vaccine, which is currently the light at the end of a very dark tunnel, is in danger," Danish minister for food and fisheries Mogens Jensen said in a statement on 5 November.

But researchers who have reviewed the available data say these claims are speculative. The Cluster-5 variant seems to be a "dead end" in people, because it hasn't spread widely, says Iversen. The variant has not been seen since September despite extensive sequencing and data sharing, she says.

Iversen adds that the experimental work is too limited to draw any conclusions about its implications for therapies and vaccines. "It is really important in this situation not to over-interpret very preliminary data."

Spread in people

One mink-associated mutation has spread more widely in people. The mutation, Y453F, also encodes an amino-acid change in the spike protein and has been found in about 300 virus sequences from people in Denmark, and in sequences from mink and people in the Netherlands. An experimental study suggests that virus variants with the Y453F mutation partially escaped detection by a commercial monoclonal antibody.

But that does not mean that this mutation will hinder the drug's therapeutic effect in the body, says Iversen.

It's also not clear whether all the mink-associated mutations in people actually originated in mink, because not all the data have been released, says David Robertson, a virologist at the University of Glasgow, UK.

But there are some examples of mutations originating in mink and passing to people, says Kasper Lage, a computational biologist at Massachusetts General Hospital and the Broad Institute of MIT and Harvard in Boston. And many researchers are worried that uncontrolled spread of the virus through millions of mink could lead to problematic mutations.

In Denmark, the world's largest producer of mink pelts, authorities are struggling to rein in farm outbreaks, despite extensive control measures. In many affected farms, almost all animals have antibodies against the virus. Outbreaks have also been detected on mink farms in the Netherlands, Sweden, Spain, Italy and the United States. The Netherlands plans to cull its entire mink population by 2021, accelerating plans to end mink farming there by 2024.

Scientists still don't know how the virus is entering farms, says Anette Boklund, a veterinary physician at the University of Copenhagen. Her team has found low levels of viral RNA on house flies, as well as in hair and air samples close to mink cages. They have also tested nearby wildlife. The only positive wildlife sample was from a seagull's foot. Infected farm workers are the most likely source, says Boklund.

ALAMY

Early cases of COVID-19 were linked to a meat market in Wuhan, China.

INVESTIGATION INTO COVID ORIGIN BEGINS BUT FACES CHALLENGES

Identifying the source and managing the political sensitivities between the US and China will be tricky.

By Smriti Mallapaty

The World Health Organization (WHO) has released its plan to investigate the origins of the COVID-19 pandemic. The search will start in Wuhan — the Chinese city where the coronavirus SARS-CoV-2 was first reported — and expand across China and beyond. Tracing the virus's path is important for preventing future viral spillovers, but scientists say the WHO team faces a daunting task.

Most researchers think the virus originated in bats, but how it jumped to people is unknown. Other coronaviruses have passed from an intermediate animal host; for example, the virus that caused an outbreak of severe acute respiratory syndrome (SARS) in 2002–04 probably came to people from raccoon dogs (*Nyctereutes procyonoides*) or civets.

"Finding an animal with a SARS-CoV-2 infection is like looking for a needle in the world's largest haystack. They may never find a 'smoking bat'" or other animal, says Angela Rasmussen, a virologist at Columbia University in New York City. "It will be key for the investigators to establish a collaborative relationship with scientists and government officials in China."

Nailing down the origins of a virus can take years, if it can be done at all, and the investigation will also have to navigate the highly sensitive political situation between China and the United States. US President Donald Trump has been "calling it a China virus and the Chinese government is trying to do everything to prove that it is not a China virus", says Linfa Wang, a virologist at Duke–National University of Singapore Medical School. The political blame game has meant that crucial details about research under way in China have not been made public, says Wang, who was part of the WHO mission that looked for the origin of SARS in China in 2003.

He hopes the situation with the new US administration will be less volatile. President-elect Joe Biden has also said he will reverse Trump's withdrawal from the WHO. Support from China and the United States will create "a much more positive environment to conduct research in this field", says Wang.

An international team of epidemiologists,

virologists and researchers with expertise in public health, animal health and food safety will lead the WHO's COVID-19 investigation. The agency has not released their names.

The team held its first virtual meeting, including researchers in China, on 30 October, and is reviewing the preliminary evidence and developing study protocols, says the WHO. The initial phase of investigations in Wuhan will probably be conducted by researchers who are already in China, and international researchers will travel to the country after reviewing those results, the agency says.

In Wuhan, researchers will take a closer look at the Huanan meat and animal market, which many of the earliest people diagnosed with COVID-19 had visited. What part the market played in the virus's spread remains a mystery. Early investigations sampled frozen animal carcasses at the market, but none found evidence of SARS-CoV-2, according to a 5 November report on the WHO mission's terms of reference (see go.nature.com/2uiz8ik). However, environmental samples, taken mostly from drains and sewage, did test positive for the virus. "Preliminary studies have not generated credible leads to narrow the area of research," the report states.

