the White House and install leaders at public-health agencies until Inauguration Day on 20 January. As *Nature* went to press, however, Trump had refused to concede the election, delaying the typical transition of power. According to several US news reports, in outlets including *The Washington Post* and *The New York Times*, a Trump appointee in the General Services Administration has not given Biden access to funding and office space typically provided to new administrations to ensure a smooth handover.

Meanwhile, Biden has echoed public-health advice in his own remarks. In a 9 November address, he urged people in the United States to wear masks — his plan proposes that all governors introduce mask mandates in their states. The Trump administration has presented conflicting advice on mask wearing, even though scientists have been saying for months that the coverings are a necessary first line of virus defence.

"This is just a simple thing that everybody can do," says Gayle. "The fact that there's a part of our population that has resisted that message is unfortunate."

COVID MINK ANALYSIS SHOWS MUTATIONS ARE NOT DANGEROUS — YET

But scientists say the coronavirus's rampant spread among the animals means mink still need to be killed.

By Smriti Mallapaty

Health officials in Denmark have released genetic and experimental data on a cluster of SARS-CoV-2 mutations circulating in farmed mink and in people, days after they announced the mutations could jeopardize the effectiveness of potential COVID-19 vaccines.

News of the mutations prompted Danish Prime Minister Mette Frederiksen to announce plans to end mink farming for the foreseeable future — and cull some 17 million animals — sparking a fierce debate about whether such action was legal. But scientists were careful not to raise the alarm until they saw the data.

Now, scientists who have reviewed the data say the mutations themselves aren't particularly concerning, because there is little evidence that they allow the virus to spread more easily among people, make it more deadly or will jeopardize therapeutics and vaccines. "The mink-associated mutations we know of are not associated with rapid spread, nor with any changes in morbidity and mortality," says Astrid Iversen, a virologist at the University of Oxford, UK.

The coronavirus SARS-CoV-2 transmits rapidly among mink.

OLE JENSEN/GETTY

But researchers say culling the animals is probably necessary, given the virus's rapid and uncontrolled spread in mink — it has been detected on more than 200 farms since June — which makes the animals a massive viral source that can easily infect people. In regions with affected mink farms, the number of people with COVID-19 increases a lot, says Iversen. And there are roughly three times more mink than people in Denmark. "The mink cull is necessary," she says.

Uncontrolled spread in mink also increases the opportunity for the virus to evolve and develop mutations that could be concerning, says Jannik Fonager, a virologist at the State Serum Institute, the Danish health authority leading the investigations, based in Copenhagen. He says scientists shared their concerns with the government, but that the government decided to cull the mink.

The government submitted legislation to enable the cull on 10 November, and has urged farmers to begin the process.

Mink mutations

Fonager says researchers in Denmark have sequenced viral samples from 40 mink farms and identified some 170 coronavirus variants. In viral samples from people — representing about one-fifth of the country's confirmed COVID-19 cases — they've found some 300 individuals with variants that contain mutations thought to have first emerged in mink. "That is something we really want to keep a close eye on," adds Fonager.

In the viral samples from mink and people, researchers have identified several mutations in the gene encoding the spike protein that the coronavirus uses to enter cells. This concerns researchers because changes in this region could affect the immune system's ability to detect infection. Many vaccines also train the immune system to block the spike protein.

Of particular concern is a virus variant containing a unique combination of mutations called Cluster-5, which was found in 5 farms and 12 people in the North Jutland region of northern Denmark. Fonager says the Cluster-5 variant causes three amino-acid changes and two deletions in the spike protein.

Preliminary cell experiments suggest that antibodies from some people who had recovered from COVID-19 found it more difficult to recognize the Cluster-5 variant than to spot coronaviruses that did not carry these mutations. This suggests that the variant could be less responsive to antibody treatments or vaccines, and informed the government's decision to cull the farmed mink, according to a letter from Denmark's chief veterinary officer to the World Organisation for Animal Health. "It is the right thing to do in a situation where the

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.

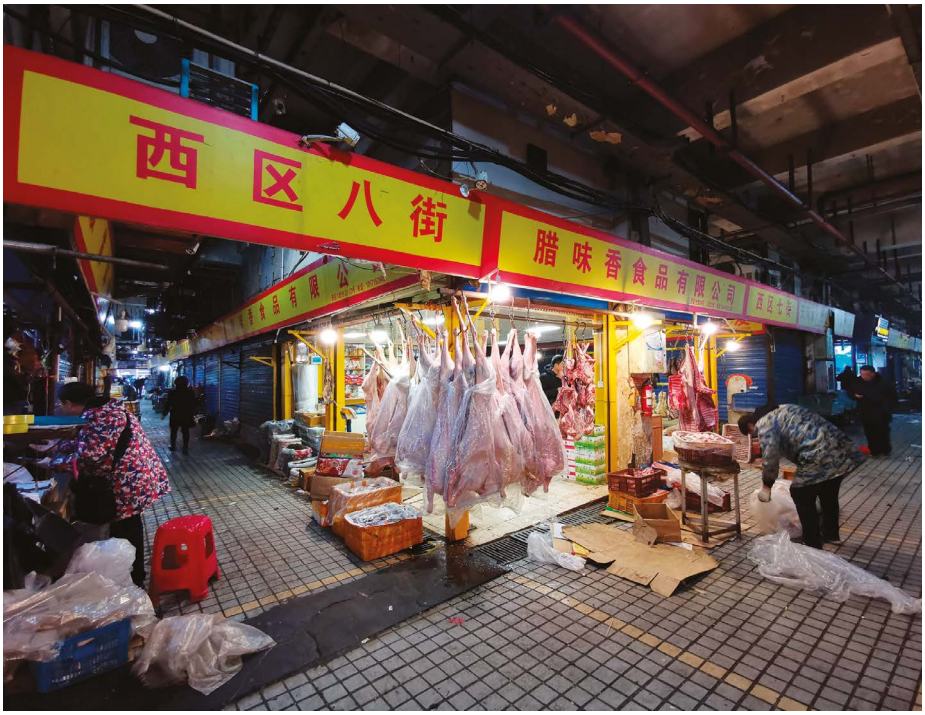
But that does not mean that this mutation will hinder the drug's therapeutic effect in the body, says Iversen.

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,