
**A column exploring the real-life details of police work.**

## Microscopic Murder

Knives and guns pale in comparison to the instruments of death that are nearly invisible to the human eye. These tiny, but deadly, microorganisms can destroy every organ, and they can shut down the body's entire operating system.

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### Bioterrorism and Germ Warfare

The threat of a biological attack looms over the heads of our government officials. A minute amount of one of these viruses or bacteria can be cultured and multiplied, many times over. The process is simple, and the organisms are much easier to obtain than they should be, despite stringent government regulations imposed since the 9/11 terrorist attacks on the United States.

Government employed or sponsored scientists who possess and work with potentially deadly organisms are required to maintain a current government security clearance. To obtain that clearance, they, as did I (Denene), undergo an extensive application process and security risk assessment.

Scientists responsible for the handling and testing of dangerous toxins and hazardous agents submit a copy of their fingerprints to the FBI's Bioterrorism Security Risk Assessment Module E-3. The fingerprints are entered into AFIS (Automated Fingerprint Identification System) and electronically compared to the national database of all known criminals.

Once cleared, scientists are free to order bacteria and viruses (a k a "bugs") from biological resource centers. These repositories maintain large inventories of some of the deadliest microbes known to man. Microorganisms are normally shipped from the companies to the scientists as freeze-dried samples. The chance of a terrorist stealing a package containing smallpox or anthrax is unlikely, but possible.

Microbiology laboratories are classified according to the types of infectious agents and toxins to be studied. The Center for Disease Control (CDC) established four laboratory biosafety levels (BSL) which specifies the type of agents that can be safely handled within a particular lab.

The lowest safety level is Biosafety Level 1 (BSL-1). In this type of lab,

anyone with minimal skill and supervision may work with organisms that do not cause disease in humans. An example would be an entry-level college microbiology laboratory. Work in a Level 1 lab requires no special safety equipment or extra safety barriers.

Next is the BSL-2, where scientists need specialized training, since organisms known to cause human disease (i.e., pathogens) are studied in these labs. Hospital laboratories where human blood, tissues, or body fluids are handled are BSL-2 labs. At this level, labs must have a secured, locked entrance and the CDC requires personal protection equipment (gowns, gloves, face shields) and waste contamination equipment.

In a BSL-3, scientists conduct experiments on agents with a potential for respiratory transmission of dangerous or even lethal, infections, such as tuberculosis. Access to these labs is restricted and testing is performed in enclosed equipment in a negative-pressure room.

Great technique, skill, and high-level training are required to work in a BSL-4. There are only a handful of these labs in the entire United States. The pathogens there are easily transferred by aerosol and are usually lethal, since there may not be an effective treatment or vaccine available for them, anywhere. This includes diseases such as Ebola (hemorrhagic fever).

Airtight, full-body, pressurized protective "space suits" with dedicated air supplies are essential when working inside a BSL-4 lab. Don't forget the decontamination shower on your way out.

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**Growing and Tracking Cultures**

Scientists grow bacteria (cultures) on an agar plate, a sterile petri dish that contains a growth medium, or in a nutrient broth inside an incubator. Cultures are stored in a sub-zero freezer or in liquid nitrogen until ready for research to begin.

Scientist are obligated to maintain accurate records and account for each organism. However, since they receive only small amounts of microbes from repositories they must multiply that pathogen, and they do, thousands of times. As a result, it is difficult to know how much bacteria each scientist has cultured. Therefore, auditors may find it challenging to determine if any material is missing.

Someone with ill intentions could use a cotton swab to scrape a minute portion of frozen culture from a vial, and then start the process of multiplying the bacteria or viruses. They could repeat the process as many times as they desire. Once the organisms have grown sufficiently, terrorists, for example, could combine them with an aerosol propellant and deliver them to an unsuspecting person, or an entire population. The results could be devastating. This procedure can be performed anywhere, at any time, in any home or backyard garden shed in America.

