HOW TO SURVIVE A CHEMICAL OR BIOLOGICAL WEAPONS ATTACK

SELF-RELIANCE CENTRAL

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Introduction

"If Anyone From the Race of Adam Is Left Alive, May He Finish This Chronicle"

So ends a medieval Irish manuscript written at the time of the Black Death (Bubonic Plague) in 1349. Chillingly underneath this text someone else has written, "here it seems the author died."

There could no better illustration of the devastating impact of a virulent epidemic on a western country.

Given its importance it is surprising that for most of the last 50 years biological and chemical warfare has, in general, played a back seat to nuclear warfare in most western countries. While films like Failsafe and Dr Strangelove focused on thermonuclear war, very few looked at the threat posed by the deliberate use of diseases, and fewer still looked at how one might survive them.

Then came September 11, 2001 and the subsequent anthrax outbreaks. For the first time people and their governments realized that they were faced with a danger far more subtle than bombs or hijackings, and far more deadly. While deadly nuclear devices are feared, especially the terrifying notion of a "dirty bomb" planted in a briefcase in a busy urban location, the reality remains that radioactive substances capable of great damage are still relatively difficult to obtain and transport. Chemical warfare is hideous and immediate with the potential to slay many people at one time, in one place.

Biological weapons, however, are totally different. During the Anthrax mail attacks of 2001 the real scare came with the realization that Anthrax is a naturally occurring substance, relatively easy to grow. Although the 2001 letters contained weapons grade Anthrax, finely milled to increase its potency, Anthrax is found in dirt and is relatively easy to grow. It is also highly effective as a killer agent with an estimated mortality rate of 95% is inhaled. Then came the Senate ricin scare of February 2004. The response was less hysterical but nonetheless the Senate offices were closed for days and the business of government impeded because someone with a grudge understood how to prepare a deadly toxin with no known antidote from the commonly available castor bean.

As a nation we have been a flurry of action as we endeavor to prepare our reactions to terrorist attacks of any sort. How are we doing?

“Recent events have focused attention on the ability of communities to respond to acts of terrorism. In addition to intentionally generated incidents, most communities have been struggling with preparedness against a range of natural and technological hazards. Public safety and emergency management personnel have developed and tested response plans, and considerable federal resources have been expended toward the same end—albeit with inconsistent results. With some exceptions, community preparedness efforts have faltered at a common, though not exclusive, point: hospitals. Those involved in preparedness and response recognize the quandary: hospitals are essential, irreplaceable resources for planning, response, and recovery associated with disasters, but they carry a unique set of constraints that makes effective participation in such efforts challenging at best.” So said Jeffrey N. Rubin in the Journal of Homeland Security, January 2004.

In December 2003, a Trust for America’s Health's report discovered that after nearly $2 billion of federal bioterrorism preparedness funding, states are only modestly better prepared to respond to health emergencies than they were prior to September 11, 2001. The TFAH report, *“Ready or Not? Protecting the Public's Health in the Age of Bioterrorism,”* examined ten key indicators to assess areas of improvement and areas of ongoing vulnerability in our nation's effort to prepare against bioterrorism and other large-scale health emergencies.

The ten key indicators of a state’s preparedness for a bio terrorism attack

- Spent or obligated at least 90% of Fiscal Year 2002 federal funds
- Passed on at least 50% of federal funds to local health departments
- State spending on public health was increased or maintained
- Sufficient workers to distribute Strategic National Stockpiles supplies
- Has at least one BT Lab (Biosafety Level 3)
- Has enough BT labs to handle a public health emergency
- No more than 3 counties without alert capability
- Has initial BT plan
- Has pandemic flu plan
- State-specific information about SARS was available during crisis.

The report showed that nearly 75 percent of states scored only half (five) or fewer of the ten possible indicators. California, Florida, Maryland and Tennessee scored the highest, earning seven of the 10 possible indicators. Arkansas, Kentucky, Mississippi, New Mexico and Wisconsin scored the lowest, meeting just two.

The report also found that while progress had been made in most states to expand the health emergency communications network, upgrade public health laboratories and develop initial bioterrorism response plan there were many concerns remaining. Those addressed by the report included: cuts to public health programs in nearly

two-thirds of states; an impending shortage of trained professionals in the public health workforce; disagreements between state and local health agencies over resource allocation; and tie-ups of much of the federal bioterrorism funding due to bureaucratic obstacles. The report also found that only Florida and Illinois were prepared to distribute and administer emergency vaccinations or antidotes from the national stockpile. It also revealed that states' readiness for other health emergencies, such as major infectious disease outbreaks such as severe acute respiratory syndrome (SARS) or a pandemic flu, were seriously inadequate.

So how worried should we be? And more importantly – what can we, as self-reliant individuals, do about it?

As usual knowledge is power.

Chapter One

What is the Difference between a biological attack and a chemical attack?

Very often chemical and biological attacks are lumped together as if they were basically the same sort of thing. In fact, though there are similarities there are substantial differences. For although they can both linger in the atmosphere for some time, most chemicals and gases last only for a limited period, though of course they can be deadly for that time. Diseases, however, can be spread from one person to another, which means that they can pervade an entire society, unlike gases or chemical poisons.

Toxins are poisons produced by living organisms and their synthetic equivalents. These are classed as chemical warfare agents if they are used for military purposes and are covered by the Biological and Toxin Weapons Convention of 1972. This convention bans the development, production and stockpiling of such substances not required for peaceful purposes.

Although biological warfare, often called germ warfare, has never been officially employed on the modern battlefield, the increased amount of research and testing of disease-producing viruses and bacteria for military purposes has caused worldwide alarm. As a result, the Biological Weapons Convention signed by the United States, the United Kingdom, the Soviet Union, and 67 other nations in 1972 prohibited the development, production, and stockpiling of bacteriologic agents and toxins.

Definitions

Bioterrorism is the intentional use of biological agents, or germs, to cause illness. Biological agents are viruses, bacteria, fungi and toxin from living organisms that have illness-producing effects on people plants, or livestock. The effects of a biological agent disseminated in a public place may not be known immediately because of the delay between exposure and onset of illness. Those most likely to identify the symptoms of such attacks are the primary care physicians. School nurses or teachers may be the first to detect an illness from a biological attack in children. Among the biological agents of greatest concern are: anthrax, smallpox, plague, and botulism. A biological agent may be introduced to the system through the skin, or by ingestion or inhalation.

Chemical terrorism involves the dissemination of chemical agents to kill, deliberately harm or incapacitate people. Chemical agents are poisonous gasses, liquids, or solids that have a toxic effect on people, animals, or plants. They are introduced through inhalation or absorption through the skin or mucous membranes from food, water, or the air. An acute chemical event develops rapidly in a defined geographic area. The effects are immediate and obvious. Types of chemical agents include nerve, blood, blister, pulmonary, and incapacitating agents; heavy metals; volatile toxins; pesticides; explosive nitro compounds; flammable or poisonous industrial gases, solids, or liquids; or

corrosive industrial acids and bases.

Detectors

The aims of detection are to identify the agent and provide a warning - to those who are unaffected - of the advent and the extent of a chemical or biological attack. Considerable media coverage recently has focused on 'chem-bio detectors', with calls for them to be deployed in crowded public places such as underground stations or airport lounges. The reality is that there is a great deal of difference between chemical and biological detection because the agents differ greatly in character. A common feature of both chemical and biological detectors is the fact that they spot the harmful agent by sampling their environment. Some detectors continuously sample the surrounding air, using a variety of technologies to identify and quantify the proportion of agent present in the air stream. Other systems are designed to detect harmful agents in soil or in water.

In biodetection, the goal is to achieve instantaneous and specific identification; right down to the individual strain of a disease bacterium or virus, in order to trigger the alarm, set the remedial action in motion and minimize exposure.

Handheld devices

There are now handheld biodetection systems available in the USA. These give results within around 15 minutes of the agent being picked up in the air-sampling unit. Some modern systems mimic the human body's creation of antibodies to ward off infection. Others use genetic analysis, detecting base sequences for a particular disease using DNA 'probes'. Also, a process called Polymerase Chain Reaction (PCR) allows much higher detector sensitivity by amplifying the sequences by as much as 108 times. New techniques, involving mass spectrometry, will allow many more biochem agents to be quickly analyzed and identified.

The assay and DNA probe systems operate by using a test strip, which is placed in a reader and compared against library data held by a database that includes the commonly identified threat agents. These “libraries” can be updated quickly to include emerging threat agents or other agents that, while neutral to humans could damage food chain crops or animals. All these systems have to process samples of the agent material and deliver a visual result, either in the form of a color change to a paper sample, by detecting fluorescence or by presenting the data on screen.

There is, meanwhile another technology for detection. In the USA, which is the most active participant in the war on bioterrorism, cloud recognition systems are under trial with the aim of identifying clouds of biological or chemical agent that have been released into the air.

The two technologies used together begin to deliver true stand-off warning of chemical or biological attack. Clearly a biological attack presents the greatest challenge, as the triggers that would prompt the defender to deploy detectors

occur much later in the event cycle. In other words, people will become ill before it is realized that an attack has taken place, since the incubation period for disease is usually in the order of days.

Chapter Two

The History of bio-weapons

Pick up any history book, and you will probably find yourself reading the story of how different civilizations came to dominate others. For centuries most historians simply looked at who had the best army or the best leaders and took it from there. Recently however a number of historians are beginning to claim that the history of human beings is essentially the history of disease, with whole cultures and populations disappearing after major epidemics. That the power of illness and disease to reduce and demoralize enemies is well documented.

The deadly timeline

7th century BC - Assyrians used ergot (a fungal disease of rye) to poison water supplies. The fungus produces a natural hallucinogen related to LSD that also induces a disease widely known in later times as St Anthony's Fire.

c.600BC - The purgative hellebore was used during the siege of Cirrha, the port of Delphi. The defenders of Cirrha suffered violent diarrhea resulting in their defeat.

500BC - A burning mixture of wood, pitch and sulfur was used to incapacitate a beleaguered Athenian force prior to assault.

431-404BC - Peloponnesian War. Arsenic smoke was used during the sieges of Plataea and Delium by the Spartans.

c.200BC - Maharbal, a Carthaginian officer sent against rebellious North African tribesmen, drugged wine which he then abandoned so that the enemy captured it and were subsequently incapacitated.

187BC - Siege of Ambracia in Epirus. Inhabitants employed toxic smoke to drive off Romans who were undermining the walls.

184BC - Hannibal was alleged to have fired earthen vessels full of venomous snakes onto the ships of Eumenes II of Pergamon.

82-72BC - Romans used 'toxic smoke' against the Charakitanes in Spain causing pulmonary problems and blindness, leading to their defeat in 2 days.

1155 - Siege of Tortona, Italy. Emperor Frederick Barbarossa conquered the town after poisoning the water supply.

1346 - Tartar army catapulted corpses of plague victims over the city walls in siege of Kaffa - supposed origin of Black Death in Europe.

1346-1710 - Use of plague victims, as a means of spreading disease, became commonplace.

c.1500 - Leonardo da Vinci devised a chemical weapon: a mixture of powdered arsenic and powdered sulfur packed into shells to be fired against ships.

1675 - Article 57 of Strasbourg Agreement of 27 August between French and German armies directed that neither side should use poisoned bullets. This was the first international agreement in modern history in which use of such weapons was prohibited.

1754-63 - Evidence of attempts by British troops to use smallpox-infected blankets as a weapon during the French and Indian war.

1797 - Napoleon attempted to infect the inhabitants of the besieged city of Mantua with swamp fever during his Italian campaign.

1812 - Capt. Thomas Cochrane, British Royal Navy, submitted plans for chemical weapons to be used in the Napoleonic War to a secret committee. The committee recommended that the plan should be sealed up and not used, taking the view that - 'it was so perfectly new that we cannot venture an opinion on it'.

1830 - Invention of "obus asphyxiant incendiaire" by the French pharmacist, Lefortier, in Sévres. This invention was never applied in practice.

1845 - Use of 'green wood smoke' by General Pilissier in Ouled Ria resulted in the massacre of the Kabyl tribe.

1846 - Cochrane (now Rear Admiral) submitted a new plan involving, amongst other things, the use of shells containing cacodyl and cacodyl oxide mixed with a self-igniting liquid. This time the committee, endorsed by the Duke of Wellington, suppressed the plan on the grounds that - 'it would not accord with the feelings and principles of civilized warfare'.

1855 - British War Department considered shells containing cacodyl and cacodyl oxide mixed with self-igniting liquid for use in Crimean War. Again Admiral Cochrane proposed the use of ships to disperse poison gas based on sulphur and charcoal during the siege of the Russian garrison at Sevastopol. Although supported by the government of the time the plan failed on technological grounds (delivery system). Similar plans were considered during the American Civil War and turned down for the same reason.

1863 - In the American Civil War during General Johnston's retreat from Vicksburg in July, General Sherman's pursuing troops found the water supply poisoned.

1868 - Declaration of St Petersburg renounced the use in war of explosive projectiles and those charged with fulminating or inflammable substances. This was obligatory upon contracting parties in the event of going to war. Twenty signatories participated, of which the UK, France, and Germany are still adherents. Russia is no longer bound by this treaty.

1874 - Conference of Brussels, held as a result of Russian initiative, reached an agreement prohibiting the use of poisons or poisonous weapons - Brussels Declaration.

1899 - Hague Declaration prohibited poison or poisoned arms. Twenty seven states finally ratified this treaty, including Russia (although no longer bound) and UK which finally signed in 1907. The United States did not sign.

1907 - Second Hague International Conference, again convened under Russian initiative.

WW1 1914-1918

Chemical weapons (including chlorine, phosgene and mustard agents) were used on a large scale for the first time. Some 125,000 tonnes of toxic chemicals were used on the battlefield and caused 1,300,000 gas casualties, of which over 90,000 were fatal.

1914 - August saw the first use of gas in World War I. The French deployed 26mm gas grenades containing irritants. This was ineffective in open country and was soon discarded as worthless. In October the Germans at Neuve-Chapelle started using a chemical-type projectile dispensing dianisidine chlorosulphonate (nowadays called

4,4-diamino 3,3-dimethoxy biphenyl). This was of low potency and was soon discontinued.

1915 - In January chemical shells were used against Russians at Bolimow in Poland where over 18,000 "T-shells" containing xylyl-bromide were fired on Russian positions. Low temperatures negated the effect and the German attack was repulsed with heavy casualties. In March the Germans again used T-shells, this time on the Western Front and the French responded with grenades against the Germans. April saw the first large scale use of gas; dispersed by Germans from cylinders containing 268 tonnes of chlorine against French salient at Ypres. September saw the first British use of chlorine at Loos.

1917 - Mustard gas was first used by the Germans at Ypres on 12 July 1917. UK, US and France all developed chemical weapons munitions in response and utilised them to a considerable extent; mustard gas, because of its persistent and greater incapacitating qualities, was the preferred agent (the British first used mustard gas in 1918). Baron Otto Karl von Rosen was arrested for smuggling sugar lumps containing anthrax spores into Norway. He was thought to be trying to infect horses and reindeer used to draw sledges containing British arms into Russia.

1922 - Washington Arms Conference Treaty included a statement prohibiting "the use of asphyxiating, poisonous or other gases and all analogous liquids, materials or other devices". Although ratified by several countries, including the USA, the treaty never came into force because of an objection by France to the wording of another section of the treaty.

1925 - Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare - known as the Geneva Protocol. This prohibited the use of biological and chemical weapons but did not outlaw their acquisition or stockpiling. Several countries, including the UK, made reservations allowing a response with such weapons if they were first attacked with them.

1935-36 - Italian forces used chemical agents, mainly mustard gas delivered by aircraft spray, in Ethiopia.

WWII – 1939-1945

Biological weapons research widely conducted but no confirmed battlefield use. UK anthrax trial on Gruinard Island. Major powers: Germany, Italy, Japan, France, UK, US and Russia produced and stockpiled chemical weapons, but no confirmed use.

1937- 43 - Japan employed chemical (and allegedly biological) weapons against Chinese forces during Sino-Japanese war. Japanese BW Unit 731 conducted human trials.

Late 1950s - UK abandoned its biological and chemical weapons capability.

1972 - Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction - known as the Biological and Toxin Weapons Convention (BTWC). This entered into force in March 1975.

1979 - Accidental release of anthrax from Soviet Military Compound 19 in Yekaterinburg - admitted as biological weapons related in 1992. (This was initially referred to as the ‘Sverdlovsk incident’ and has been well documented.)

1980-88 - Iran-Iraq War. Chemical weapons were used. Iraqi chemical weapons attack on Halabja involved the use of mustard and nerve gas agents against a civilian target in March 1988.

1989 - USA/USSR Agreement on Destruction and Non-Production of Chemical Weapons.

1990-91 - Threat of possible use of biological and chemical weapons by Iraq during the Gulf conflict.

1991 - UN Security Council Resolution 687 requiring Iraq unconditionally to accept, under international supervision, destruction of its weapons of mass destruction and to declare its holdings within 15 days. After initially denying any biological weapons program, Iraq's admission of "biological research for defensive military purposes".

1993 - Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction - known as the Chemical Weapons Convention (CWC) was opened for signature in Paris in January 1993. The Organization for the Prohibition of Chemical Weapons (OPCW) came into existence in May 1997 in The Hague, Netherlands, to implement the CWC, which entered into force in April 1997.

1994-5 - Japanese Aum Shinrikyo sect researched biological and chemical weapons and means of delivery. Sarin attacks took place at Matsumoto in June 1994 and on the Tokyo underground in March 1995.

1995 - Iraq's first admission of an extensive biological weapons program, including weaponization, and the production of VX nerve agent.

1998 - Independent experts advised UNSCOM that Iraq had not yet met the terms of UNSCR 687. Saddam refused to co-operate further with UNSCOM claiming that Iraq had met its obligations under UNSCR 687. *December 1998* - Operation Desert Fox.

1999 - A disarmament panel established by the Security Council reported that Iraq had still not complied with U

Early bio warfare attempts

The most famous epidemic in history - The Black Death (bubonic plague), is believed to have its origins in 1338 during the siege of the city of Caffa in the Far East. Following an old tried and true tactic the people in Caffa used their catapults to fling infected corpses into the surrounding army. The surrounding army promptly became infected and proceeded to spread the disease throughout Europe.

When the Europeans began colonizing the world in the following centuries, disease was used to capture whole continents. It is now believed that the Spanish conquest of the New World was not achieved by gunpowder and horses as all the history books used to say, but by measles and smallpox. It has been estimated that the total pre-Colombian population of the Americas was reduced by well over fifty per cent. Some tribes disappeared altogether.

