



Leveraging One Health to understand and mitigate risks posed by emerging viruses

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180,000 ft²
World-class CL3-Ag facility

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VIDO.ORG



(Some) recent viral outbreaks



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SARS-CoV (2002-04)
9.5%



SARS-CoV-2 (ongoing)
0.4-15%



MERS-CoV (ongoing)
35%



Nipah virus (ongoing)
40-75%



Ebola virus (periodic)
25-90%
Average ~50%



Marburg virus (periodic)
24-88%
Average ~50%

Bats and viruses

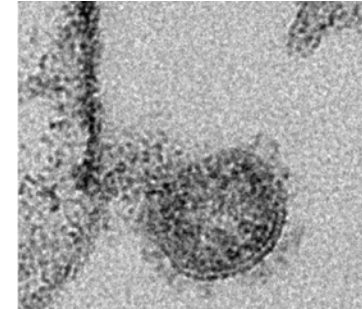


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M. Schaechter

Filovirus (Ebola, Marburg)

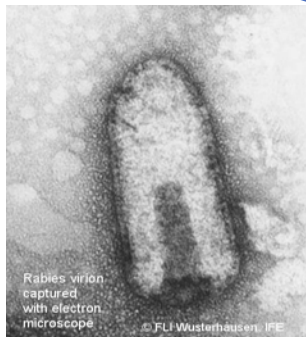


Banerjee *et al.* (2020)

Coronavirus
(SARS, MERS, PED, SADS,
COVID-19)



Image: Brock Fenton

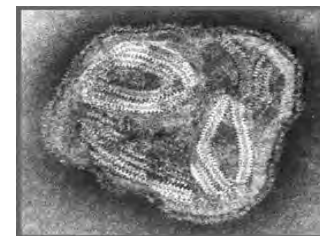


Rabies virion
captured
with electron
microscope
© FLI Wusterhausen IPE

FLI Wusterhausen

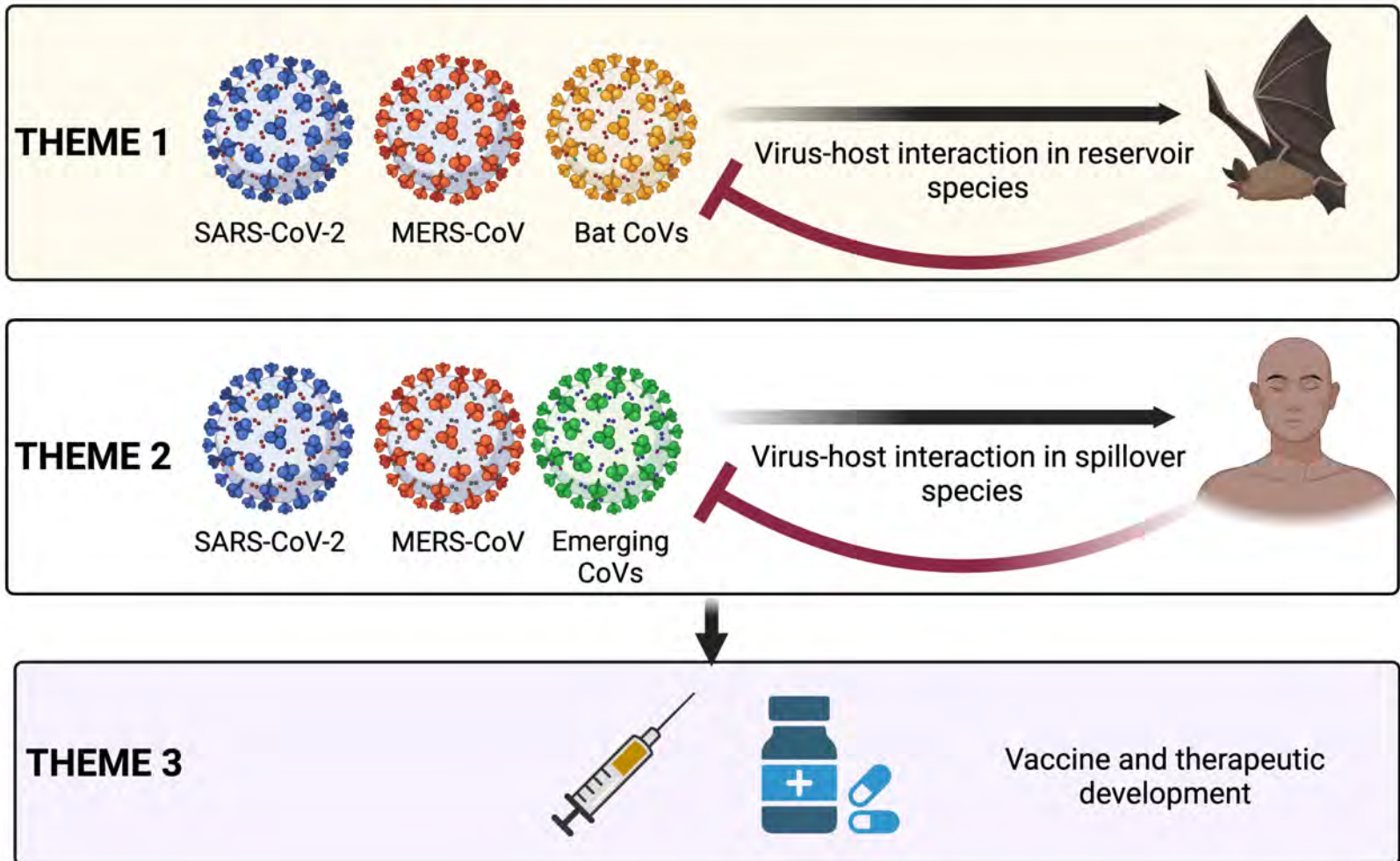
Lyssavirus
(Rabies)

