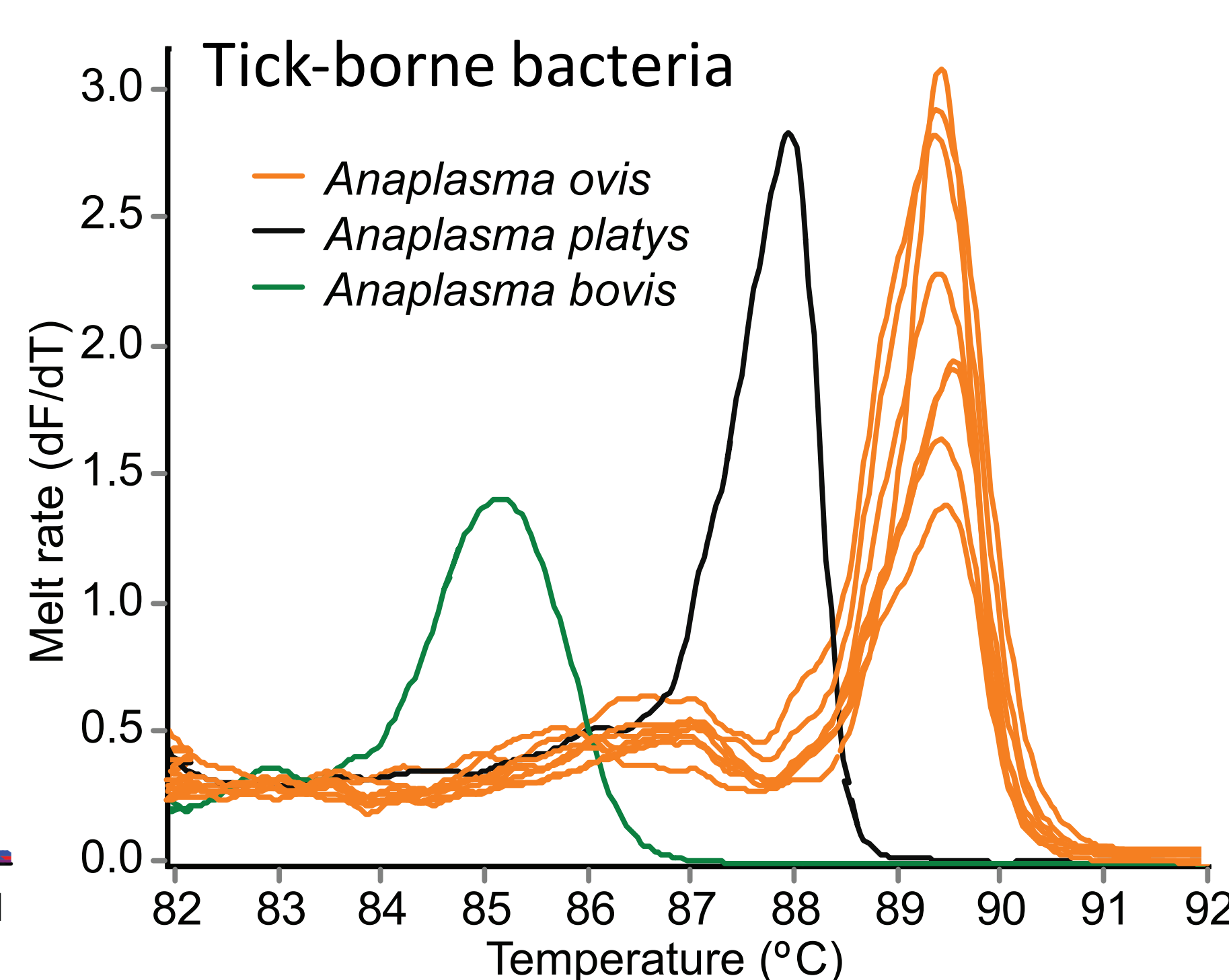
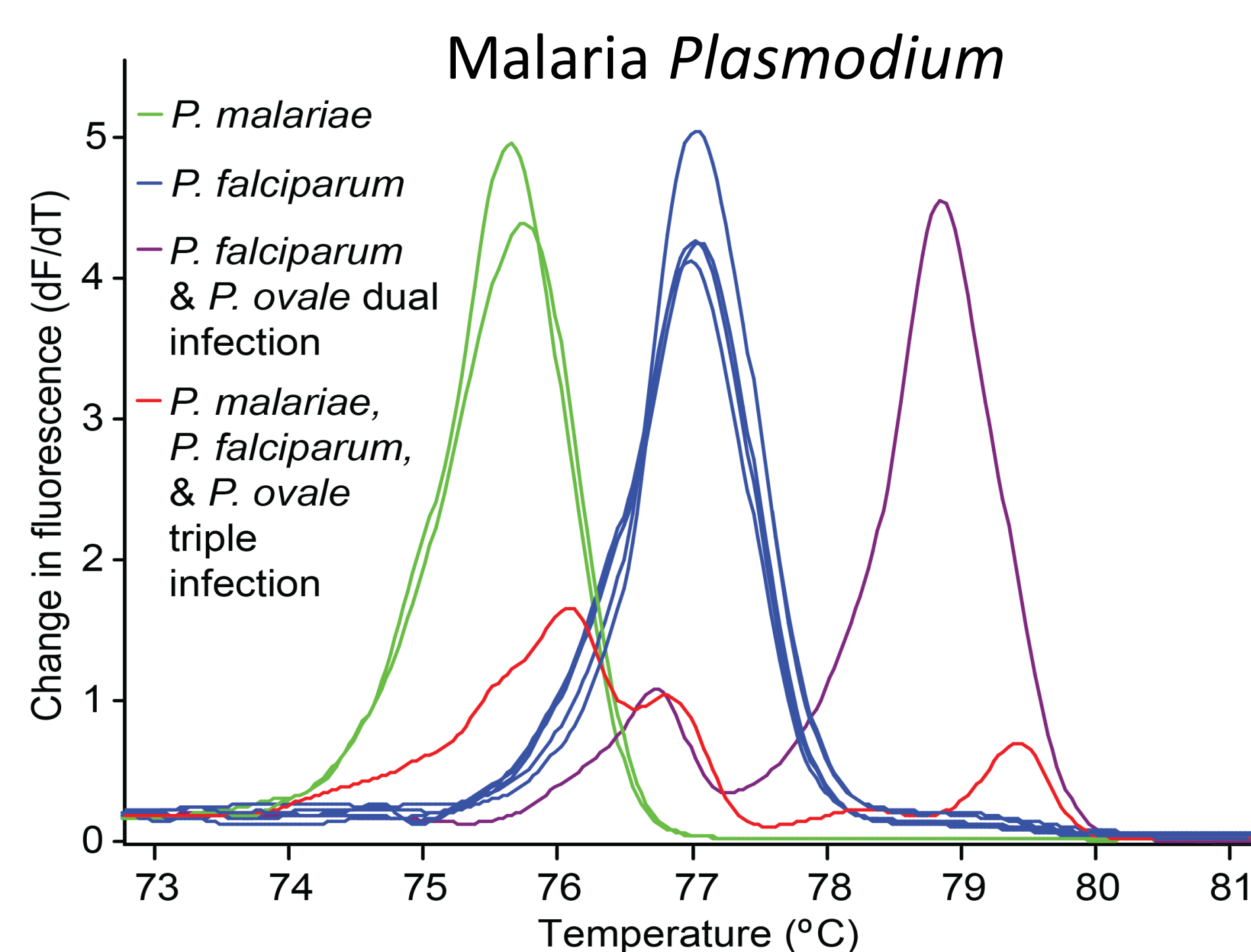
Diverse arthropod-borne viruses (arboviruses), malaria *Plasmodium*, and tick-borne bacterial and protozoan pathogens are endemic to East Africa. However, surveillance and diagnostic efforts focus only on a small fraction of these agents of disease, leading to significant undiagnosed and misdiagnosed etiologies of human and livestock diseases. This impacts disease prognosis and food security in the region, especially in poorer rural communities.

