Press Release

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- Paper Title: Diverse Bat Organoids Provide Pathophysiological Models for Zoonotic Viruses

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World's Largest Bat Organoid Platform Paves the Way for Pandemic Preparedness

- IBS scientists create a diverse model to study bat-borne viruses, advancing early detection and drug testing for future outbreaks -

Did you know that more than 75% of new infectious diseases affecting humans originally come from animals? Bats, in particular, are natural hosts to some of the world's most dangerous viruses—including those responsible for COVID-19 (SARS-CoV-2), MERS-CoV, influenza A, and hantavirus outbreaks. Yet, despite their importance, scientists have long struggled to study how these viruses behave inside bats, simply because the right biological tools didn't exist.

Until now, most research used either generalized cell samples or organoids made from just one type of tropical fruit bat, and only from a single organ. But a breakthrough has arrived: a research team led by the Institute for Basic Science (IBS) in Korea, along with international collaborators, has created the world's most comprehensive bat organoid platform. These "mini-organs" are grown from five common bat species found across Asia and Europe and represent four different organs—airway, lungs, kidneys, and small intestine.

"Reconstructing bat organ physiology in the lab lets us explore how zoonotic viruses—those that jump from animals to humans—work, in unprecedented detail," said KOO Bon-Kyoung, Director of the IBS Center for Genome Engineering.

Testing Viruses Where They Live

Armed with these new tools, the researchers were able to directly test how key viruses—including SARS-CoV-2, MERS-CoV, influenza A, and hantavirus—infect different bat species and organs. They found that each virus behaves uniquely, sometimes infecting only certain organs or bat species. For example, a virus that grew easily in one bat's lung might fail to grow in another's kidney. This helps explain why some viruses can jump to humans, while others remain confined to bats.

Senior Researcher KIM Hyunjoon emphasized, "This platform lets us isolate viruses, study infections, and test drugs all within one system—something you can't do with ordinary lab cell models. By mimicking the bat's natural environment, it boosts the accuracy and real-world value of infectious disease research."

The team also uncovered another mystery: bats' immune systems respond differently to the same virus depending on the organ and the species. This could help explain why bats are able to carry so many viruses without becoming sick themselves.

Another big achievement was the discovery of two previously unknown bat viruses—an orthoreovirus and a paramyxovirus—directly from wild bat feces. Notably, one of these viruses could not be grown in standard cell cultures but thrived in the new bat organoids, proving just how valuable this technology is for future virus discovery.

And, by converting the organoids into a two-dimensional version, the scientists made it possible to quickly test potential antiviral drugs, like Remdesivir. These tests gave more reliable results than traditional lab methods.

A Global Biobank for Future Pandemic Preparedness

This bat organoid platform marks a new era for infectious disease research, making it possible to safely and effectively study dangerous viruses in a setting that closely mirrors real life. For the first time, scientists can screen for new viruses, assess their risk, and test drugs using bat tissues from multiple species and organs.

"With these standardized, scalable bat organoids, we now have a global biobank resource that will be central to national and international biosecurity," said CHOI Young Ki, Director at the IBS Korea Virus Research Institute.

The team aims to expand their work to monitor bat viruses worldwide, investigate what makes some viruses dangerous for people, and build detailed genetic maps of key bat species. Ultimately, this platform will support efforts by health organizations, including the World Health Organization (WHO), to predict and prevent future pandemics.