Paramyxovirus
(Nipah, Hendra)



<http://web.stanford.edu/group/virus/paramyxo/2005/>

The Laboratory of Zoonotic Viruses and Comparative Immunology (#LZCI) Vaccine and Infectious Disease Organization





Malaysian flying fox

Yinpterochiroptera

Megachiroptera



Indian flying fox
1.8 m wingspan
1.6 kg

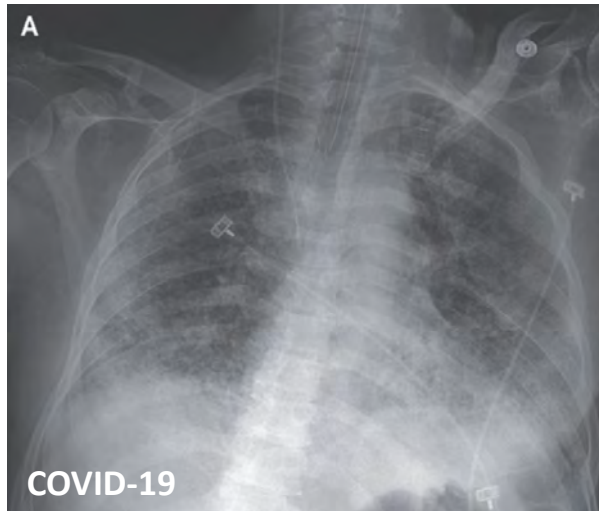
Yangochiroptera

Microchiroptera



Bumblebee bat
15 cm wingspan
2 gm

Pathology in SARS, MERS and PEDV is driven by inflammation



Chest radiography (Panel A) shows bilateral ground-glass opacities and consolidations. Berlin *et al.*, *NEJM*, 2020

Successful treatment of suspected organizing pneumonia in a patient with **Middle East respiratory syndrome** coronavirus infection: a case report.

Kim I, Lee JE, Kim KH, Lee S, Lee K, Mok JH.

J Thorac Dis. 2016

Oct;8(10):E1190-E1194.

