

The discovery of a new ebolavirus Bombali virus: Further support for bats as hosts of ebolaviruses

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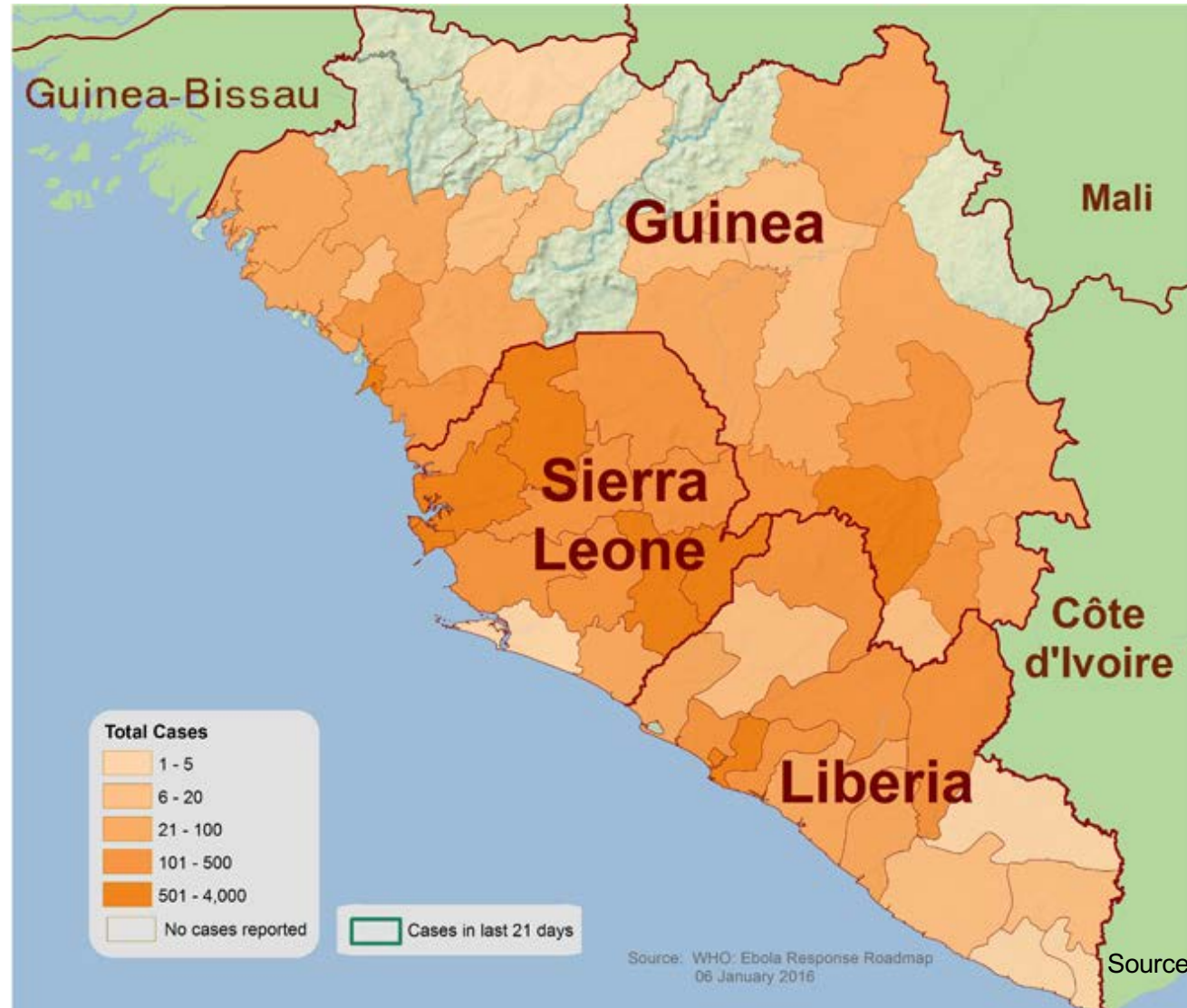


METABIOTA



Smithsonian
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2014-2016 Ebola Virus Disease Outbreak



