GENES & CELLS

Giant virus pulled from permafrost

Scientists revive ancient, record-breaking microbe

BY MEGHAN ROSEN

After lying dormant in Siberian permafrost for 30,000 years, the largest virus ever discovered is just as deadly as it was when mammoths roamed the Earth.

The virus targets amoebas rather than humans. But thawing, drilling and mining of ancient permafrost could potentially unleash viruses that infect people, say the discoverers of the oversized microbe.

At 1.5 micrometers long, *Pithovirus sibericum* is 25 to 50 percent longer than the previous record holders and about 15 times as long as a particle of HIV. Though shaped like another type of giant virus, *P. sibericum* has a relatively tiny genome, scientists report March 3 in the *Proceedings of the National Academy of Sciences*.

"It's quite different from the giant viruses already known," says Eugene Koonin of the National Center for Biotechnology Information in Bethesda,

Md., who was not involved with the research.

The team was led by Jean-Michel Claverie and Chantal Abergel of Aix-Marseille University in France, who helped discover the world's first giant virus about 10 years ago. Dubbed *Mimivirus*, the microbe was so large that researchers could see it with a light microscope. Before the finding, Claverie says, "we had this silly idea that all viruses were basically very small."

Years later, the discovery of a few viruses resembling *Mimivirus* led researchers to believe that all giant viruses might belong to a single family. But last summer, Claverie, Abergel and coworkers uncovered a second, completely different family that includes the even larger *Pandoravirus*, scooped from the mud of a Chilean river and a pond in Australia (*SN*: 8/10/13, p. 19).

The team has rattled the field once again with the discovery of yet another family of giant viruses.

"Now, with this *Pithovirus*, we are totally lost," Claverie says. "It adds to the confusion."

After reading about a plant revived from 32,000-year-old Siberian permafrost (*SN*: 4/7/12, p. 15), Claverie, Abergel and colleagues went hunting for viruses in Siberia's frozen soil.

The team added samples of permafrost to dishes containing amoebas and then waited to see if the one-celled organisms died. They did. When the researchers looked at the dead amoebas under a microscope, they spotted lots of oval-shaped particles of the virus.

"Either we are very good, we are very lucky or there are many of them," Claverie says.

Now scientists don't know just how big viruses can get, Koonin says. "I would be excited but not terribly surprised if something even larger comes up tomorrow."

Because *Pithovirus* has survived for so long, Claverie says it's not hard to

BODY & BRAIN

Camels are likely source of MERS

Most animals tested in Saudi Arabia had signs of infection

BY BETH MOLE

Three-quarters of dromedary camels in Saudi Arabia have been infected with the virus that causes Middle East respiratory syndrome, or MERS, according to the most thorough survey of the animals there. The finding adds to mounting evidence that camels are a source of the deadly infections in humans.

In September 2012, health experts isolated the first human case of MERS

coronavirus, which was discovered in Saudi Arabia and is related to the SARS virus. Since then, the World Health Organization has reported 189 cases and 82 deaths while researchers have scrambled to identify a source of the infections. So far, scientists have found signs that camels and bats harbor the virus (*SN Online*: 8/8/13; *SN*: 9/21/13, p. 18), which causes severe pneumonia in humans.

Of more than 200 Saudi Arabian camels surveyed in 2013, researchers found that 74 percent showed signs of previous infections and around 25 percent had signs of active infections. In more than 250 archived samples of camel blood dating back to 1992, researchers found high rates of MERS exposure, from 93 to 100 percent, in every year represented.

Several research teams have found evidence of MERS in Middle Eastern camels over the last year. But the new study, published February 25 in *mBio*, confirms that the virus is common in camels in Saudi Arabia, which appears

to be the epicenter of the disease. The study is also the first to find signs of the virus dating back to the 1990s.

The study doesn't prove that camels passed the virus to humans, says epidemiologist W. Ian Lipkin of Columbia University. But, he adds, it shows that there doesn't need to be another animal source. Domesticated camels and camel meat are common in Saudi Arabia.

Lipkin and colleagues collected blood samples and nasal and rectal swabs from camels across the country. The team found that 95 percent of adult animals showed signs of past MERS infections, based on antibodies in their blood; only 55 percent of young camels had antibodies. But younger camels were more likely than adults to have fragments of viral genetic material in their noses, suggesting an active infection.

The team speculates that MERS is like the chicken pox of camels, with most animals getting the virus while they're young and then becoming immune. The camels

A dromedary camel stands in the Omani desert.