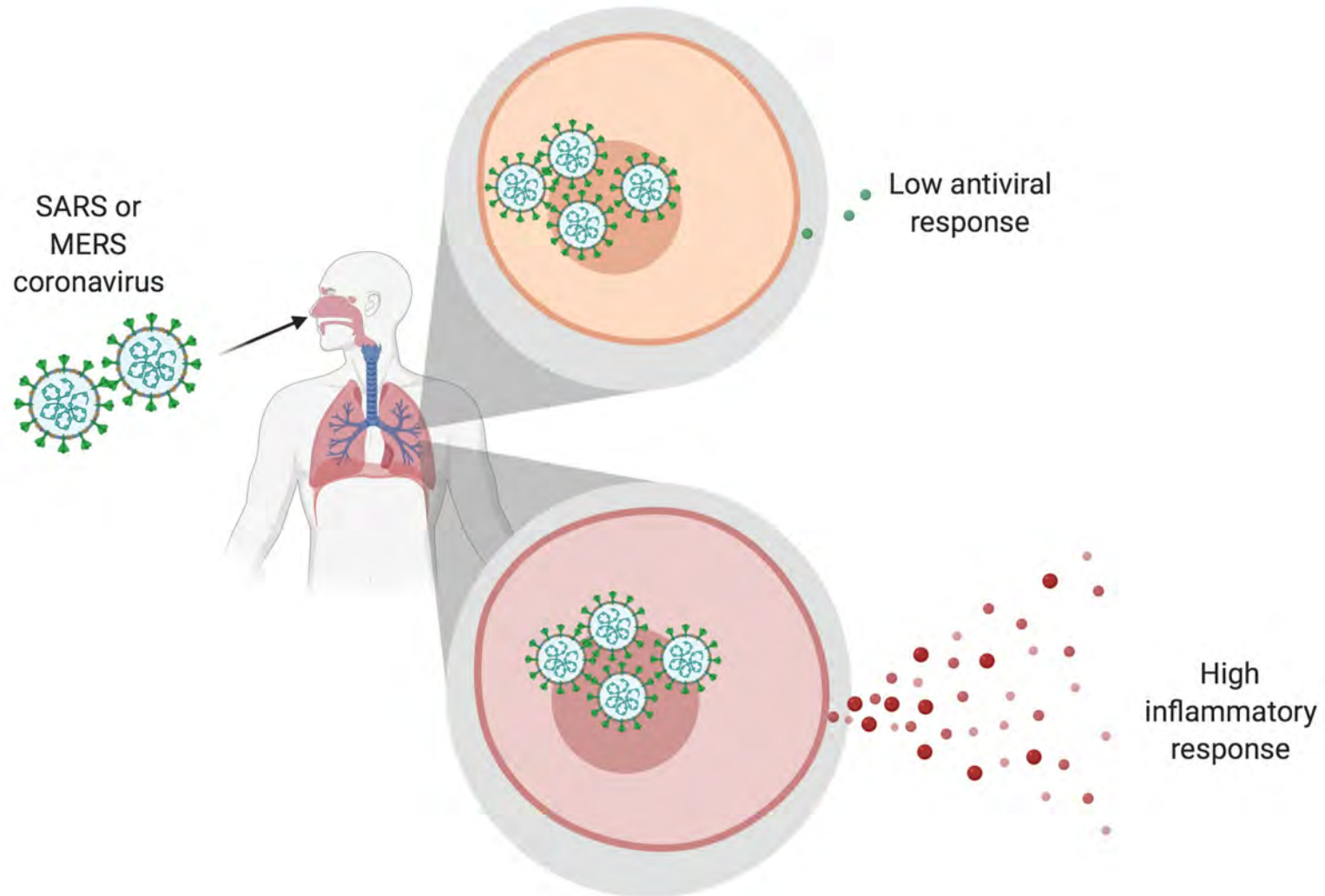
Pathology and pathogenesis of **severe acute respiratory syndrome**. Gu J, Korteweg C. Am J Pathol. 2007 Apr;170(4):1136-47.

