People who are potentially exposed should:
1. Follow instructions of health care providers and other public health officials.
2. Cover their mouths and noses with layers of fabric that can filter the air but still allow breathing.
3. Wash with soap and water.
4. Contact authorities.
5. Watch TV, listen to the radio, or check the Internet for official news and information including the signs and symptoms of the disease, if medications or vaccinations are being distributed, and where to seek medical attention if they become sick.
6. Seek emergency medical attention if they become sick.

Medical Treatment
Table 2 lists general medical treatments for several biological agents. In general, bacterial illnesses are treated with antibiotics, and viral illnesses are treated with supportive care, although there are a few specific medications to treat viral infections. Brotsman are treated with antivirals or antineutrophilic. Vaccines can prevent or mitigate the effects of a disease. The anthrax vaccine may provide protection even if given 1–4 days after exposure, and the anthrax vaccine can be given even if not indicated if accompanied by treatment with antibiotics for a number of weeks.

CONTROLLING THE SPREAD OF CONTAGIOUS DISEASES
Methods include controlling the environment (e.g., ventilation, barrier methods; gloves, masks, eye protection), and hand washing. Rapid identification of potentially infected persons increases the effectiveness of these methods.

WHAT ARE THE LONG-TERM CONSEQUENCES?
Monitoring and Clean-Up
After a biological attack has been identified, officials will take steps to characterize how long the agent will persist. Clean-up within buildings may entail the use of gas or liquid decontaminants to kill the agent. For example, chlorine dioxide gas was released through ventilation systems of buildings contaminated with anthrax. In some cases, multiple rounds of decontamination may be necessary. Decisions regarding how much cleaning will be necessary will depend on:
• The amount of agent released.
• The nature of the agent.
• How the space will be used following clean-up.

Long-Term Health Consequences Following Exposure
The long-term health consequences for those who survive exposure to biological agents are unknown. A long-term medical surveillance program would likely be established to monitor potential health effects of those exposed.

Economic Impact of an Agricultural Attack
Once detected, an act of agricultural terrorism may quickly halt the movement and marketing of stock or the affecting crop, making it potentially necessary to account for economic consequences for producers, shippers, and consumers. It may also disrupt normal trade and commerce.

ADDITIONAL INFORMATION
Centers for Disease Control and Prevention—http://www.cdc.gov
Infectious Disease Society of America—http://www.idsociety.org
National Institute of Allergy and Infectious Diseases—http://www.niaid.nih.gov
U.S. Army Medical Research Institute of Infectious Diseases—http://www.arl.army.mil
This report brief was prepared by the National Academy of Engineering and the National Research Council of the National Academies in cooperation with the Department of Homeland Security.

For more information, contact Randy Atkins at 202-334-1508, atkins@nae.edu.

HUMAN PATHOGENS, BIOTOXINS, COMMUNICATING IN A CRISIS

WHAT IS IT?
A biological attack is the intentional release of a pathogen (bacteria causing) or biotoxin (poisonous substance produced by a living organism) against human beings, plants, or animals. An attack on people could be used to cause illness, death, fear, societal disruption, and economic damage. An attack on agriculture and animals could result in prime agricultural damage. A potential source of disease for food supplies for a long period of time. It is crucial to distinguish between two kinds of biological agents:

1. Transmissible agents that spread from person to person (e.g., smallpox, polio) or animal to animal (e.g., foot and mouth disease).
2. Agents that may cause adverse effects in exposed individuals but do not transmit those individuals contagious to others (e.g., anthrax, botulinum toxin).

Availability of Agents
The Centers for Disease Control and Prevention (CDC) lists the bioterror threat agents considered to pose the highest threat (see Table 1). Once obtained, agents must be cultured or grown in quantity and then processed for use in an attack (“weaponized”). Agents can be:
• Isolated from sources that have been allayed or made safe. In the case of bacteria or agents that cause zoonotic diseases (that occur in wildlife and are transmissible to humans) — except for anthrax, which is only a human disease and has been eradicated from nature.
• Acquired from laboratories or bioweapons stockpiles. Smallpox virus is officially used in only two laboratories in the world. Anthrax is wildly cultured in labs. Hemorrhagic fever viruses are only used in limited high-security locations. Most high threat agents had been studied and stockpiled in transcontinental programs of the United States until as recently as the 1990s.
• Synthesized or genetically manipulated in a laboratory. This would require expertise and access to advanced technology.

