



On New Year's Day, Wuhan health authorities closed a live animal market linked to the mysterious outbreak.

INFECTIOUS DISEASES

New SARS-like virus in China triggers alarm

Pneumonia outbreak in Wuhan appears to subside, but the virus could re-emerge

By **Jon Cohen** and **Dennis Normile**

Had the nightmare returned? That's the question many were asking in the first 10 days of this year, after a new form of pneumonia emerged in Wuhan, a megacity in central China. The outbreak revived memories of severe acute respiratory syndrome (SARS), the disease that emerged in China in 2002 and sickened 8098 people in 37 countries before it was quashed in the summer of 2003. Like SARS, the Wuhan pneumonia cases were linked to a market selling myriad species of live animals, and they appear to be caused by a new member of the coronavirus family closely related to the SARS virus. And once again, China appeared to be less than forthcoming with information.

Today, global health experts are breathing a little easier. As *Science* went to press, only one of 42 people known to be infected had died: a 61-year-old man already suffering from abdominal tumors and chronic liver disease. (SARS had a 9.6% mortality rate.) No evidence suggests the virus easily passes between humans, which can turn a local problem into a global crisis. And Chinese researchers have now shared the sequence of six genomes of the as-yet-unnamed virus with the world, which scientists elsewhere have used to quickly

develop and publish a diagnostic test. Ralph Baric, a coronavirus researcher at the University of North Carolina, Chapel Hill, is already trying to synthesize live virus from the data so that he can study it in animals.

Still, many questions remain. Researchers have not identified the animal species at the marketplace that harbored the virus. When it emerged and the true number of people infected remain a mystery. Meanwhile, a case in Thailand, reported on 13 January—in a tourist who flew from Wuhan to Bangkok—led World Health Organization (WHO) Director-General Tedros Adhanom Ghebreyesus to consult experts on outbreak responses. The patient had not visited the Wuhan market at the center of the outbreak but had been to other animal markets, suggesting the virus has spread within Wuhan, the *South China Morning Post* reported on 14 January.

The first known patient developed symptoms—which can include difficulty breathing and fever—on 8 December 2019. Officials closed the seafood market on New Year's Day, and no new patients have been identified in Wuhan since 3 January. The virus was not found in 763 close contacts of those infected, or in health care workers, who often fall ill during outbreaks of viruses that can transmit between humans.

"It is a limited outbreak," says Xu Jianguo, who runs an infectious disease laboratory at the Chinese Center for Disease Control and Prevention and heads an evaluation committee that's advising the Chinese government. "If no new patients appear in the next week, it might be over."

WHO said in a 12 January statement that it was "reassured of the quality of the ongoing investigations and the response measures implemented in Wuhan, and the commitment to share information regularly."

But others criticized the way early information came out. News that researchers had discovered a novel coronavirus came in an 8 January story in *The Wall Street Journal*; Xu confirmed the finding on a state-run TV station several hours later. "It's not a good situation when *The Wall Street Journal* [reports] a SARS-like coronavirus before the Chinese government announces it," Baric says. On 10 January, Jeremy Farrar, an infectious disease specialist who heads the London-based Wellcome Trust, tweeted his worry about rumors that the Chinese government did not share "critical public health information" because Chinese researchers wanted to ensure publication of their findings in high-profile journals first.

Less than 12 hours later, however, evolutionary biologist Edward Holmes of the University of Sydney published an "initial"

sequence of the new coronavirus on virological.org, on behalf of a consortium led by Zhang Yong-Zhen of Fudan University in Shanghai. The next day, three groups working under China's National Health Commission posted another five sequences of the virus, gathered from different patients, on GISAID, a database primarily used for sharing data on influenza viruses.

The six sequences differ little from each other, which evolutionary biologist Andrew Rambaut of the University of Edinburgh says is "consistent with a point source"—meaning they likely came from the same batch of infected animals at the Huanan Seafood Wholesale Market, which also sells birds, snakes, and rabbit meat. (No coronaviruses have ever been found in fish.) But the fact that cases surfaced over the course of 1 month suggests the source was more than one group of animals at one location, Farrar says: "It makes me worry that whatever the exposure was to, it went on for quite a long time." Virologist Guan Yi of Hong Kong University agrees that the Wuhan outbreak was caused by multiple jumps from animal to human hosts "separately and independently."

