→ Mark your confusion.
→ Purposefully annotate the article (1-2 mature, thoughtful responses per page to what the author is saying)
→ Write a 250+ word response to the article.
(If you are a teacher or student who would like to modify this Google Doc, go to File > Make a Copy. I cannot and do not respond to Share requests -- my apologies!)

Why does the bubonic plague still exist?

By Jack Denton for *Pacific Standard*, via *The Week*, 02-23-19

Sniffles, coughing, fever, aches and pain, swollen lymph nodes, vomiting, and diarrhea. It's that time once more: The bubonic plague is again upon us.

Last month, a third cat in Wyoming was diagnosed with the plague, precipitating a warning from state health officials. Though the disease is most famous for causing the Black Death in the 14th century, the plague is still very much with us. According to the Wyoming Department of Health, about seven human infections occur in the United States each year. Globally, hundreds, at minimum.

All of these infections stem from one definitive sickness: the bubonic plague — the plague. Or rather, it's one of the three potential forms that the disease caused by the bacterium Yersinia pestis can take. Its name comes from the swollen lymph nodes, where infected cells, known as "buboes," tend to congregate. Plague caused by Yersinia pestis can also manifest as pneumonic plague, in which the infection is focused in the lungs, and can be spread by coughing airborne droplets. The final form is the truly horrific septicemic plague, in which the infection spreads to the blood, turning body tissue a frostbite black.

Our world is filled with so many plagues — bubonic, sure, but also locusts, the flu, climate change, Starbucks, Twitter — but few have had as severe an impact as the plague. "Bubonic plague is by far the most common, and the most iconic plague," both historically and now, says David Markman, a biologist who will receive his PhD from Colorado State University next month.

According to University of Oslo biologist Nils Christian Stenseth no other documented disease outbreak comes close to the lethality of the Black Death, which killed off 50 percent of Europe's population at the time — hundreds of millions of people. The Plague of Justinian killed tens of millions of people around the rim of the Mediterranean Sea nearly a millennium before the Black Death, and a third pandemic spread globally from China's Yunnan province at the turn of the 20th century. Historical records document numerous smaller plague outbreaks between these larger pandemics.

And that same bubonic plague has been chronic up through today. Until recently, there was debate over whether the contemporary plague caused by Yersinia pestis was even the same disease as the plagues of the past. The evidence was long limited to similarity in description, from admittedly constrained records. However, researchers, including Stenseth's team, have been able to use genetic testing to prove that the plague is the plague. "By looking at carcasses, skeletons that are known to have died from what they called the plague during the Black Death, they have found the Yersinia pestis, the same bacterium, there," he says. "That discussion is settled."

In the U.S., plague cases dot the West, but nowhere else. These areas tend to be more rural than the plague-free East, but Markman says this is probably coincidental. While the exact causality of the disease's geographic concentrations is not yet settled science, Markman points to average soil moisture and the presence of burrowing rodents like prairie dogs as potential factors. Stenseth, too, believes the answer may lie in the dirt, a factor that might be related to the evidence that climate change is increasing outbreaks in some areas, and decreasing them in others. "My hunch is that might be something about the soil properties, that it's not too dry, but it's not too wet either, very humid," Stenseth says. "It always occurs in rodent species, typically in a burrowing species. These colonies are usually quite humid. But I don't know, and the scientific field doesn't know."

Beyond the handful of annual infections that occur in the western U.S., the plague is still a significant contemporary problem, especially in developing nations with a particular mix of climate conditions. Globally, thousands die of it each year. In 2017 and 2018, Madagascar experienced a particularly virulent outbreak of pneumonic plague — the form enabling rapid human to human spreading — with thousands of infections and hundreds of deaths. Central Asia, Northern China, and parts of South America experience minor outbreaks every year. "We should be aware that this is not just a historic thing. It's

happened plenty in the last century. Plague is occurring all over the world right now," Stenseth says.

Markman points to the relative inaccessibility of antibiotics and other medical care in Madagascar, as well as differences in hygiene, as major factors for the outbreak. Stenseth highlights Madagascar's risk factors as reasons that most of the world should not fear an outbreak. "If it is true, as I believe, that human ectoparasites" — fleas and lice — "play a key role, then if you get rid of the ectoparasites, you get rid of the disease too." (Even the Black Death, which was long blamed on rats, was probably mostly spread by fleas alone, according to Stenseth.)

This is the thing about plague. While humans get the disease, it's not really ours. "You have to remember, always remember that plague, although we are concerned with it because of the human cases, is really a wildlife disease," Stenseth says.

The vast majority of cases occur among animals — rodents and fleas, mostly — many of which go undiscovered by humans. "This is one of the hurdles we face with plague, because it is maintained in wildlife populations and then spills over into humans," Markman says. "So that makes studying it a bit different."

That animals carry the disease may answer the question of why the plague has persisted for so many centuries, even during periods without mass human outbreak. "Whether it's being maintained at low levels in animal populations, and the low level eludes our detection, or whether the bacteria are maintained in a different [kind of] reservoir that just harbors it for long periods of time, we don't know," Markman says.

Markman's research has focused on the possibility that plague bacteria might be stored in amoeba cells, hiding out and planning the next big outbreak. His lab has shown that Yersinia pestis can survive and multiply within amoeba, but, in the wild, plague-filled amoeba have yet to be discovered. Were Markman's hypothesis correct, it would mean that plague-amoeba are sometimes ingested by a rodent or flea, and then kicked back into the infection cycle.

Markman says that hundreds of other human and animal pathogens have proven capable of spreading through amoeba this way, including legionnaires' disease and leprosy. "A comparison I like to use is of a Trojan horse," he says. "So the potential of amoeba to act as a long-term reservoir for these pathogens is concerning both from a public-health perspective, but also from a biosecurity perspective."

Concerning, perhaps. But bio-attack is not likely, at least according to Stenseth. Although he notes the Soviet Union's Ministry of Defense studied the plague bacterium closely for half a century, and that the Japanese spread plague-infected fleas over China during World War II by air cannon, he says, "the plague is not a very efficient agent for doing bio-terror. It has a very low occurrence among rodents, and it is very hard to spread."

Still, for Stenseth, the accidental cases of plague that still persist globally are terror enough.

Response option(s):

- How does this article’s treatment of the bubonic plague compare to your historical understanding of the same disease?
- What new facts surprised you from this article, and why might they be important?
- Pick any passage and respond to it.