Delayed induction of proinflammatory cytokines and suppression of innate antiviral response by the novel **Middle East respiratory syndrome coronavirus**: implications for pathogenesis and treatment. Lau SK, *et al.* J Gen Virol. 2013 Dec;94(Pt 12):2679-90.

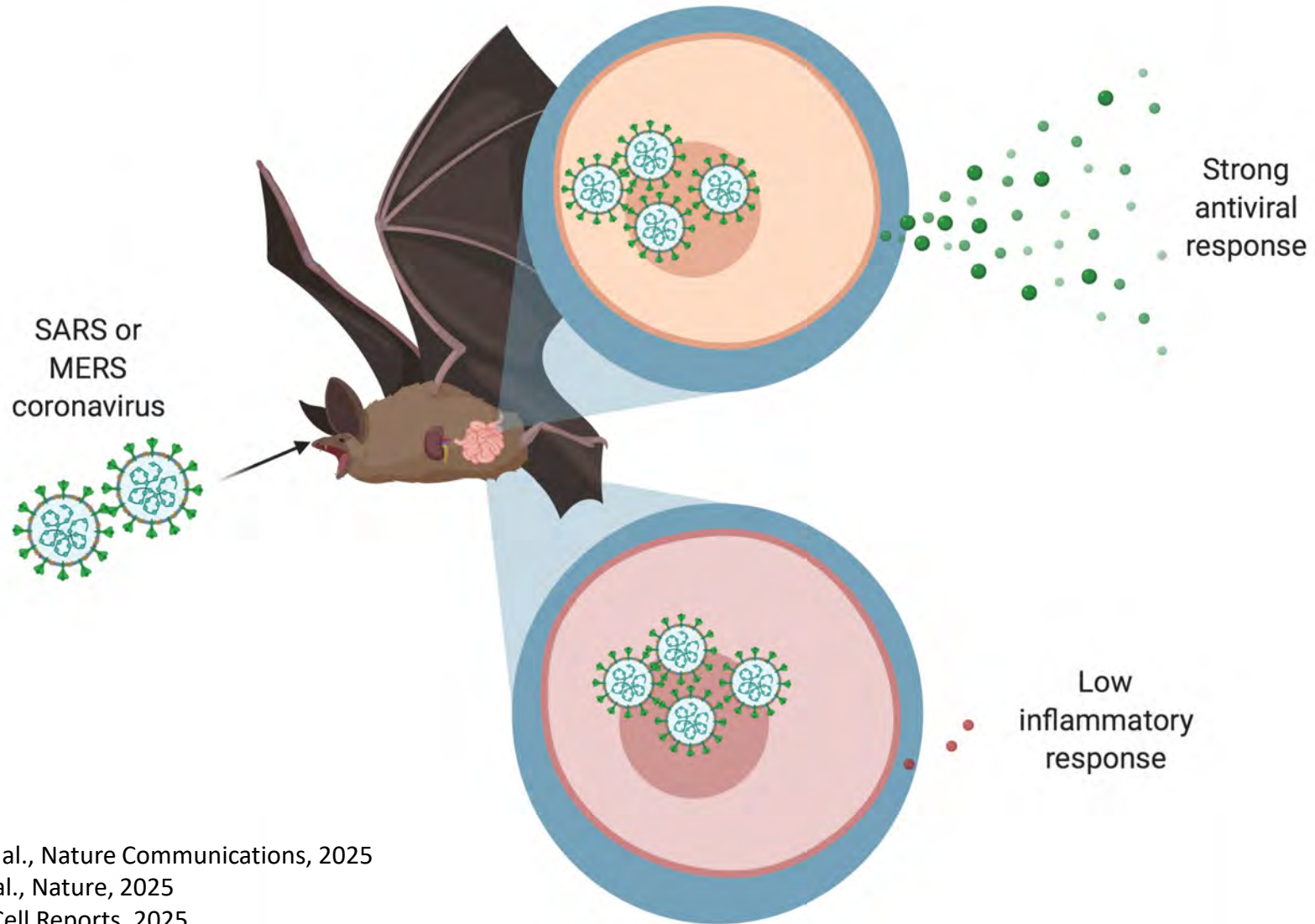
Porcine epidemic diarrhea virus E protein causes endoplasmic reticulum stress and up-regulates interleukin-8 expression.