OBJECTIVES

- Develop low-cost and rapid molecular techniques for high throughput surveillance and discovery of broad diversities of arthropod-vector pathogens in vertebrate and arthropod samples.
- Identify diversity of arboviral, bacterial and protozoan pathogens circulating in arthropod vectors, and their vertebrate hosts.

METHODOLOGY

- High resolution melting (HRM) analysis for high throughput surveillance.



- Sequencing and/or cell culture used for confirmation.

KEY RESULTS

- A wide diversity of vertebrate host and vector reservoirs:
 - Bunyamwera virus (BUN): Humans, 2 wildlife ruminants, ticks, 4 mosquito genera, vertical transmission in mosquitoes.
 - Sindbis virus (SINV): Humans, wildlife, livestock, mosquitoes.
 - Chikungunya virus (CHIKV): Buffalo, primates, mosquitoes.
 - Wesselsbron virus (WBV): Isolated in Kenya for the first time from mosquitoes.
 - Tick-borne *Anaplasma*, *Ehrlichia*, *Rickettsia*, *Theileria*, *Coxiella*, and *Babesia*: Ticks, wildlife and livestock.

IMPACT

Mosquito-specific viruses identified may be exploited to block disease transmission (i.e., dengue or malaria).

CONCLUSION

Many of the pathogens identified in *icipe*'s ML-EID laboratory have been associated with severe morbidity and/or mortality in humans (Wesselsbron, chikungunya, bunyamwera and sindbis viruses, *Ehrlichia*, *Rickettsia*) and livestock (sindbis virus, *Anaplasma*, *Theileria*, *Coxiella*, *Babesia*), but are rarely identified as causal agents of disease in East Africa. This is due to poor diagnostics and surveillance of these neglected and emerging infectious diseases. There is need for differential arbovirus diagnosis and surveillance to guide appropriate treatment and management, especially at the interface of humans, livestock, and wildlife.

REFERENCES

- Kipanga P.N., Omondi D., Mireji P.O., Sawa P., Masiga D.K. and Villinger J. (2014) High-resolution melting analysis reveals low *Plasmodium* parasitaemia infections among microscopically negative febrile patients in western Kenya. *Malaria Journal* 13, 429.
- Mwamuye M.M., Kariuki E., Omondi D., Kabii J., Odongo D., Ouso D., Masiga D. and Villinger J. Novel *Rickettsia* and emergent tick-borne pathogens: A molecular survey of ticks and tick-borne pathogens in Shimba Hills National Reserve, Kenya. (In review @ *Ticks and Tick-Borne Diseases*).
- Omondi D., Masiga D.K., Fielding B.C., Kariuki E., Ajamma Y.U., Ouso D. and Villinger J. Molecular detection of tick-borne pathogens along the shores and adjacent islands of Lakes Baringo and Victoria, Kenya. (In review @ *Parasites & Vectors*).
- Omondi D., Masiga D.K., Ajamma Y.U., Fielding B.C., Njoroge L. and Villinger J. (2015) Unraveling host vector-arbovirus interactions by two-gene high resolution melting mosquito bloodmeal analysis in a Kenyan wildlife–livestock interface. *PLoS ONE* 10(7), e0134375.
- Villinger J., Mbaya M.K., Ouso D.O., Kipanga P.N. and Masiga D.K. Discovery of a new clade of *Anopheles* specific flaviviruses and the first Wesselsbron virus in Kenya by novel pan-arbovirus multiplex high resolution melting analysis. (In revision @ *Molecular Ecology Resources*).