

GLOBAL HEALTH

Animal spillover? Lab leak? What the science says about the origins of COVID-19

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By Rachel Carlson



Members of the Wuhan Hygiene Emergency Response Team leave the shuttered Huanan Seafood Wholesale Market in the city of Wuhan, in Hubei, Province on January 11, 2020. Investigations of the origin of COVID-19 have centered on the animals sold at the market.

Noel Celis/AFP/via Getty Images

Sen. Rand Paul, R-Ky., faced off with leading COVID-era infectious diseases specialist Dr. Anthony Fauci during a Senate hearing today, bringing renewed attention to ongoing debates about the origins of the coronavirus that caused the pandemic.

Fauci, who directed the National Institute of Allergy and Infectious Diseases from 1984 to 2022, has long supported the theory that the virus jumped from animals to humans.

Paul and the Trump administration say that the virus leaked from a Chinese laboratory, either accidentally or intentionally. In 2025, the Trump administration took down some

government websites providing COVID-19 information and replaced them with a page called "LAB LEAK: The True Origins of COVID-19," dedicated to the controversial theory.

The lab in question, the Wuhan Institute of Virology, is located in the city where the first cases of COVID were recorded.

What does the evidence show?

Supporters of what's now known as the "lab leak" theory note that the analysis of the virus by scientists relied on incomplete data provided by the Chinese government. They also point to the lack of a smoking gun in previous analyses — an animal infected with SARS-CoV-2, the virus that causes COVID-19, at a market in Wuhan, China.

Some U.S. intelligence agencies have also expressed a low-to-moderate degree of confidence in the accidental lab leak theory.

But virologists who study pandemic origins are much less divided than the U.S. intelligence community. They say there is "very convincing" data and "overwhelming evidence" pointing to an animal origin.

In a report issued in June 2025, the World Health Organization stated: "the weight of available evidence ... suggests zoonotic spillover ... either directly from bats or through an intermediate host."

That conclusion was based on three years of research by the 27 members of The WHO Scientific Advisory Group for the Origins of Novel Pathogens.

NPR's reporting has supported that theory.

A 2024 study in the peer-reviewed journal *Cell* found multiple lines of evidence showing the virus spilled over from wild animals to humans.

GOATS AND SODA

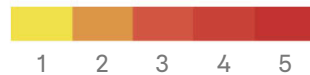
Why They're Called 'Wet Markets' — And What Health Risks They Might Pose

The authors of the study, a team of scientists that includes prominent names such as Michael Worobey and Angela Rasmussen, say the analysis shows with unprecedented granularity that coronavirus-susceptible wildlife and the SARS-CoV-2 virus were mingling, along with human beings, in a very specific part of the wet market in Wuhan.

Where samples positive for the coronavirus were found in Huanan Seafood Wholesale Market in January 2020

Starting Jan. 1, 2020, the Chinese Center for Disease Control and Prevention took samples from the surfaces of stalls in Wuhan's Huanan Seafood Wholesale Market after animals had been removed. Samples that tested positive for the SARS-CoV-2 coronavirus were largely clustered in the southwest corner, where live animals were sold and where a scientist took photos in 2014 (shown below) because of concern about potential disease transmission there.