Xu *et al.*

SARS and MERS coronaviruses induce strong inflammation in human cells



MERS-CoV and SARS-CoV-2 induce low inflammation in bat cells



Gonzalez et al., Nature Communications, 2025

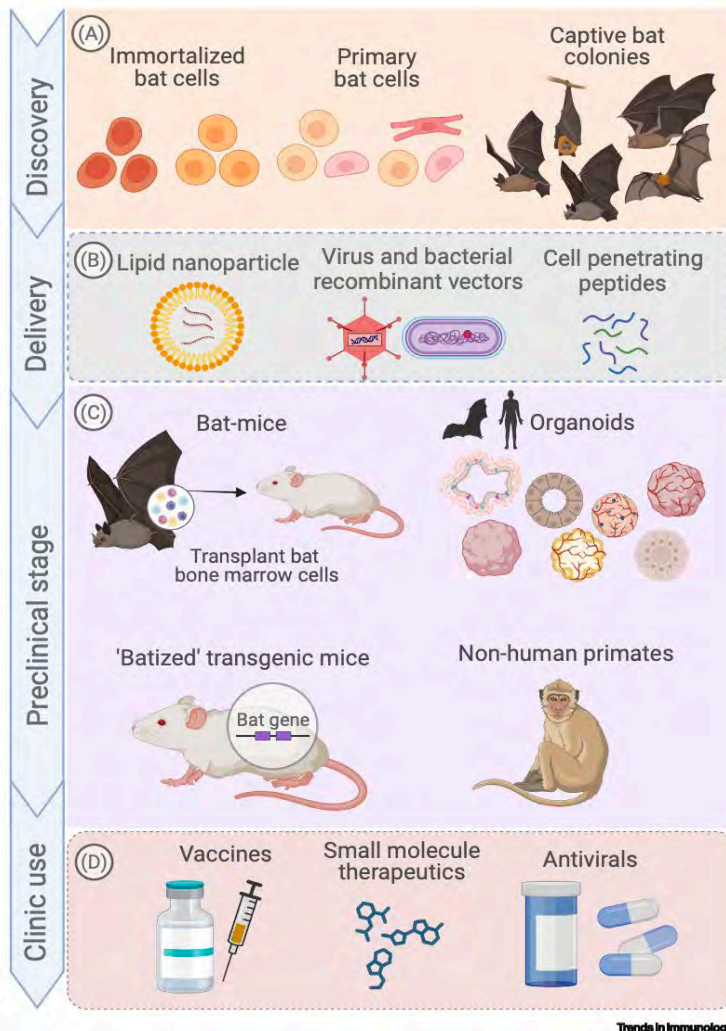
Morales et al., Nature, 2025

Baid et al., Cell Reports, 2025

Can we discover new bat-inspired therapies?

Key figure

Model for 'bench-to-bedside' translational pipeline derived from bat research



CellPress

Trends in
Immunology

Opinion

The translational potential of studying bat immunity

Kaushal Baid,¹ Aaron T. Irving,^{2,3,4,5} Nolwenn Jouvenet,⁶ and Arinjay Banerjee^{1,7,8,9,10,*}

