



Virus Hunter

[NARRATOR:] Jon Epstein is a virus hunter. He chases viruses that can cause outbreaks of infectious diseases.

[JONATHAN EPSTEIN:] Over the past 40 or 50 years, we have seen a real increase in the number of emerging infectious diseases.

[NARRATOR:] In Bangladesh, Epstein is monitoring a virus called Nipah. It caused a severe outbreak in 2004. Since then, outbreaks have occurred almost every year.

[EPSTEIN:] Nipah virus is a really severe disease when it gets into people. It causes fever, malaise, a feeling of flu-like symptoms that can progress to a loss of consciousness. About three-quarters of the people who get infected with Nipah virus die. That's here in Bangladesh.

[NARRATOR:] Nipah is one of the many viruses present in animal populations that have the potential to infect people. Scientists want to know where these viruses are, how they're transmitted to humans, and how we can stop them from spreading.

[NARRATOR:] Nipah is a zoonotic disease, a disease caused by a virus that can be transmitted from animals to humans.

Embedded Question 1: Disease-causing microorganisms (including certain viruses, bacteria, protists, and fungi) are called **pathogens**. A **zoonotic pathogen** spreads disease from animals to humans. List some diseases that you think might be caused by zoonotic pathogens.

[EPSTEIN:] Nipah virus is a great illustration of a zoonotic disease. It's carried by these fruit-eating bats that are common throughout Asia and Australia and the South Pacific.

[NARRATOR:] Several lines of evidence suggest that bats are what scientists call a reservoir for the virus.

Embedded Question 2: A **reservoir** is an animal species in which a pathogen survives and replicates, often without causing disease. What data would support the conclusion that fruit bats are the reservoir species for Nipah virus?

[EPSTEIN:] Initially, what was largely detected in bats were antibodies against Nipah virus. So this is an indirect form of evidence. It says that these bats were exposed to Nipah virus. They probably carried it at one point.

[NARRATOR:] Scientists then determined that some bats also have the infectious virus in their blood and excretions — evidence that the virus is actively reproducing.

[EPSTEIN:] We found that evidence in different forms of excreta. So the bat is shedding this virus.

[NARRATOR:] The last bit of evidence that bats are the natural reservoir for Nipah is that no other wild animal carries the virus.

[EPSTEIN:] Now, we've also tested rodents, other animals throughout a long course of research. And no other animal carries Nipah virus the way these bats do, not to the extent that they do. And that gave us a very full picture that this indeed was a natural reservoir.

Embedded Question 3: Certain viruses have evolved to cause only mild or no symptoms in their reservoir species. Why might this be advantageous for the virus?

[NARRATOR:] In Bangladesh, less than 4% of fruit bats carry the virus. Unlike people, infected bats don't get sick. In their bodies, the virus replicates and is passed from bat to bat.

Embedded Question 4: List some ways in which a human might be exposed to a virus from a reservoir species. Think about how the human and the reservoir species might come in contact, directly or indirectly.

[NARRATOR:] How does the virus spill over from bats to human populations? People hunt bats and eat their meat year round. But here, this was not the source of the annual outbreaks. Outbreaks occur primarily between December and March, the time of the year when, in some areas, date palm sap is collected and sold.

Scientists discovered that, as date palm sap drips out of the tree into a collecting pot, fruit bats drink the juice and may contaminate it with their saliva or urine. If a person drinks contaminated sap, they may become infected with Nipah. They may then transmit the virus to other people through saliva and other bodily fluids.

[EPSTEIN:] So if there are parts of the world where you have the bats and you have the virus, and it is getting into people and we don't know about it, well, that's a ticking time bomb waiting to explode.

[NARRATOR:] Epstein is now monitoring fruit bats throughout their range. He wants to know which populations carry the virus and the potential risk of transmission to humans. The first step is catching bats from different populations.

[EPSTEIN:] One of the villagers came up to us and suggested that we employ some local talents to help us catch bats. And thus came Putu and Gafur. Putu and Gafur first and foremost were bat hunters. And they had an incredible understanding of bat behavior and ecology, so they knew exactly where to set nets and how to catch them.