Scientists frequently visit one another to keep abreast of all the latest ideas, testing equipment, and procedures. They may exchange information and even obtain organisms off the record and return home carrying the borrowed microbes in a vial, a travel style microbiologists call VIP, an acronym

meaning "Vial In Pocket." VIP travel is used to avoid tight government restrictions and intensive paperwork.

Scientists with ill intentions could travel to other labs to swab bacteria, such as *Bacillus anthracis*, place the swab in a plastic vial, and then return home on the plane "VIP" while seated next to unsuspecting passengers. Vials could be disguised as tubes of lipstick, or the organisms could be incorporated into tubes of toothpaste.

Once they're back in their own labs, they can begin the multiplication of the swabbed microbe for use as a bioweapon.

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## Potential Threat Agents:

### Anthrax

Anthrax is caused by the bacterium *Bacillus anthracis*. The bacteria thrive in a natural habitat and can infect animals such as cows.

Anthrax may be delivered to intended victims as a powder, such as in the cases of letters delivered to elected officials. The most effective way, however, to deliver anthrax is in aerosol form. When bacteria are inhaled, the disease progresses so rapidly that, once the symptoms begin to show, it is most likely too late to prevent a person's death. Some symptoms of anthrax exposure may be fever, fluid in the lungs, difficulty breathing, nausea, diarrhea, and bleeding. Anthrax infection is not a contagious disease, and it cannot be passed from one person to another.

Anthrax study requires that the work be conducted in a BSL-2 laboratory; however, if the study is to be performed on anthrax in aerosol form, a BSL-3 lab is required.

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### Tularemia

Tularemia *(Francisella tularensis)*, or rabbit fever as it's commonly called, is no stranger to the United States. After its discovery in 1911 in Tulare, California, the disease became known as a killing machine. It killed many ground squirrels before finding its way into humans who handled the infected animals or ate undercooked meat. Ticks and deer flies can transfer the sickness to humans through their bites.

Since it is possible to transform the tularemia microbe to an aerosol form, the plague-like disease could be used as an effective biological weapon.

Killers in mystery novels and stories might find tularemia an efficient means to murder their victims since pathologists and toxicologists do not routinely screen for it during autopsy. Tularemia is not easily detected by doctors.

The use of tularemia in germ warfare is not new to the military. In 1932 and again in 1945, the Japanese studied using tularemia as a possible biological weapon. Around this same time, the U.S. military also conducted their own experiments with the bacteria.

Thousands of Soviet and German soldiers serving on the Eastern front during WWII succumbed to tularemia. There is some speculation that the

disease was introduced to them intentionally.

Like anthrax, tularemia study requires a BSL-2 or BSL-3, depending on the type of experiments.

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## Botulism

Now for a true story. It wasn't murder, just an unfortunate accident that involved a woman, some green beans, and a home canning jar. Canning jars have lids designed to exhibit a slight indentation in their centers when food is fresh. If the indentation inverts (pops up), the vegetables may be contaminated, and should be discarded.

A woman who was preparing dinner for her family decided to serve some of her home-canned green beans that evening. She picked up a jar of beans but thought the pop-up didn't look quite right. So, to satisfy her curiosity she opened the jar, touched her finger to the bean juice, and tasted it. It tasted fine to her, so she cooked the beans and served the steaming hot dish to her family. The next day the woman died, but her family survived. The beans contained botulism toxin produced by the bacteria, *Clostridium botulinum*.

Why didn't the other members of the family die? The toxin is inactivated by heat, and they consumed cooked beans. The woman, however, sampled the uncooked product containing active toxin.

Botulism toxin is one of the most powerful neurotoxins known to man. About twenty aerosolized ounces could kill everyone on Earth.

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## Ebola

Ebola, or Ebola hemorrhagic fever, is a disease that is often fatal to humans and other primates, such as gorillas and monkeys. The disease is caused by the Ebola virus and can be spread by direct contact with the blood, or other body fluids, of an infected person. Ebola is normally contained within the continent of Africa.

