

PLAQUE ON OUR SHORES

The outbreak of plague in 1899 was one of the most dramatic public-safety disasters in Hawaiian history. Two invasive species were responsible for the spread of this terrifying disease: rats and fleas.

(Stage directions indicated in CAPITALS.)

Act I: Infection

ACTOR A: On Oct. 20, 1899, the freighter America Maru unloaded rice and other foodstuffs at the wharf in downtown Honolulu. The cargo sat on the pier for a few weeks.

ACTOR B: As December rolled around, dockworkers began noticing wharf rats behaving strangely.

ACTOR C: The rodents were venturing out in the daylight, and dying in agony. Not just a few. Hundreds of rats littered the pier.

ACTORS A, B, C, & E: IMITATE RATS; STUMBLE AND DIE IN AGONY.

ACTOR D: Workers shrugged and swept the dead animals off into the harbor. Good riddance.

ACTOR D: SHRUG AND SWEEP RATS AWAY.

ACTOR C: SCRATCH FLEA BITE.

ACTOR E: A few blocks away at the Wing Wo Tai grocery, You Chong scratched at a flea bite.

ACTOR A: That bite carried the bubonic plague, otherwise known as Black Death.

ACTOR B: A week after the fleabite, Chong's temperature skyrocketed to 105 degrees. Plague bacteria multiplied in his bloodstream. They settled into his liver, spleen, kidneys, lungs, and brain.

ACTOR C: SHIVER, SHAKE, CONVULSE, AND BREATHE IN GASPS.

ACTOR B: Chong began to shiver.

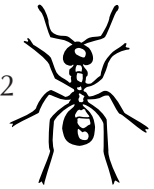
ACTOR D: His pulse raced like a runaway locomotive. His breath came in gasps.

ACTOR E: The lymph nodes in Chong's thighs, neck, and armpits began to swell.

ACTOR C: GRAB THIGHS, NECK AND ARMPITS IN PAIN.

ACTOR A: The swellings, called buboes give bubonic plague its name. Within hours, they grow to the size of tangerines. They turn black as blood pools beneath the skin.

ACTOR B: Black Death is aptly named.



ACTOR D: Within three days, Chong died.

ACTOR C: DIE IN AGONY.

ACTOR B, D, & E: EXAMINE DEAD BODY WITH CONCERN AND HORROR.

ACTOR A: Horrified doctors examined his body. They knew that the most feared disease in human history had come to Honolulu.

Act II: History of the Black Death

ACTOR A: Black Death swept across the globe in three waves. The first pandemic, known as the Justinian Plague started in the year 541. It began in Egypt and spread throughout the Middle East and Mediterranean, killing 70,000 people—one thousand victims a week.

ACTORS A, C, D, & E: COLLAPSE AND DIE.

ACTOR B: Later, in the 1340s, a second wave of horror devastated Europe. Entire cities fell ill and died. Pyres burned without ceasing. Wagons piled with swollen bodies creaked through narrow streets.

ACTOR C: PUSH WAGON AND CRY: “Bring out your dead! Bring out your dead! Bring out your dead!”

ACTOR D: In just five years, 25 million Europeans—a third of the population—fell to Black Death. By the year 1400, 40 million were dead.

ACTOR E: The horror rattled Western culture to its core.

ACTOR A: Hawai‘i was hit during the third wave of bubonic plague, which began in 1890. Over ten years, the disease infected China, Japan, India, and Southeast Asia. Twenty million people died. Eventually Black Death crossed the Pacific and flared up in San Francisco, stopping in Honolulu on its way.

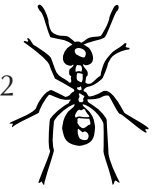
ACTOR B: By 1899, humankind had the tools of science to combat the disease. If scientists could identify what caused the Black Death and how it spread, they could stop its terrible fate.

ACTORS A, B, D, & E: FOCUS MAGNIFYING GLASS, SCRIBBLE NOTES, AND SCRUNCH EYEBROWS IN CONCENTRATION.

ACTOR C: Scientists identified the bacteria that caused plague: *Yersinia pestis*.

ACTOR D: Under a microscope, the bacteria looks like rice musubi.

ACTOR E: Scientists learned that rats contracted the disease. Large numbers of dead rats often preceded a plague epidemic in humans.



ACTOR A: But the no one knew yet that fleas spread the disease from rats to humans.

ACTOR E: Meanwhile, within hours of You Chong's death in Honolulu, four more victims were diagnosed with bubonic plague. They too died. All were residents of Honolulu's Chinatown.