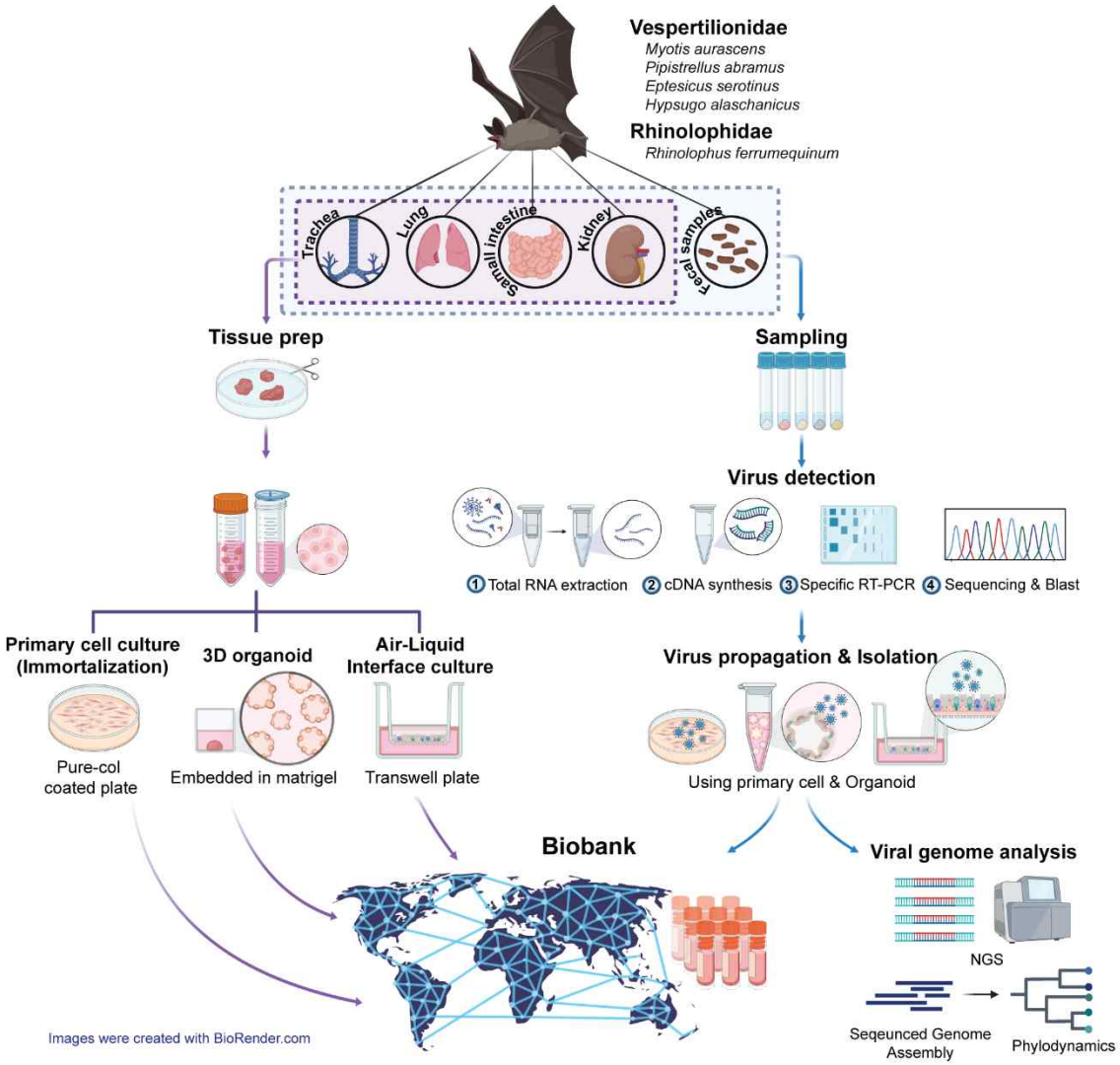

Figure 1. How scientists built a multi-species bat organoid platform to track and fight emerging viruses.

Researchers created 3D “mini-organs” from the trachea, lungs, kidneys, and intestines of five insect-eating bat species commonly found in Korea and Europe. The platform includes both organoids and lab-grown cell lines stored in a global biobank. Combined with fecal sample testing, virus detection, and in-lab virus isolation, the system enables scientists to identify, analyze, and test treatments against bat-borne viruses—including newly discovered ones. This breakthrough supports global virus surveillance and pandemic preparedness.