In South America the conquistador Pizzarro deliberately distributed smallpox infected blankets to the native inhabitants. So effective did these prove that the Amazonian Indians later claimed that the breath of a Spaniard was in itself poisonous. The traffic wasn't all one way; according to the generally accepted theory the Native Americans seem to have given their Spanish conquerors syphilis.

Pandemic viruses – death on a global scale

At the end of WW1 (1918) the world suffered the greatest pandemic in recorded human history: Spanish flu.

Originating in China (despite its name) by the time this contagion burnt out it is estimated that one fifth of the world's total population had been infected. 28% of all Americans living during this period contracted the illness of who some 675,000 died - ten times as many as in the world war.

One story from 1918 which shows how virulent these diseases can be, told of four seemingly healthy women who met to play bridge together late into the night. Overnight and during the game three died from influenza. Others stories tell of people on their way to work suddenly developing the flu and dying within hours of arriving.

In World War II scientists in each of the major countries involved (particularly Japan) worked to come up with effective biological weapons. However their efforts were always constrained by the single fact that has always restricted the development of biochem weapons – how diseases can be controlled to infect only one side. Like poison gas, diseases infect any and everyone; they make no political decisions.

Chapter 3

Modern biochem activity and legislation

In 1972, the United States, UK, and USSR signed the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction, commonly called the Biological Weapons Convention. Over 140 countries have since added their ratification. This treaty prohibits the stockpiling of biological agents for offensive military purposes, and also forbids research into such offensive employment of biological agents. However, despite this historic agreement among nations, biological warfare research continued to flourish in many countries hostile to the United States. Moreover, there have been several cases of suspected or actual use of biological weapons. Among the most notorious of these were the "yellow rain" incidents in Southeast Asia, the use of ricin as an assassination weapon in London in 1978, and the accidental release of anthrax spores at Sverdlovsk in 1979.

Testimony from the late 1970s indicated that planes and helicopters delivering aerosols of several colors attacked Laos and Kampuchea. After being exposed, people and animals became disoriented and ill, and a small percentage of those stricken died. Some of these clouds were thought to be trichothecene toxins (in particular, T2 mycotoxin). These attacks are grouped under the label "yellow rain". There has been a great deal of controversy about whether these clouds were truly biological warfare agents. Some have argued that the clouds were nothing more than feces produced by swarms of bees.

In 1978, a Bulgarian exile named Georgi Markov was attacked in London with a device disguised as an umbrella. The device injected a tiny pellet filled with ricin toxin into the subcutaneous tissue of his leg while he was waiting for a bus. He died several days later. On autopsy, the tiny pellet was found and determined to contain the toxin. It was later revealed that the Bulgarian secret service carried out the assassination, and the technology to commit the crime was supplied by the former Soviet Union.

In April, 1979, an incident occurred in Sverdlovsk (now Yekaterinburg) in the former Soviet Union which appeared to be an accidental aerosol release of *Bacillus anthracis* spores from a Soviet Military microbiology facility: Compound 19. Residents living downwind from this compound developed high fever and difficulty breathing, and a large number died. The Soviet Ministry of Health blamed the deaths on the consumption of contaminated meat, and for years controversy raged in the press over the actual cause of the outbreak. All evidence available to the United States government indicated a massive release of aerosolized *B. anthracis* spores. In the summer of 1992, U.S. intelligence officials were proven correct when the new Russian President, Boris Yeltsin, acknowledged that the Sverdlovsk incident was in fact related to military developments at the microbiology facility. In 1994, Meselson and colleagues published an in-depth analysis of the Sverdlovsk incident (*Science* 266:1202-1208). They documented that all of the cases from 1979 occurred within a narrow zone extending 4 kilometers downwind in a southerly direction from Compound 19. There were 66 fatalities of the 77 patients identified.

In August, 1991, the United Nations carried out its first inspection of Iraq's biological warfare capabilities in the aftermath of the Gulf War. On August 2, 1991, representatives of the Iraqi government announced to leaders of United Nations Special Commission Team 7 that they had conducted research into the offensive use of *Bacillus anthracis*, botulinum toxins, and *Clostridium perfringens* (presumably one of its toxins). This open admission of biological weapons research verified many of the concerns of the U.S. intelligence community. Iraq had extensive and redundant research facilities at Salman Pak and other sites, many of which were destroyed during the war.

In 1995, further information on Iraq's offensive program was made available to United Nations inspectors. Iraq conducted research and development work on anthrax, botulinum toxins, *Clostridium perfringens*, aflatoxins, wheat cover smut, and ricin. Field trials were conducted with *Bacillus subtilis* (a simulant for anthrax), botulinum toxin, and aflatoxin. Biological agents were tested in various delivery systems, including rockets, aerial bombs, and spray tanks. In December 1990, the Iraqis filled 100 R400 bombs with botulinum toxin, 50 with anthrax, and 16 with aflatoxin. In addition, 13 Al Hussein (SCUD) warheads were filled with botulinum toxin, ten with anthrax, and twowith aflatoxin. These weapons were deployed in January 1991 to four locations. In all, Iraq produced 19,000 liters of concentrated botulinum toxin (nearly 10,000 liters filled into munitions), 8,500 liters of concentrated anthrax (6,500 liters filled into munitions) and 2,200 liters of aflatoxin (1,580 liters filled into munitions).

The threat of biological warfare has increased in the last two decades, with a number of countries working on the offensive use of these agents. The extensive program of the former Soviet Union is now primarily under the control of Russia. Former Russian president Boris Yeltsin stated that he would put an end to further offensive biological research; however, the degree to which the program was scaled back is not known. Recent revelations from a senior BW program manager who defected from Russia outlined a remarkably robust biological warfare program. There is also growing concern that the smallpox virus, now stored in only two laboratories at the CDC in Atlanta and the Institute for Viral Precautions in Moscow, may be in other countries around the globe.

There is intense concern in the West about the possibility of proliferation or enhancement of offensive programs in countries hostile to the western democracies, due to the potential hiring of expatriate Russian scientists. It was reported in January 1998 that Iraq had sent about a dozen scientists involved in BW research to Libya to help that country develop a biological warfare complex disguised as a medical facility in the Tripoli area. In a report issued in November 1997, Secretary of Defense William Cohen singled out Libya, Iraq, Iran, and Syria as countries "aggressively seeking" nuclear, biological, and chemical weapons.

Finally, there is an increasing amount of concern over the possibility of the terrorist use of biological agents to threaten either military or civilian populations. There have been cases of extremist groups trying to obtain microorganisms that could be used as biological weapons, which have raised awareness that terrorist organizations

could potentially acquire or develop weapons of mass destruction for use against civilian populations. Subsequent investigations revealed the organization had attempted to release botulinum toxins and anthrax on several occasions.

During the cold war rumors were rife that both of the superpowers were busy developing biochem weapons, which they would deploy when conflict began. Unlike nuclear weapons, however, it was easier to keep biochem weapons research secret so although there was much speculation, there was little evidence. In general, the superpowers seemed to prefer spending their defense funds on armaments, not biochem weapons. So despite all the guesses and all the theories it remained a fact that, until recently, bio warfare was the stuff of fantasy - then came anthrax.

When the anthrax outbreaks hit in 2001, many believed that this was the first time the US, or indeed the world had ever been hit by bio crimes. But of course this was not the case. There are many examples. Some perpetrated by individuals, some by terrorists. Each example, in its way, reveals the relative ease by which these crimes can be committed. The following list includes some of those recorded in the American Institute of Biological Science's magazine, Bioscience.

Aum Shinrikyo, Tokyo, Japan April 1990-March 1995

Aum Shinrikyo, a 10,000-member Japanese cult, was responsible for releasing Sarin nerve gas in the Tokyo subway system, as well as for many failed attempts to disseminate biological agents. For example, in April 1990, an automobile outfitted to disseminate botulinum toxin was driven around Japan's parliament building; in June 1993, they tried to disrupt the wedding of Japan's crown prince in the same way; in late June 1993, an attempt was made to spread anthrax from the roof of a building in Tokyo (dissemination was carried out for 4 days); on 15 March 1995, cult members planted three briefcases designed to release botulinum toxin in the Tokyo subway. Nine failures in nine attempts attest to the ineptness of the cult and to the difficulty of actually deploying biological weapons to cause mass casualties.

The Dalles, OR, September 9th – October 10th 1984

The Rajneeshees religious cult grew Salmonella typhimurium and contaminated the salad bars of 10 local restaurants in Oregon to make opposing voters sick so that they would be unable to vote on Election Day. This contamination resulted in 753 confirmed cases of salmonellosis.

South Africa, 1989

South African government agents failed in an alleged attempt to contaminate a refugee camp's water supply with cholera and yellow fever organisms.

Brian T. Stewart, St. Charles, MO., January 1998

Stewart, a blood lab techician, was sentenced to life in prison for deliberately infecting his 11-month-old baby with HIV-infected blood to avoid child support payments.

Serland Squires, January 1999

Squires, a 21-year-old female US soldier infected with the AIDS virus, was sentenced to three years in a military prison for having unsafe sex with nine men. Squires pleaded guilty to charges of aggravated assault and disobeying a superior officer who had told her to tell sex partners of her medical condition and to insist they use a condom.

Abortion clinics, November 1998

Letters claiming to contain anthrax were delivered to a Planned Parenthood clinic in Indianapolis and to four other abortion clinics in three states.

Federal Officials, October 1998

Two men accused in an alleged plot to use biological weapons on federal officials were convicted on two counts of sending threatening e-mail to government agencies. The men had purportedly threatened to kill President Clinton and FBI Director Louis Freeh with botulinum toxin.

Richard Schmidt, Lafayette, LA, October 1998

Schmidt, a gastroenterologist, was convicted of attempted second degree murder and sentenced to life in prison with hard labor for infecting his former lover, nurse Janice Allen, with HIV by injecting her with blood from an AIDS patient.

Diane Thompson, Dallas, TX. October 1996

Thompson, a laboratory technician, allegedly infected 12 of her coworkers with *Shigella dysenteriae* Type 2 that she had placed in doughnuts and muffins in the office lunchroom.

Dr. Debora Green, KS, August 1995

Green, a physician, was convicted of trying to murder her estranged husband with ricin she made herself from castor beans.

Scotland, June 1990

Nine people living in an apartment building in Scotland became ill with a diarrhoeal disease when feces contaminated with Giardia lamblia were placed in their water tanks.

Rhodesia, 1976-1980

The Rhodesian government's Central Intelligence Organization is alleged to have used biological agents in water supplies against black civilians in Rhodesia and Mozambique.

The range of attacks outlined here was generated by private disputes and government action. However it should not be forgotten that whether it is simply a case of a disaffected worker wanting to get back at his employer, or a country seeking to crush a disaffected minority the danger from biochem attack, once released, biochem weapons are next to impossible to control. The fact that many of these examples failed should not fill us with confidence. New biochem weapons are being developed all the time.

Chapter 4

How do you switch off a bio-weapon? The long-term effects.

The long-term effects of a biological attack were recently demonstrated in a Tokyo Court Room where witnesses stated that the diseases caused by plague-infested fleas dropped on China by Japan during the Second World War remained virulent long after the war ended. The retreating Japanese forces unleashed fleas tainted with cholera, typhoid, anthrax and bubonic plague in one attack on China's southwestern Zhenjian province these attacks were believed to have killed 50,000 people in six years."

Chinese doctors have described how the effects of the biological weapon attacks continued for years after the Japanese Imperial Army spread infected fleas in the city of Ningbo, Zhejiang province, in October 1940. Similarly, cases of typhus persisted into the 1950s in the city of Quzhou, Zhejiang province, which was attacked in the same month.

Qiu Ming-xuan, a survivor of a bacterial attack, and a doctor at the Quzhou epidemic-prevention station, said Japanese planes dropped paper bags on his city, each containing about ten fleas, as well as rags and grains of wheat. Qiu believes the items carried bubonic plague, cholera, typhoid and anthrax bacteria.

Proving that biochem weapons can linger, Qiu has also studied the after-effects of attacks on Quzhou, and says cases of typhus were found there as late as 1953. "Even 60 years on we are still finding positive antibodies to bubonic plague in rats, dogs, cats and other animals," Qiu has told reporters. "And not only animals. Every year a certain number of healthy people develop typhoid problems, so this problem still exists."

Qiu testified that residents fled Quzhou after the attack, unwittingly helping to spread the diseases to surrounding rural areas. He added that Quzhou had never experienced bubonic plague in its history, yet no less than 50,000 people died from the disease in the years following the attack. Bacteriologist Huang gave the first evidence in court of a link between the dropping of fleas on Ningbo and the outbreak of bubonic plague a few days later.

The incubation period of plague is normally seven to ten days, but Huang said the fleas had been infected with a more toxic form of plague. He added that the fleas were not native to the area. "Only Unit 731 was capable of making such an intensified bacterium," Huang told the court.

Unit 731 ran Japan's biological warfare program and had among its ranks some of Japan's top doctors and bacteriologists. The unit experimented on Chinese civilians and prisoners of war in a lab complex near Harbin in the north of China, which was then under Japanese control.

Recreating the Spanish flu?

Influenza kills many people each year, particularly the elderly; but a case of the flu is generally seen as an inconvenience rather than a life-threatening situation. But flu viruses are serious. In 1918 and 1919, the so-called "Spanish flu" killed an estimated 20-40 million people worldwide and, since then, the highly changeable flu virus has resurfaced in a variety of particularly nasty and highly infectious incarnations.

The 1918 strain of influenza virus was very aggressive. It caused a severe disease and tended to kill fit young adults rather than older people. The mortality rate was more than 2.5%, compared with under 0.1% in other flu epidemics. This high mortality rate, focusing as it did on young people, lowered the average life expectancy in the USA by nearly 10 years.

Influenza can be transmitted by aerosol and as it is so virulent, a small amount of virus can cause a full-blown infection. The public health authorities in the USA view the potential for terrorist use seriously. In fact, the US National Institutes of Health granted $15 million to Stanford University to study how to guard against the flu virus "if it were to be unleashed as an agent of bioterrorism".

The Sunshine Project is an activist organization dedicated to exposing the international development of biochem weapons and committed to working towards their eventual eradication. It takes its name from the fact that UV rays in sunshine kill many different types of biological agents. It reports that US scientists led by a Pentagon pathologist are currently attempting to genetically reconstruct the 1918 influenza strain. In one experiment, it claims that mice were injected with a partially reconstructed 1918 virus and a virus construct with genes from a modern flu virus. The 1918 strain killed the lab mice while the modern virus “had hardly any effect. “

Attempts to recover the Spanish flu virus date to the 1950s, when scientists unsuccessfully tried to revive the virus from victims buried in the permafrost of Alaska. In the mid 1990s, Dr Jeffrey Taubenberger from the US Armed Forces Institute of Pathology started to screen preserved tissue samples from 1918 influenza victims.

A sample of lung tissue from a 21-year-old soldier, who died in 1918 at Fort Jackson in South Carolina, yielded some viral RNA that could be analyzed and sequenced. In 1997, nine short fragments of Spanish flu viral RNA were revealed but because of the primitive tissue preparation procedure in 1918, no living virus or complete viral RNA sequences were recovered.

By 2002, however, four of the eight viral RNA segments had been completely sequenced from other sources. These includied the genes for hemagglutinin (HA) and neuraminidase (NA); the properties responsible for the Spanish flu's virulence.

The project did not stop at sequencing the genome. According to the Sunshine Project, the Armed Forces Institute of Pathology teamed up with a microbiologist from the Mount Sinai School of Medicine in New York. Together, they started to reconstruct the Spanish flu. In a first attempt, they combined gene fragments from a standard lab flu strain with one 1918 gene and infected mice with it. It turned out that the 1918 gene made the virus less dangerous for mice. However, in a second experiment, published in October 2002 (Tumpey et al. 2002), the scientists successfully created a virus with two 1918 genes which was more deadly to mice. It is believed that this experiment is only one step away from recreating the deadly 1918 Spanish flu virus.

The scientists knew what they were doing and although the experiments were conducted under high biosafety conditions at a US Department of Agriculture lab in Athens, Georgia they obviously considered the possible hostile use of their work as the report includes the comment "the available molecular techniques could be used for the purpose of bioterrorism".

Reference: (Tumpey TM, Garcia-Sastre A, Mikulasova A, Taubenberger JK, Swayne DE, Palese P, Basler CF (2002) "Existing antivirals are effective against influenza viruses with genes from the 1918 pandemic virus." PNAS 99:13849-13854).

Chapter 5

The Impact of a Bioterrorist attack

While natural diseases can have a devastating impact, the damage potential for manufactured contagions is enormous.

This is because:

- Most of the diseases used in a biochem attack are likely to have a higher potency than naturally occurring forms.
- Their distribution is likely to be more controlled and targeted for maximum effect.
- They will occur in a far more sustained manner and will not be as affected by seasons or biological imperatives, such as the size of the rat population (which generated the Black Death).
- They can be coordinated for maximum effect with other disasters such as economic downturns or bad weather e.g. flooding.
- Biological weapons are relatively easy to manufacture, store and distribute. One person can carry enough of a particular culture to destroy a whole civilization. The WMD team in Iraq was looking for a total stash that would easily fit into a standard garage. This makes them the obvious choice for those countries that cannot afford to invest in conventional arms.

Estimates of the potential death toll from a biochem attack vary, but it is generally accepted that most manufactured biochem weapons aim to disable at least two thirds of the active population. It should be stressed that this is seen as a minimum number and the actual death and disablement rates are likely to be much higher. In the absence of any evidence, all casualty rates are little more than best guesses.

But a guess is better than nothing so:

Estimates of casualties from a hypothetical biological attack based on the release of 50 kg of various agents by an aircraft flying along a 2 km path upwind of a city of half a million people.

Agent	**Casualties**	**Fatalities**
Rift Valley fever	35,000	400
Tick-borne encephalitis	35,000	9500

Typhus	85,000	19,000	
Brucellosis	125,000		500
Q fever	125,000		150
Tularemia	125,000	30,000	
Anthrax	125,000		95,000

These figures are based on World Health Organization estimates.

The real problem

Whatever the actual death rate from infection, this is not likely to be the main impact of a biochem attack. The loss of such a large part of the population would cause severe operational problems for the national infrastructure: medical services, law enforcement, food distribution, emergency services, etc. This in turn would lead to massive collateral casualties. In addition to the huge number of fatal casualties a large part of population would be incapacitated in other ways. Blindness, deafness, constant weakness and heart complaints are just some of the lingering conditions that effect survivors of mass epidemics.