ACTORS B, C, D, & E: CONVULSE, GASP, AND DIE.

ACTOR A: The Hawaii Board of Health sent inspectors to investigate Chinatown. What they found shocked them.

ACTOR B: The neighborhood was a bustling business district, but it was also overcrowded and un-sanitary.

ACTOR C: More than 7,000 residents were crammed into Chinatown's fifty acres at the turn of the century, in an era when no building rose above two stories.

ALL ACTORS: SQUISH TOGETHER LIKE SARDINES.

ACTOR D: Many were Japanese immigrants renting from Chinese landlords, who in turn paid Hawaiian and haole landowners.

ACTOR E: The neighborhood was bursting with shanty buildings, chicken coops and livestock corrals.

ACTOR A: Sewage and garbage overflowed into the streets. The outdoor toilets reeked. The alleys swarmed with rats, maggots, flies, lice, and cockroaches.

ACTOR B: It was the perfect environment for the plague.

Act III: Rapid Response

ACTOR A: Board of Health officials swung into action. That same day, on Dec 12th, 1899, they quarantined Chinatown and posted guards around its edges.

ACTORS B, C, D, & E: STAND GUARD WITH IMAGINARY RIFLES.

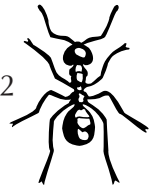
ACTOR B: They built a temporary hospital, camp, and crematorium outside of town on Sand Island.

ACTOR C: Anyone showing signs of plague was immediately moved to the hospital.

ACTOR D: Anyone who had been in contact with a plague victim was sent to live in the temporary camp.

ACTOR E: Those who died were quickly cremated.

ACTOR A: The Board deputized private citizens to locate plague victims. Deputies raided private



homes, and sprayed the insides with lime to disinfect them.

ACTOR B: They destroyed outdoor toilets, and dug new cesspools. They ordered residents to dump their rubbish and belongings into the street to be burnt.

ACTOR A: KNOCK DOWN DOOR & SEARCH FOR PLAGUE VICTIMS. ACTOR C: SPRAY LIME ON WALLS. ACTOR D: TORCH BELONGINGS. ACTOR E: DIG CESSPOOLS.

ACTOR C: Schools were closed. Marine traffic, the main artery of business in the Islands, came to a halt.

ACTOR D: The Board of Health closed the port of Honolulu to incoming and outgoing ships. No vessel could leave Honolulu Harbor without clearance from the Board.

ACTOR E: Foreign ships were ordered to stay offshore. Shore leave for sailors and passengers was cancelled.

ACTOR A: After one week, if no cases of plague developed onboard and no contact had been made with land, a vessel was declared plague-free and allowed to sail away.

ALL ACTORS: BLOW KISSES AND WAVE BON VOYAGE.

ACTOR B: Ships already docked at the wharf weren't that lucky. They were ordered to move six feet away from the dock, grease their mooring lines, and attach rat-guards on lines anchored to the shore.

ALL ACTORS: PULL ON IMAGINARY ROPES, GREASE LINES.

ACTOR C: Cargo was exchanged via shuttlecrafts, to minimize contact with land. Exports were inspected to insure that they were plague-free. Imports were taxed to pay for quarantine costs and rat extermination.

ACTOR D: A week passed without any new cases of plague in the city. Many were hopeful that the disease had been caught early enough to prevent a general outbreak.

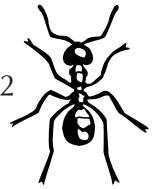
ACTOR E: Meanwhile, Chinatown residents trapped by the quarantine grew impatient. They wanted access to fresh food and supplies, and the ability to move freely.

ACTOR A: Business owners were losing money; they wanted their shops re-opened.

ACTOR B: Ship captains were anxious to get back to their home ports.

ALL ACTORS: ACT IMPATIENT, DEMAND END TO QUARANTINE.

ACTOR C: Under pressure from the business sector, the Board of Health lifted the quarantine at noon on Dec. 19th. Everyone was relieved.



ACTOR D: But...over the days leading up to Christmas, several more people died. Their terrifying symptoms could not be ignored.

ACTOR E: The Black Death was still alive in Honolulu.

Act IV: The Great Chinatown Fire

ACTOR A: The Board of Health reinstated the quarantine. This time they decided to burn down contaminated households and stores.

ACTOR B: Personal belongings and commercial goods that could be easily moved were sprayed with lime and moved to a warehouse. Everything else was burned.