How Biological Agents Could Be Disseminated
For an attack on people, biological agents could be disseminated in one or more of the following ways:
• Aerosol dissemination is the dispersal of an agent in air from sprayers or other devices. The agent must be cultured and processed to the prop- er size to maximize human infections, while maintaining the agent’s
The Biological and Toxins Weapons

• The Geneva Convention of 1925 was the first international agreement to address chemical and biological weapons. It prohibited “bacteriological methods of chemical and biological weapons. It was the first international agreement to address chemical and biological weapons. It prohibits “bacteriological methods of warfare,” which includes the use of biological weapons.

• In 1984, the cult followers of Baghwan Shree Rajneesh sickened 751 people in Oregon by placing salmonella bacteria in salad bars in restaurants to keep people from voting in an election.

• In 2001, the anthrax attacks through the U.S. mail or other means resulted in more than 50,000 deaths. Laboratory scientists will work quickly to identify the specific pathogen. Epidemiologists will attempt to trace the path of infections back toward a single person, vector (insect or animal), vehicle (food or water), or other point of origin. Attribution of a biological attack is typically much more difficult than attribution of a conventional terrorist attack.

**TABLE 2. DREAD, Health Impacts, and Treatment for Some Agents of Concern**

<table>
<thead>
<tr>
<th>Disease</th>
<th>Incubation Period</th>
<th>Symptoms</th>
<th>Spread (person to person)</th>
<th>lethality</th>
<th>Persistence of Organism</th>
<th>Source State</th>
<th>Medical Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plague</td>
<td>1–6 days</td>
<td>Fever, cough, profound sweats, muscle swelling, gangrene</td>
<td>No (only electron spread)</td>
<td>High</td>
<td>Variable</td>
<td>Montana</td>
<td>Antibiotics</td>
</tr>
<tr>
<td>Anthrax</td>
<td>1–2 days</td>
<td>Fever, cramps, diarrhea, meningitis, hemorrhage</td>
<td>Not very stable</td>
<td>Very low</td>
<td>Sensitive</td>
<td>Montana</td>
<td>Antibiotics</td>
</tr>
<tr>
<td>Bacillus anthracis (anthrax)</td>
<td>1–3 days</td>
<td>Pneumonic anthrax</td>
<td>No (only electron spread)</td>
<td>Low</td>
<td>Variable</td>
<td>Montana</td>
<td>Antibiotics</td>
</tr>
<tr>
<td>Plague (Bacillus anthracis)</td>
<td>2–14 days</td>
<td>Cutaneous anthrax</td>
<td>No (only electron spread)</td>
<td>Variable</td>
<td>Variable</td>
<td>Montana</td>
<td>Antibiotics</td>
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<tr>
<td>Plague (Bacillus anthracis)</td>
<td>3–9 days</td>
<td>Glanders (Pasteurella pestis)</td>
<td>No (only electron spread)</td>
<td>Low</td>
<td>Variable</td>
<td>Montana</td>
<td>Antibiotics</td>
</tr>
<tr>
<td>Typhus fever</td>
<td>7–10 days</td>
<td>Rat-bite fever, itching, vesicles, muscle swelling</td>
<td>No (only electron spread)</td>
<td>Low</td>
<td>Variable</td>
<td>Montana</td>
<td>Antibiotics</td>
</tr>
<tr>
<td>Typhus fever (Rickettsia typhi)</td>
<td>7–8 days</td>
<td>Endemic typhus</td>
<td>No (only electron spread)</td>
<td>Low</td>
<td>Variable</td>
<td>Montana</td>
<td>Antibiotics</td>
</tr>
<tr>
<td>Typhus fever (Rickettsia prowazekii)</td>
<td>7–8 days</td>
<td>Epidemic typhus</td>
<td>No (only electron spread)</td>
<td>Low</td>
<td>Variable</td>
<td>Montana</td>
<td>Antibiotics</td>
</tr>
<tr>
<td>Typhus fever (Rickettsia prowazekii)</td>
<td>7–8 days</td>
<td>Scrub typhus</td>
<td>No (only electron spread)</td>
<td>Low</td>
<td>Variable</td>
<td>Montana</td>
<td>Antibiotics</td>
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<td>Typhus fever (Rickettsia prowazekii)</td>
<td>7–8 days</td>
<td>Typhus (fever or rash)</td>
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**IMPACT FOLLOWING THE RELEASE OF A PATHOGEN**