Symptoms of an Ebola infection are fever, pain, diarrhea, vomiting, rash, red eyes, and both internal and external bleeding.

Terrorists would most likely use an aerosol to deliver the Ebola virus. A murderer could use a syringe to inject the virus into their victim.

Ebola requires the highest biosafety level protection, a BSL-4.

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## Ricin

Ricin is a toxic protein that's derived from the seeds of castor beans. Castor beans are used to make castor oil, a substance that's used to ease constipation and sometimes to induce vomiting. Ricin is produced from the waste that's left over after castor oil is processed.

An accidental exposure to ricin would be a highly unlikely event; therefore, someone who dies from exposure to it has likely been murdered. Symptoms of ricin poisoning vary depending upon how the toxin is introduced into the body (injection, inhalation, ingestion).

In 1978, Bulgarian writer Georgi Markov was attacked by an umbrella

wielding man. The tip of the specially designed umbrella was rigged to inject a pellet containing ricin. Markov experienced organ failure and internal bleeding and died shortly after the attack.

There is no antidote for ricin poisoning.

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### COVID-19

You need only to look to the events of the most recent pandemic to get an understanding of why microorganisms have been used as biowarfare agents. Look how quickly COVID-19 spread across the globe and the devastation it caused. As bad as it was, though, it could have been much, much worse.

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the agent responsible. Before the pandemic, I (Denene) and other microbiologists were familiar with the coronavirus family of diverse but related viruses. On one end of the disease spectrum are coronaviruses that cause the common cold. Somewhere in the middle, COVID-19. But on the other end of the spectrum is the coronavirus causing Middle East respiratory syndrome (MERS). It has an alarming fatality rate of approximately 33%.

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## Availability of Pathogens and Toxins

The pathogens and toxins listed above are all available to research scientists, college and university laboratories, medical facilities, pharmaceutical companies, biotech companies, and hospitals.

Terrorists, foreign or domestic, could work in any of these facilities and, if they do, they have access to any of these deadly agents. At any given time, an employee could take home a vial from their workplace and begin culturing the destruction of humankind.

Likewise, a disgruntled worker, an angry wife, a jealous husband, or a serial killer with a desire for a new method to commit murder could do the same. After all, killing with microbes is much neater than using a gun or knife.

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### Interesting Facts

- Diseases that can be spread from animals to humans are called zoonoses.
- For every cell in your body, there are about ten bacteria.
- You cannot catch a cold from a dog.
- Bubonic plague has killed more people than WWI and WWII combined. The three major epidemics in recorded world history killed 137 million people.
- In 1979, nearly seventy people died from anthrax. It is believed that the disease was spread from an accidental release of spores into the air from a military base.
- If you get a Botox jab for wrinkles, you will be injected with a small amount of botulism toxin to paralyze your facial muscles.
- Microorganisms are natural-born killers. They are responsible for more deaths than cancer, heart attacks, and war.

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## Bioterrorism, a Challenge for Law Enforcement

Microscopic murder presents unique challenges for law enforcement since proactive policing—preventing crime rather than reacting to crimes that have already happened—is the preferred approach to protecting the public. But how do you stop something you can't see?

To make matters even more challenging for investigators, biological material and bioterrorism-related information is readily available, for sale, on the darknet/dark Web, an unregulated, "anything-goes" secretive area of the Internet that requires special browsers to gain access.

Fortunately, law enforcement officers around the world are assigned to units and task forces that receive specialized intelligence training to combat terrorism and cybercrime. Training is provided by agencies such as Interpol, who provide detailed instruction related to the detection and collection of evidence associated with biological and chemical material offered on the darknet.

I (Lee) attended Department of Justice and Interpol intelligence training courses, and later put that training to use in the field. Denene once served as Director of North Carolina Operations for a company that specialized in high-level anti-bioterrorism research and development. She supervised several projects, including government-sponsored research for the Defense Advanced Research Project Agency (DARPA).

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The stories we could tell . . . if only we could.