The largest virus ever discovered, the 1.5-micrometer-long *Pithovirus sibericum*, seen in this false-color electron microscope image, was roused from 30,000-year-old permafrost.

imagine that viruses harmful to humans can too.

But Koonin is not too worried about dangerous viruses escaping from the permafrost and infecting humans. “This is a completely far-fetched idea,” he says. There’s no evidence that long-frozen soil hides greater amounts of unusual viruses than other environments, he adds.

Koonin is more interested in what the find says about giant viruses. Scientists have only just begun to tap into their diversity, he says. ■

don’t seem to experience symptoms, so it’s hard to spot an infection, Lipkin says.

“Every camel I’ve ever seen has a runny nose,” he says. “It’s very difficult to tell if it’s unusually runny.”

Finding signs of MERS from the 1990s is important, says coronavirus researcher Matthew Frieman of the University of Maryland School of Medicine in Baltimore. “It shows that this virus has been in camels for longer than we expected.”

Virologist Chantal Reusken of Erasmus University Medical Center in Rotterdam, Netherlands, agrees. The disease could also have infected people much earlier than the first confirmed case. That theory could be tested using archived samples of blood and nasal swabs from humans, she says, which could clarify how the virus evolved and spread to people.

If studies confirm camels as the virus’ source, Lipkin says, the next step might be to develop a vaccine for camels that could curb the virus’ spread to humans. ■

HUMANS & SOCIETY

Evolution of dark skin reconsidered

Melanin could have protected early hominids from cancer

BY BRUCE BOWER

Common forms of skin cancer were Stone Age killers that prompted the evolution of dark skin among human ancestors in Africa, a controversial new analysis concludes.

Evidence gathered over the last 40 years shows that albinos in tropical parts of Africa and Central America, where people are constantly exposed to high levels of the sun’s ultraviolet radiation, frequently develop skin cancer and die young, says biologist Mel Greaves of the Institute of Cancer Research in London.

Early members of the genus *Homo* in Africa were probably pale skinned and spent a lot of time hunting and foraging in direct

sunlight, Greaves asserts. Researchers generally agree that the loss of most body hair helped hominids control body temperature in tropical savannas.

Nonmelanoma skin cancers probably killed many light-skinned early hominids before they could reproduce, he proposes in the April 22 *Proceedings of the Royal Society B*. Genes that produce dark skin capable of filtering UV radiation would have spread relatively quickly in populations that had much greater sun exposure throughout life than modern groups do.

“Skin cancer could have plausibly been the most potent selective force responsible for the emergence of black skin in ancient hominids,” Greaves says.

Other researchers have rejected the idea partly because skin cancer doesn’t kill many people today.

Ancient, largely hairless hominids probably had skin more like that of living African apes than like human albinos’, remarks biological anthropologist Nina Jablonski of Penn State. Apes’ pale

skin, when exposed to sunlight, develops enough protective melanin pigmentation to enable tanning similar to that of light-skinned people today. Apes possess a gene variant that makes tanning possible, while human albinos don’t. Early *Homo* species probably carried the gene and weren’t as prone to skin cancer as Greaves assumes, Jablonski says.

In her view, dark skin evolved in Africa around 1.2 million years ago to keep UV radiation from lowering the body’s levels of folate, a B vitamin necessary for fertility and development.

Greaves responds that albinos, despite lacking skin-darkening melanin, can tan with careful sun exposure. So as with African albinos today, tanning wouldn’t

have deterred fatal skin cancers in pale-skinned hominids, he argues. Albinos represent an imperfect but useful modern analog for ancient hairless hominids living in the tropics, he says.

African albinos in the tropics develop serious or fatal cases of squamous cell and basal cell cancer by their

African albinos often develop skin cancer at a young age, studies find.

early 30s, Greaves says. Several studies have concluded that less than 10 percent of albinos in equatorial Africa survive beyond their 30s, mainly due to skin cancer. Other investigations have found that nearly all Native American albinos living on islands off Panama develop skin cancers by young adulthood that are fatal without treatment.

Nonmelanoma skin cancer is usually treatable in pale, nonalbino adults. Greaves says that’s due to less sun exposure today — partly thanks to sunscreens — than earlier hominids had.

Studies have indicated that a gene needed to produce skin-darkening melanin appeared between 1.8 million and 1.2 million years ago in Africa. Genetic changes that lightened skin appeared as humans left the tropics at least 60,000 years ago.

Analyzing ancient DNA could clarify the timing of hominid skin color changes (*SN*: 2/22/14, p. 14). But DNA preserves poorly in tropical climates. ■