In addition any potential biochem attack may not be restricted to human beings. Virulent strains of crop and livestock diseases would also have a devastating impact by causing widespread hunger. The chaos caused in the UK by the Hoof and Mouth epidemic, when whole flocks were slaughtered, farms compulsorily quarantined and the movement of animals outlawed, gives a clear indication what might be in store from a deliberate biochem attack on agriculture.

All this makes for gloomy reading, and you might be led into thinking that there is no defense against bio-warfare. In some ways this is a healthy attitude, biochem weapons do represent a significant challenge, but not an insurmountable one and by taking some sensible precautions you can increase your chances of survival.

Chapter 6

Possible Sources of Biochem attack

In order to defend yourself effectively against biochem attack, you will need to be able to identify where the threat is likely to come from.

Accident

In 1979, a leak from a biochem weapons facility outside the city of Sverdlovsk in Russia led to the release of anthrax which left around 70 people dead. Further downwind, animals died. It is estimated just one gram was released – about a trillion spores.

There are likely to have been other accidents as well. Again unlike conventional weapons we are unlikely to know when such an accident has occurred since the casualties won't be easily recognizable. However given that there are at least 30 biochem weapons facilities in the world the likelihood of accident is likely to be high.

The problem is going to be how we identify precisely which facility is malfunctioning.

Hostile countries

As we know from the Iraq situation, no one can be certain which countries have biochem weapons and which do not. The fact that biochem weapons, though costly to develop, are cheap to produce means that they are the ideal weapon for those states that cannot afford more conventional weapons. It has been estimated that the equipment used to produce biochem weapons would only cost $10,000. It is reasonable to assume that many countries feeling threatened by their enemies could have a store of biochem weapons. As we now know, India and Pakistan managed to develop their nuclear arsenals practically undetected. It is therefore theoretically possible that they have also been secretly developing biochem weapons.

A quick look around the globe reveals a few terror states from which bioterror attacks could emerge.

Commonwealth of Independent States (CIS) former Soviet Union

Azerbaijan, Armenia, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, Uzbekistan and Ukraine.

Population: 282 million

One of the more promising developments in the wake of September 11, 2001 was the positive role taken by the Commonwealth of Independent States. While this serves to relieve international tension, it remains a fact that the

CIS has a vast stockpile of biochem weapons built up over the period of the Cold War. But the former Soviet Union is a very different place these days and research and production facilities in Russia and the new independent states are poorly guarded and vulnerable to theft. Moreover, Russia continues to deny international inspectors access to four biochem weapons facilities for inspection.

Scientists are particularly concerned about the possible theft of smallpox virus samples from Russian stockpiles. The only official repositories for the virus, which was officially eradicated throughout the world in 1980, are at the U.S. Centers for Disease Control in Atlanta and the State Research Center for Virology and Biotechnology in Koltsovo, Russia. However other facilities in Russia or the CIS may hold the virus, too, the fact is no one really knows. A smallpox outbreak would wreak havoc. Even the few of us who were inoculated for overseas trips back in the 1970s have lost our immunity. We have nations of people, billions, who have never been exposed to this killer illness.

Egypt

Population: 71 million

Egypt is the largest country in the Arab world in terms of population, but despite having no clear external enemies it is known to be actively researching biological agents for offensive and defensive programs. Possible Biochem weapons include: Anthrax, botulinum toxin, plague, cholera, tularemia, glanders, brucellosis, melioidosis, psittacosis, Q fever, Japanese B encephalitis, Eastern equine encephalitis, influenza, smallpox, mycotoxins.

France

Population: 60 million

France is a signatory state to the Biological Weapons Convention and it is presumed that the former program was terminated and their stockpile destroyed in the1980s. France’s supposed weapons include potato beetle and rinderpest, there may be others but as yet these remain unknown.

Germany

Population: 83 million

This signatory state to the Biological Weapons Convention terminated its program and destroyed its stockpile in the 1970s when it was producing plague, cholera, yellow fever, typhus, foot-and-mouth disease, glanders, potato beetle and wheat fungus.

India

Population: 1 billion

Although a signatory state to the Biological Weapons Convention India is thought to be actively conducting biological weapons defense research although the agents they are producing are unknown.

Iran

Population: 67 million

Iranian officials who report directly to the leadership of the Islamic state have approached dozens of Russian scientists who once made germ weapons, offering as much as $5,000 a month to people who earn far less than that a year in the chaotic Russian economy. Russian scientists say that most of these entreaties have been rebuffed. But they acknowledge that at least five of their colleagues have gone to work in Iran in recent years. Others have accepted contracts that allow them to continue living in Russia while conducting research for Tehran, the scientists said.

In interviews in Russia and neighboring Kazakhstan, more than a dozen former biochemists reported contacts with Iran, and two said they had been asked specifically to help Tehran make biological weapons. American officials say that many more Russian scientists have revealed such contacts and believe Iran is developing a germ arsenal. The Islamic Republic of Iran developed several lines of artillery rockets, ballistic missiles, unmanned aerial vehicles, and-although a member of the Chemical Weapons Convention (CWC)- has a robust chemical weapons capability. It is also believed to be working to acquire serious biological warfare capabilities. However, as we learned in Iraq, part of the difficulty with precisely identifying areas where bio-research is taking place is that such research can be carried out virtually anywhere—in hospitals, farms, even in the home.

Itself a victim of weapons of mass destruction, aggression and missile attacks from Iraq, Iran is seeking to deter its potential opponents as well as to gain more regional power in the Persian Gulf and Caspian regions through the acquisition and development of biological and other weapons.

Reported agents include: Aflatoxin, a deadly agent that infects the liver, anthrax and VX nerve gas.

North Korea

Population: 22 million

North Korea continues to have the scientists and facilities for producing biological products and microorganisms and the ability to produce traditional, infectious biological warfare agents or toxins and biological weapons.

However given the stranglehold of the administration within the country it keeps knowledge of its defense measures top secret.

What is known is that acting on the orders of former leader Kim Il-Sung, in November 1980, North Korea accelerated the development of biological weapons, organizing research institutions and plants with specialists from other countries.

Currently Pyongyang's resources presently include a rudimentary (by Western standards) biotechnology infrastructure that is sufficient to support the production of limited quantities of toxins, as well as viral and bacterial biological warfare agents.

It is believed that North Korea possesses a sufficient munitions-production infrastructure to accomplish weaponization of biological warfare agents. In addition, the North Koreans have terrestrial missile capability of various ranges and a navy equipped with short-range missiles.

Terrorist organizations

Possibly the most likely source of biochem attack would be through some terrorist organization. In many ways biochem weapons, which can be dispersed easily, are very suitable for small organizations without a large established infrastructure. The problem here is identifying the most likely culprits. Obviously there is the much-discussed Al-Queda network. However, as is now being realized, many terrorist associations are extremely loose and many are not interested in publicity. Protecting yourself against them is therefore extremely difficult.

Signals

The following are a number of points, gleaned from nuclear advice in the 1950s that might indicate that the government is aware of a forthcoming incident:

- Have any high profile people been restricting their appearances? Have any national occasions been suddenly cancelled?
- What is happening in the countries with the capability of spreading a biochem attack? Have they been acting aggressively? Are they locked in a long-term conflict e.g. Pakistan and India.
- What is their relations regarding the US - this is a complex area because infection may be spread by third parties with no direct relation to the US at all.
- Are there signs of an epidemic breaking out in some other neutral country?

Homicide bomber?

The following are signs that might indicate a homicide bomber or terrorist. Remember, we are all responsible for remaining vigilant. Listen to that inner voice that nags at you when something is not quite right but you can't put your finger on what it is. And remember too, that sometimes people are just strange – unusual behavior might not be criminal. The trick here is to assess the situation in context. And if in doubt, call 911 and report your suspicions.

- The clothing is out of sync with the weather conditions. For instance, it is a hot day and the individual is wearing a heavy coat that obscures his/her body.
- Carrying an unusual piece of luggage that doesn't fit the picture.
- Obvious disguise such as police officer's uniform with the wrong insignia
- Profuse sweating
- Light colored skin where a beard may have been shaved off.
- Super-clean as though the person has taken a ritual cleansing rite.
- The suspect won't answer a direct question and remains focused on their journey. It's as though they have tunnel vision.
- A "pregnancy" bump without the peculiar gait genuine pregnant women have.

Never approach a suspect bomber. Call the police. The best way to stop a genuine bomber is a clean shot to the head. That's why you need to alert the police. They need to make that call.

Chapter 7

How to detect a Biochem attack

Accurate intelligence is required to develop an effective defense against biological warfare. Once a biochem agent has been dispersed, detection of the biological aerosol (airborne particles) prior to its arrival over the target, in time for personnel to don protective equipment, is the best way to minimize or prevent casualties. However, interim systems for detecting biological agents exist only in the military. Until reliable detectors are available in sufficient numbers, usually the first indication of a biological attack in unprotected areas will be the sick person.

Detector systems are evolving, and represent an area of intense interest with the highest priorities within the research and development community. Several systems are now being trialed by the military. These are:

- The Biological Integrated Detection System (BIDS)

BIDS is vehicle-mounted and concentrates aerosol particles from environmental air, then subjects the particle sample to both genetic and antibody-based detection schemes for selected agents.

- The Long Range Biological Standoff Detection System (LRBSDS)

LRBSDS will provide a first time biological standoff detection capability to provide early warning. It will employ infrared laser to detect aerosol clouds at a standoff distance up to 30 kilometers. An improved version is in development to extend the range to 100 km. This system will be available for fixed-site applications or inserted into various transport platforms such as fixed-wing or rotary aircraft.

- The Short-Range Biological Standoff Detection System (SRBSDS)

SRBSDS is in the research and development phase. It will employ ultraviolet and laser-induced fluorescence to detect biological aerosol clouds at distances up to five kilometers. The information will be used to provide early warning, enhance contamination avoidance efforts, and cue other detection efforts.

The principal difficulty in detecting biological agent aerosols (air-dispersed) stems from differentiating the artificially generated bio warfare cloud from the background of organic matter normally present in the atmosphere. Therefore, these detection methods must be used in conjunction with intelligence, physical protection and medical protection to provide layered primary defenses against a biological attack.

Warning of a terrorist attack

Assume no warning. The terrorist will probably be dressed as a businessman carrying a briefcase, a nanny pushing a carriage, or a delivery guy wheeling a box on a handcart. Or, it could be a bag dropped into a trashcan with a time delay detonator. Don't look for a crazed maniac with a towel on his head screaming Arabic phrases of hate. Those are all convenient media images that bear little resemblance to reality.

Signs in the population that a biochem attack has occurred

There are very few signals that can be detected at the time of dispersal. In aftermath of an attack, there are several signals the authorities will look for:

- Fairly obviously, large numbers of people with similar symptoms of disease
- Large numbers of patients with unexplained symptoms, diseases, or deaths
- Higher than expected death rates associated with a common disease
- Failure of illness to respond to traditional therapy
- A single case of a disease caused by an atypical agent
- Unusual geographic or seasonal distribution
- Unusual disease symptoms
- Genetically engineered, or antiquated strains of pathogens
- Endemic disease with a sudden unexplained increase in incidence
- Simultaneous clusters of similar illness in separate areas
- Death or illness among animals that may be unexplained (as in the case of the plagues) or attributed to an agent of bioterrorism that precedes or accompanies illness or death in humans
- What's the international situation? Are particular states becoming more aggressive?

The central issue underlying all these points is that the Government is unlikely to announce the existence of a biochem attack until such an attack is actually underway and well established because:

- Unlike conventional weapons biochem weapons are silent and insidious
- This is unlike a nuclear strike where logistical and other information can sometimes give a warning.
- Governments will be reluctant to announce statistics or give early warning for fear of generating panic.
- Without in depth knowledge it is difficult to identify one disease from another. Anthrax for example resembles ordinary flue in its early stages.
- Terrorists using biochem weapons won't give a pre-warning, such as a declaration of war or diplomatic breakdown.

Take some comfort from the fact that this is a very survivable attack situation although you are fairly limited in what you can do. Biological agents can be in a variety of forms, ranging from a vapor to a liquid or gel. The probability of your learning of a biological attack ahead of time is mixed. If a virus is released, the incubation period is such that it will already have taken effect by the time you find out. FEMA will assess the threat and provide instructions on how to handle the situation.

Biochemical Delivery

The most important route of exposure to biological agents is through inhalation. In military terminology, biological warfare agents are dispersed as aerosols by one of two basic mechanisms:

- point source dissemination
- line source dissemination

Unlike some chemical threats, aerosols of bio warfare agents sprayed by low-flying aircraft or speedboats along the coast do not leave hazardous residues (although anthrax spores may persist and could pose a hazard where they were dropped). On the other hand, aerosols generated by point-source munitions (that is, a stationary aerosol generator, bomblets, etc.) are more apt to produce ground contamination, but only in the immediate vicinity of dissemination.

Point-source munitions leave an obvious signature that would alert the military to the fact that a biological warfare attack had occurred. Because point-source munitions always leave an agent residue, this evidence can be exploited for detection and identification purposes.

Other routes for delivery of biological agents are thought to be less important than inhalation, but are nonetheless potentially significant. Contamination of food and water supplies, either purposefully or incidentally after an aerosol biological warfare attack, represents a hazard for infection or intoxication by ingestion. If you live in an affected area, don't eat anything you are given after an attack unless you are sure that the food and water supplies are free from contamination.

Note:
Infection is the result of exposure to a virus or bacteria.
Intoxication is the result of exposure to a toxin.

Aerosol delivery systems for biological warfare agents most commonly generate invisible clouds containing tiny particles or droplets. They can remain suspended in air for a long time. The major risk is pulmonary (lung) retention of inhaled particles. To a much lesser extent, particles may stick to an individual or his clothing, so there is a need for individual decontamination.

The effective area covered by bio warfare agents will depend upon many factors, including wind speed, humidity, and sunlight. In the absence of an effective real-time alarm system or direct observation of an attack, the first clue would be mass casualties fitting a clinical pattern compatible with one of the biological agents. This may occur hours or days after the attack.

Bio warfare agents could be delivered via aerosol from a low flying plane to attempt contamination of water supplies. For the most part, the suburbs won't be affected by a vapor delivery since air movements have a tendency to dissipate the agents fairly quickly. In addition, the U.S. Department of Homeland Security has the skies covered now, so terrorists are unlikely to be able to use a crop duster to target the suburbs. There is also the issue of water treatment, which would kill many pathogens.

Going into the city, the terrorists are most likely to try and get the biggest bang for their buck and target congested areas such as subways, large indoor malls or indoor arenas where infected visitors will take their infections away and distribute them far and wide.

Chapter 8

Preparing for a biochem attack

Arrange an emergency meeting plan with your family in advance of any disaster. This plan is all-purpose and can be used for any type of emergency.

Emergency meeting plan

Pick two places to meet:

- Outside your neighborhood in case you can't return home. Everyone must know the address and phone number.
- Right outside your home in case of a sudden emergency, such as a fire.
- Ask an out-of-state friend to be your "family contact." After a disaster, it's often easier to call long distance. Other family members should call this person and tell them where they are. Everyone must know your contact's phone number.

Long range precautions

If a biochem attack takes place at a location far from you, your main worry is that a family member or neighbor may come in contact with a person exposed to the biological agent or to an infected person carrying the illness. Most illnesses will take a few days for the symptoms to reveal themselves and people can travel great distances during these day, spreading their infection as they go. It is important that you work out whom you have touched or been close to since any outbreak began and what their movements were in the time leading up to your meeting. Telephone and email will help minimize face-to-face meetings and the exposure risks they carry.

Interestingly every major epidemic to strike humanity in recordable history seems to have had two basic effects on the morale of the people concerned.

- There are those who see the disease as being unbeatable and believe in taking no particular precautions; a form of hysteria takes over.
- And there are those who take every precaution, whether sensible or otherwise, and over-react.

Both reactions are basically manifestations of panic and both contain dangers. Overreacting, for example, will lead to spreading panic. Try to assess the risk as accurately as you can, based upon the most reliable information you can obtain. This might sound obvious but another phenomenon, which occurs during time of national stress such as an epidemic, is the growth of rumor, particularly in terms of supposed cures or protections. It is very understandable and human to seize upon fresh news as gospel. Just remember that even in peacetime almost every story you see or

hear being reported is riddled with inaccuracies. Just imagine how much worse this would be during a panic situation. Try and keep your head while all about are losing theirs. Commonsense will go a lot farther than desperate measures.

Because no disease ever kills everyone it infects and people get infected in different ways, it is very easy to slip into the belief that by performing some ritual or taking some type of folk remedy you can ward off the illness. Try to see a biochem attack in the same way as a nuclear or conventional weapons strike - go strictly by the science and what is known. Remember that diseases do not have personalities, they do not make moral judgments nor do they have a sense of charity or revenge.

Remember also that every supposed cure has to have a solid scientific reason as to why it works. Folk remedies may have the benefits of age-old wisdom but you should always seek to know exactly why they work in the way claimed.

Finally, and most importantly remember that 90% of the purpose of a bioattack is to spread panic. By making the attempt to assess the situation accurately you have at least the chance to avoid giving the enemy a significant victory.

If you are suddenly informed that a biological attack is underway and people have been contaminated in your building then take the following steps:

- Abandon the building immediately – and try, as far as possible to avoid congregating with large groups of people.
- If you are caught out in the open when a formal announcement is made, immediately seek shelter.
- If you are at home, go to the emergency room and seal off the room.
- Try to do the same things that you would do in the event of a flu epidemic.
- Try to get information on how contagious the disease is, and how far it has spread.
- Listen to the radio as much as possible and try contacting the local emergency services for any details.
- Strictly follow any guidance given to you by the local emergency and medical authorities.
- If you have to go outside, and you don't have any protective clothing then place a wet rag over your face and nose as a protection against infection.

One of the greatest difficulties you are going to face with an emergency is deciding what you are going to do if members of your family are in widely disparate places. If they are in a safe place then it might be worth leaving them there until the situation is normalized. Bear in mind that any member of your family could be carrying the

infection. It may be that you are instructed to evacuate your home, be prepared to do so. Do not hesitate or seek to delay. No one is asked to evacuate lightly.

NOTE: During any type of bio attack, wash your hands frequently, avoid close proximity to an infected, (or potentially infected) person. Make sure you are thorough; bleach surfaces, sinks, taps, toilets etc. Boil wash clothing that an infected person may have touched in disinfectant and soap. Avoid touching your eyes. These basic hygiene practices will greatly increase your chances of avoiding infection.