Trends in Immunology

nature microbiology

Perspective

<https://doi.org/10.1038/s41564-025-02020-9>

A One Health approach to understanding and managing Nipah virus outbreaks

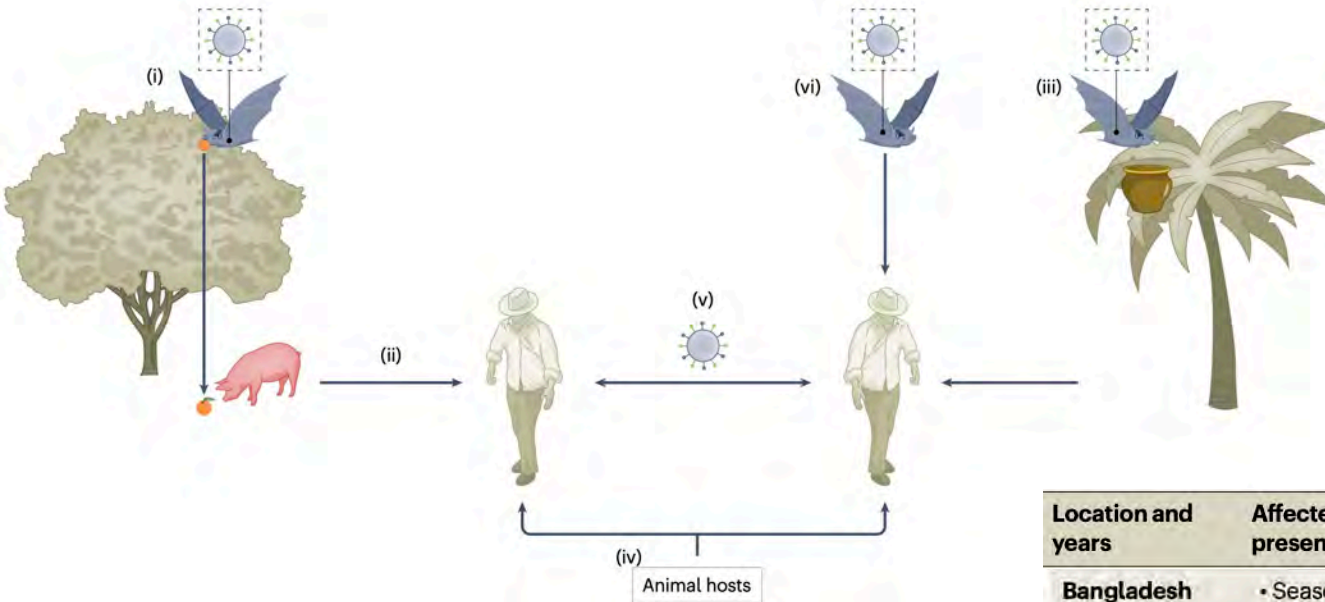
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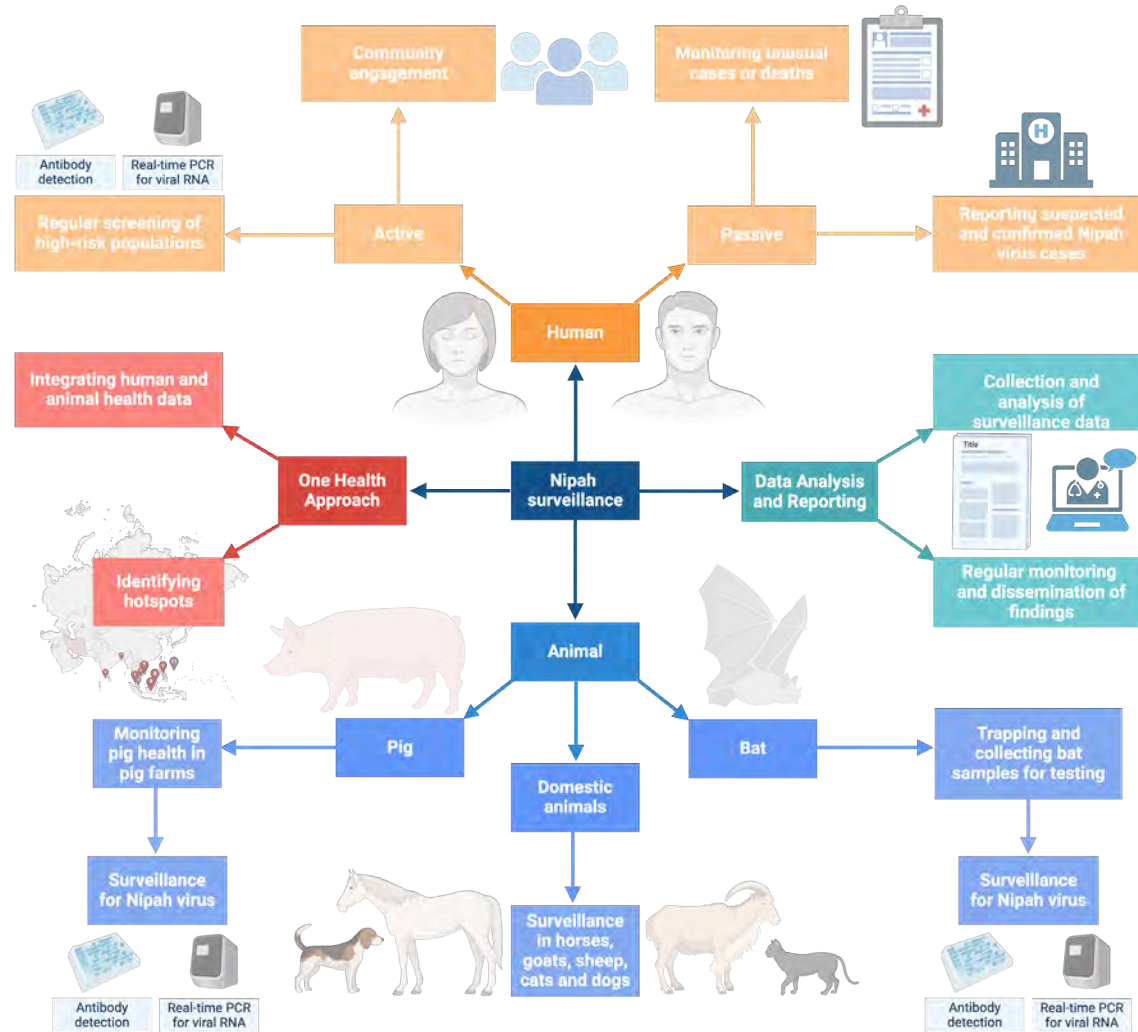
Pragya D. Yadav ^{1,15}, Kaushal Baid ^{2,15}, Deepak Y. Patil¹, Tahmina Shirin³,
Mohammed Ziaur Rahman⁴, Alison J. Peel ⁵, Jonathan H. Epstein ⁶,
Joel M. Montgomery ⁷, Raina K. Plowright⁸, Henrik Salje ⁹, Emily S. Gurley¹⁰,
Syed M. Satter⁴ & Arinjay Banerjee ^{2,11,12,13,14} 