Source: CDC, January 2016

Ebolaviruses

- Despite more than 40 years of research and continued outbreaks, reservoir(s) remain unknown
- Five species to date: *Zaire* (EBOV), *Bundibugyo* (BDBV), *Sudan* (SUDV), *Tai Forest* (TAFV), and *Reston ebolavirus* (RESTV)
- Past outbreaks linked to contact with infected non-human primates
- Evidence suggests they are maintained in bats

Bats as Hosts

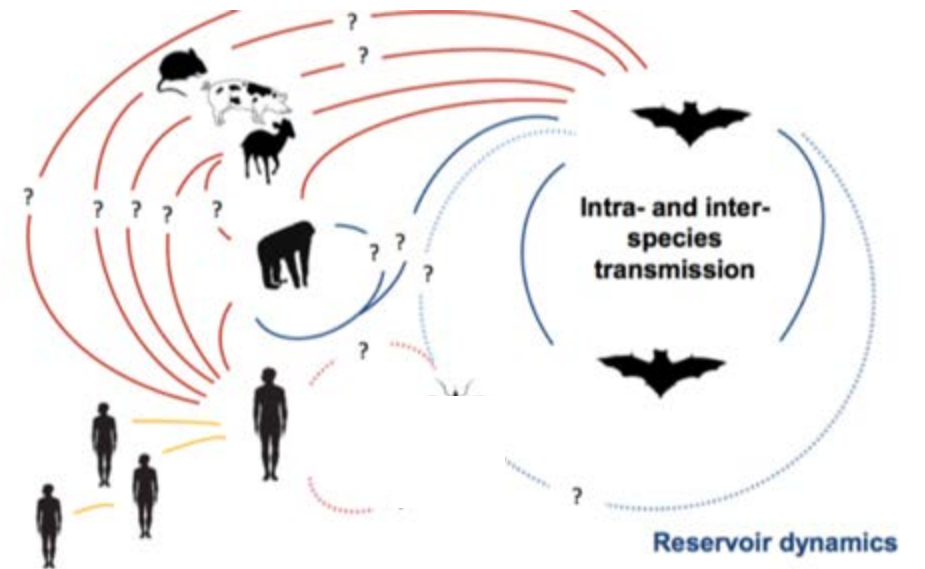
- EBOV RNA and antibodies found in bats across Africa, in Bangladesh, China, Singapore
- Other filoviruses found in bats: Marburg (Egyptian fruit bat) Lloviu (Schreiber's long-fingered bat)
- Evolutionary relationship between NPC1 in bats and filoviruses
- Index case in 2014 outbreak in West Africa believed to have contact with Angolan free-tailed insectivorous bat

Survey in Sierra Leone to identify hosts of EBOV and additional filoviruses in wildlife

Non-destructive animals sampling

No human biological sampling

- Goal: 20,000 animals
 - Geographic distribution
 - Urban vs rural vs forest
 - Host species distribution
 - Reservoirs: bats, rodents, primates
 - Spillover hosts: dogs, cats, pigs, goats/sheep
 - Seasonality
 - Multiple samplings over time, dry vs wet season