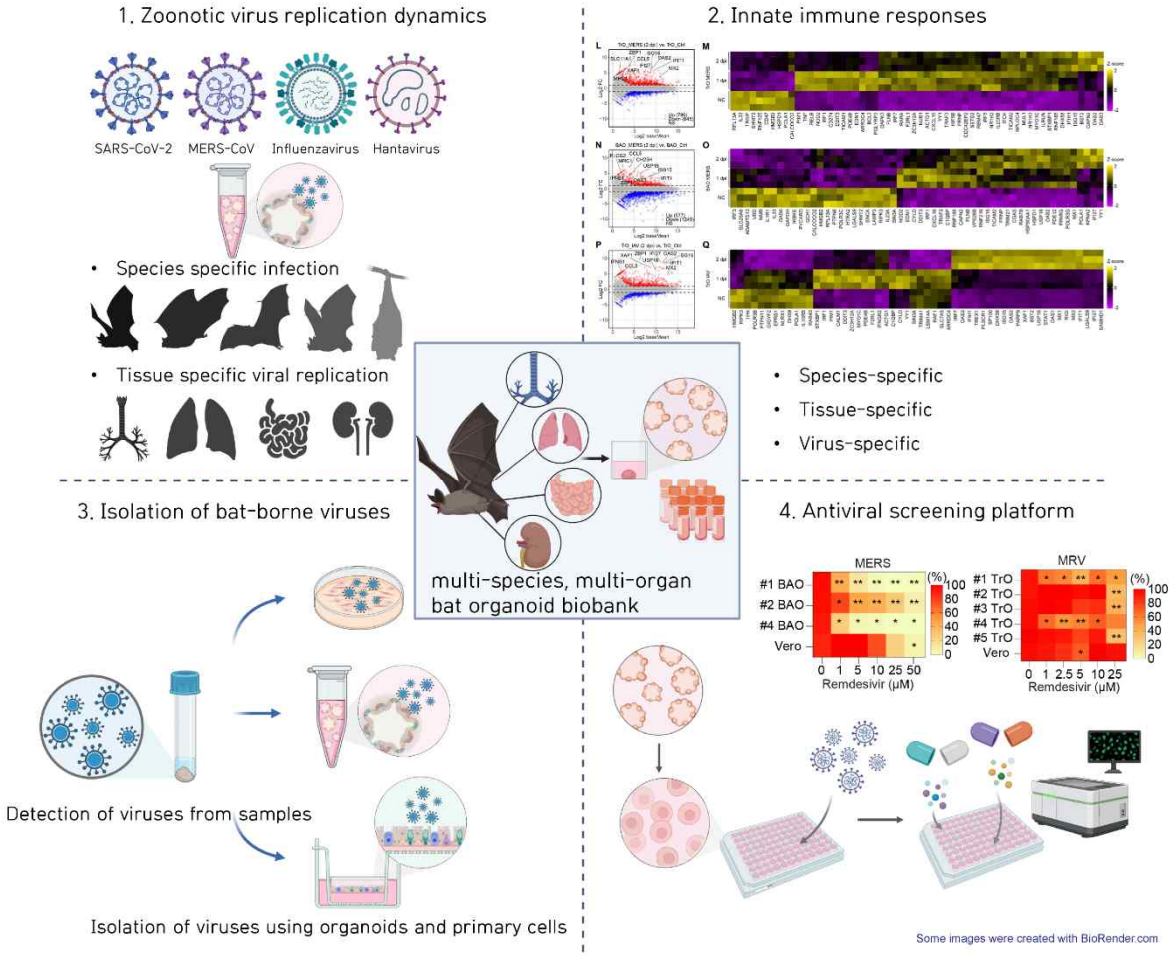

Figure 2. Key Research Findings Using Bat Organoids

1. Scientists infect tiny 3D “mini-organs” from different bat species with viruses like SARS-CoV-2, MERS, influenza, and hantavirus, to see how they spread in different tissues.

2. They track how the bat’s immune system reacts, comparing responses between species and organs.

3. The platform helps scientists find and isolate new viruses straight from bat samples, using organoids for safer, more accurate testing.

4. It also lets researchers quickly screen antiviral drugs on these mini-organs, speeding up the search for effective treatments.

Notes for editors

- References

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- About the Institute for Basic Science (IBS)

IBS was founded in 2011 by the government of the Republic of Korea with the sole purpose of driving forward the development of basic science in South Korea. IBS has 7 research institutes and 32 research centers as of January 2025. There are eight physics, three mathematics, five chemistry, seven life science, two earth science, and seven interdisciplinary research centers.