Nipah virus and One Health

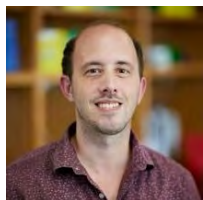
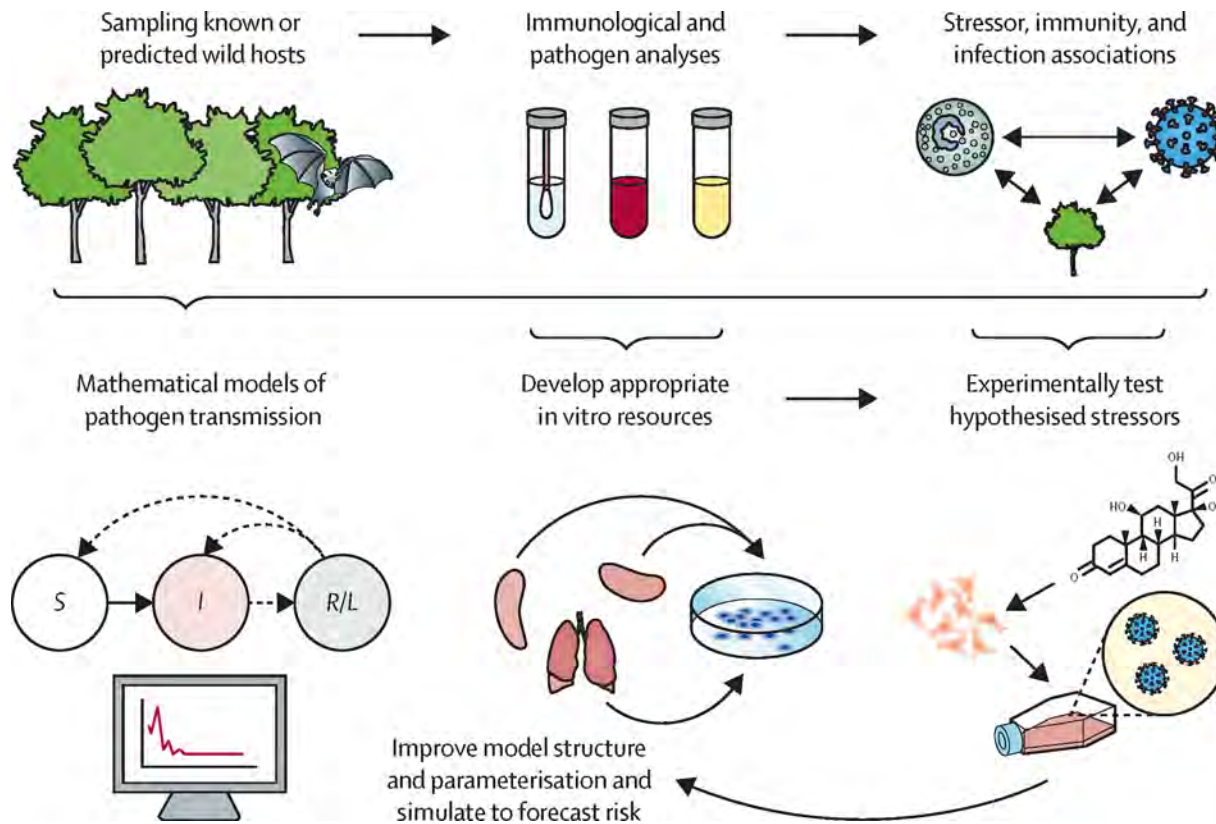


Location and years	Affected population and clinical presentation	Cases	Deaths
Bangladesh 2017–2024	- Seasonal outbreaks - In 2023, 14 cases were recorded, making it the largest outbreak since 2015	42	29
India (Kerala) 2018 2019 2021 2023 2024	- Index patient in 2018 outbreak traced back to fruit bat exposure 2019: survivor case of NiV encephalitis 2021: fatal case of NiV encephalitis - Nosocomial transmission - Fever, myalgia, respiratory distress, headache, vomiting, cough, altered sensorium and encephalitis with seizures - Public health lockdown used during 2023 NiV outbreak in Kerala 2024: fatal case of NiV infection - Consumption of contaminated wild hog plums hypothesized	27	20

Nipah virus and One Health



Coupling field and lab studies



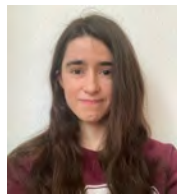
Dr. Daniel Becker



Dr. Ansil B.R.
PDF



Manuela Pereira
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Rita Quintela
PhD student

Becker and Banerjee, 2023, *Lancet Microbe*
Das et al., 2025, *mBio*
Becker et al., 2025 (ANYAS)



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National OH training program



Canadian One Health Training Program on Emerging Zoonoses



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Trainees

40+

Mentors

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Why bats don't get sick - Arinjay Banerjee

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TEDEd Animation

Let's Begin...

Consider a bat that is infected with several deadly viruses, including ones that cause rabies, SARS, and Ebola. While this diagnosis would be lethal for other mammals, the winged wonder is totally unfazed, and may even spend the next 30 years living as if this were totally normal—because for bats, it is. So what's protecting bats from these dangerous infections? Arinjay Banerjee investigates.



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Journal of Virology



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