Viral Discovery

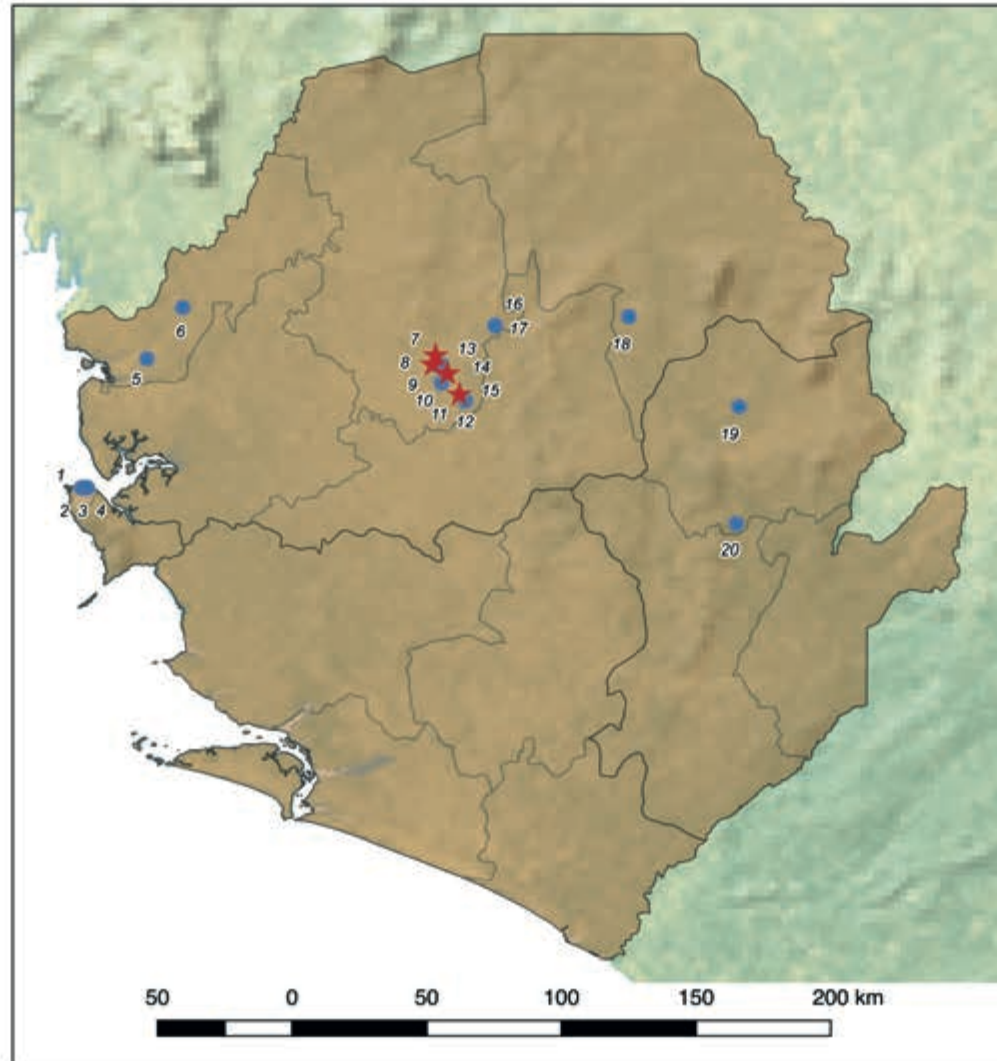
- March to September 2016 1278 oral, rectal, blood samples from 535 animals: 244 bats, 46 rodents, 240 dogs, and 5 cats
- Samples screened:
 - 1) a nested filovirus 'family level' cPCR
 - 2) an *Ebolavirus* 'genus level' cPCR
 - 3) a real-time PCR specific for the EBOV
 - 4) BOMV load, quantitative real-time PCR
- Genome sequencing

Bat Species	Bat Family	No. Tested	No. Positive by Filovirus cPCR	No. Positive by Ebolavirus genus PCR	No. Positive by qRT-PCR for BOMV
Insectivorous Bats					
<i>Chaerephon pumilus</i>	Molossidae	55	3	2	4
<i>Glauconycteris poensis</i>	Vespertillionidae	1			
<i>Hipposideros abae</i>	Hipposideridae	7			
<i>Hipposideros jonesi</i>	Hipposideridae	4			
<i>Hipposideros ruber</i>	Hipposideridae	50			
<i>Mops condylurus</i>	Molossidae	52	1		1
<i>Myotis bocagii</i>	Vespertillionidae	3			
<i>Neoromicia rendalli</i>	Vespertillionidae	2			
<i>Nycteris hispida</i>	Nycteridae	1			
<i>Pipistrellus nanulus</i>	Vespertillionidae	3			
<i>Rhinolophus fumigatus</i>	Rhinolophidae	3			
<i>Rhinolophus landeri</i>	Rhinolophidae	1			
<i>Rhinopoma microphyllum</i>	Rhinopomatidae	1			
<i>Scotophilus viridis</i>	Vespertillionidae	26			
Unidentified <i>Chaerephon</i> bat	Molossidae	1			
Unidentified Molossid bat	Molossidae	1			
Unidentified <i>Hipposideros</i> bat	Hipposideridae	1			
Unidentified Nycterid bat	Nycteridae	3			
Fruit Bats					
<i>Eidolon helvum</i>	Pteropodidae	2			
<i>Epomophorus gambianus</i>	Pteropodidae	1			
<i>Epomops buettikoferi</i>	Pteropodidae	2			
<i>Micropteropus pusillus</i>	Pteropodidae	2			
<i>Myonycteris angolensis</i>	Pteropodidae	14			
Unidentified <i>Myonycteris/Epomophorus</i> bat	Pteropodidae	3			
Unidentified <i>Epomophorus</i> bat	Pteropodidae	5			
Total		244	4	2	5