Detection of a Biological Attack

Unlike a chemical or nuclear attack, a biological attack may go unnoticed for hours, days, or potentially weeks (depending on the agent used) until people, animals, or plants show disease symptoms. If there are no immediate signs of the attack as with these toxins, a biological attack will probably be detected by local health care workers observing a pattern of unexplained illness or respiratory symptoms that detect anthrax. Evidence of an attack may include:

- Numbness in animal brains before death.

The Area Affected

For an anthrax release, the area affected would depend on the quantity of agent released, whether the release is indoor or outdoor, and whether the agent is aerosolized or delivered in an infected plant or animal or its fluids could spread through the soil, air, or water. Biological agents are lost in the environment by wind, rain, and evaporation. Some species of anthrax, for instance, are difficult to locate in soil.

Finding the Cause and Source of Disease

There may be some information about the cause for an attack, but there are exceptions. If the exact location or origin of the initial release, the type of biological agent used, and likelihood of additional releases. Laboratory scientists will work quickly to identify the specific pathogen. Epidemiologists will attempt to trace the path of infections back toward a single person, vector (insect or animal), vehicle (food or water), or other point of origin. Attribution of a biological attack is typically much more difficult than attribution of a conventional terrorist attack.

What is the Danger?

Dose Response in Humans

The exact infective dose (the number of organisms needed to cause disease) for most biological agents is unknown; approximate doses are extrapolated from animal studies. Whether a person becomes ill after exposure to a biological agent depends on a number of factors including:

- The type and amount of agent taken into the body.
- Duration of exposure.
- Type of exposure (inhalation, ingestion, insect bite).

How long will symptoms last?

Clinical syndromes vary based on the specific illness and the site of entry (e.g., respiratory tract, eye, skin). The duration of clinical illness can be days or months. For example, Q fever can last for up to two months.

Differences in Intentional vs. Natural Outbreaks of Disease

Naturally occurring outbreaks of category A agents have become rare because of improved living standards, hygiene, and health services in developed nations. For example, human bubonic plague, which was transmitted by rats to humans in poor communities in the absence of health care, has virtually been wiped out. However, agents used in an attack may differ significantly from naturally occurring agents and could produce a form of the disease with a shorter time of onset or illness, making timely diagnosis, management, and containment more difficult.

Spread of Diseases

Some transmissible (contagious) diseases can spread through respiratory droplets from coughing and sneezing or when a person comes in contact with a surface harboring a virus or bacteria and then touches their mouth or nose. The viral hemorrhagic fevers, plagues, anthrax, and some Category B agents. Even a small amount of some biothreat agents released in air could result in significant loss of life, depending on a number of factors including:

- The infectivity of the agent (how many particles are needed to cause illness).
- The lethality of the agent.
- The length of time it takes to detect and treat those who are exposed or become sick.

What Should People Do to Protect Themselves?

During a declared biological emergency:

1. Do not go outdoors in the group or area that authorities have linked to exposure who have developed symptoms to avoid potential exposure.

2. Use common sense, practice good hygiene and cleanliness to avoid spreading germs.
The Australia Group is a loose association of nations that agrees not to export tools and technologies, including pathogens, that have been used or developed, stockpiled, or retained for biological weapons and forbids States from developing, producing, or retaining biological weapons on legitimate or nefarious purposes.

In World War II, Unit 731 in Japanese-occupied Manchuria dropped anthrax-infected fleas in China, allegedly infecting Allied livestock with anthrax and glanders. In 1984, the cult followers of Baghwan Shree followed the religious and spiritual path of Aum Shinrikyo in Japan. In the 1990s, Aum Shinrikyo failed in an attempt to produce and disseminate biological agents to cause death and injury. In 2001, the anthrax attacks through the U.S. Postal System were the first terrorist biological attacks on U.S. soil.