Personal Measures

Before examining the measures and equipment that you might need to take to save yourself in the advent of a biological attack the most important factor to consider is your own psychological state. Do not under estimate this. In the extensive research that was undertaken regarding the possible effects of a nuclear war one of the chief factors to emerge was the attitude of the survivors. As one authority admitted "we can take precautions to ensure that some at least survive the initial attack, but then we are faced with the question – will the living envy the dead?" Very grim but ignoring this issue won't make it go away. If you endure a major biological attack you may have to cope with:

- The death of family members and close family friends.
- The disappearance of reassuring and familiar rituals and people. No corner store visits, maybe no TV or radio, certainly very different TV and radio. No sport to play or watch, no papers, customers or deliveries or organized religious worship.

The idea that you may have to do without your daily paper might seem a fairly trivial consideration; in fact life is made up of small-scale rituals and repeated behavior. The impact that the removal of the familiar can have can be traumatic and it may sap your desire to live at all, especially if you know that many members of your family have already been killed.

In crisis situations, interestingly enough, it often seems that those who survive are those who don't give in to despair. Sometimes they have made little preparation, but if they strictly focus on their own survival their chances of coming through are radically improved. In order to prepare yourself psychologically there are several steps you can take:

- Fear and despair are contagious; discuss the impact of a possible attack (calmly) with your family. Do not try to panic them; aim at presenting the situation as realistically as possible.
- Try to note those things that you do which you would most keenly miss and brace yourself. Often it is discovering that you can't do something you expect to do which has the worst impact.

- In your emergency pack include something diverting such as a game (a set of cards, a board game), or even frivolous (within reason) items. No matter how dire the situation, human beings need to be able to switch off on occasion.

Fitness

Again it might seem obvious, but the people most likely to survive a bio attack are those who are fit and healthy in the first place. If you have no health regime, ignore exercise, smoke and drink excessively and are either significantly over or under weight, then you are more likely to become a victim of any deliberately induced contagion. Even if you suffer from a medical condition such as diabetes, or asthma, the fitter you are the more likely you are to survive.

Hygiene

Some biochem weapons are spread through human contact. It is a good idea to improve your hygiene regime. Remember to drain standing water as it attracts mosquitoes which can be disease carriers. Keep your house clean so that it doesn't attract disease-infested flies, rats and other creatures.

Toilet Facilities

The disposal of human waste is an unpleasant but necessary task. It has to be dealt with efficiently and promptly. Some diseases, including cholera are spread by means of human waste. It is at least possible that the bio disease you are attempting to shield yourself from may involve some kind of virulent vomiting or diarrhea as part of its symptoms. Should you be in a room with three people suffering from these symptoms you will not need convincing of the importance of proper toilet arrangements.

It is also possible that the conventional sewage facilities may cease to function due to lack of maintenance during the emergency. It's also fair bet that finding a plumber during a bio emergency is going to be difficult. So all in all it is important to take steps to address this difficult area.

If you live in a rural area and you have a well pump that supplies your water, any loss of power will disable your normal means of flushing the toilet. If you have surface water nearby, possibly a swimming pool, pond, stream or swamp, you can fill a bucket from one of these water sources and use it to flush the toilet by pouring it into the toilet bowl. If you live in the city it will be difficult to find water to flush a toilet.

Adapting

Camping supplies sell various commode-type toilets that either come with a bucket or a plastic bag arrangement. With either option there is usually a disposable bag liner and some sort of deodorizer. When the bag liner gets full you take it out, put a twist tie on the bag and get rid of it.

The next question is how to get rid of it. If you don't have power, water or sewer the chances are that you won't have trash removal either. Dig a hole in your back yard and bury the bags. Do not bury waste products within 50 feet of a water source. Clearly label where this bio-hazard is being buried. If you do not have a place to bury these items the local authority will probably suggest alternatives. Do not dump these bags outside in the street or in a deserted area. You will only add to the risk of infection, as animals will almost certainly tear them apart and infect both themselves and any parasites they might be hosting. This will add to the severity of the epidemic. Do not be selfish.

Outside privy

Go out in the back yard and dig a trench or hole two to three feet deep. Take the seat off your toilet and rig some sort of support frame over the hole to put the seat on. One suggestion is to cut a large plastic barrel in half, upturn it over an indentation about 6-9 inches in the soil and cut a hole in the top (which was the bottom of the barrel) and attach a toilet seat around the hole. Move the toilet arrangement when the indentation is full and cover the mess with disinfectant, dirt and/or sand. Keep animals away.

If you have wood ashes from a fireplace or wood stove, save these and put them in a bucket next to your privy with an empty tin can. Every time you use the toilet, throw a small can of ashes over the excrament. It will keep the smell and flies down.

Don't forget to stockpile some toilet paper. Having to do without toilet paper would probably be one of the hardest tests of all. Fortunately this situation is ideal for recycling "used" paper.

Wash your hands in a water bleach solution kept by the privy. Keep this in a half-gallon plastic jug such as spring water comes in. Place a piece of soap in the foot of a pair of pantyhose, or a knee-high. Tie this to the jug handle. Pierce the jug lid with "pepperpot' holes. This makes a handy hand washing station. Make sure you have a stockpile of bleach and soap.

Note: Bleach, soap and toilet paper become high value barter items in hard times.

If you feel that these measures seem extreme it might help to reflect that merely fifty years ago measures like these were standard procedure in unsewered areas in most rural communities. People coped then, so you should be able to cope now. In terms of other types of trash, a good burn barrel will work wonders.

City dwellers

Relying on the authorities to come to your aid is optimistic and unreliable. It is better to have local plans of your own. For instance, working with others in your apartment block, or street to prearranged the location of privies and burn barrels; to coordinate waste disposal or water collection; arrange timetables for washing stations; arrange for disposal of the dead, etc. in advance of any disaster will help maximize efficiency and reduce contagion risks during an emergency.

Disposing of the dead

A mass biochem attack will inevitably mean mass casualties. And mass casualties can mean disease. You may not want to face it, few do, but in the immediate aftermath you may find yourself having to dispose of dead bodies. Remember before disposing of any bodies to make sure that you get anything that may identify the individual. Put any personal effects aside in a secure place. You also need to bear in mind the following points:

- Prepare yourself psychologically. It will be rough dealing with dead bodies, especially of loved ones, but there is no alternative. You just have to recognize that this whole process is vitally necessary.
- Never touch a dead body with your hands, tie back long hair so that you don't keep rubbing your hands across your face, wear disposable gloves; a builder's mask soaked in disinfectant or bleach may help you deal with any odor issues, and wear protective, disposable clothing, particularly in a bio emergency.
- Bodies should be washed down with a bleach solution and wads of bleach-soaked cotton/cotton wool placed in orifices before the body is moved to prevent leaks or spills of potentially infectious matter or liquids.
- You will need to get the correct equipment: spades, petrol, and if necessary landfill. Burial is the better option but burning is a good second. If you do decide on burning you will need to dig a pit to have the best effect. Bodies should be encased in plastic trash bags when moved.
- Note that burials should be six foot deep and any cremations should be as thorough as possible.
- You will have to choose a place to dispose of the bodies – somewhere that is far enough away from your dwelling, but close enough to be convenient.
- If you can, make sure any graves are marked with the name of the deceased, the date and cause of death. You may not be around to tell anyone else.

Chapter 9

What about protection?

What the military use and what's available to the general public are two very different things. Military equipment is based upon the battlefield risk, not on a civilian attack. Civilians will find that there are very few protective items available to them, and for good reason. The military have a good idea what a conventional enemy is going to use to attack. We have almost no idea what a terrorist will use. There are no universal protective garments that would be practical in any real world scenario.

What the military have

The current US military chemical protective equipment includes a protective mask, battle dress overgarment (BDO), protective gloves, and overboots.

Masks

The M40 protective mask is available in three sizes, and when worn correctly, will protect the face, eyes, and respiratory tract. The M40 utilizes a single screw-on filter element that involves two separate but complementary mechanisms:

1) impaction and adsorption of agent molecules onto ASC Whetlerite Carbon filtration media, and
2) static electrical attraction of particles initially failing to contact the filtration media. Proper maintenance and periodic replacement of the crucial filter elements are of the utmost priority. The filter MUST be replaced under these circumstances: the elements are immersed in water, crushed, cut, or otherwise damaged; excessive breathing resistance is encountered; the "ALL CLEAR" signal is given after exposure to a biological agent; 30 days have elapsed in the combat theater of operations (the filters must be replaced every 30 days); supply bulletins indicate lot number expiration. The filter element can only be changed in a non-contaminated environment.

Two styles of optical inserts for the protective mask are available for soldiers requiring visual correction. A drinking tube on the mask allows the wearer to drink while in a contaminated environment. Note that the wearer should disinfect the canteen and tube by wiping with a 5 percent hypochlorite solution before use.

The battle dress overgarment suits come in eight sizes and are currently available in both woodland and desert camouflage patterns. The suit may be worn for 24 continuous hours in a contaminated environment, but once contaminated, it must be replaced and incinerated or buried. Chemical protective gloves and over boots come in various sizes and are both made from butyl rubber. They may be decontaminated and reissued. The gloves and over boots must be visually inspected and decontaminated as needed after every 12 hours of exposure in a contaminated environment. While the protective equipment will protect against biological agents, it is important to

note that even standard uniform clothing of good quality affords a reasonable protection against dermal exposure of surfaces covered.

What you can use

Certainly the most traditional way of avoiding infestation is to wear a mask. During the bubonic plague doctors used to visit patients equipped with huge beak shaped masks which they filled full of sweet smelling herbs.

The first and most obvious problem is that a mask would only protect you if you were wearing it at the exact moment an attack occurred. Unfortunately few terrorists are likely to give a warning; a release of a biological agent is most likely to be done "covertly," that is, without anyone knowing it. That means you would not know ahead of time to put on your mask.

To wear a mask continuously or "just in case" a bio terrorist attack occurs is impossible. No matter how virulent the attack you will still need to eat and drink. To work effectively, masks must be specially fitted to the wearer, and wearers must be trained in their use. This is usually done for the military and for workers in industries and laboratories who face routine exposure to chemicals and germs on the job.

Gas masks purchased at an Army Surplus store or off the internet carry no guarantees that they will work. In fact, one national chain of surplus stores provides the following statement: "(X) has been selling gas masks as a novelty item since 1948. We have never been able to warrant their effectiveness and we cannot do so at this time...We do not know what each type of gas mask we sell might or might not be effective against...We do not know the age of each gas mask..."

More serious than the fact that they may be unreliable is the point that the masks can actually be dangerous. There are numerous reports of accidental suffocation when people have worn masks incorrectly.

Builders' masks can be briefly effective against some large-particle agents. They may be useful, soaked in disinfectant for very short periods of time, when the wearer is trying to prevent the inhalation of infected breath or mucus. Hospital masks will obviously help against airborne germs but without the sterility of an OR you still run the risk of becoming infected. It should be remembered that many of the biological agents can enter the body through the eyes.

Types of Gas Masks

When most people think about gas masks or respirators, what they usually envision is a tight-fitting plastic or rubber mask with some sort of filter cartridge. The mask covers the nose and mouth. These are called half-mask air-purifying respirators.

Depending on the chemical or biological agents in the environment, a half mask may not be sufficient because the eyes are very sensitive to chemicals and offer an easy entry point for bacteria. In this case, a full-face respirator is called for. It provides a clear mask or clear eye pieces that protect the eyes as well.

Air-purifying respirators have two advantages:

- They are the least-expensive option.
- They are the least-complicated option.

However, the disadvantage with air-purifying respirators is that any leak in the mask makes them ineffective. The leak could come from a poor fit between the mask and the user's face, or from a crack or hole somewhere on the mask.

Two other types of respirator systems solve the leak problem:

- The supplied-air respirator uses the same sort of filter cartridge found in an air-purifying respirator. However, instead of placing the filter directly on the mask and requiring the user's lungs to suck air through it, the filter attaches to a battery-operated canister.
- The canister uses a fan to force air through the filter, and then the purified air runs through a hose to the mask. The advantage is that the air coming into the mask has positive pressure. Any leak in the mask causes purified air from the canister to escape, rather than allowing contaminated air from the environment to enter. Obviously, positive pressure creates a much safer system, but it has two disadvantages: if the batteries die, so do you and the constant air flow through the filter means that the filter does not last as long. However, for infants and children this may be the only option because their small faces make masks difficult to fit reliably.

The best system is called an SCBA (self-contained breathing apparatus) system. If you have ever seen a firefighter wearing a full-face mask with an air tank on his or her back, then you have seen an SCBA system. The air tank contains high-pressure purified air and is exactly like the tank used by a SCUBA diver. The tank provides constant positive pressure to the facemask. An SCBA provides the best protection, but has the following problems:

- The tanks are heavy and bulky. This is an important consideration for it means that working wearing SCBAs will be difficult.
- The tanks contain only 30 or 60 minutes of air.

- The tanks have to be refilled using special equipment.
- SCBA systems are expensive.

With their limited capacity SCBA systems are not altogether practical for long-term exposure.

NOTE: Some experts consider that simply using a rolled up handkerchief soaked in water would be as effective as most types of gas mask.

If you do decide to invest in a gas mask or masks

- Do not buy them over the internet. Gas masks must fit perfectly to be effective and will therefore need to be modeled on your face, and the faces of your family. This necessity for a tight fit means that you should make sure you shave before putting your mask on as even ordinary stubble means that the mask will not fit as tightly as required.
- Do not buy second hand or surplus. Frequently these masks contain flaws, holes, leaks etc. Only buy from a known supplier.

Protective clothing for civilians

On the face of it protective clothing seems like a good idea. A simple glance at the emergency services shows how important protective clothing can be in a crisis. There is no question that, initially at least ,protective suits work. They are relatively easy to obtain, being extensively used in industry throughout the country. However, you have to ask what are you protecting yourself against. If it is a biohazard, this is very different from a chemical attack. Most protective suits are for use against chemical exposure. They are only designed to be used for a few hours or longer; they are not intended to offer protection over a significant period. They can be very expensive, especially the quality ones, and they are meant for fairly specific objectives so it is essential that you obtain the right suit.

Those suits that protect against biochem attack are likely to be very different from those that offer protection from fire, etc. Like gas masks, the effectiveness of a suit tends to depend on when you put it on. Again, this implies either wearing it or having it close to hand, both of which may be difficult if you happen to be working. Protective suits can also be difficult to get on or get off. Prices vary but protective suits are not cheap and getting ones for children can be difficult.

How can I tell if I have been infected?

This is perhaps one of the most obvious questions to ask regarding biochem attacks, and is one of the most difficult to answer. This is because many diseases start off in the same way – fevers, nausea etc. By the time you have developed unmistakable symptoms it could be too late.

This is why it is positively dangerous to try to give any preliminary advice on how to tell whether someone has become a victim. Later in this handbook is a section reviewing the biological agents that are the most likely to be used by terrorists. Each agent is reviewed and the symptoms and signs of infection are listed. In many cases, however, the first signs are very similar to those you would expect to suffer if you had flu or a cold.

It is absolutely vital that you assess your risk or biological infection based on risk rather than fear. If you were in an exposed area, met with someone from an infected area, had face-to-face contact or touched the clothes or personal items of an infected person, or were the recipient of an envelope containing an unidentifiable substance then you should present yourself at a hospital or doctor's surgery making sure to call in advance to determine their admissions policy. If you are not at risk, remember that the emergency services will be stretched to the limit and time wasters will put an even greater strain on resources.

So:

- Do not panic. It is entirely possible that what may seem to be the onset of plague is in fact a simple cold. Assuming the worst will have a catastrophic effect on those around you, as well as yourself.
- Take precautions. Even though you should not automatically assume the onset of a serious illness - you should follow basic hygiene rules. Restrict access and exposure to the ill person (including yourself), thoroughly destroy all waste and be extra careful over hygiene.

Water filters

One way to ensure that you get a fairly continuous supply of fresh water is to install a water filter. But what type? Filters come in a wide range. There are the "do-it-yourself" under-sink type and whole house water filters that are designed for easy installation. In these cases clamping a saddle valve around your cold water supply line is all there is to installing your filter. However, if you do not want to tap into your cold water line or if you live in a rental unit and cannot tap into the pipes, a faucet mounted or countertop water filter is what you need.

Point of Entry (POE) Whole House Water Filters

A whole house filter will reduce bio infection in addition to rust and sediment picked up from the pipes that deliver water to your home from your well or municipal water system, known bio targets. It will also remove much of the chlorine that can cause itchy skin and damage your clothing.

Point of Use (POU) Water Filters

Having coped with general water demand you should install a high-contaminant-removal filter in your kitchen (or bathroom) where water is used for cooking and drinking. Called “Point of Use” filters, these units remove contaminants and provide clean, safe, great tasting water on demand.

Emergency Electricity Supplies

If the electricity supply collapses you will need an emergency source of power – a portable generator is one option. To purchase they start from a couple of hundred dollars and go up into the thousands depending on the size, power and number of outlets. Most run on diesel or gas although newer ones are solar powered. They are noisy! The advantages of a portable generator are

- They are readily available – most towns etc have hardware shops that can supply some form of generator. However, there will be a run on these in an emergency. Consider getting your own or splitting the cost – and the power – with a neighbor. It may be that you only need power to keep your deep freeze working, or to use a computer or TV. If you live in a street, you and your neighbor can run a power line into each of your homes off the same generator.
- They are based on tried and true technology – mobile generators have been around for decades.
- They are normally easy to use. Modern generators are not intended to be complicated.
- They are easily maintained.

NOTE: These generators give off carbon monoxide. This means that you cannot keep them in your safety room. They must be stored outside.

Air filters and purifiers

Since many biological and chemical agents are dispersed through the air you may consider purchasing an air filter for your home. This really only makes sense if you live in a high-risk neighborhood such as a location close to a military, political or business target or are downwind of a factory producing chemicals or toxins. Air lilters are based on tried and true technology and have been around for some time which would seem to indicate that they work. However, they can run into several thousand dollars. Some can be bought for less, but these are unlikely to be an effective way of protecting your nearest and dearest over time. They also need a power source, which means they draw power from other equipment and they require continual maintenance.

Basically, domestic air filters can induce a false note of security. They are not as sophisticated as HVAC systems in modern office buildings and they probably don't add enough extra peace of mind to make the expense worthwhile.

Quarantine

Traditionally whenever a plague or some similar disease struck a society attempts were made to isolate the infected. This was done extensively during the Middle Ages. The maritime republic of Venice for example was frequently ravaged by seaborne plague and drew up a list of stern statutes that had to be obeyed by all ships that sought to use the port, in general they didn't work, rats could swim. During the Great Plague of London in 1665, families where someone contracted the disease were forcibly sealed into their houses. In more modern terms the UK in the nineteenth century passed regulations which obliged anyone contracting TB (the white plague) to attend a sanatorium.