ACTOR C: A government photographer took pictures of each building and its contents. Then it was set alight.

ACTOR A: TAKE PHOTOS OF BUILDINGS, ACTOR B: SET HOUSE ON FIRE.

ACTOR D: Inhabitants were forcibly moved to the hospital or detention camp.

ACTORS A & D: DRAG B & C OUT OF HOUSE. SPRAY THEM WITH LIME. IF THEY RESIST, THREATEN TO ARREST OR SHOOT THEM. TORCH HOUSE.

ACTORS B & C: RESIST QUARANTINE. SOB OVER BURNING HOUSE.

ACTOR E: Honolulu firemen sprayed nearby buildings with streams of water.

ACTOR A: Soldiers and police kept crowds in line and watched for looters.

ACTORS A & D: ACT AS SOLDIERS.

ACTOR B: Chinese residents felt unfairly targeted. They accused the Board of Health of racism and demanded compensation for their burned homes and belongings.

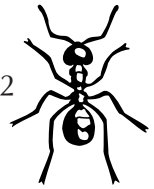
ACTOR C: Although thousands of Hawaiian and Japanese were affected by the quarantine and burnings, Chinese-owned businesses absorbed the brunt of property damage.

ACTOR D: The newspapers kept track of the burnings with maps. Lists of the dead were updated daily.

ALL ACTORS: CHECK NEWSPAPERS FOR DEATHS.

ACTOR E: By late January, dozens of people had passed away.

ACTOR A: The new crematorium on Quarantine Island blazed day and night.



ACTOR B: On the morning of Jan. 20th, firemen were conducting a controlled burning when the wind scattered embers across neighboring rooftops.

ACTOR C: The wooden roof of Kaumakapili Church, the tallest building in the area, erupted into flame.

ACTOR B: Like blazing dominos, one after another, buildings began to ignite.

ACTOR C: Wetting the buildings made no difference; water evaporated instantly in the heat of the firestorm.

ACTOR D: Merchants frantically tried to drag their goods out of storefronts.

ACTORS A & B: FRANTICALLY DRAG GOODS OUT OF STORE. ACTORS C & D: STOP

ACTORS A & B WITH RIFLES.

ACTOR E: Chinatown was ablaze, and yet it was still a quarantine zone. As buildings exploded around them, police prevented citizens from fleeing.

ACTOR A: The inhabitants were trapped.

Act V: An End to the Plague-We Hope

ACTOR A: By mid-afternoon, more than 4,000 Chinatown residents were locked up on the grounds of Kawaiahao church, a stone building that survived the fire.

ALL ACTORS: HUDDLE TOGETHER LOOKING SAD AND SCARED.

ACTOR B: Luckily the flames burnt themselves out before the entire population was seized by panic.

ACTOR C: No one died in the fire, but Chinatown was reduced to ashes.

ACTOR D: As night fell, the city struggled to cope with the huge number of homeless refugees.

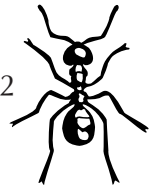
ACTOR E: There was a silver lining: the breeding grounds for rats and fleas vanished in the flames.

ACTOR B: Unfortunately, Honolulu's quarantine had been lifted prematurely. Infected ships carried the plague to the neighbor islands.

ACTOR C: Starting in January of 1900, several people on Maui, Kauai, and the Big Island contracted the plague.

ACTORS A, B, C, & E: CONVULSE & DIE.

ACTOR D: On Maui, like on Oahu, the deaths were concentrated in the Chinatown district. Officials



decided to burn the Kahului Chinatown to the ground.

ACTOR E: That kept the plague from erupting as an epidemic, but did not eliminate the disease entirely.

ACTOR A: Over the next five decades, random cases of bubonic plague would show up around the Islands.

ACTOR B: The Chinese population in Hawaii never recovered. The numbers of Chinese continued to slip over the years, from 20 percent of the population to less than 5 percent in the 1990 census.

ACTORS A, C, D, & E: PACK UP YOUR BAGS, PUT ON YOUR HAT, AND BOARD BOAT BACK TO CHINA. WAVE GOODBYE.

ACTOR B: WAVE GOODBYE TO YOUR FRIENDS & FAMILY WHO ARE LEAVING.

ACTOR C: According to a report published in the early 1930s, 337 people in Hawaii were known to have contracted bubonic plague. Only 34 survived. This 95 percent death rate is high, even for Black Death.

ACTOR D: The last human case of plague in Hawaii was documented in 1947 in Kamuela.