[NARRATOR:] To catch bats for analysis, the team lashes poles and nets to treetops in the forest.

[EPSTEIN:] Bats will often use corridors in the forest as flyways. And so we can see that. We can see where there are clearings in the forest. And we can set our nets accordingly.

What we are doing now is we're testing the line to make sure that it doesn't hit any branches when we raise and lower it. When we come here tonight, we'll actually open up the net and we'll raise the net, and that's when we'll begin catching.

Putu and Gafur went from hunting bats to fully appreciating how important bats were ecologically.

[PUTU BISWAS (SPEAKING BANGLA)]: Bats travel far and they bring fruits from other countries, fruits that we don't have here. The fruits fall on the ground and new plants grow.

Embedded Question 5: What do you think the scientists and bat hunters will do with the wild bats that they capture?

[EPSTEIN:] Lights out. Now we just need some bats. OK. Down, down, down. Quick! Let's bring it down. Quick, quick, quick. Hurry hurry hurry. Down down. Come on.

Got to be very careful with the wings. They have some delicate bones inside the wings.

[EPSTEIN (NARRATION):] Bats are angular animals. Every piece of their anatomy is angular. It's like having barbs and hooks in every direction.

[PERSON:] OK? Get it. OK.

[EPSTEIN:] OK, got it. Good job.

[EPSTEIN (NARRATION):] After we catch the bats, the first thing we do is we bring them inside and we anesthetize them to reduce stress, reduce their anxiety, and allow us to work with them safely.

[NARRATOR:] After the team collects blood samples and excretions, the bats get a treat to help them recover.

[EPSTEIN:] So we feed the bats mango juice because over the course of the night, when they haven't eaten as much, as we're taking blood, they get a little bit — potentially get a little dehydrated. And they do seem to like it. A little bit of a reward for entering our study.

Embedded Question 6: If you had the tools to analyze the blood of the bats, what data would you collect and why?

[NARRATOR:] The samples are sent to the lab to determine if the virus is present and, if it is, analyze its genetic makeup. Ongoing monitoring in both bats and in people could reveal if the virus is changing over time and becoming more infectious.

Embedded Question 7: How could a mutation in Nipah virus make it more infectious in humans? Describe what changes could help the virus spread more easily among people.

[EPSTEIN:] One concern is mutation. It's possible that Nipah virus changes as it jumps from a bat host into humans. And it may adapt to a human host and become more easily transmitted.

Embedded Question 8: Would a human vaccine for the Nipah virus permanently protect a human population from disease? Why might we need to continue developing new vaccines, especially when there is a nearby reservoir species?

[NARRATOR:] Scientists are also looking for Nipah virus in bat populations close to large urban centers, where an outbreak could be devastating.

[EPSTEIN:] This is a colony situated in a park surrounded by the hustle and bustle of the city. And we know these bats carry Nipah virus throughout most of their range. So the question is, what if they carry Nipah virus in the middle of a city of 12 million people?

Embedded Question 9: How could community members and scientists help reduce the virus's spread among people?

[NARRATOR:] Part of what we know about Nipah virus is that it needs a way to get out of bats and into people. There isn't a clear pathway that we know of yet. But it's an important question to answer if we're going to hope to avoid an outbreak in a densely packed megacity.

[NARRATOR:] The coexistence of humans and wildlife can have deadly consequences. Determining where people are most at risk and understanding how our activities can contribute to spillover may help reduce future outbreaks.

[EPSTEIN:] It's easy to understand why people would think, if wildlife are the source of all of these plagues, of all of these problems, why not just get rid of them? And the truth of the matter is we can't afford to. Wildlife are so critically important to balancing our ecosystems and to our own health. We need to learn to live with them in a much better way that reduces our risk of disease.

Embedded Question 10: Where you live, what examples are there of human populations being close to wildlife? How might this lead to disease?