Of course all of these measures involved treating someone who was already ill, and thus were of limited use in preventing the spread of the disease. Doubtless if a bio attack does occur, governments will attempt to quarantine the sick, but to stay ahead of the danger there are some measures you should take.

- Try to understand how a disease is spreading before you do anything. Is it water borne? Is it spread through respiration? How long is the incubation period? How long before it is safe to go back outside?
- Make an accurate assessment of your situation - where you live; what medical, food and water resources are available.
- Remain focused on reality. If you have children, elderly relatives, or people who require medical attention, etc., your ability to restrict your contacts with the outside world may be limited.
- Be aware also that attempting to restrict your access to the outside world is going to impact on your social relationships. Compensate and try to stay in touch by phone and email.

If the biochem attack took place in a location far from where you were at the time your main worry is that a family member or neighbor may have been in contact with a person exposed to the biological agent or to an infected person carrying the illness. Most illnesses will take a few days for the symptoms to reveal themselves and people can travel great distances, spreading their infection as they travel.

What to avoid

If the health risk is something that can be spread from person to person you will want to avoid, as far as possible, public areas and crowds. This might seem obvious but the implications are that you will need to stay away from:

- Public transport
- Theatres, sports events and other types of mass entertainment
- Doctors' offices, hospitals.
- Supermarkets, shopping malls
- Gas stations

This list shows how constraining attempting to isolate yourself and your family can be. And it doesn't end there.

One of the most poignant stories to emerge from the plague epidemic of 1665 in the UK was that of the village of Eyam in Derbyshire. Hearing that the plague was raging in London the villagers attempted to protect themselves from the disease by cutting themselves off from the capital. This worked to an extent but the local tailor took a delivery of cloth from a London manufacturer. The cloth contained infected fleas and within days the plague was raging in the village. Mindful of their responsibilities the villagers cut themselves off from the outside world and stayed strictly within the village bounds and died in large numbers.

The Eyam example highlights one of the central problems in all do-it-yourself quarantines – making sure it is not breached by outside authorities. The other problem is that you will need to keep in touch with the outside world if only to obtain news, supplies and equipment. You will therefore need to establish procedures to make sure that all ingoing communications are carefully regulated.

Storing antibiotics

Antibiotics were the wonder of the Twentieth Century and made a major contribution to the world's health. It is natural in the light of this to assume that stocking up on antibiotics may well be an answer to at least some bioattacks. However there are a number of problems associated with trying to get hold of a useful store of antibiotic, or indeed other cures.

Storage

Simply trying to store antibiotics can present a difficult challenge. Many need to be stored under particular conditions in terms of temperature. At first this might seem a fairly easy task – all that is required being to place the antibiotics in a fridge. However this of course assumes that regular power supplies will still exist during a national crisis – and that is by no means a small assumption.

Supply

Many antibiotics require a continuous or at least sustained supply to be effective. Antibiotics have a limited "shelf life" before they lose their strength. Once again obtaining supplies this may seem simple, but in times of crisis this could be difficult to obtain.

Range

One problem you will face if you intend to stock up on antibiotics or other cures is deciding exactly what disease is likely to be used in a bioattack. No single pill can protect against all types of biological weapon attacks.

Another and major problem is that some people are allergic to antibiotics. Before administering any it is essential that you find out if this is the case with the person you are trying to treat.

Types of antibiotics

Tetracycline and doxycycline.

If given within sufficient time, these antibiotics are useful in preventing the development of Anthrax for which an individual may have been exposed. However, exposed means during an attack. Anthrax is not contagious -- that means it does not pass from one person to another. So there is no reason for people to take antibiotics out of fear of contracting the disease. It is not recommended to take these antibiotics continually.

Ciprofloxacin hydrochloride

Cipro is an antibiotic used to treat bacterial infections in many different parts of the body. It does not work for viral infections (for example, the common cold). Cipro is approved for use in patients who have been exposed to the inhaled form of anthrax.

Side effects

Under normal situations, these antibiotics are avoided in children and pregnant women. However, if that individual has been exposed to anthrax, the benefit may outweigh the risks of taking the antibiotic. These are consensus recommendations, but they have not been studied in children and pregnant women. Some possible side effects include:

- central nervous system (CNS) side effects including: dizziness, confusion, tremors, hallucinations, depression, increased risk of seizures
- an allergic reaction (difficulty breathing; closing of the throat; swelling of the lips, tongue, or face; or hives)
- pain, inflammation, or rupture of a tendon
- a severe tissue inflammation of the colon
- increased sensitivity of the skin to sunlight

Alternative remedies

Given the difficulties of finding a particular antibiotic during an emergency you might feel inclined to try popular remedies such as stabilized oxygen and colloidal silver. During the outbreak of every popular epidemic people have turned to the weird and wonderful in hopes of finding a sustainable cure. Whether you give credence to these claims is up to you. Whatever you do, do not abandon your agreed emergency procedures and measures and place your hope solely in these cures.

Handling suspicious packages or envelopes

As was shown with the recent Anthrax attack the most obvious way of spreading the disease is through the mail. You won't want to cut yourself off from the postal service entirely, so here are a few steps you can take to minimize the chance of any risk.

- do not shake or empty the contents of a suspicious package or envelope. This is a fairly obvious point, but many people believe that shaking and listening carefully to a suspicious piece of mail will give some guide to the contents. In fact it doesn't and in the case of a deliberately infected mail piece it certainly won't.
- do not carry the package or envelope, show it to others or allow others to examine it. This is not always possible, but it makes sense to put a firewall of others between you and the package if you can.
- put the package or envelope down on a stable surface. Do not sniff, touch, taste, or look closely at it or at any contents that may have spilled. There is little point in subjecting the contents to such inspection as you are unlikely to see anything that will look like a bio weapon.
- wash your hands with soap and water to prevent spreading potentially infectious material to face or skin. Again it's obvious, but again it's vital. Washing your hands should become second nature in this situation.
- if you do encounter a package that you think is suspicious do not hesitate to contact the proper authorities. Never forget that the best defense against becoming infected is to ensure that others aren't infected and that the disease dies out.
- if you receive a suspicious letter try to find out who may have sent it. If possible, create a list of persons who know your address and may have sent the letter to you. Give this list to both the local public health authorities and law enforcement officials.

Communications during a biochem attack

Keeping in touch with the outside world will be essential. However, most modern forms of communication rely on a regular power supply, which cannot be guaranteed in an emergency. An exception is the clockwork radio, now used widely all over the world where power supplies are erratic or absent. There is also a wind-up phone battery charger called Sidewinder, which, it is claimed, will generate six minutes of talk time for most cell phones with just two minutes winding. As for TV viewing, if the TV networks are broadcasting you might not get to see them if your signal comes in via satellite or cable. Consider a portable battery TV such as fans use at football games, or an AC/DC TV with a "rabbit ears" aerial that plugs into the cigarette lighter in your car. Relatively cheap and easy to run, these devices have proved their worth and it might be an idea to invest in one.

Do you need a safe room?

Establishing a safe room may not be necessary. As with other measures it depends on two main factors:

- that you are able to tell that an attack is occurring and imminent, and

- that the danger is only going to last for a limited period, for instance that it will be a chemical attack of short duration.

Given these constrictions a safe room is a valuable precaution. You can put up duct tape and plastic sheeting if it makes you feel better, but the probability is that there won't be enough ambient vapor from the first release to make it to your house or office, much less penetrate it. Your main priority is to prevent person-to-person contact. Remember, sealing your house and making it airtight, will increase the level of carbon dioxide and monoxide build-up inside so it is probably counterproductive unless advised over the Emergency Alert System on your TV or radio.

Selecting the room

Some of the following prescriptions may not be available to you, but they should be considered:

- Choose a room with as few outside portals as possible, windows, doors etc.
- Can the room be sealed off.
- If you live in a two-storey house the room should be upstairs.
- The room should be big enough to accommodate all your family members.

Select your safe room some time before an attack seems imminent. And, having selected it, you should try to store essential materials in it. Put together a safety pack. This should contain all the essentials for a short emergency. Allocate a chest or use a rubber storage box with a lid. You can hide it in a cupboard or under a throw. It should contain some of the following:

- Chemical toilets and sanitary facilities. It is worth remembering that if water supplies are cut off that normal toilets are not likely to function. In a dire emergency, a bucket and kitty litter could be used.
- Diversions such as toys, games, crayons, books etc.
- Drinking water.
- Duct tape to seal up doors and windows if advised.
- Eating utensils - cup, knives even plates. These items may not seem vital but remember during a bio attack you are trying to reduce human contact as much as possible. This means that if you can you should try to reduce the sharing of bottles, food etc.
- Electronic media – radio, television and, if possible internet connections. Wind-up radios and phone battery chargers should be left in this room.
- Elementary first aid - band-aids, disinfectant, bandages, scissors a first aid book.
- Emergency lighting. Consider keeping an emergency lighting system connected at all times so that it cuts in when the mains go out. Alternatively you should have battery powered lamps and flashlights. If you need a permanent light source, consider glow-sticks. These contain two chemicals which when mingled

produce a fluorescent glow. These are available at camping stores and party supplies stores, especially around Halloween. Depending on size, they will produce light for up to 12 hours.

- Fire extinguisher, preferably one that you know how to use.
- First aid kit and instructions. Ideally one of your family should take first aid lessons.
- Food. Just a few basics to get you through a few hours. Your main food stash will be stored elsewhere. See Chapter 10 for more details.
- Gas masks and protective clothing – if you decide to get them.
- Safety lighter – always useful.

Make sure that the people you want to use the room are aware of its existence and have a clear idea of their duties in the event of a disaster. And there will be duties, you cannot expect to do everything and others will have to lend a hand.

Finance

Unless society breaks down altogether you are going to need cash in an emergency. And if the emergency involves the risk of infection you are not going to want to wait in a bank line.

There are several steps you can take:

- Stash some cash right now. As much as you can afford, hidden in more than one safe place. Do not tell anyone other than the other responsible adult that you have done this.
- Don't withdraw cash during a bio attack or the period afterwards. Notes and currency are ideal media for spreading disease.
- You might consider buying some gold, either bullion or coins or precious stones. These types of items can usually be readily exchanged but they do have a number of disadvantages: although are not likely to be of much use in obtaining simple items such a disinfectants or a bottle of milk.
- Be prepared to barter. Purchase extra bleach, milk powder, batteries, etc. and trade with neighbors. Never let people know that you have a large store of emergency supplies. Trade small amounts and don't draw attention to yourself. In a dire emergency even people you consider friends may become desperate and try and take your supplies away from you.

Security

Most agree that the best form of security to employ in a biochem attack is discretion. By not advertising your preparations you are less likely to find yourself at the receiving end of unwanted attention. Clearly there are some sensible security measures you can take such as installing strong locks and making sure that you hide away all your

supplies. Fortunately few of these are valuable enough of themselves, so they are not likely to be of much interest to the average criminal.

However, social order may break down during an emergency situation. You should be prepared for it, just as you are prepared for all the practical problems you and your family will face. Even though you have made provision for an emergency you can be sure that plenty of other folk will have done nothing, or made completely inadequate arrangements. This is one reason why you don't want everyone to know how prepared you are. What would you do if they came to you in an emergency? Could you turn them away? Would they become aggressive if you did?

Remember that if you have a gun that the possibility of an accident occurring is greatly increased while stress levels are running high. Also, if they occur, finding medical help in a national emergency is likely to be difficult. In addition, if the bad or the desperate know that you have a gun there's a good chance they will try to take it off you.

Chapter 10

Emergency Food Supplies

Every home should have a basic level of supplies to meet an emergency. Not just for biochem terrorism but for black outs, water shortages, labor strikes, severe weather conditions. Obviously, the amount of food you can put away for an emergency depends on your resources and available space. The following is a suggested list, but by no means comprehensive. It contains the basics and is laid out by meal to help you plan ahead. Remember food is not simply a matter of nutrition. Eating is also a key social activity and, just as importantly, will keep you busy and keep your mind off your troubles. Don't forget your pets need to eat and drink, too.

Breakfast

Eggs – Fresh eggs will keep much longer than you think in a temperate climate. Don't wash them. There is a bloom on eggs, which the hen coats on as it passes from her, that prevents germs entering the shell. This is removed with washing or boiling. Eggs are usually good for at least 6 weeks. Try the float test if in doubt. A good egg will sink to the bottom of a bath of water; a bad egg will float.

Eggbeaters® are good for 90 days from the day they leave the production line. Powdered egg – that wartime staple – is still available from specialist stores and online from waltonfeed.com. Powdered eggs are a non-perishable food when stored in an airtight container. Stored in the absence of oxygen and placed in a cool storage environment gives powdered eggs a storage life of 5 to 10 years.

Cereals, granola, and muesli are all easy to obtain and easy to store.

Oxygen absorbers

Oxygen, along with moisture, can cause spoilage in many foodstuffs. Oxygen absorbers are a non-toxic chemical compound which, when placed in a properly sealed package, reduce the inner oxygen level considerably. Reducing it increases shelf life by inhibiting oxidation (deterioration) of vitamins, spices, fats and oils, and prevents mold growth. They are good for both long and short-term (sending cookies, etc.) packaging needs. Absorbers are labeled by how many cubic centimeters (cc's) of oxygen they will absorb (400cc, 500cc, etc.). They can be found online at sites such as waltonfeed.com, sorbentsystems.com, or by calling packaging companies in your local yellow pages.
Storage in Mylar bags is popular. These are oxygen barrier bags coated with Mylar®, hence the name.
Dry grains, legumes, powders, etc. have low water activity (WA) levels, and require absorbers that activate rapidly (sometimes known as 'D' absorbers), a few minutes after being opened.

Do the math!

First you must determine the volume of air your container will hold (when empty) in ccs:

#10 can = 3,950 cc
1 gallon plastic pail/ Mylar® bag = 3,788.4 cc
5 gallon plastic pail/ Mylar® bag = 18,942 cc
6 gallon plastic pail/ Mylar® bag = 22,730.4 cc

Industry standard states that when your container is *full* of what you packaged (grains, beans, legumes) there will be 38% of air-filled space remaining (in the very top and between the grains) in the container. For example, if you filled a #10 can with beans, all but 38% of the can's volume would be taken up. So 1,501 cc of air would be left (3,950cc x .38 = 1,501 cc). But air is not what you want to absorb - the *oxygen* in the air is. Since oxygen makes up only 21.5% of the total volume of air, you must find 21.5% of 1,501 cc, or (1,501 x .215), which comes to approximately 323 ccs of oxygen. Therefore, a 400cc oxygen absorber would be more than enough to protect your #10 canned goods.

Food storage under ground
The best storage devices are half-gallon juice jugs that have been cleaned in soapy water, rinsed well and air-dried. Fill and seal with wet and dry roofing cement. The advantage with this system is that the food will keep for a long time, you can bury it in the ground, it's critter-proof and you can see what is in the container.

Milk – fresh milk is hard to store, but Longlife®, canned milk and milk powders are readily available. Remember that any powdered products will require rehydrating and plan your water supply with this in mind.

Lunch
Camping and military meals – These come in aluminum packages with a shelf life of some two years. They vary in quality.

Canned soups, pasta, beans provide carbohydrate energy in a very efficient form. If planning for a long-term emergency, add beans and pulses to your diet to provide fiber and nutrients. These can be purchased dry and stored in juice bottles until you have to soak them, or purchased in cans.

There are several grain staples that can be stored for long periods of time when packaged properly. These are the perfect standby for emergency situations and contain all essential food groups as well as many elements, minerals and vitamins. Get them from local health food stores or buy online. Don't forget, you'll need a grinding mill to turn your grains into flour and you'll need to keep all grains and flours very dry. Weevils can get in and spoil grains so make sure all containers are clean and well sealed.

Good grains to store

Wheat is high in gluten (A protein in flour that develops elasticity when kneaded, this is desirable in bread as it helps trap the carbon dioxide in the dough and enables it to rise with less risk of collapsing. Strong flour is high in gluten.) and is packed with protein, vitamins and minerals. Hard winter wheat, usually white, is best for bread making; soft summer wheat, usually red, is best for pastries and pasta. Wheat flour can be mixed with lower gluten flours to help bread rise.

Buckwheat (actually a fruit, not a grain) can be mixed with wheat flour to provide the eight essential amino acids that can't be manufactured in the body (tryptophan, lysine, methionine, phenylalaine, threonine, valine, leucine & isoleucine), plus vitamins, minerals, iron, zinc, and linoleic acid. Alone, it makes delicious pancakes, and can be mixed with wheat flour for muffins and breads.

Rye is high in fiber, vitamin E, riboflavin and lysine, eliminating the need for combining with other grains to form a whole protein. It is low in gluten so mix with wheat flour to produce a dark, dense bread. Useful as a filler in sauces, soups, and sausage.

Triticale is a hybrid between rye and wheat with a higher protein but lower gluten content than its parents. It tastes like wheat but should be mixed with wheat flour when high gluten is needed.

Barley contains more fiber, vitamins and lysine than wheat. It can be bought in hulled (hull removed) or pearl (polished) form. While pearl barley cooks faster, the hulled variety retains much more nutrition.

Oats must also be purchased with its hull removed. High in fiber, vitamins and proteins, oats are also higher in calories than wheat. The best oats to store are oat groats, steel cut, or rolled. These can be ground into flour and made into bread (best combined with wheat), cooked as breakfast cereals, or used as fillers in soups, casseroles, or meatloaf. And oatmeal makes great cookies!

Yellow corn, although low in amino acids, contains B vitamins, iron, zinc, magnesium and linoleic acid. Grinding it yourself is most nutritious, since store-bought meal has had the outer skin removed, and with it, fiber and vitamins. It can be stored in its "flint" strain for meal or grits, and the "dent" type for tortillas.

Brown rice is far more nutritious than white because its outer layers, which contain B vitamins, fiber, iron, zinc, and many other vitamins, has not been polished off. Its short shelf life, however, dictates that it must be stored frozen or oxygen-depleted (*see below*). Converted rice goes through a process of steaming before hulling, which drives more minerals into the rice than regular white. Although it stores more easily, it is more expensive than other rice.

Dinner

Canned meats, fish and vegetables add up to tasty meals. Top with mashed potato from either fresh or dried potatoes, or place on beds of rice, or sandwich between sheets of pasta to make wholesome one-dish meals that stretch a bit further. Improve taste with dried herbs, bouillon cubes and bottled condiments such as soy, relish, etc. Vegetables can also be purchased dried, or you may wish to consider purchasing a dehydrator and producing your own desiccated foodstuffs for your personal emergency larder.

Canned fruits contain vitamins and are sweet, so as well as providing essential nutrients they are comforting and good for morale.