Whatever species spread the virus at the market may have picked it up from some natural reservoir. Many coronaviruses occur naturally in bats, and the new virus is closest to four bat viruses that have surface proteins capable of infecting human cells. Still, Rambaut cautions there may well be another natural host. "It's quite similar to a bat virus in parts of its genome, but not so much in other parts," he says.

Farrar notes that most confirmed cases to date were mild, which means that even before health officials recognized the outbreak, the virus may have infected many other people who never sought medical care. That makes it premature to conclude the pathogen doesn't spread from human to human, he says. Nurses and doctors, too, may have been infected without anyone noticing, he adds: "With a coronavirus, I'd be very surprised if there wasn't some limited human-to-human transmission." So far, cases have been confirmed by detecting nucleic acid from the virus, which disappears after patients recover. Now that the virus has been isolated, researchers can also develop antibody tests that pick up signs of past infection.

Limited as the outbreak appears to date, Farrar and others still worry that travel of hundreds of millions of people for the Lunar New Year celebration on 25 January could spread the virus from Wuhan, a major transportation hub, to other cities. "With people, food and animals move," says Farrar, who suspects that this outbreak "is not going away anytime soon." ■

NUCLEAR PHYSICS

Electron-Ion Collider would lay bare the proton's innards

Department of Energy picks site for billion-dollar machine

By **Adrian Cho**

The United States has taken a key step toward building its first new particle collider in decades. Last week, the U.S. Department of Energy (DOE) announced that the Electron-Ion Collider (EIC) will be built at Brookhaven National Laboratory in Upton, New York. The machine would enable nuclear physicists to probe the mysterious structure of the proton and how its mass and spin emerge from a teeming sea of even smaller subatomic particles inside it.

"The U.S. has been at the front end in nuclear physics since the end of the Second World War and this machine will enable the U.S. to stay at the front end for decades to come," said Paul Dabbar, DOE's undersecretary for science, in a telephone press

conference. Gluons, quarks, and antimatter antiquarks that flit in and out of existence too quickly to be directly observed. Many of the proton's properties—including its mass and spin—emerge from that sea of "virtual" particles in ways that theorists don't understand, says Gordon Baym, a nuclear theorist at the University of Illinois, Urbana-Champaign, who led a 2018 study by the National Academies of Sciences, Engineering, and Medicine that called for an EIC (*Science*, 27 July 2018, p. 317). "What is [the gluons'] distribution in space? What is their distribution in momentum?" he says. "We don't know much about that."

It's not for lack of trying. Since 1994, the Continuous Electron Beam Accelerator Facility (CEBAF, pronounced "see-baff") at Jefferson lab has fired electrons into targets rich in protons and neutrons. But



The Electron-Ion Collider would add an electron beam to the Relativistic Heavy Ion Collider ring in New York.

conference announcing the site selection for the machine, which will cost between \$1.6 billion and \$2.6 billion and could begin to run by 2030. DOE's Thomas Jefferson National Accelerator Facility in Newport News, Virginia, had also vied to host it.

For decades, physicists have fired electrons into protons and atomic nuclei. In the early 1970s, these experiments showed that each proton (and neutron) consists of three less massive quarks, which bind to one another by exchanging quantum particles called gluons.

However, quantum uncertainty causes the proton's interior to roil with countless

CEBAF can only probe the more energetic of the proton's virtual quarks and gluons, those that individually carry more than about 20% of the proton's total momentum.

With its more intense and energetic beams, the EIC should see the more numerous quarks and gluons that carry as little as 1/100,000 of the proton's momentum. That throng of gluons should crowd together so much that their identities as individual particles blur as they form a new state of matter called a color-glass condensate, says Peter Braun-Munzinger, a high-energy and nuclear physicist at the GSI Helmholtz Center for Heavy Ion Research in Darmstadt, Germany.

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Science **367** (6475), 234-235.
DOI: 10.1126/science.367.6475.234

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