Technologies, including pathogens, that have been used or developed, stockpiled, or retained for biological weapons on legitimate or nefarious purposes. The biological agent depends on a number of factors including:

- The length of time it takes to detect and treat those who are exposed or have become sick.
- The lethality of the agent.
- The infectivity of the agent (how many particles are needed to cause illness).
- The amount and type of agent taken into the body.
- The duration of exposure.
- Type and amount of agent taken into the body.
- The occurrence of human-to-human transmission.
- Duration of exposure.
- Some transmissible (contagious) diseases can spread through respiratory droplets from coughing and sneezing or when a person comes in contact with a surface harboring a virus or bacteria and then touches their mouth or nose.
- The viral hemorrhagic fevers and cholera are spread by direct contact with contaminated body fluids or feces. People infected with contagious diseases may widely disseminate the disease with a shorter time of onset of illness, making timely diagnosis, medical treatment, and containment more difficult.

Impact following the release of a pathogen

Detection of a Biological Attack

Unlike a chemical or nuclear attack, a biological attack may go undetected for hours, days, or potentially weeks (depending on the agent used), unlike animals, plants, or diseases show symptoms of disease. If there are no immediate signs of the attack as the anthrax letters, a biological attack will probably be noticed by local health care workers are observing a pattern of unexplained fevers or respiratory issues. The worst case is a lethal biological agent, which can kill millions. Evidence of an attack may include:

- The incrimination of the attack (how many people are affected by the disease).
- The lethality of the attack.
- The length of time it takes to detect and treat those who are exposed or become ill.

Dose Response in Humans

The most recent cases of the disease are extremely rare, often occurring in individuals, groups are categorized from animal studies. Whether a person becomes ill after exposure to a bioterrorism attack depends on a number of factors including:

- The type and amount of agent taken into the body.
- The occurrence of human-to-human transmission.
- Duration of exposure.
- Some forms of infection (inhalation, ingestion, insect bite).

Differences in Intentional vs. Natural Outbreaks of Disease

Naturally occurring outbreaks of category A agents have become rare because of improved sanitation standards, hygiene, and health services developed over decades. For example, humans boiled plague plagues which are transmitted by rats to humans in poor countries in the 1900s. In large urban areas, there has been very little control. However, agents used in an aerosol attack may differ from naturally occurring outbreaks. The biological plagues could produce a form of the disease with a shorter time of onset of illness, making timely diagnosis, medical treatment, and containment more difficult.

Spread of Diseases

Some transmissible (contagious) diseases can spread through respiratory droplets from coughing and sneezing or when a person comes in contact with a surface harboring a virus or bacteria and then touches their mouth or nose. The viral hemorrhagic fevers and cholera are spread by direct contact with contaminated body fluids or feces. People infected with contagious diseases may widely disseminate the disease with a shorter time of onset of illness, making timely diagnosis, medical treatment, and containment more difficult.

WHAT IS THE DANGER?

Impact on Human Health

Bioweapons agents have the potential to produce a life-threatening illness. Bioweapons are essentially poisons that can be lethal or highly toxic. Table 2, "Infectious disease agents and their effects," shows that some Category A agents from a small amount of some bioweapons agents relative to the volumes by which they are contained can be lethal. This is significant in light of the fact, depending on a number of factors that include:

- The incrimination of the attack (how many people are affected by the disease).
- The lethality of the attack.
- The length of time it takes to detect and treat those who are exposed or become ill.

WHAT SHOULD PEOPLE DO TO PROTECT THEMSELVES?

During a declared biological emergency:

1. Do not panic. In the group or area where you have been linked to someone who has symptoms that match those described should seek medical evaluation.