Dried cheese. Powdered cheese is available from specialist stores and online from waltonfeed.com. It looks like the powder in Macaroni cheese boxes. It can be mixed with water to produce a sauce, as well as added to recipes to add calories and taste.

There are also instant meals available from your local supermarket, such as Betty Crocker's Complete Meals, that include dried food items and cans of meat. These will require baking so you will need electricity unless you have an alternative baking source – such as a cardboard box and a handful of barbecue charcoals.

Box ovens – courtesy of the Scouts

You will need:

- One large box (whisky or any double corrugated box that will fit a cake pan or cookie sheet with about 1" all around will do.) Note: this does not have to have a lid or top.
- Lots of large high quality, heavy duty, aluminum foil
- 4 small tin juice cans such as the 6 fl.oz. Dole pineapple cans
- A 9"x13" cake pan or small cookie sheet
- One #10 can, open at both ends and vented at bottom for charcoal chimney.
- One small stone to vent

Method

Cover the inside of the box with two layers of foil. Be sure you have no box showing anywhere. You can tape it down on the outside – not the inside. Home Depot carries an aluminum tape which is also useful but regular sticky tape is fine.

Place a large sheet of foil on a flat, level, not burnable, piece of ground.

Place the charcoal chimney on the foil and place a fire starter and whole charcoals (one for every 40 degrees of temperature plus one or two for cold, wet, or wind) Light the chimney and wait about 20 min for charcoal to be ready.

Pull off the chimney and spread out the gray, hot charcoals to fit under the cake pan or cookie sheet.
Place four small juice cans at corners of the charcoal to support the cake pan or cookie sheet.
Place item to be cooked on the pan.
Lower the box oven over the whole thing.
Vent on leeward side (away from the wind) with the small stone. Cook for the amount of time called for in your recipe. If cooking for much more than 30 minutes replenish charcoal.

Tips: Be sure and lift box straight up or you will "dump" the heat. No peeking allowed. Control the baking temperature of the oven by the number of charcoal briquettes used. Each briquette supplies 40 degrees of heat (so, a 360 **degree** F temperature will take nine briquettes). It is possible to build an oven to fit your pans - or your menu: You can bake bread, brownies, roast chicken, pizza or a cake. Try the oven over the coals of a campfire.

Snacks

Nuts and dried fruits contain vital minerals and vitamins as well as being good sources of calories and taste. Corn is also an easy item to store and prepare as it can be boiled, baked, creamed and, of course, popped. Jerky keeps for a long time and is a good source of protein.

Fresh drinking water

It would be extremely difficult for bioterrorists to contaminate enough drinking water supplies to cause widespread illness. First, a huge amount of water is pumped daily from our reservoirs, most of which is used for industrial and other purposes; very little is actually consumed. Thus anything deliberately put into the water supply would be greatly diluted. Secondly, water treatment facilities routinely filter the water supply and add chlorine in order to kill harmful germs, which would include cholera.

If the security threat is more about the disruption of the water supply than affecting its quality it makes sense to have an alternative supply. Water is easily available in two and half gallon plastic containers from the supermarket. It makes sense to have some in your house in advance of an emergency, as they will sell out quickly. Juice or spring water jugs, the same as those mentioned above, are also good for storing water. If you are worried about contamination put 30 drops of bleach in the water. When you are ready to drink that bottle leave it open for a while or pour the water back and forth between two containers. The bleach will be driven off into the air.

On average (depending on the season) the average human adult will need about a gallon of water a day for hygiene and drinking.

Chapter 11

Decontamination

Definitions:

- Contamination is the introduction of an infectious agent on a body surface, food or water, or other inanimate objects.
- Decontamination involves either disinfection or sterilization to reduce microorganisms to an acceptable level on contaminated articles, thus making them suitable for use.
- Disinfection is the selective reduction of undesirable microbes to a level below that required for transmission.
- Sterilization is the killing of all organisms.

Decontamination methods have always played an important role in the control of infectious diseases. However, we are often unable use the most efficient means of rendering microbes harmless (e.g., toxic chemical sterilization), as these methods may injure people and damage materials that are to be decontaminated. Bio warfare agents can be decontaminated by mechanical, chemical and physical methods:

- Mechanical decontamination

  This involves measures to remove but not necessarily neutralize an agent. An example is the filtering of drinking water to remove certain water-borne pathogens, or in a bio warfare context, the use of an air filter to remove aerosolized anthrax spores, or water to wash agent from the skin.

- Chemical decontamination

  This renders bio warfare agents harmless by the use of disinfectants that are usually in the form of a liquid, gas or aerosol. Some disinfectants are harmful to humans, animals, the environment and materials.

- Physical means

  These include heat, freezing and radiation.

Dermal (skin) exposure to a suspected bio warfare aerosol should be immediately treated to soap and water decontamination. Careful washing with soap and water removes nearly all of the agent from the skin surface. Hypochlorite solution (5% chlorine bleach solution) or other disinfectants are reserved for gross contamination (i.e. following the spill of solid or liquid agent directly onto the skin). In the absence of chemical or severe biological contamination, washing with bleach will confer no additional benefit, as it may be caustic, and may actually make it more likely that infection enters through the skin by reducing the normal skin flora. Grossly contaminated skin

surfaces should be washed with a 0.5% sodium hypochlorite solution, if available, with a contact time of 10 to 15 minutes.

To mix a 0.5% sodium hypochlorite solution, take one part Clorox® and nine parts water (1:9) since standard stock Clorox® is a 5.25% sodium hypochlorite solution. The solution is then applied with a cloth or swab. The solution should be made fresh daily with the pH in the alkaline range. Chlorine evaporates quickly; leaving behind salt so frequent applications may be necessary on surfaces that are evaporating rapidly in wind or extreme warmth.

Chlorine solution must not be used in:

- open body cavity wounds
- brain and spinal cord injuries
- in the eyes.

For decontamination of fabric clothing or equipment, a 5% hypochlorite solution should be used. For decontamination of equipment, a contact time of 30 minutes prior to normal cleaning is required. This is corrosive to most metals and injurious to most fabrics, so rinse thoroughly and oil metal surfaces after completion.

Heat and radiation

Bio warfare agents can be rendered harmless through such physical means as heat and radiation. To render agents completely harmless, sterilize with dry heat for two hours at 160 degrees centigrade. Solar ultraviolet (UV) radiation has a disinfectant effect, often in combination with drying. This is effective in certain environmental conditions but hard to standardize for practical usage for decontamination purposes. But if you do live in the sun – use it.

The health hazards posed by environmental contamination by biological agents differ from those posed by persistent or volatile chemical agents. Basically, they disappear.

Aerosolized particles in the 1-5 μm size range will remain suspended due to Brownian motion; suspended bio warfare agents would be eventually deactivated by ultraviolet light from the sun, desiccation (drying out), and oxidation. Little, if any, environmental residues would occur. Possible exceptions include residues near the dissemination line, or in the immediate area surrounding a point-source munitions. Bio warfare agents deposited on the soil would be subject to by environmental degradation.

Outdoor contamination

Environmental decontamination is costly and difficult and should be avoided, if possible. If it is necessary to decontaminate streets and roads, chlorine-calcium or lye may be used. Otherwise, rely on the natural processes, which especially outdoors, lead to the decontamination of an agent by drying and solar UV radiation.

Indoors

Rooms in fixed spaces are best decontaminated with gases or liquids in aerosol form (e.g., formaldehyde). This is usually combined with surface disinfectants to ensure complete decontamination. Commercial decontaminants are generally used by the security and emergency services. Only a few of these offer a practical alternative for domestic users.

The disadvantages are clear:

- They are sold in large quantities. This raises problems regarding safe storage – fire hazard, leaking etc. as well as issues of safe disposal.
- They can have undesirable side effects; very often they are poisonous and need to be applied with protective suits.
- You do not know which type of biological or chemical agent you will need to neutralize.
- Given that you probably do not want to keep vats full of poison around the house you would be wise to make your own form of decontaminants.

Domestic decontaminants

Water

This is a fairly obvious solution. Washing surfaces thoroughly is the first and most effective form of decontaminants. However, finding sufficient water might be a problem. In an emergency, water is likely to become a precious commodity. There is also the problem of runoff. Easily forgotten, until you start washing down your protective clothing when you have to ask, what happens to the wastewater? It would be irresponsible to re-release the pathogens or chemicals back into the environment.

Flour

This might seem a surprising but if water is not available, talcum powder or flour are also excellent means of decontamination of liquid biological agents. Sprinkle the flour or powder liberally over the affected skin area, wait 30 seconds, and brush off with a rag or gauze pad. (Note: The powder absorbs the agent so it must be brushed off thoroughly. If available, rubber gloves should be used when carrying out this procedure.)

Note: when brushing off potential decontaminants be careful not to breath up the spores or to brush the powder somewhere where you will come into contact with it again.

Bleach

Regular Clorox® or any household bleach will kill anthrax, cholera and many other pathogens. Dilute the bleach in the ratio of one part Clorox® to nine parts water (1:9) and wash down surfaces you fear might have had contact with infected sources.

Chapter 12

Chemical attacks

If you're caught outside and are aware of a chemical incident, be sure your skin is covered, wear a hat, and carry a handkerchief, or hand-wipe; it won't protect you from everything, but it may help a little. The idea is to minimize skin contact and help screen out what you inhale until you can get indoors where you'll be relatively safe in the short term. Wash and shower as soon as you can. Discard the clothes you were wearing and boil wash them in a powerful detergent before sealing them in a plastic bag and disposing of them.

Stay indoors. If you work in a new office with a HVAC (Heating, Ventilation and Air Conditioning) system you are probably safer inside than out. Newer HVAC systems in commercial buildings are set up with filtration systems that can isolate contaminated areas within the building and prevent dispersal of the agents. If you are at home go into lockdown mode. Quarantine your home and family, just as they did during the plague.

Gas/protective masks are relatively worthless unless you know what the agent threat is; even then, they are not very efficient against multiple threats.

The chemical agents that could be used fall into the following categories.

Nerve Agents

These are absorbed through your skin or lungs. Although many of the nerve agents are called gases, they are actually oily liquids, which can be released as an aerosol spray or mixed with other liquids. Nerve agents are considered the most dangerous of the chemical warfare agents. Nerve agents can cause loss of consciousness and convulsions within seconds and death within minutes of exposure. The most common nerve agents, Tabun, Sarin and Soman, were originally developed as pesticides by Germany in the 1930s. Great Britain developed another type of nerve agent, VX, in the 1950s.

A nerve agent signals glands in your body to "turn on." However, the glands no longer can turn themselves off. As a result, the body produces copious secretions, runny nose, watery eyes and excess saliva. The nerve impulses cause uncontrollable muscular movement and in the final stages, seizures and convulsions. Exposure to nerve agents can occur via inhalation (breathing), skin contact or ingestion (eating). All nerve agents are readily absorbed through the skin and eyes in liquid form. In vapor form, they are quickly absorbed into the respiratory tract and eyes. Ingestion is rare, but deadly.

The length of time a nerve agent will remain in the air varies according to the agent:

• Sarin is generally non-persistent and evaporates at approximately the same rate as water.

• Tabun is persistent from one to six days depending on the temperature and evaporates 20 times more slowly than water. It persists twice as long in seawater.
• Soman can last from one to two days under average weather conditions.
• VX is very persistent, especially in cold weather, and can last for months.

Nerve agents are clear, colorless and tasteless liquids that mix in water. They are difficult to detect when mixed, as they are almost odor free. In their pure form, Soman and Tabun have a slightly fruity odor and Sarin and VX are odorless.

Symptoms

Nerve agents all produce similar symptoms. Depending on the amount of exposure, nerve agents can cause: pinpoint pupils (miosis), watery eyes, runny nose (rhinorrhea), difficulty in breathing, drooling, excessive sweating, tightness in the chest, nausea, vomiting, loss of consciousness, convulsions, seizures, twitching, jerking, staggering, paralysis, headache, confusion, drowsiness, coma, and death. The inhalation of vapors causes respiratory tract effects within seconds or minutes. Death can occur within minutes to hours from respiratory failure.

Medical response

There is some assistance for nerve agent victims that trained emergency responders can provide, however:

- Do not attempt to treat nerve agent victims yourself. You cannot treat victims of chemical poisoning, unless you are trained in emergency medical response and have the proper protective gear.
- If you are in a safe area, remain where you are so that you do not become a victim yourself. In order that you do not become a victim yourself, you must not have any contact with vapor or liquid.
- Rescuers can become contaminated with nerve agents by direct contact with skin or clothing or by off-gassing vapor, even after the vapor has dissipated from the area. If you can see the victims, you are too close and will need to be decontaminated. Seek nearby medical assistance and listen to your local Emergency Alert System (EAS) radio or television stations for information and instruction.

Trained medical responders treat patients in the following ways:

- Medical personnel can decontaminate the patient.
- Medical personnel may administer antidotes (atropine, pralidoxime chloride and diazepam.)
- Medical personnel can also supply ventilation to support respiratory function.

Decontamination

Procedures for decontamination are similar for various nerve agents:

- immediately flush eyes with water for 10 to 15 minutes.

- quickly remove contaminated clothing and place in sealed bags if possible. Secondary exposure can occur from contact with contaminated clothing and when evaporation from contaminated clothing occurs.
- Wash skin with large amounts of soap and water.
- Seek nearby medical assistance immediately.

Blister Agents

Blister agents, also called vesicants, are chemical agents that cause red skin (erythema), blisters, irritation, eye damage, respiratory damage and gastrointestinal damage. Mustard is one of the commonly used blister agents. Blister agents, specifically mustard, have been a military threat since first introduced in World War I. Italy allegedly used mustard in the 1930s against Abyssinia. Egypt used mustard in the 1960s against Yemen. Iraq used mustard against Iran and against the Kurds. Mustard in its pure liquid form is colorless and odorless; however, weapons grade material is yellow to dark brown or black. Mustard's odor is described as similar to horseradish, onions or burning garlic.

Symptoms

The effect of blister agents is similar to that of a corrosive chemical like lye or a strong acid. Sulfur mustards are extremely toxic if inhaled and may damage the eyes, skin and respiratory tract and suppress the immune system.

- the most common injuries associated with blister agents are large skin blisters.
- the primary effects of mustard occur in the eye, airways and skin, causing burns, blisters and irritations.
- the eyes are the organs most sensitive to a mustard vapor injury. Symptoms of eye injury appear earlier than skin injury.
- erythema (reddening of the skin) is the first and earliest form of skin injury appearing after exposure to mustard. The reddening resembles sunburn. It is associated with itching or burning, stinging pain.
- when inhaled, mustard causes coughing, bronchitis and long-term respiratory problems. If the amount inhaled is large, mustard can cause respiratory failure. This is the most common cause of death following exposure to mustard.
- the gastro-intestinal tract is also susceptible to damage from mustard, from absorption or accidental ingestion.
- mustard has been linked to the development of lung cancer in survivors.

Although mustard causes cellular changes within minutes of contact, the onset of pain and other symptoms is delayed. (If a mustard-Lewisite mixture is used the onset of pain is more immediate.)

- Following mustard exposure reddening of the skin appears within 2 to 24 hours.
- Eye irritation appears 1 hour or more after exposure.
- Respiratory reactions in the upper and lower airway develop several hours after exposure, progressing over

several days.

Treatment

There is no antidote for mustard exposure. Decontamination within minutes after exposure is the only effective means of decreasing tissue damage. Medical responders may also provide ventilation for respiratory distress. Do not attempt to treat victims yourself. Call local emergency responders for assistance. You cannot safely treat victims of chemical poisoning, unless you are trained in emergency medical response and have the proper protective gear.

- if you are in a safe area, remain where you are so that you do not become a victim yourself.
- if you are not in a safe area, leave the area immediately. You must not have any contact with vapor or liquid. Victims whose skin or clothing is contaminated with liquid sulfur mustard can contaminate rescuers by direct contact or through off-gassing vapors.
- wait for medical assistance to arrive, do not become a victim yourself.
- listen to your local Emergency Alert System (EAS) radio or television station for information and instruction if you cannot access emergency contact numbers.

Decontamination

Procedures for decontamination are:

- flush the eyes immediately with water for 5 to 10 minutes.
- quickly remove contaminated clothing. Bag and seal any contaminated clothing if possible.
- wash your skin with large amounts of soap and water.
- do not cover eyes with bandages. Dark eyeglasses can be used.
- remember secondary exposure can occur from contact with contaminated clothing. It can also occur when evaporation from contaminated clothing occurs.

Choking Agents

Choking (pulmonary) agents are toxic industrial chemicals such as chlorine and phosgene. Historically, both sides in World War I used chlorine and phosgene. The U.S. military no longer stockpiles these agents.

Inhaled chlorine mixes with the moisture in the lungs and turns to hydrochloric acid. The acid causes fluid build-up in the lungs, which impedes oxygen transfer and causes the victim to drown. This condition is often called "dry-land drowning." In its pure form, chlorine is a greenish-yellow gas with a pungent odor. Phosgene is a colorless gas with the odor of mowed grass or hay.

Symptoms

The primary effect of choking agents is pulmonary edema – water in the lungs. Other symptoms may include eye and airway irritation, shortness of breath and chest tightness, nausea, vomiting, choking, severe coughing and dry-land drowning. Direct skin exposure to any form of phosgene causes immediate pain. Immediate irritation also occurs to the upper respiratory tract. Exposure to high concentrations of chlorine gas immediately leads to respiratory distress.

Also:

- chlorine and phosgene cause eye and airway irritation and damage.
- phosgene, when inhaled, causes severe breathing problems and fatal lung congestion, and usually results in death. Inhaled chlorine causes labored breathing and the buildup of fluid in the lungs. High exposure results in death.
- chlorine is corrosive to the skin, causing burns.
- chlorine can cause frostbitten skin and eyes.

Treatment

There is no known treatment for phosgene exposure. Mortality is high; however, some exposed people have survived. There is no antidote for chlorine. Treatment for poisoning by either chemical is supportive.

Do not attempt to treat victims yourself. Call your local emergency responders for assistance. Only trained emergency medical responders with the proper protective equipment can treat choking agent victims.

- If you are in a safe area, remain where you are so that you do not become another victim of the terrorist attack.
- If you are in an unsafe area, leave immediately and seek nearby medical assistance – you will need to be decontaminated.

Decontamination

There are some basic decontamination steps to take if you have been exposed to choking agents and if you do not have chlorine gas-induced frostbite. If you have frostbite from chlorine exposure do not attempt decontamination. Do not rinse with water. Seek nearby medical help or wait for help to arrive.

If you do not have frostbite symptoms, you can:

- Flush the eyes immediately with water for 5 to 10 minutes.
- Quickly remove contaminated clothing and seal it in bags. Secondary exposure can occur from contact with contaminated clothing. It can also occur when evaporation from contaminated clothing occurs.
- Wash your skin with large amounts of soap and water.

