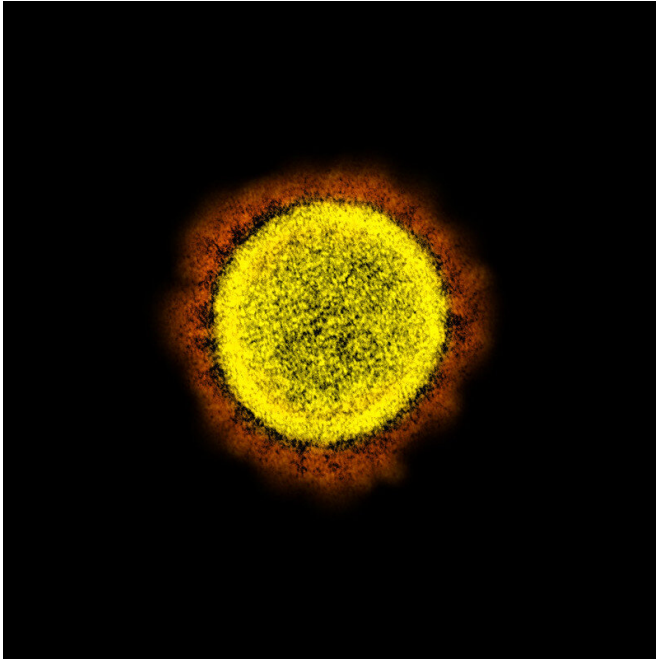


COVID origins report: the four theories in play

29 March 2021



Novel Coronavirus SARS-CoV-2 Transmission electron micrograph of SARS-CoV-2 virus particles, isolated from a patient. Image captured and color-enhanced at the NIAID Integrated Research Facility (IRF) in Fort Detrick, Maryland. Credit: National Institute of Allergy and Infectious Diseases, NIH

The COVID-19 pandemic origins report looked into four hypotheses as to how the virus entered the human species, ranking them from the most to the least likely.

The [final report](#), a joint WHO-China study, which AFP obtained Monday ahead of its official release, spelled out how the joint team of Chinese scientists and international experts thrashed out the hierarchy of probability.

Here are the four theories, in descending order of probability:

Intermediate host animal

This hypothesis, deemed by the experts as a "likely to very likely pathway", argues that the [virus](#) first spread from the original host animal, likely a bat, to another intermediate host animal before being passed on to humans.

— Arguments for:

Although the closest-related viruses were found in bats, the evolutionary distance between those bat viruses and the SARS-CoV-2 virus that causes COVID-19 disease is estimated to be several decades, suggesting a "missing link" in between, the report said.

Highly similar viruses have also been found in pangolins, suggesting cross-species transmission from bats at least once.

The report also pointed out that an intermediary step involving an amplifying host has been observed for several other viruses.

— Arguments against:

While SARS-CoV-2 has been found in a growing number of animal species, studies suggest they were infected by humans.

And so far, tests of a wide range of domestic and wild animals in the region where the outbreak first started have shown no evidence of SARS-CoV-2.

— Next steps:

The experts suggested the virus might have been introduced through imports to Wuhan of meat from wildlife farms in provinces where bats have been shown to carry similar coronaviruses.

"While this does not prove a link, it does provide a meaningful next step for surveys," the report said.

Direct transmission

This hypothesis, deemed "possible to likely", assumes that SARS-CoV-2 jumped directly from the original host, likely a bat, to humans.

— Arguments for:

Most current human coronaviruses come from animals, the report said.

Surveys, it said, had found viruses with high genetic similarity to SARS-CoV-2 in *Rhinolophus* bats.

It also pointed out that "antibodies to bat [coronavirus](#) proteins have been found in humans with close contact to bats".

Similar viruses have been found in Malayan pangolin, and mink have proven also highly susceptible, it said, adding it could not rule out that minks might be the primary source.

— Arguments against:

Though the closest genetic relation to SARS-CoV-2 is a bat virus, analysis indicates "decades of evolutionary space" between them, suggesting an intermediate host route is more likely.

"Also, contacts between humans and bats or pangolins are not likely to be as common as contact between humans and livestock or farmed wildlife."

— Next steps:

Trace-back studies of the Wuhan markets' supply chains provided some "credible leads", which should be expanded to other countries, said the report.

Cold food chain

This hypothesis, which was deemed "possible", suggests that frozen [food products](#) or their packaging might have been a route of introduction and transmission of SARS-CoV-2.

— Arguments for:

China witnessed some outbreaks related to imported frozen products in 2020.

SARS-CoV-2 has been found on the outer package of imported frozen products, suggesting the virus can persist on contaminated frozen products.

— Arguments against:

"There is no conclusive evidence for foodborne transmission of SARS-CoV-2 and the probability of a cold-chain contamination with the virus from a reservoir is very low," the report said.

— Next steps:

The experts called for screening of leftover frozen cold-chain products, especially farmed wild animals, sold in Wuhan's Huanan market from December 2019, if still available.

Laboratory leak

This hypothesis, which was found to be "extremely unlikely", considers that SARS-CoV-2 was introduced through a laboratory incident.

The experts examined only the theory that the natural virus escaped a lab through the accidental infection of staff. It did not consider the hypothesis of deliberate release or deliberate bioengineering of the virus, which scientists have already ruled out.

— Arguments for:

"Although rare, laboratory accidents do happen", the report said.

And CoV RaTG13, the closest strain to SARS-CoV-2, found in bat anal swabs, had been sequenced at the Wuhan Institute of Virology.

— Arguments against:

"There is no record of viruses closely related to SARS-CoV-2 in any laboratory before December 2019, or genomes that in combination could provide a SARS-CoV-2 genome," the report said.

"The risk of accidental culturing SARS-CoV-2 in the laboratory is extremely low," it added.

— Next steps:

"Regular administrative and internal review of high-level biosafety laboratories worldwide. Follow-up of new evidence supplied around possible laboratory leaks."

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