The WHO mission will investigate the wild and farmed animals sold at the market, including foxes, raccoons (*Procyon lotor*) and sika deer (*Cervus nippon*). They will also investigate other markets in Wuhan, and trace the animals' journeys through China and across borders. The investigators will prioritize animals that are known to be susceptible to the virus, such as cats and mink.

The team will also look at Wuhan's hospital records, to find out whether the virus was spreading before December 2019. The researchers will interview the first people identified to have had COVID-19, to find out where they might have been exposed, and will test blood samples collected from medical staff, laboratory technicians and farm workers in the weeks and months before December, looking for antibodies against SARS-CoV-2. The report acknowledges that some of this work might already be under way in China.

Longer-term plans

The initial investigation in Wuhan will inform longer-term studies into the pandemic's origins, which could take investigators outside China. "Where an epidemic is first detected does not necessarily reflect where it started," the WHO report states, noting preliminary reports of viral RNA detected in sewage samples before the first cases had been identified.

This statement could refer to a study, posted on the preprint server medRxiv without peer review (G. Chavarria-Miró *et al*. Preprint at medRxiv https://doi.org/fhw5; 2020), which retrospectively tested Spanish sewage samples from March 2019 and found SARS-CoV-2 fragments, says Raina MacIntyre, an epidemiologist at the University of New South Wales in Sydney, Australia. "If this study was correct, we have to ask how the virus was in Spain in March last year," she says.

Plans to look beyond China are sensible, given that extensive surveillance in bats in China since the 2002 SARS outbreak has identified only a distant relative of SARS-CoV-2, says Wang. A growing number of experts think that the immediate or close ancestors of SARS-CoV-2 are more likely to exist in bats outside China, says Wang. He says the WHO team should survey bats and other wildlife across southeast Asia for SARS-CoV-2 antibodies.

The investigation should also prioritize carnivorous mammals farmed for fur, such as raccoon dogs and civets, which had a role in the SARS outbreak, says Martin Beer, a virologist at the Federal Research Institute for Animal Health in Riems, Germany. "It is surprising that there is no mention of these animals in the report, and we have no information from China about whether these animals have been tested," says Beer.

A spokesperson for the WHO says the mission will be guided by science, and "will be open-minded, iterative, not excluding any hypothesis that could contribute to generating evidence and narrowing the focus of research".

UNDERDOG TECH MAKES GAINS IN QUANTUM COMPUTER RACE

Trapped-ion technologies are gaining momentum in the quest to make a commercial quantum computer.

By Elizabeth Gibney

A technology for building quantum computers that has long been sidelined by commercial developers is gaining momentum. As quantum computing has transformed from academic exercise to big business over the past decade, the spotlight has mostly been on one approach — the tiny superconducting loops embraced by technology giants such as IBM and Intel. Superconductors last year enabled Google to claim it had achieved 'quantum advantage' with a machine that for the first time performed a particular calculation that is beyond the practical capabilities of the best classical computer. But a separate approach, using ions trapped in electric fields, is gaining traction in the quest to make a commercial quantum computer.

Earlier this year, technology and manufacturing company Honeywell launched its first quantum computer that uses trapped ions as the basis of its quantum bits, or 'qubits', which it had been working on quietly for more than a decade. Honeywell, headquartered in Charlotte, North Carolina, is the first established company to take this route, and it has a 130-strong team working on the project. In October, seven months after the launch, the firm unveiled an upgraded machine; it already has plans to scale this up.

And Honeywell is not the only company planning to make trapped-ion systems at scale. Last month, University of Maryland spin-off firm IonQ in College Park announced a trapped-ion machine that could prove to be competitive with those of IBM or Google, although the company has yet to publish details of its performance. Smaller spin-off firms — such as Universal Quantum in Brighton, UK, and Alpine Quantum Technology in Innsbruck, Austria — are also attracting investment for trapped-ion projects.

Trapped-ion quantum computers, which store information in the energy levels of individual charged atoms held in an electric field, are far from new: they were the basis of the qubits in the first basic quantum circuit in 1995, long before anyone used superconducting loops (C. Monroe *et al*. *Phys. Rev. Lett.* **75**, 4714; 1995). But efforts to put all the building blocks together to build viable commercial systems are "sort of bursting on the scene now", says Daniel Slichter, a quantum physicist at the US National Institute of Standards and Technology in Boulder, Colorado.

Rising challenger

"I think nowadays people say 'superconductors' and 'trapped ions' in the same breath, and they weren't saying that even five years ago," says Chris Monroe, a physicist at the University of Maryland who worked on the 1995 experiment and is a co-founder of IonQ. Quantum computing is still in its infancy, and although various companies are jockeying to claim that their quantum computer is the most