- Seek immediate nearby medical assistance.

Blood Agents

Blood agents are toxic industrial chemicals such as cyanide. Pure weaponized forms of these agents are gases, but many cyanide compounds are found as solids, powders or in liquid form. The French used about 4,000 tons of cyanide in World War I without significant success.

The United States chemical industry manufactures over 300,000 tons of hydrogen cyanide annually. Cyanides are used in electroplating, mineral extraction, dyeing, printing, photography and agriculture, and in the manufacture of paper, textiles and plastics.

Exposure can occur by contact with either liquids or vapors. Although it is a colorless gas or liquid, some victims report an odor of bitter or burnt almond or peach kernels.

Symptoms

These chemicals can cause rapid respiratory arrest and death by blocking the absorption of oxygen to the cells and organs through the bloodstream. These agents irritate the eyes, the skin and the respiratory tract. Inhalation of blood agents causes confusion, drowsiness and shortness of breath. Symptoms of exposure may include increased heart rate, difficulty breathing, dizziness, nausea, vomiting, headaches, convulsions, cardiac arrest and death.

Treatment

There are some antidotes that trained medical personnel can use for blood agents. Also, moving the victim to fresh air, if possible, can help minimize the impacts of cyanide exposure. There is nothing an untrained person without the proper protective equipment can do to assist a victim of blood agents.

- Call your local emergency numbers for assistance. Do not attempt to treat victims.
- Do not touch the victims. You can become contaminated by direct contact with skin or clothing or by off-gassing vapor, even after the vapor has dissipated from the area.
- Unless you are a trained emergency responder or medical provider with proper protective gear, leave the area where victims are as quickly as possible and seek nearby medical assistance.

Irritant agents

Irritants are commonly used in riot control and for personal protection. Irritants include tear gas, Mace and pepper spray.

Symptoms

Tear gas, Mace and pepper spray cause burning and pain to exposed skin and mucous membranes. Exposure to irritants causes an immediate burning of the eyes, coughing, involuntary eye closure, burning in the nostrils, respiratory discomfort, and tingling of exposed skin. Other symptoms will be tearing, coughing, choking, difficulty breathing, nausea and vomiting. If pepper spray is used, there will be a characteristic peppery odor in the area and on exposed clothing. The effects of irritants occur within seconds of exposure, but seldom persist beyond a few minutes after the exposure has ended. Victims with respiratory problems such as asthma, small children and the elderly may experience symptoms for a longer period.

Treatment

Call for medical assistance. You should not attempt to treat victims of irritants if local authorities have not identified the nature of the chemical attack. If you do not know from a reliable source that irritants were used do not approach the scene. To avoid becoming a victim yourself, you must not have any contact with vapor or liquid. If local authorities have identified the chemical agent as an irritant such as tear gas or pepper spray and it has dissipated from the area, victims can be treated in the following ways:

- Seek immediate medical aid for anyone experiencing severe allergic reactions.
- Move victims to fresh air, rest in a half-upright position. Instruct them not to rub their eyes.
- Decontamination with cool water and soap will alleviate some of the burning on the skin
- A steady stream of air, such as a fan will also help.
- Seek additional medical care.

Likelihood of attack

When the Iraqis used nerve and chemical agents on the Kurds in northern Iraq, with thousands of casualties, the delivery of these agents was via aerial bombardment and artillery barrages. As the skies are now watched so carefully and an unexplained plane or missile would probably be shot out of the air on approach to a major conurbation, the threat of aerial bombardment is much less than it once was. Unless they are very sophisticated and use unmanned craft, or they access crop-dusters or other small airplanes, a terrorist in the US could not disperse biological or chemical agents from the air.

The probability of one or more of these biological, chemical or even radioactive attacks is pretty high and the target(s) will likely be cities. The terrorist is looking for the most dramatic effects possible, and he can get publicity by whipping up fear or causing mass casualties. Fortunately for us, this requires a lot of sophisticated planning; a flexible and effective means of delivery, and ensuring that the devastation is not so overwhelming that it wipes out the media that would give him his coverage. Most terrorists do not possess this level of sophistication and resources. This is not to say that small attacks are not possible. One major threat is the terrorist bomber who includes anthrax

spores, or ricin, or medical radioactive waste in a suitcase bomb. It would take time to establish that the threat was not very great but in the meantime panic would have gripped the city where it occurred and attention would have been focused on the terror group.

Chapter 14

Types of biological weapons

Biowarfare Agent Characteristics

Disease	Transmit Man to Man	Infective Dose (Aerosol)	Incubation Period	Duration of Illness	Lethality (approx. case fatality rates)	Persistence of Organism	Vaccine Efficacy (aerosol exposure)
Inhalation anthrax	No	8,000-50,000 spores	1-6 days	3-5 days (usually fatal if untreated)	High	Very stable - spores remain viable for > 40 years in soil	2 dose efficacy against up to 1,000 LD_{50} in monkeys
Brucellosis	No	10 -100 organisms	5-60 days (usually 1-2 months)	Weeks to months	<5% untreated	Very stable	No vaccine
Cholera	Rare	10-500 organisms	4 hours - 5 days (usually 2-3 days)	≥ 1 week	Low with treatment, high without	Unstable in aerosols & fresh water; stable in salt water	No data on aerosol
Glanders	Low	Assumed low	10-14 days via aerosol	Death in 7-10 days in septicemic form	> 50%	Very stable	No vaccine
Pneumonic Plague	High	100-500 organisms	2-3 days	1-6 days (usually fatal)	High unless treated within 12-24 hours	For up to 1 year in soil; 270 days in live tissue	3 doses not protective against 118 LD_{50} in monkeys
Tularemia	No	10-50 organisms	2-10 days (average 3-5)	≥ 2 weeks	Moderate if untreated	For months in moist soil or other media	80% protection against 1-10 LD_{50}
Q Fever	Rare	1-10 organisms	10-40 days	2-14 days	Very low	For months on wood and sand	94% protection against 3,500 LD_{50} in guinea pigs
Smallpox	High	Assumed low (10-100 organisms)	7-17 days (average 12)	4 weeks	High to moderate	Very stable	Vaccine protects against large doses in primates
Venezuelan Equine Encephalitis	Low	10-100 organisms	2-6 days	Days to weeks	Low	Relatively unstable	TC 83 protects against 30-500 LD_{50} in hamsters
Viral Hemorrhagic Fevers	Moderate	1-10 organisms	4-21 days	Death between 7-16 days	High for Zaire strain, moderate with Sudan	Relatively unstable - depends on agent	No vaccine
Botulism	No	0.001 μg/kg is LD_{50} for type A	1-5 days	Death in 24-72 hours; lasts months if not lethal	High without respiratory support	For weeks in nonmoving water and food	3 dose efficacy 100% against 25-250 LD_{50} in primates
Staph Enterotoxin B	No	0.03 μg/person incapacitation	3-12 hours after inhalation	Hours	< 1%	Resistant to freezing	No vaccine
Ricin	No	3-5 μg/kg is LD_{50} in mice	18-24 hours	Days - death within 10-12 days for ingestion	High	Stable	No vaccine
T-2 Mycotoxins	No	Moderate	2-4 hours	Days to months	Moderate	For years at room temperature	No vaccine

In technical terms biochem weapons come in three main types:

- **Microorganisms.**
  These diseases infect and grow in the target host producing a clinical disease that kills or incapacitates. Such microbes may be natural, wild-type strains (such as plague) or may be the result of genetically engineered organisms.

- **Biologically derived bioactive substances (BDBS).**
  These are products of metabolism (usually, but not always, of microbial origin) that kill or incapacitate the targeted host. These include biological toxins, as well as substances that interfere with normal behavior, such as hormones, neuropeptides (affect the brain) and cytokines (affect the immune system).

- **Artificially designed biological-mimicking substances**
  Modern biological processes make it possible for scientists to design and manufacture substances that mimic the actions of "biologics". These processes bind specifically to receptors of targeted organisms, much as diseases will do. Eventually, the possibility will exist to create "designer" substances that can be specifically targeted to a particular cell-type in an enemy (e.g. people with blond hair and blue eyes).

Appearance of biochem weapons

In appearance the most powerful biochem weapons are dry powders formed of tiny particles; bio dusts that are designed to lodge in the human lung. The particles are usually amber or pink. They have a strong tendency to fly apart from one another, dispersing rapidly, becoming invisible to the human eye within a few seconds of release. So, you can't see a bio weapon, you can't smell it, you can't taste it, and you don't know it was there until days later, when you start to cough and bleed, and by that time you may be spreading it around.

The particles of a bio weapon are also very small, about one to five microns in diameter. The particles are light and fluffy, and don't fall to earth.

Biological weapons – Descriptions, symptoms

Clearly knowing what disease is likely to be used in a biochem attack is fundamental to protecting yourself against its effects. Once again however there is a problem – there is no definitive list of what diseases are likely to be used. New strains are being devised all the time and trying to select one is virtually impossible.

Scientists cannot even predict the occurrence of natural diseases, much less manufactured ones. No one, for example, predicted the AIDS epidemic and each new flue virus comes as a surprise to those who contract it.

That said the most commonly identified culprits are:

Bacterial Agents

Anthrax

Brucellosis

Cholera

Glanders and Melioidosis

Mousepox

Plague

Q Fever

Tularaemia (rabbit fever)

Bacteria are unicellular organisms. They vary in shape and size from spherical cells - cocci - with a diameter of 0.5-1.0 μm (micrometer), to long rod-shaped organisms - bacilli - which may be from 1-5 μm in size. Chains of bacilli may exceed 50 μm in length. The shape of the bacterial cell is determined by the rigid cell wall. The interior of the cell contains the nuclear material (DNA), cytoplasm, and cell membrane that are necessary for the life of the bacterium. Under special circumstances some types of bacteria can transform into spores. The spore of the bacterial cell is more resistant to cold, heat, drying, chemicals and radiation than the vegetative bacterium itself. Spores are a dormant form of the bacterium and, like the seeds of plants, they can germinate when conditions are favorable.

The term rickettsia generally applies to very small, coccobacillary organisms of the genera *Rickettsia* and *Coxiella*. Rickettsiae are unique from classical bacteria in their inability to grow (with rare exceptions) in the absence of a living host cell, but many are susceptible to treatment with antibiotics.

Bacteria generally cause disease in human beings and animals by one of two mechanisms:

- by invading host tissues, and
- by producing poisons (toxins).

Many pathogenic bacteria utilize both mechanisms. The diseases they produce often respond to specific therapy with antibiotics. It is important to distinguish between the disease-causing organism and the name of the disease it causes (in parentheses below). This guide covers several of the bacteria or rickettsiae considered to be potential bio warfare threat agents: *Bacillus anthracis* (Anthrax), *Brucella* spp. (Brucellosis), *Burkholderia mallei* (Glanders), *Burholderia pseudomallei* (melioidosis), *Yersinia pestis* (Plague), *Francisella tularensis* (Tularemia), and *Coxiella burnetii* (Q Fever).

It is vital to understand that these are the only identified diseases. As can be seen from Mousepox, scientists have for some time had the chance to create diseases, so it is difficult to try and predict what type of diseases they might have created.

ANTHRAX

First, the good news. Anthrax is hardly ever transmitted from person to person and the records have been reported with cutaneous anthrax. And, as bacteria, it is treatable with antibiotics. As far as biochem weapons go, the inhaled form of Anthrax is generally accepted to be the favored type, because of ease of dispersion. The very bad news is that Anthrax is almost always fatal if not diagnosed and treated on the first day of contagion.

Anthrax bacteria are easy to cultivate and spore formation is easily induced. The spores are highly resistant to sunlight, heat and disinfectant. As a bioterrorism agent, anthrax can be delivered as a bio-aerosol. If anthrax spores are released as a bio-aerosol, there will be a sudden influx of people with severe flu-like symptoms seeking treatment in the hospital's emergency rooms. Most likely, these persons will require assisted ventilation and immediate antibiotic support. The mortality rate will be high. Any suspected case of anthrax should be reported to the infection control practitioner and the local health department immediately.

Bioterrorism attacks using the *Bacillus anthracis* spores sent through the US mail have resulted in 15 anthrax cases and three deaths. Anthrax is not a manufactured disease; it exists in dirt and animals and has been known for centuries. It is found in every major continent around the Globe.

Anthrax is a zoonotic disease. In humans, anthrax has three clinically distinct syndromes:

- cutaneous,
- inhalation, and
- gastrointestinal.

Cutaneous

The cutaneous form occurs most frequently on the hands, forearms, neck and face of animal handlers dealing with infected livestock (cattle, sheep, goats and horses). Gastrointestinal anthrax is transmitted to humans by ingesting insufficiently cooked meat from infected animals. Skin infection begins as a raised bump that resembles an insect bite. Within 1-2 days, the bump fills with fluid and then ruptures to form a painless ulcer (eschar) with a characteristic black area in the center. After about 1 – 2 weeks, the lesion dries and the eschar separates from the skin leaving a permanent scar. There is pronounced edema associated with the ulcer due to the release of edema toxin by *B. anthracis* resulting in swelling of the lymph glands in the adjacent area. Approximately 20% of the untreated cases result in death, either because the disease becomes systemic or because of respiratory distress caused by edema in the cervical or upper thoracic region.

Inhalation

Inhalation anthrax, also known as Woolsorter's disease, results from the inhalation of spores and occurs mostly in persons who handle contaminated hides, wool, and furs. The incubation period for inhalation anthrax is normally 1

– 6 days but may be as long as 60 days after spores are released. During an outbreak of inhalation anthrax in the Soviet Union in 1979, exposed victims developed symptoms six weeks after the aerosol release. Initially the disease onset is insidious with non-specific flu-like symptoms including fever, malaise, fatigue, headache, vomiting, chills, and abdominal discomfort. The victim may also develop a non-productive cough and mild chest discomfort. These initial symptoms may be followed by several hours to 3 days of improvement followed by an abrupt onset of severe respiratory distress. Septicemia, shock and death occur within 24-36 hours after the onset of respiratory distress and mortality approaches 100%. Approximately 50% of cases will develop hemorrhagic meningitis.

Gastrointestinal

The gastrointestinal form of the disease is generally caused by consumption of contaminated meat. There are two possible clinical presentations: abdominal and oropharyngeal. Abdominal symptoms include nausea, loss of appetite, vomiting and fever followed by abdominal pain, vomiting of blood and possibly severe, bloody diarrhea. Lesions may be seen in the colon.

Vaccination

An anthrax vaccine is available; however, it is currently limited to military personnel.
Should vaccination be recommended following the release of anthrax, the United States Public Health Service may change the recommendations to allow vaccination of the civilian population.

Treatment

Penicillin-resistant strains of anthrax exist naturally. Stronger antibiotics by laboratory manipulation may be possible. To be effective, antibiotic therapy must be started as soon as the diagnosis is suspected. Because of the very high mortality rates it is recommended that antibiotics are taken by pregnant women, children and other groups who might otherwise not take them.

There are currently three types of antibiotics approved for anthrax: ciprofloxacin, tetracyclines (including doxycycline), and penicillin. For people who have been exposed to anthrax but do not have symptoms, 60 days of one of these antibiotics is given to reduce the risk or progression of disease due to inhaled anthrax.

BRUCELLOSIS

Brucellosis is one of the world's most important veterinary diseases, and is caused by infection with one of six species of *Brucellae*. In animals, brucellosis primarily involves the reproductive tract, causing septic abortion which can result in sterility. Consequently, brucellosis is a disease of great potential economic impact in the animal husbandry industry. Four species (*B. abortus, B. melitensis, B. suis*, and, rarely, *B. canis*) can infect humans. Infections in abattoir and laboratory workers suggest that the *Brucellae* are highly infectious via the aerosol route. It is estimated that inhalation of only 10 to 100 bacteria is sufficient to cause disease in man. Brucellosis has a low mortality rate (5% of untreated cases), with rare deaths caused by heart failure or meningitis. Also, given that the disease has a relatively long and variable incubation period (5-60 days), and that many naturally occurring infections are asymptomatic, its usefulness as a weapon may be diminished. Large aerosol doses, however, may shorten the incubation period and increase the clinical attack rate, and the disease is relatively prolonged, incapacitating, and disabling in its natural form.

In 1954, *Brucella suis* became the first agent weaponized by the United States at Pine Bluff Arsenal when its offensive BW program was active. Brucella weapons, along with the remainder of the U.S. biological arsenal, were destroyed in 1969, when the offensive program was disbanded.

Human brucellosis is now an uncommon disease in the United States, with an annual incidence of 0.5 cases per 100,000 population. Most cases are associated with the ingestion of unpasteurized dairy products, or with abattoir and veterinary work. The disease is, however, highly endemic in southwest Asia (annual incidence as high as 128 cases per 100,000 in some areas of Kuwait). The risk of endemic brucellosis can be diminished by the avoidance of unpasteurized goat-milk and dairy products, especially while traveling in areas where veterinary brucellosis remains common. Live animal vaccines are used widely, and have eliminated brucellosis from most domestic animal herds in the United States, although no licensed human brucellosis vaccine is available.

Signs and Symptoms

Fever, headache, sore muscles, back pain, sweats, chills, and generalized malaise. Fatalities are uncommon. Diagnosis requires a high index of suspicion, since the symptoms are fairly common and similar to other, less serious diseases. Laboratory diagnosis can be made by testing blood or bone marrow.

Treatment

Antibiotic therapy with doxycycline + rifampin or doxycycline in combination with other medications for six weeks is usually sufficient in most cases.

Isolation and Decontamination

Standard precautions are appropriate for healthcare workers. Person-to-person transmission has been reported via tissue transplantation and sexual contact. Environmental decontamination can be accomplished with a 0.5% hypochlorite solution.

CHOLERA

Cholera is an acute intestinal infection caused by *Vibrio cholerae*. The infection is often mild and is acquired primarily by ingesting contaminated water or food; person-to-person transmission is rare.

Cholera has killed millions of people since it emerged out of the filthy water and living conditions of Calcutta, India in the early 1800s. Since then, there have been a total of eight cholera pandemics. A cholera pandemic is a cholera epidemic that can last many years or even a few decades at a time, and that spreads to many countries and across continents and oceans.

Cholera's value as a weapon comes from the fact that it infects water supplies. Since water is a fundamental need, the potential for Cholera to spread terror is clear.

Note: Freezing does not kill Cholera; it can be contained in iced cubes.