POSITIVE SARS-COV-2 SAMPLES FOUND IN STALL

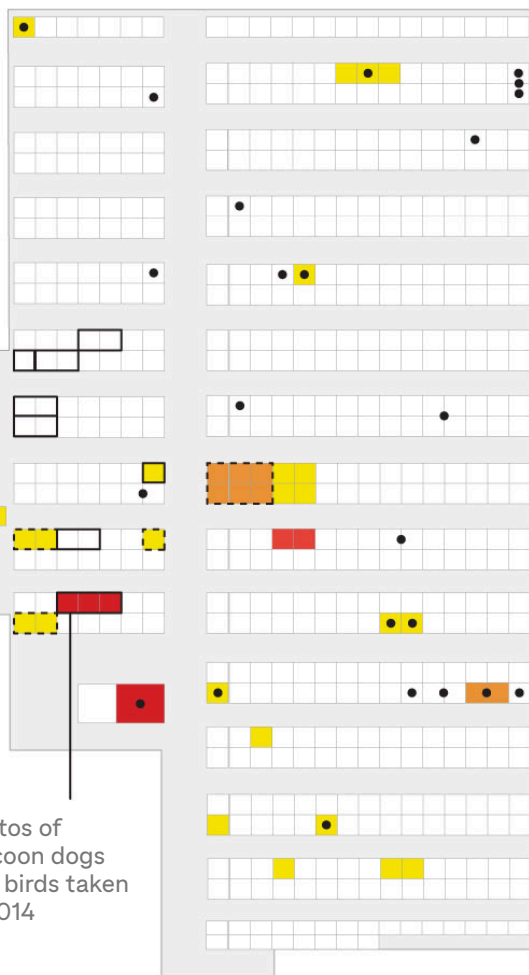


● Self-reported case of COVID-19 in vendors

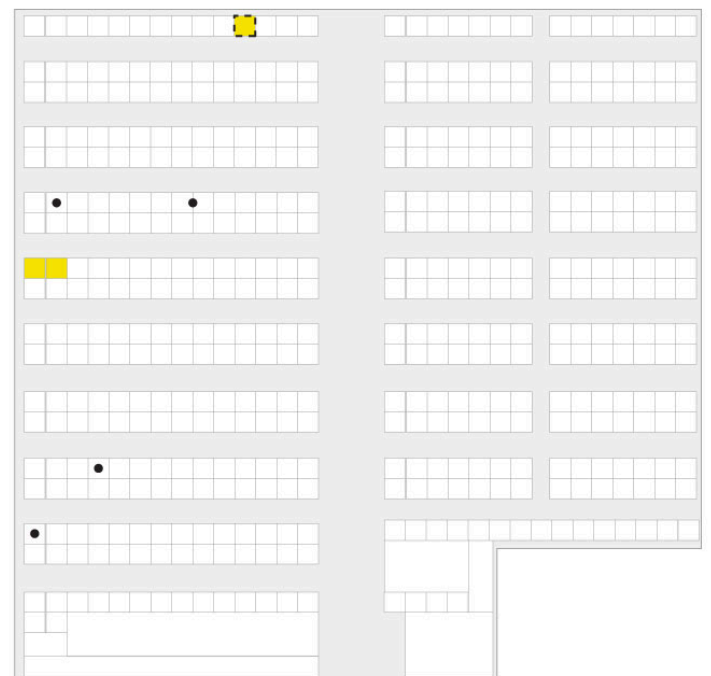
□ Stall selling live mammals

□ Stall selling meat

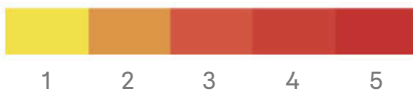
WEST SIDE



EAST SIDE



POSITIVE SARS-COV-2 SAMPLES FOUND IN STALL



Self-reported case of COVID-19 in vendors



Stall selling live mammals



Stall selling meat

WEST SIDE



In two extensive, peer-reviewed studies published in the journal *Science* in 2022, researchers looked at the distribution of the earliest known cases and found that they formed a bull's-eye centered at the wet market. If the outbreak had started at the lab, researchers argue cases would've spread out from there.

Worobey, an evolutionary biologist who worked on the *Science* and *Cell* papers and was at the forefront of the pandemic-origins research, spoke to NPR in 2022 about the data.

"It's absurd how strong the geographical association is [to the market]," he told NPR.

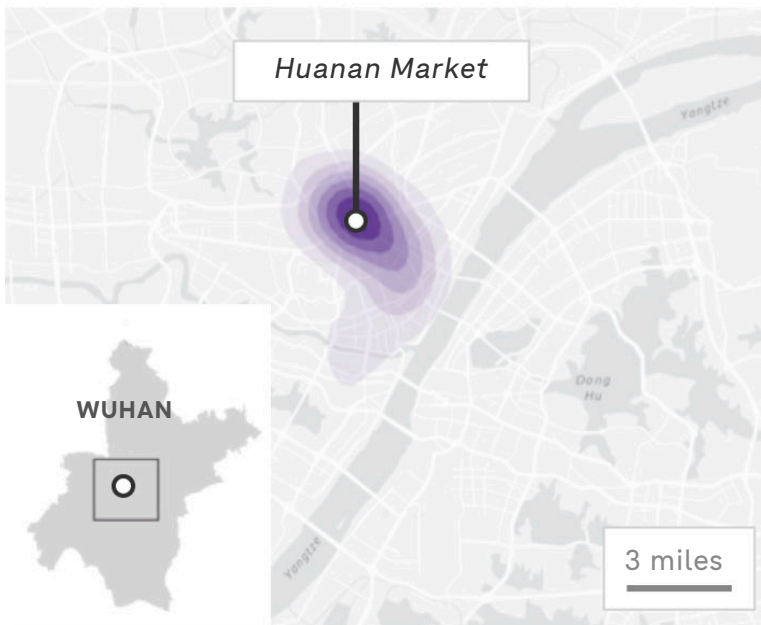
Worobey said that the likelihood of a coincidence — wherein the virus *did* come from a lab, even though the first cluster of COVID-19 cases occurred at the market — was "1 in 10,000."