2. Use common sense, practice good hygiene and cleanliness to avoid spreading germs.
The Geneva Convention of 1925 was the Biological Weapons Laws and Treaties Governing. In World War I, German agents successfully placed salmonella bacteria in salad bars in occupied Manchuria, dropping thousands of salmonella in the attempt to infect those within. In World War II, Unit 731 in Japanese-occupied Manchuria dropped 30,000 people in concentration camps, resulting in more than 50,000 deaths. In 1984, the cult followers of Baghwan Shree Ram spread anthrax, of which five died. An additional 11 mail infected 11 people with inhalational anthrax (Bacillus anthracis), making it potentially high on the U.S. mail terrorist threat list to people want to keep people from eating in a recipe. The 1970s and 1980s brought the use of biological weapons by terrorists to new levels. In September 1979, terrorists in Lebanon spread anthrax, of which five died. An additional 11 mail infected 11 people with inhalational anthrax (Bacillus anthracis), making it potentially high on the U.S. mail terrorist threat list to people want to keep people from eating in a recipe.

**Impact Following the Release of a Pathogen**

**Detection of a Biological Attack**

Unlike a chemical or nuclear attack, a biological attack may go undetected for hours, days, or potentially weeks (depending on the agent used) until people, animals, or plants show symptoms of disease. If there are no immediate signs of the attack in the air with airborne toxins, a biological attack will probably be detected by local health care workers observing a pattern of disease or by monitoring systems that detect airborne anthrax. Evidence of an attack may appear in animals before humans.

**The Area Affected**

For an aerosol release, the affected area would depend on the quantity of agent released, whether the release is indoors by respiratory droplet, through body fluids or feces. People infected with contagious diseases may widely disseminate the disease by travel. Some transmissible (contagious) diseases can spread through respiratory droplets from coughing and sneezing or when a person comes in contact with contaminated hands or objects. The terms "infectious" and "transmissible" are used in another sense in organism and pathogen groups. The biological and weapon functions (BWF) of some contagious and noncontagious pathogens are different. The biological term is a disease caused by an infectious agent. The weapon term is the disease caused by an infectious agent. The weapon term is the disease caused by an infectious agent.

**Finding the Cause and Source of Illness**

There may be uncertainty about causation if there is no exact location or onset of the incident, the type of biological agent used, and likelihood of additional releases. Laboratory scientists will work quickly to identify the specific agent. Epidemiologists will attempt to trace the path of infections back toward a single person, vector (insect or animal), vehicle (food or water), or other point of origin. Attribution of a biological attack is typically more difficult than attribution of a conventional terrorist attack.

**WHAT IS THE DANGER?**

Impact on Human Health

Biologic agents have the potential to produce a life-threatening illness. Biological warfare is essentially that which can be lethal or fall enough. Table 2 lists historical impact in terms of fatalities from some Category B agents. From a small amount of some biological agents released into the environment, a disease outbreak could be of significant local or international impact. Depending on a number of factors, an attack may include:

- The kinetic effect of the attack (how many people are exposed to the attack).
- The lethality of the agent.
- The length of time it takes to detect and treat those who are exposed or become ill.

**Dose Response in Humans**

The exact infectious dose (the number of organisms needed to make one sick) can vary depending on the organism and the particular patient. Approximate doses are categorized from animal studies. Whether a person becomes ill after exposure to a bioagent is highly dependent on a number of factors including:

- Type and amount of agent taken into the body.
- Duration of exposure.
- Route of exposure (inhalation, ingestion, insect bite).