Viral Detection

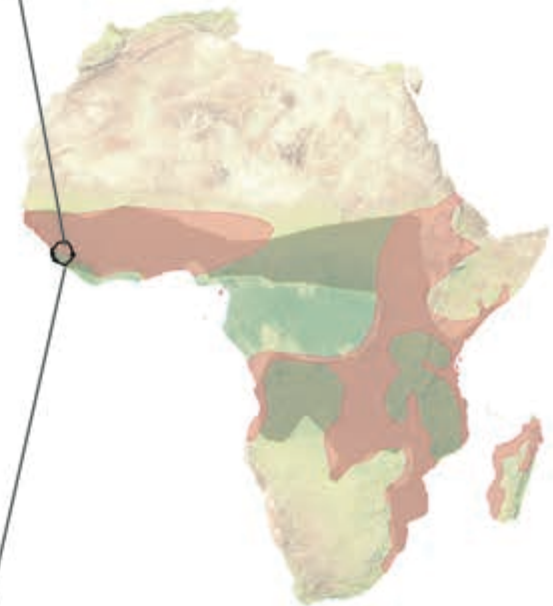
- ★ Positive sampling site
- Sampling site

No.	District
● 1	Western Area Urban
● 2	Western Area Urban
● 3	Western Area Urban
● 4	Western Area Urban
● 5	Kambia
● 6	Kambia
★ 7	Bombali
★ 8	Bombali
● 9	Bombali
● 10	Bombali
● 11	Bombali
● 12	Bombali
● 13	Bombali
★ 14	Bombali
★ 15	Bombali
● 16	Bombali
● 17	Bombali
● 18	Koinadugu
● 19	Kono
● 20	Kono