ACTOR E: Authorities routinely test Honolulu's wharf rats for plague, because a new outbreak could occur at any time.

ACTORS A, B, C, & D: COLLECT RATS AND TEST THEM FOR DISEASE

ACTOR A: The Black Plague still roams the earth. It is rampant in the wild rodent population of the Western United States. Infected fleas can live for weeks after their host dies.

ACTOR B: According to the National Science Foundation, bubonic plague is on the rise, as well as other rodent-borne pathogens such as hantavirus.

ACTOR C: Campers and hikers should avoid sites where animals have suddenly died en masse.

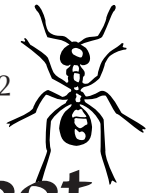
ACTOR D: In 2012, a young girl contracted bubonic plague while camping in Colorado.

ACTOR E: Luckily, no one has to die from the plague today. It can now be treated with antibiotics.

ACTOR A: But Black Death has not gone away. The plague bacterium is still part of our global environment.

ACTOR B: Out in the wild, the disease is biding its time, quietly mutating with infinite patience.

ACTOR C: An antibiotic resistant strain may one day appear on our city streets.



Plague on Our Shores Worksheet

As an audience member, what character were you? (circle)

ship captain, ship passenger, doctor, epidemiologist, Chinese merchant, Hawaiian landlord,
lawyer, fireman, church pastor, schoolteacher, pregnant mother, plague victim, crematorium
operator, other _____

Describe what happened in each act and your reactions:

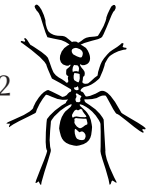
Act I:

Act II:

Act III:

Act IV:

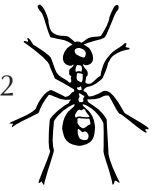
Act V:



List at least five steps the Department of Health took to prevent the spread of the bubonic plague in Honolulu.

What kind of resistance did the Department of Health encounter?

What long-term effects did the bubonic plague outbreak have on Hawai‘i?



Rat Lungworm Disease Fact Sheet

Rat lungworm (*Angiostrongylus cantonensis*) is a parasitic worm transmitted between rats and mollusks, including slugs or snails. When humans ingest an infected snail or slug — or even the slime left by these creatures — they can contract angiostrongyliasis, or rat lungworm disease.



Rat lungworm (Angiostrongylus cantonensis) larvae burrow into nervous system tissue after they are consumed by humans. Photo courtesy of: Center for Disease Control

People react differently to rat lungworm infection. Some do not have any symptoms, and others have only mild symptoms for a brief period of time. Severe cases can result in coma, brain damage, and death.

The parasite's lifecycle: Adult worms lay eggs inside the lungs of a rat. These eggs hatch into larvae, which are then coughed up from the rat's lungs and swallowed back into its stomach. The larvae are expelled in the rat's feces, which slugs or snails (and sometimes freshwater prawns, crabs, and frogs) feed on. A second rat eats one of these parasite-infected mollusks. The parasites travel through the rat's bloodstream to mature in its lungs and the lifecycle repeats itself.

When humans accidentally consume rat lungworm larvae, the parasites cannot finish their lifecycle. They burrow into the tissue of the nervous system, including the brain. The body's immune system mounts a defense against the invasion. This response causes inflammation and swelling around the brain and the spinal cord, a condition known as meningitis. Common symptoms of meningitis include: severe headaches, skin tingling and sensitivity, stiffness in the back and neck, sensitivity to light, hallucinations, nausea, and vomiting.

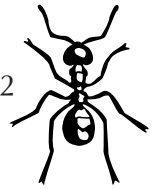
Rat lungworm disease is extremely rare worldwide. It has been documented in Asia, the Caribbean, and the Pacific Islands, including Hawai'i. Cases in the continental United States have been linked to travel to those parts of the world. The parasite has likely been spread by rats on ships and by the introduction of mollusks.

Rat lungworm disease was first found on Oahu in 1958. But between 2004 and 2011, at least ten cases were reported on the island of Hawai'i. The spike in the disease corresponds to the introduction of the semi-slug *Parmarion martensi* to Hawai'i in 2004. (Semi-slugs are in between slugs and snails; they are mollusks with thin, insubstantial shells.) *Parmarion martensi* is particularly susceptible to rat lungworm infection; as it begins to dominate the slug habitat in Hawai'i, the prevalence of the disease increases.