"The evidence is amongst the best we have for any emerging virus," he said. "It's important to note we haven't found a related virus from the intermediate host. But we have a bunch of other evidence."

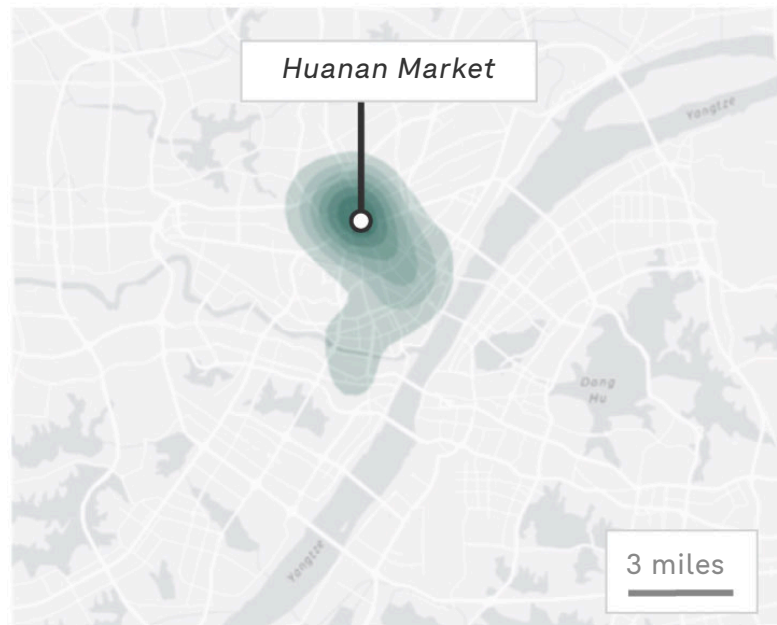
Mapping the first reported cases of COVID-19 in Wuhan

These maps show the estimated concentration of the earliest 156 cases of COVID-19 in Wuhan, China, in December 2019. The highest concentration of those cases centered on the Huanan Seafood Wholesale Market. Even for the subset of 123 individuals with no direct contact with the market, the same pattern emerged, strongly suggesting community transmission of the coronavirus began at or near the market.

Concentration of all COVID-19 cases in December 2019



Concentration of COVID-19 cases not directly linked to Huanan market in December 2019



Concentration of all COVID-19 cases in December 2019

Concentration of COVID-19 cases not directly linked to Huanan market in December 2019

Preparing for the future

Many scientists still express the need to keep an open mind if new information about the pandemic's origins surfaces.

In the WHO's 2025 report, the authors note ongoing uncertainty about the pandemic's origins. They wrote that much of the information needed to assess the lab leak theory had not been made available to them.

"While a zoonotic origin with spillover from animals to humans is currently considered the best supported hypothesis by the available scientific data, until requests for further information are met or more scientific data becomes

available, the origins of SARS-CoV-2 and how it entered the human population will remain inconclusive," the report states.

WHO director-general Tedros Adhanom Ghebreyesus offered this perspective: "As things stand, all hypotheses must remain on the table, including zoonotic spillover and lab leak. We continue to appeal to China and any other country that has information about the origins of COVID-19 to share that information openly, in the interests of protecting the world from future pandemics."

That call for a forward-looking perspective has been echoed by many in the scientific community.

"In my view it's important to keep investigating this question with an open mind while also proactively taking steps to minimize the risks of both future research-related and zoonotic outbreaks," evolutionary virologist Jesse Bloom wrote in an email to NPR.

Some scientists, including Felicia Goodrum, a virologist at Dartmouth College, are concerned Sen. Paul's ongoing focus on the pandemic's origins, particularly Fauci's personal notes, may erode public trust in research.

She believes the goal is "to sow distrust in science and scientists," Goodrum said to NPR on Monday from the American Society for Virology meeting in Minneapolis.

She says many virologists are concerned that funding cuts and the ongoing tension regarding the pandemic's origins are already hindering research focused on preventing the next pandemic.

"We are less safe. We are less prepared for a pandemic right now than we were in 2019," says Goodrum. "And this is terrifying to all of us."

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