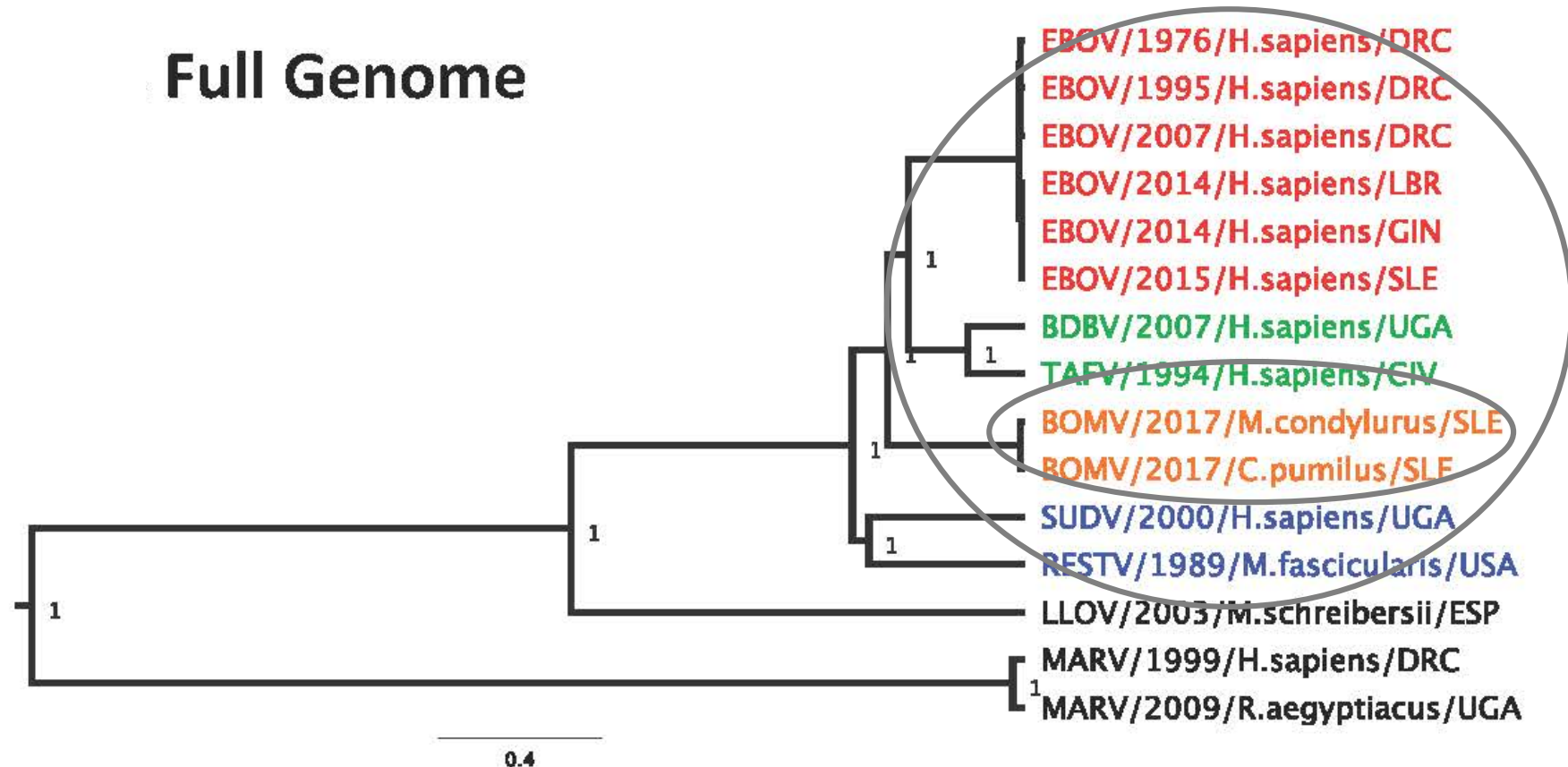


Distribution of bats:

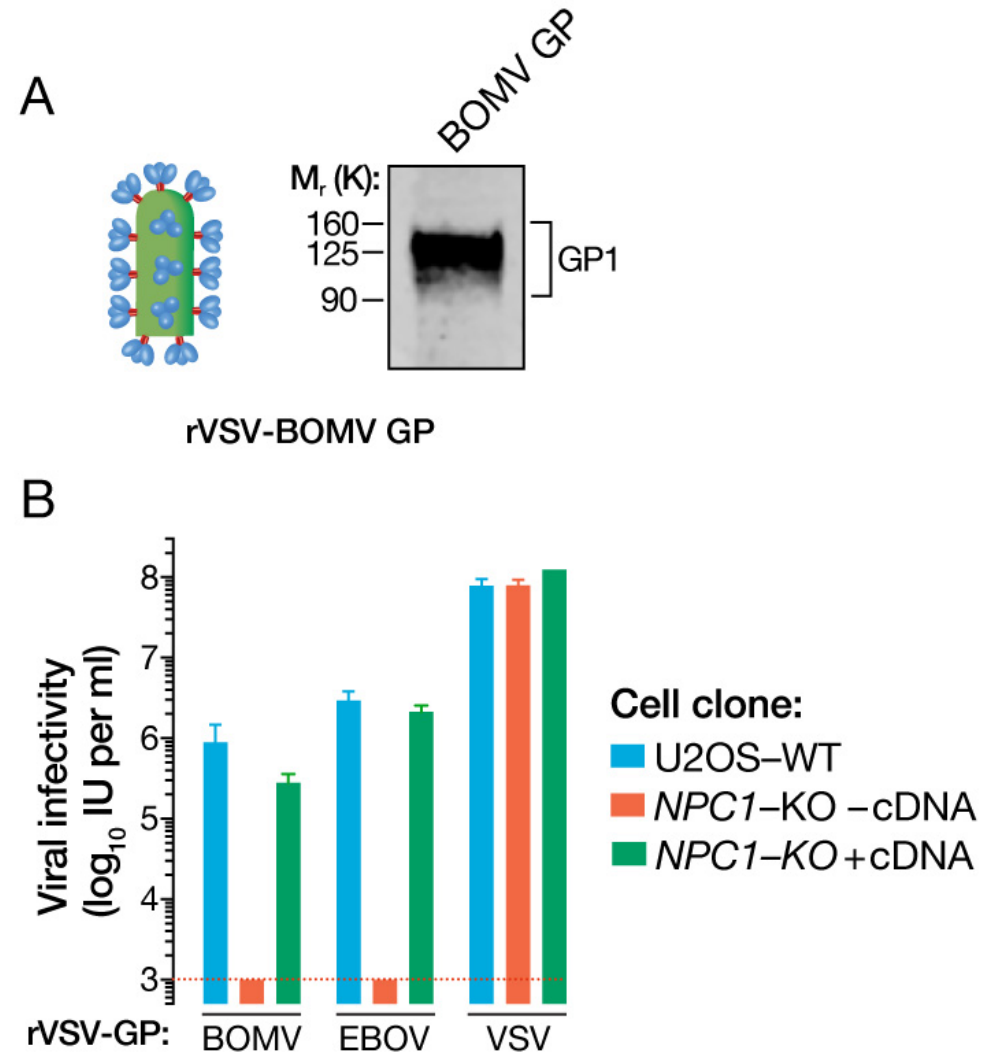
- Angolan free-tailed bat (*Mops condylurus*)
- Little Free-tailed Bat (*Chaerephon pumilus*)



