“ The uncertainty principle has been demonstrated in many different ways, but to see it on a visible mechanical object is totally awesome. ” — KEITH SCHWAB, PAGE 16

In the News

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Mind & Brain Fear on the brain

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Humans Dating the Neandertal demise

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STORY ONE

Scientists race to understand deadly new virus

SARS-like infection causes severe illness, but may not spread quickly among people

By Tina Hesman Saey

WASHINGTON — A deadly new virus has scientists scrambling to learn more about it and figure out whether it will become a pandemic or remain a limited threat.

The virus has sickened 13 people and killed seven of them in the Middle East and England since last April. All but one of those infected were hospitalized with severe pneumonia, and several also developed kidney failure.

“We have a new and virulent virus,” Gwen Stephens, of the Saudi Arabia Ministry of Health in Riyadh, told members of the American Society of Microbiology on February 27 during the annual Biodefense and Emerging Diseases Research Meeting. “We can only guess at its risks.”

The mysterious culprit is a coronavirus, a class that includes the virus that causes SARS, or severe acute respiratory syndrome. SARS spread quickly in 2002 and 2003, infecting some 8,100 people and killing nearly 800.

The new virus is most closely related to coronaviruses that bats carry, but it probably didn’t jump directly from

bats to people, Vincent Munster of the National Institutes of Health’s Virus Ecology Unit in Hamilton, Mont., said at the meeting. None of the people who got the disease had direct contact with bats, he said, and the virus is not identical to any known to infect bats.

But W. Ian Lipkin, an epidemiologist at Columbia University, won’t let bats or other animals off the hook yet as possible virus reservoirs. People may have come into contact with animals without realizing it. Such unrecognized contacts have spread the Nipah virus and hantavirus, he said.

Much like SARS, the new virus causes severe pneumonia. But that, Stephens said, is where the similarities between the viruses end.

While SARS passed easily from person to person through the air, the new virus doesn’t seem to spread that way. With the exception of one family, relatives and health care workers who have cared for people sick with the novel coronavirus have not fallen ill, Stephens said. That suggests that people must come into direct contact with the virus, such as by

A new type of coronavirus, pictured in a false-color micrograph, has sickened 13 people, seven of whom have died.

touching something an infected person has coughed or sneezed on.

In February, the first known case of human-to-human transmission of the virus emerged. A 60-year-old England resident who had traveled to Pakistan and Saudi Arabia got sick with the coronavirus and passed it to his son, who died. A young female relative probably also caught the virus from the older man. She had a mild case that didn’t require hospitalization, raising the possibility that other people may have contracted the new virus but mistaken it for the flu or another common respiratory illness, said Alison Bermingham of the U.K. Health Protection Agency.

Still, scientists do not know how people catch the virus or how infectious it is. Also uncertain is whether the new virus could evolve into a SARS-like pandemic, or whether it will slip away as mysteriously as it appeared. “This is a cause for concern, but not alarm,” said Susan

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Gerber, a medical epidemiologist at the U.S. Centers for Disease Control and Prevention. “What we do know is that there is no evidence of sustained chains of person-to-person transmission.”

To find out how widely the new coronavirus has spread, researchers hope to screen blood from many people for antibodies that would indicate previous exposure to the virus.

Meanwhile, Munster and his colleagues are conducting animal studies to learn how the virus produces illness and perhaps how to counter it. His group tried — and failed — to infect mice and ferrets, both common stand-ins for people in infectious disease studies. Rhesus macaques did get mildly to moderately ill when infected with the novel coronavirus.

These monkeys lost their appetites and developed fevers, goose bumps, rapid breathing and hunched postures, Munster reported. The virus damaged the monkeys' lungs but didn't show up in any other body tissues. The monkey study confirms that the coronavirus isolated by scientists really can cause disease.

To stop the virus, researchers first have to know how it damages the body. The monkey study begins to address that issue. After the monkeys were infected with the virus, the activity of 173 of their genes changed, Munster's group found. Many of those genes are known to fight viruses or produce inflammation. By day six of the infection, the monkeys were already starting to clear the virus out of their bodies, and the activity of all but 37 genes had returned to normal, Munster reported.

No therapies have proven effective against coronaviruses yet, said Eric Snijder, a molecular virologist at Leiden University Medical Center in the Netherlands. SARS was stopped by using old-fashioned quarantines. “We had to resort to 15th or 16th century techniques,” he said. “People who had the plague weren't treated much differently.”

Some antiviral drugs and vaccines were developed against SARS, but the virus disappeared before researchers got a chance to put the therapies through clinical trials. No one knows if the new coronavirus could be stopped by therapies directed against SARS. The new virus grabs onto a different protein than SARS did to gain entry into human cells, Marcel Müller of the University of Bonn Medical Center in Germany and colleagues reported in the January/February *mBio*.

Snijder and his colleagues are studying how the new coronavirus replicates. If they can figure it out, they may be able to design drugs to interfere with the process. ■

Back Story | VIRUS HUNTING

The discoveries made thus far about the new coronavirus have occurred thanks to serendipity and some public health sleuthing.

In June, Egyptian physician and microbiologist Ali Mohamed Zaki was working at a hospital in Jeddah, Saudi Arabia, when a 60-year-old man was admitted with a severe respiratory illness. After striking out on tests for the usual viruses, Zaki decided to see if he could find clues under the microscope. “If the patient had lived, I would not have worried” about identifying the virus, he said. But the patient died, so he persisted.

Zaki sent a sample to a lab in the Netherlands led by virologist Ron Fouchier (in the news recently for his work on H5N1 influenza, SN: 6/2/12, p. 20). Scientists there determined that it was a coronavirus in the same family as SARS. Meanwhile, Zaki had come to the same conclusion. “When I saw it was a coronavirus, I said, ‘this is something dangerous,’” Zaki said.

In September, Zaki posted a short description of the virus and the patient's symptoms on an online public health forum called ProMed-mail, and later described the patient and the details of the virus in the Nov. 8 *New England Journal of Medicine*.

Zaki's forum post proved interesting reading for Alison Bermingham of the United Kingdom's Health Protection Agency. Bermingham and her colleagues had been trying to identify an unknown virus that caused pneumonia and kidney failure in a 49-year-old Qatari man who was being treated in a London hospital. Tests confirmed that the man was infected with a coronavirus nearly identical to the one Zaki had described.

Scientists discovered later that the coronavirus had killed two people in Jordan in April. Researchers should test anyone with symptoms for signs of the virus, regardless of whether they have been to places where the virus is known, Bermingham said. — *Tina Hesman Saey*