Parmarion martensi is not yet known to be established on Maui. It is a high-priority for prevention through inter-island quarantine, along with other invasive pests such as coqui frogs and little fire ants. Like the little fire ant, the semi-slug is occasionally intercepted amidst the large quantities of cut *ti* leaves sent to Maui from the Big Island for *luau* decorations at Maui hotels.



The semi-slug Parmarion martensi is a prime carrier of rat lungworm parasites. Photo courtesy of Digital Taiwan



Slugs can be clear and less than an inch long, making them hard to spot. Each one can carry thousands of worms. Slugs may leave parasites in their slime trails, contaminating countertops, cooking utensils, and even toothbrushes.

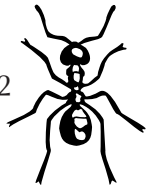
To prevent rat lungworm infection: Regularly disinfect cooking surfaces, utensils, and any areas that might be infested with slugs. Use protective gear (gloves and/or tongs) when handling infected rats, slugs, or other animals. Seal slugs in a plastic bag so that their slime will not be spread.

Most importantly, take time to decontaminate fruits and vegetables before eating. Examine produce before washing. Remove any dirt, debris, insects, snails, or slugs. Discard leaves that might have been damaged by snails or slugs. Clean raw vegetables and fruits well before peeling, cutting, eating, or cooking. Wash produce under a cold-water spray and then soak for 1-2 minutes. Use a vegetable brush for produce with thick skin (melons, cucumbers, winter squash, citrus, potatoes). Waxy-skinned citrus fruits and cucumbers also may have pathogens sticking to the outside peel. With bunched fruit (blueberries, grapes, raspberries, strawberries, and similar fruits) spray or rinse in a colander with cold water. Remove all visible dirt and blot dry with a paper towel.



Snails and slugs can hide in the folds of lettuce. Wash your vegetables thoroughly!

*Photo courtesy of:
University of Massachusetts*



Rat Lungworm Disease Response Strategy

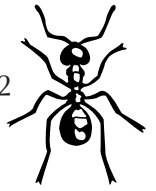
Whenever public health is threatened, government officials are expected to respond quickly and efficiently. Hopefully a response strategy has been agreed upon in advance, so that emergency staff can get to work without delay. Sometimes, as was the case with the plague, officials have to act without knowing critical details—such as how the disease was transmitted. Use what you learned about the 1899 plague epidemic to create a response strategy for a modern outbreak of rat lungworm disease.

Are quarantine measures for sick patients required? Why or why not?

Do any invasive species need to be controlled? If so, which ones? What methods will be used to control them?

What kind of expertise is needed to respond to this emergency? Which agencies need to be involved?

What kinds of decontamination procedures are necessary?

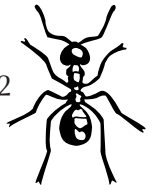


List equipment that will be needed:

What is your general plan? Describe steps to be taken.

When and for how long will the plan be implemented?

What information will be shared with the public? How and when will the public be alerted?



Disease Diagnosis Chart

A group of friends arrived in the emergency room complaining of various symptoms—some quite serious. It's too much of a coincidence that they all became sick simultaneously. You suspect that they are victims of a mysterious epidemic. Use this chart to diagnose them as a group. If any member of the group has the symptom described, assume they all could have it and proceed to the next symptom.

Question #1:
Do patients have severe headache?



YES: Could be caused by many ailments.
Continue to question #2 to narrow it down.

NO: No diagnosis.

Question #2:
Are patients suffering from nausea? Vomiting?



YES: Continue to question #3.

NO: Diagnosis: dehydration.

Question #3:
Are patients experiencing sensitivity to light? Hallucinations?



YES: Continue to question #4.

NO: Diagnosis: Influenza.

Question #4:
Are patients experiencing skin tingling or numbness?



YES: Continue to question #5.

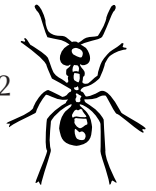
NO: Diagnosis: Possible drug overdose.

Question #5:
Do patients have severe stomach cramps and muscle spasms?



YES: Continue to question #6.

NO: Diagnosis: Migraine.



Question #6:
Do patients have diarrhea?



YES: Diagnosis: Food Poisoning.

NO: Continue to question #7.

Question #7:
Do patients have inability to urinate?



YES: Diagnosis: Meningitis, continue to question #8 to determine type and cause.

NO: Diagnosis: Viral meningitison.

Question #8:
Were patients exposed to raw vegetables?



YES: Diagnosis: Parasitic meningitis, caused by rat lungworm infection.

NO: Diagnosis: Bacterial meningitis, caused by pneumococcus.