Comparison to other Ebolaviruses



Ability to Infect Human Cells

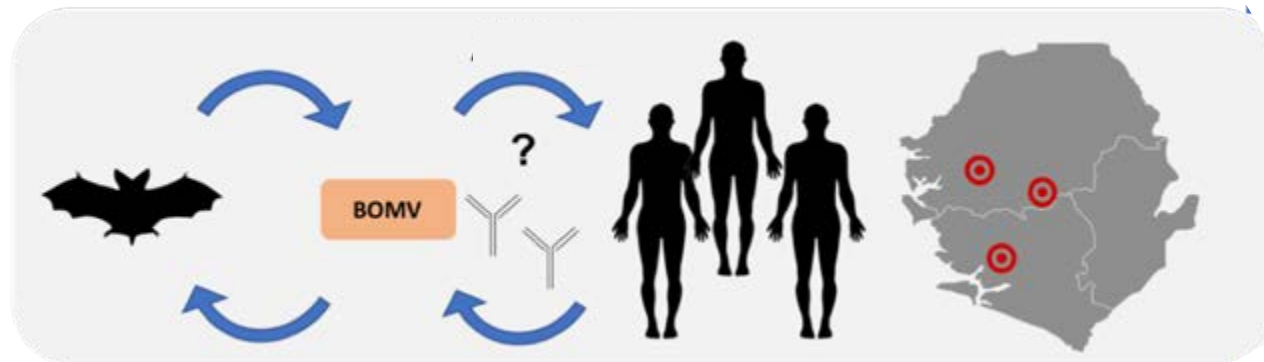


Significance

- First full ebolavirus genome from a bat
- Strong evidence that bats are a natural reservoir of ebolaviruses
- Insectivorous bats play a role in ebolavirus ecology
- BOMV GP able to mediate entry into human cells, first critical step for spillover
- Suggests BOMV has zoonotic potential
- Bats found roosting inside houses, potential for human transmission
- Further studies needed to investigate whether exposure has actually occurred or if BOMV is pathogenic in humans

Future Directions

- Virus isolation and viral rescue ongoing
- Surveys to examine exposure in people
- Prevalence and patterns of shedding in bats
- Comparison to other ebolaviruses



A person wearing a white protective suit, blue gloves, and a blue cap is working with a sample under a bright light. The person is holding a small object, possibly a sample, and is using a tool to manipulate it. The background is a plain, light-colored wall.

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