**Incubation Period**

Table 2: Clinical, Health Impacts, and Treatments for Some Agents of Concern

<table>
<thead>
<tr>
<th>Disease</th>
<th>Incubation Period</th>
<th>Symptoms</th>
<th>Mortality</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plague (Bacillus anthracis)</td>
<td>1–7 days</td>
<td>Fever, cough, shortness of breath, bloody diarrhea</td>
<td>High</td>
<td>Antimicrobial therapy</td>
</tr>
<tr>
<td>Smallpox (Vaccinia)</td>
<td>14–21 days</td>
<td>Pustular rash, fever, headache, muscle aches</td>
<td>High</td>
<td>Vaccination</td>
</tr>
<tr>
<td>Ebola (Ebovirus)</td>
<td>2–21 days</td>
<td>Fever, muscle aches, headache, diarrhea</td>
<td>High</td>
<td>Supportive care</td>
</tr>
<tr>
<td>Anthrax (Bacillus anthracis)</td>
<td>2–65 days</td>
<td>Fever, chills, diarrhea, skin rash</td>
<td>Moderate to high</td>
<td>Antimicrobial therapy</td>
</tr>
<tr>
<td>SARS (SARS-CoV)</td>
<td>2–15 days</td>
<td>Fever, cough, fatigue, diarrhea</td>
<td>High</td>
<td>Antimicrobial therapy</td>
</tr>
<tr>
<td>Measles (Measles virus)</td>
<td>7–14 days</td>
<td>Fever, cough, runny nose, red eyes</td>
<td>Moderate</td>
<td>Supportive care</td>
</tr>
<tr>
<td>Malaria (Plasmodium)</td>
<td>10–15 days</td>
<td>Fever, sweats, fatigue, nausea</td>
<td>Moderate</td>
<td>Antimalarial therapy</td>
</tr>
<tr>
<td>Typhoid (Salmonella)</td>
<td>1–2 weeks</td>
<td>Fever, headache, vomiting, diarrhea</td>
<td>Moderate</td>
<td>Antimicrobial therapy</td>
</tr>
<tr>
<td>Tetanus (Clostridium tetani)</td>
<td>3–21 days</td>
<td>Rigors, muscle spasm, fever</td>
<td>Low</td>
<td>Antitoxin if available</td>
</tr>
<tr>
<td>Typhus (Rickettsia)</td>
<td>1–7 days</td>
<td>Fever, headache, rash</td>
<td>Moderate</td>
<td>Antibiotics</td>
</tr>
<tr>
<td>Rabies (Rabies virus)</td>
<td>1–30 days</td>
<td>Fever, confusion, agitation</td>
<td>High</td>
<td>Antivenom</td>
</tr>
</tbody>
</table>

**Finding the Cause and Source of Illness**

There may be uncertainty about causation if there is no exact location or onset of the incident, the type of biological agent used, and likelihood of additional releases. Laboratory scientists will work quickly to identify the specific agent. Epidemiologists will attempt to trace the path of infections back toward a single person, vector (insect or animal), vehicle (food or water), or other point of origin. Attribution of a biological attack is typically more difficult than attribution of a conventional terrorist attack.

**WHAT SHOULD PEOPLE DO TO PROTECT THEMSELVES?**

During a declared biological emergency:

1. Do not go outside in the area that has been linked to offenders who have symptoms that match those described should seek medical evaluation immediately.

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<td>High</td>
<td>Antimicrobial therapy</td>
</tr>
<tr>
<td>Smallpox (Vaccinia)</td>
<td>14–21 days</td>
<td>Pustular rash, fever, headache, muscle aches</td>
<td>High</td>
<td>Vaccination</td>
</tr>
<tr>
<td>Ebola (Ebovirus)</td>
<td>2–21 days</td>
<td>Fever, muscle aches, headache, diarrhea</td>
<td>High</td>
<td>Supportive care</td>
</tr>
<tr>
<td>Anthrax (Bacillus anthracis)</td>
<td>2–65 days</td>
<td>Fever, chills, diarrhea, skin rash</td>
<td>Moderate to high</td>
<td>Antimicrobial therapy</td>
</tr>
<tr>
<td>SARS (SARS-CoV)</td>
<td>2–15 days</td>
<td>Fever, cough, fatigue, diarrhea</td>
<td>High</td>
<td>Antimicrobial therapy</td>
</tr>
<tr>
<td>Measles (Measles virus)</td>
<td>7–14 days</td>
<td>Fever, cough, runny nose, red eyes</td>
<td>Moderate</td>
<td>Supportive care</td>
</tr>
<tr>
<td>Malaria (Plasmodium)</td>
<td>10–15 days</td>
<td>Fever, sweats, fatigue, nausea</td>
<td>Moderate</td>
<td>Antimalarial therapy</td>
</tr>
<tr>
<td>Typhoid (Salmonella)</td>
<td>1–2 weeks</td>
<td>Fever, headache, vomiting, diarrhea</td>
<td>Moderate</td>
<td>Antimicrobial therapy</td>
</tr>
<tr>
<td>Tetanus (Clostridium tetani)</td>
<td>3–21 days</td>
<td>Rigors, muscle spasm, fever</td>
<td>Low</td>
<td>Antitoxin if available</td>
</tr>
<tr>
<td>Typhus (Rickettsia)</td>
<td>1–7 days</td>
<td>Fever, confusion, agitation</td>
<td>Moderate</td>
<td>Antibiotics</td>
</tr>
<tr>
<td>Rabies (Rabies virus)</td>
<td>1–30 days</td>
<td>Fever, confusion, agitation</td>
<td>High</td>
<td>Antivenom</td>
</tr>
</tbody>
</table>
People who are potentially exposed should: 1. Follow instructions of health care providers and other public health officials. 2. Expect to receive medical evaluation and treatment. Be prepared for long-term care. If the disease is contagious, persons exposed may be quarantined. If people become aware of a suspicious substance nearby, they should: 1. Quick get away. 2. Cover their mouths and noses with layers of fabric that can filter the air but still allow breathing. 3. Wash with soap and water. 4. Contact authorities. 5. Watch TV, listen to the radio, or check the Internet for official news and information including the signs and symptoms of the disease, if medications or vaccinations are being distributed, and telons to seek medical attention if they become sick. 6. Seek emergency medical attention if they become sick.

Medical Treatment
Table 2 lists general medical treatments for several bioterror agents. In general, bacterial illnesses are treated with antibiotics, and viral illnesses are treated with supportive care, although there are a few specific medications to treat viral infections. Bistuffs are treated with antitoxins or antivenoms, if available. Vaccines can prevent or mitigate the effects of a disease. The anthrax vaccine may provide protection even if given 1–4 days after exposure, and the anthrax vaccine can be given after inhalation exposure if accompanied by treatment with antibiotics for a number of weeks.

Controlling the Spread of Contagious Diseases
Methods to control contagious disease include isolation, quarantine, barrier methods (gloves, filter masks, eye protection), and handwashing. Rapid identification of potentially infected persons increases the effectiveness of the method.

WHAT ARE THE LONG-TERM CONSEQUENCES?
Monitoring and Clean-up
After a biological agent has been identified, officials will take steps to characterize how long the agent will persist. Clean-up within buildings may entail the use of gas or liquid decontaminants to kill the agent. For example, chlorine dioxide gas was released through ventilation systems of buildings contaminated with anthrax. In some cases, multiple rounds of decontamination may be necessary. Decisions regarding how much cleaning is necessary will depend on:
• The amount of agent released.
• How lethal the agent is.
• How the space will be used following clean-up.

Long-term Health Consequences Following Exposure
The long-term health consequences for those who survive exposure to biological attack agents are unknown. A long-term medical surveillance program would likely be established to monitor potential health effects of those exposed.

Economic Impact of an Agricultural Attack
Once detected, an act of agricultural bioterrorism may quickly halt the movement and marketing of both the affected crop or the affected livestock product, leading to potential economic consequences for producers, shippers, and consumers. It may also disrupt normal trade and commerce.

ADDITIONAL INFORMATION
Centers for Disease Control and Prevention—http://www.bt.cdc.gov
Infectious Disease Society of America—http://www.idsociety.org
National Institute of Allergy and Infectious Disease—http://www.niaid.nih.gov
U.S. Army Medical Research Institute of Infectious Diseases—http://www.amriid.army.mil
This report brief was prepared by the National Academy of Engineering and the National Research Council of the National Academies in cooperation with the Department of Homeland Security.
For more information, contact Randy Adkins at 202-334-1566, adkinsr@nas.edu. Making the Nation Safer: Report and Other National Academies reports related to this topic are available online:
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Biological Attack
Human Pathogens, Biotoxins, and Agricultural Threats

WHAT IS IT?
A biological attack is the intentional release of a pathogen (bacterio- causative of an epidemic or pandemic (bioterrorism); an organism (zoonotic disease); a genetically engineered organism (bioweapon) against humans, plants, or animals. An attack on people could be used to cause illness, death, fear, societal disruption, and socio- economic damage. An attack on agricultural plants and animals could cause economic damage, lose confidence in the food supply, or cause panic. It is useful to distinguish between two kinds of biological agents:

1. Transmissible agents that spread from person to person (e.g., smallpox, Ebola) or animal to animal (e.g., anthrax, brucellosis).

2. Agents that may cause adverse effects in exposed individuals but that do not make those individuals contagious to others (e.g., anthrax, botulism toxin).

Availability of Agents
The Center for Disease Control and Prevention (CDC) lists the bio- threat agents considered to pose the highest threat (see Table 1). Once obtained, agents may be cultured in or grown in quantity and then processed for use in an attack ("weaponized"). Agents can be:

• Isolated from natural sources
• Cultivated in the laboratory for use in biowarfare
• Purified or synthesized or genetically manipulated in a laboratory.

Table 1. Disease Agents Listed by the CDC as Potential Bioweapons Threats (as of 30 March 2005). The U.S. Department of Agriculture lists the following types of animal and plant agents of concern.

HUMAN PATHOGENS, BIOTOXINS, AND AGRICULTURAL THREATS

Table 1. Disease Agents Listed by the CDC as Potential Bioweapons Threats (as of 30 March 2005). The U.S. Department of Agriculture lists the following types of animal and plant agents of concern.

Category A: High threat to public health—biothreats that could cause severe illness, death, or societal disruption if weaponized.

Category B: Medium threat to public health—agents that may cause adverse effects but that do not make those individuals contagious to others.

Category C: Low threat to public health—agents that do not cause significant illness or death but could cause a future threat.

Biotoxins:

• Ricin toxin from castor beans

Viruses:

• Smallpox (variola major virus)
• Ebola hemorrhagic fever virus
• Marburg hemorrhagic fever virus

Bacteria:

• Brucella species
• Clostridium tetani
• Clostridium botulinum
• Shiga toxin-producing Escherichia coli

Fungi:

• Blastomyces dermatitidis
• Histoplasma capsulatum

MORE INFORMATION
For more information about bioterrorism, visit the following websites:
• The Program to Counter the Threat of Anthrax (PCTA) http://www.anthraxcoordinator.gov
• The Anthrax Vaccine Preparedness and Response Interagency Coordinating Board (AVPRICB) http://www.avpricb.gov
• Centers for Disease Control and Prevention’s Anthrax Vaccine Information Page (AVIP) http://www.bt.cdc.gov/anthrax/

HOW BIOLOGICAL AGENTS CAN BE DISSEMINATED
For an attack on people, biological agents could be disseminated in one or more of the following ways:

• Aerosol dissemination
• Contaminated letters
• Contaminated food, water, or other devices. The agent must be cultured and processed to the proper size to maximize human infections, while maintaining the agent’s virulence and infectivity.

• Synthesized or genetically manipulated in a laboratory.

• Synthesized or genetically manipulated in a laboratory.

• Raw soil, dust, and other weather:\n
• Sewage, fats, oils, and greases: \n
• Food safety threats (e.g., E. coli O157:H7, Cryptosporidium, Salmonella)
• Water safety threats (e.g., Cryptosporidium, Salmonella, norovirus, hepatitis A virus, V. cholerae, Cryptosporidium, Legionnaires disease)
• Tobacco (nicotine, tar, carbon monoxide)

• Aerosol dissemination
• Contaminated letters
• Contaminated food, water, or other devices. The agent must be cultured and processed to the proper size to maximize human infections, while maintaining the agent’s virulence and infectivity.

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Biotoxins:

• Botulism (Clostridium botulinum)
• Ricin (Lathyrus sativus)
• Sarin (Sarin sarin)
• VX nerve agent (VX)

Viruses:

• Sendai virus
• HIV
• Ebola hemorrhagic fever virus
• Marburg hemorrhagic fever virus

Bacteria:

• Brucella species
• Clostridium tetani
• Clostridium botulinum
• Shiga toxin-producing Escherichia coli

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Additional information

Centers for Disease Control and Prevention—http://www.cdc.gov
Infectious Disease Society of America—http://www.idsociety.org
National Institute of Allergy and Infectious Disease—http://www.niaid.nih.gov
U.S. Army Medical Research Institute of Infectious Diseases—http://www.amririd.army.mil

This report was prepared by the National Academy of Engineering and the National Research Council in the National Academies in cooperation with the Department of Homeland Security.

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A fact sheet from the National Academies and the U.S. Department of Homeland Security

Table 1: Diseases Agents Listed on the DHR as Potential Bioterrorism Threats (as of March 2005)

This would help people in protecting themselves and recover.