Symptoms

Most people infected with *V. cholerae* do not become ill, although the bacterium is present in their feces for 7-14 days. When illness does occur, more than 90% of episodes are of mild or moderate severity and are difficult to distinguish clinically from other types of acute diarrhea. Less than 10% of ill people develop typical cholera with signs of moderate or severe dehydration.

Severe cases begin with the explosive onset of frequent, watery stools - and vomiting may also occur.
These initial symptoms usually occur 2-3 days after exposure to cholera. If left untreated, an infected individual with severe symptoms becomes dehydrated, with abnormally low blood pressure, subnormal temperature, muscle cramps, decreased urine output, shock and coma.

Persons with severe cases respond dramatically to simple fluid- and electrolyte-replacement therapy. Fluid-electrolyte balance can be maintained by drinking fruit juice, caffeine-free soft drinks and eating salted crackers.

Antidote

Because of the rapid dehydration that may result from severe diarrhea, replacement of fluids by mouth or by the intravenous route is critical. Antibiotics, such as tetracycline, are also used to shorten the duration of diarrhea and shedding of the germs in the feces.

A vaccine is available and is sometimes recommended for travelers to certain foreign countries where cholera is occurring. However, the vaccine offers only partial protection (50%) for a short duration (two to six months). Some

physicians feel that foreign travelers almost never contract cholera and that use of the current vaccine cannot be justified.

GLANDERS AND MELIOIDOSIS

The causative agents of Glanders and Melioidosis are *Burkholderia mallei* and *Burkholderia pseudomallei,* respectively. Both are bacteria with a "safety-pin" appearance on microscopic examination. Both pathogens affect domestic and wild animals, which, like humans, acquire the diseases from inhalation or contaminated injuries.

B. mallei is primarily noted for producing disease in horses, mules, and donkeys. In the past man has seldom been infected, despite frequent and often close contact with infected animals. *B. pseudomallei* is widely distributed in many tropical and subtropical regions. The disease is endemic in Southeast Asia and northern Australia. In northeastern Thailand, *B. pseudomallei*, is one of the most common causes of community-acquired septicemia. Melioidosis has several distinct forms in humans, ranging from a subclinical illness to an overwhelming septicemia (blood poisoning) with a 90% mortality rate and death within 24-48 hours after onset. Also, melioidosis can reactivate years after primary infection and result in chronic and life-threatening disease.

These organisms spread to man by invading the nasal, oral, and conjunctival (eye) mucous membranes, by inhalation into the lungs, and by invading abraded or lacerated skin. Aerosols from cultures have been observed to be highly infectious to laboratory workers. Since aerosol spread is efficient, and there is no available vaccine or reliable therapy, *B. mallei* and *B. pseudomallei* have both been viewed as potential BW agents.

Signs and Symptoms

The incubation period ranges from 10-14 days after inhalation. The onset of symptoms can be abrupt or gradual. Inhalational exposure produces fever (commonly in excess of 102degreesF), stiffness, sweats, muscle aches, headache, lung/chest pain, and generalized pustules. Acute pulmonary disease can progress and result in bacteremia (bacteria in the blood) and acute septicemic disease. Both diseases are almost always fatal without treatment.

Treatment

Therapy will vary with the type and severity of the symptoms. Patients with localized disease, may be managed with oral antibiotics for a duration of 60-150 days. More severe illness may require intravenous therapy and more prolonged treatment.

Prevention

Currently, no pre-exposure or post-exposure vaccination is available.

Isolation and Decontamination

Person-to-person airborne transmission is unlikely, although secondary cases may occur through improper handling of infected secretions. Contact precautions should be taken while caring for patients with skin eruptions. Environmental decontamination using a 0.5% hypochlorite solution (bleach) is effective.

Mousepox

The very name Mousepox might seem to be an amusing name to give a potentially dangerous disease however there is nothing cute or ineffective about this plague. In January 2001, a virus that kills every one of its victims, by wiping out part of their immune system, was accidentally created by an Australian research team. The virus, a modified mousepox, does not affect humans, but it is closely related to smallpox and has raised fears that the technology could be used in bio warfare.

The discovery highlights a growing problem. How do you stop terrorists taking legitimate research and adapting it for their own nefarious purposes?

The Australian researchers had no intention of producing a killer virus. They were merely trying to make a mouse contraceptive vaccine for pest control. As part of a study aimed at creating a contraceptive vaccine, they were trying to stimulate antibodies against mouse eggs, which would make the animals infertile. The mousepox virus was merely a vehicle for transporting the egg proteins into mice to trigger an antibody response. The researchers added the gene for IL-4 to boost antibody production. The surprise was that it totally suppressed the "cell-mediated response"-the arm of the immune system that combats viral infection.

Mousepox normally causes only mild symptoms in the type of mice used in the study, but with the IL-4 gene added it wiped out all the animals in nine days. It would be reasonable to assume that if human IL-4 were introduced into human smallpox the lethality would be increased quite dramatically.

To make matters worse, the engineered virus also appears unnaturally resistant to attempts to vaccinate the mice. A vaccine that would normally protect mouse strains that are susceptible to the virus only worked in half the mice exposed to the killer version. If bio terrorists created a human version of the virus, vaccination programs would be of limited use.

Plague

Although major outbreaks of plague have not occurred in the West for hundreds of years there is no doubt that in terms of biowarfare this is the big one, if only in terms of its reputation. This makes it an ideal contender for bio warfare as generating panic with its resultant chaos is half the game.

Plague is one of the few diseases that has already been used in biowarfare. As mentioned earlier, during World War II the Japanese army formed a special biological warfare division that worked on developing a method to deliver the plague bacteria to the civilian population of China. They tested the effectiveness of the plague as a weapon of war first on prisoners of war, then on unsuspecting civilians. In their first tests they confined a small group of prisoners in a room with thousands of plague-infested fleas. The mortality rate was between 50-60 percent.

The next step was to release the plague on the general population of Manchuria. This was accomplished by planes flying over cities and villages and releasing huge amounts of plague infested fleas over the town. When this proved to be an inaccurate way of spreading the disease, the infected fleas were packed into the shell of a conventional bomb and dropped, exploding just over the targeted towns. While exact figures are not know, it is known that these attacks killed many people and caused wide-spread terror in the towns. Media images of carts full of postulated corpses, cries of bring out your dead etc have all contributed to the fear generated by mention of this disease.

Annually, 140 cases of all types of plague were reported (average 13 cases) by western states in the period 1971--1995. In 1993, ten countries reported 2065 cases to the World Health Organization. America, Iraq, Russia, Iran and possibly North Korea have supplies of the *Y. pestis* bacterium.

There are basically three types of plague, all of which can be traced back to the *Yersinia pestis* bacillus.

- *Bubonic,*
- *Pneumonic*
- *Septicemic*

Bubonic Plague

Currently bubonic plague occurs in around 10-20 people in the US every year and is considered active in up to 15 states. A recent outbreak in New York made front-page news.

The early symptoms of bubonic plague look deceptively like a bad cold. It starts with annoying headaches and fever up to a week after the initial infection. The disease then progresses rapidly; inducing vomiting, muscle pain, and delirium. Lymph nodes near the site of the bite begin to swell up, forming buboes, from which the disease gets its

name. Death is almost certain if not treated within a day of the onset of symptoms. The subcutaneous bleeding leads to dark blotching on the skin, hence the epithet – Black Death.

Septicemic plague

Symptoms of this strain include fever, chills, abdominal pain, shock, and bleeding into skin and other organs.

Pneumonic plague

Symptoms include fever, chills, cough, breathing difficulties and rapid shock and death if not treated early. Not surprisingly this is one of the easiest strains with which to infect a population

In the 1950s and 1960s, the U.S. and Soviet biological weapons programs developed techniques to directly aerosolize plague particles, a technique that leads to pneumonic plague, an otherwise uncommon, highly lethal and potentially contagious form of plague. A modern attack would most probably occur via aerosol dissemination of *Y pestis*, and the ensuing outbreak would be almost entirely pneumonic plague.

Dispersion

Bubonic Plague

Bubonic plague is generally not spread from person to person, except through direct contact with fluids from the swellings. The disease is mainly transmitted from the bite of infected fleas carried by rodents.

Note: Dead rodents are an early sign that bubonic plague is occurring - the fleas only bite human beings when their animal hosts have died. The fact that it relies on animals to be dispersed means that bubonic plague is generally dependent on the weather to be dispersed.

Pneumonic plague.

Pneumonic plague can be passed on by face-to-face contact, through the inhalation of bacteria from a sneeze or cough of an infected person. Terrorists would most likely attack by spraying an aerosol containing plague bacteria, causing the pneumonic variety.

Treatment

Historically, the treatment of choice for bubonic, septicemic, and pneumonic plague has been streptomycin; however, this drug is no longer readily available. Alternatives include gentamicin, doxycycline, ciprofloxacin, and chloramphenicol.

Decontamination

Y. pestis is sensitive to sunlight and heat and does not survive for long periods outside a host. A household bleach

solution, with a contact time of 30 minutes, may be used effectively for decontamination prior to normal cleaning. Organic material will quickly denature a bleach solution; therefore, if organic material is present, cleaning should precede decontamination.

Q fever

Q fever was first described in Australia and called "Query fever" because the causative agent was initially unknown. *Coxiella burnetii*, discovered in 1937, is a rickettsial organism that is resistant to heat and desiccation and highly infectious by the aerosol route. A single inhaled organism may produce clinical illness. For all of these reasons, Q fever could be used by an adversary as an incapacitating biological warfare agent. Its natural reservoirs are sheep, cattle, goats, dogs, cats and birds. The organism grows to especially high concentrations in placental tissues. The infected animals do not develop the disease, but they shed large numbers of the organisms in placental tissues and body fluids including milk, urine and feces. Exposure to infected animals at birth is an important risk factor for endemic disease. Humans acquire the disease by inhalation of aerosols contaminated with the organisms. Farmers and abattoir workers are at greatest risk. A biological warfare attack with Q fever would cause a disease similar to that occurring naturally. Q fever is also a significant hazard in laboratory personnel who are working with the organism.

Signs and Symptoms

Fever, cough, and pleuritic chest pain may occur as early as ten days after exposure. Patients are not generally critically ill, and the illness lasts from two days to two weeks. Approximately 33% of Q fever cases will develop acute hepatitis.

Diagnosis

Q fever is not a clinically distinct illness and may resemble a viral illness or other types of atypical pneumonia. The diagnosis is confirmed by blood tests.

Treatment

Q fever is generally a self-limited illness even without treatment, but tetracycline or doxycycline should be given orally for 5 to 7 days to prevent complications of the disease. This regimen has been shown to prevent clinical disease.

Vaccine

A Q fever vaccine is licensed in Australia. Vaccination with a single dose of this killed suspension of *C. burnetii* provides complete protection against naturally occurring Q fever, and greater than 95 percent protection against aerosol exposure. Protection lasts for at least 5 years. Administration of this vaccine in immune individuals may cause severe side effects including hardening of the skin, abscess formation, and even necrosis at the inoculation site. There is a skin test to detect who will suffer these adverse reactions..

Tularaemia (rabbit fever)

Tularemia was recognized in Japan in the early 1800's and in Russia in 1926. In the early 1900's, American workers investigating suspected plague epidemics in San Francisco isolated the organism and named it *Bacterium tularense* after Tulare County, California where the work was performed. Dr. Edward Francis, USPHS, established the cause of deer-fly fever as *Bacterium tularense* and subsequently devoted his life to researching the organism and disease, hence, the organism was later renamed *Francisella tularensis*

Francisella tularensis was weaponized by the United States in the 1950s and 1960s during the US offensive biowarfare program, and other countries are suspected to have weaponized this agent. This organism could potentially be stabilized for weaponization by an adversary and theoretically produced in either a wet or dried form, for delivery against U.S. forces in a similar fashion to the other bacteria discussed in this handbook.

Tularaemia is a bacterial infection transferred from an animal to a human. Infection can occur through ticks, water contaminated by rats, under-cooked meat from an infected animal such as rabbit, and also through soil that is contaminated. Symptoms include a high fever, generalized aching and swollen glands, which can last over a period of a few weeks. Normally it is not possible to catch the disease from other humans. *Francisella tularensis*, the organism that causes tularaemia, is one of the most infectious bacteria known to man.

Tularaemia was one of the biological weapons stockpiled by the US military in the late 1960s, but the supply was subsequently destroyed. The Soviet Union continued production into the early 1990s. It is thought that Russia still has stockpiles of this bacterium.

Symptoms

Symptoms of Tularaemia can be similar to pneumonia. Victims who ingest the bacteria may get a sore throat, abdominal pain, diarrhea and vomiting. Untreated, the disease can develop causing respiratory failure, shock and eventually death. The overall mortality rate is about 5%.

Dispersion

Tularaemia is not spread though human-to-human transmission. Many small mammals harbor the disease, and naturally-acquired human infection occurs through animal bites, ingestion of contaminated food or water and inhalation of infective aerosols. Aerosol dispersal would be the most likely method of terrorist attack.

Treatment

There is an effective vaccine, and the disease is treatable with antibiotics. Since there is no known human-to-human transmission, neither isolation nor quarantine are required, since Standard Precautions are appropriate for care of

patients with draining lesions or pneumonia. Strict adherence to the drainage/secretion recommendations of Standard Precautions is required, especially for draining lesions, and for the disinfection of soiled clothing, bedding, equipment, etc. Heat and disinfectants easily inactivate the organism.

Viral Agents

Smallpox

Venezuelan Equine Encephalitis

Viral Hemorrhagic Fevers

Viruses are the simplest microorganisms and contain genetic material, either RNA or DNA. Viruses are much smaller than bacteria and vary in size from 0.02 μm to 0.2 μm (1 μm = 1/1000 mm). Viruses are intracellular parasites and lack a system for their own metabolism; therefore, they are dependent on their host cells. This means that viruses, unlike the bacteria, cannot be cultivated in synthetic nutritive solutions; they need living cells in order to multiply. The host cells can be in humans, animals, plants or bacteria.

Every virus requires its own special type of host cell for multiplication because a complicated interaction occurs between the cell and virus. Virus-specific host cells can be cultivated in synthetic nutrient solutions and then infected with the virus in question. The cultivation of viruses is expensive, demanding, and time-consuming. A virus typically brings about changes in the host cell that eventually lead to cell death.

Smallpox

Smallpox is one of the oldest diseases known to affect human beings. So prevalent was it at one stage that a wanted man in Elizabethan England was identified as not having "the marks of the pox" on his face. Smallpox is often cited as the most feared biological weapon. There is no proven treatment, and the virus could race through a population before anyone realizes it has been released.

With Edward Jenner's demonstration in 1796 that an infection caused by cowpox protected against smallpox and the rapid diffusion worldwide of the practice of cowpox inoculation (vaccination), the potential threat of smallpox as a bioweapon was greatly diminished.

Smallpox is a viral infection caused by the variola virus. Historically, one in three people who contract the disease die.

Symptoms

The incubation period is about 12 days. First symptoms include fever, tiredness and an aching head and back. Over the next few days, a distinctive rash develops, usually on the face, legs and arms. Lesions then appear, which form crusts and fall away within a few weeks. Death occurs in up to 30% of cases.

Dispersion

Smallpox can be caught by inhaling the virus from an infected person. Sufferers are most infectious during the first week of illness. In the event of a purposeful attack, the virus could be released in an aerosol, or suicide attackers could deliberately infect themselves. Its stability in air and high infection rate make the smallpox virus potentially very dangerous.

Antidotes

There is a vaccine against smallpox, but routine public inoculation ended in the 1970s as incidence of the disease declined. Many people born before 1972 were vaccinated, but any immunity has probably worn off by now. In people exposed to smallpox, the vaccine can lessen the severity of, or even prevent, illness if given within four days of exposure. The US currently has an emergency supply of the vaccine.

Unfortunately vaccination has been shown to wear off in most people after 10 years but may last longer if you have been successfully vaccinated on multiple occasions. There is no proven treatment for smallpox victims - except supportive therapy to combat the symptoms.

Smallpox is extremely virulent: The American Medical Association says natural infection may occur after inhalation of fewer than 10 viral particles. Although the patient is most contagious during the first week, viral particles from

saliva and sores remain viable outside the body for a long time - for instance, on sheets and clothing -- and may infect others months later.

Smallpox is caused by the Orthopox virus, *variola*, which occurs in at least two strains, *variola major* and the milder disease, *variola minor*. Despite the global eradication of smallpox and continued availability of a vaccine, the potential weaponization of variola continues to pose a military threat. This threat can be attributed to the aerosol infectivity of the virus and the relative ease of large-scale production, and an increasingly naive populace who have no memory of smallpox.

Although the fully developed eruption of smallpox on the skin is unique, earlier stages of the rash could be mistaken for chickenpox. The secondary spread of infection constitutes a hospitalization hazard from the time of onset of a smallpox patient's skin eruption until scabs have separated.

The World Health Organization (WHO) declared endemic smallpox eradicated in 1977. In 1980, the World Health Assembly recommended that all countries cease vaccination. Although two WHO-approved repositories of the virus remain at the Centers for Disease Control and Prevention (CDC) in Atlanta and the Institute for Viral Preparations in Moscow, the extent of clandestine stockpiles in other parts of the world remains unknown.

Recent allegations from Ken Alibek, a former deputy director of the Soviet Union's civilian biochem weapons program, have heightened concern that smallpox might be used as a bioweapons because, he claims, in 1980, the Soviet government embarked on a successful program to produce the smallpox virus in large quantities and adapt it for use in bombs and intercontinental ballistic missiles; the program had an industrial capacity capable of producing many tons of smallpox virus annually.

Furthermore, Alibek reports that Russia even now has a research program that seeks to produce more virulent and contagious recombinant strains. Because financial support for laboratories in Russia has sharply declined in recent years, there are increasing concerns that existing expertise and equipment might fall into non-Russian hands. The extent of secret stockpiles in other parts of the world remains unknown.

In January 1996, WHO's governing board recommended that all stocks of smallpox be destroyed by 30 June 1999. However, action on this was delayed by the Clinton administration in May 1999 due to concerns over the need for further study of the virus given its potential as a biological warfare agent. The smallpox stockpiles were scheduled for destruction on 30 June 2002.

However, the political climate changed post 9/11. Kenneth Bernard, former U.S. assistant surgeon general, believes research on variola stocks is critical. In an Associated Press story from January 17, 2002, he said, "We regard the

potential release of smallpox as a critical national and international security issue." On that very day, WHO reversed its order, recommending the retention of smallpox for research into new vaccines and treatments. No new date was set for the destruction of the viral stockpiles. China was the only nation to protest, their ambassador to WHO, Sha Zukang, was quoted as saying that China believes "early eradication of the virus stocks is the only fundamental guarantee of the eradication of smallpox."

The Bush administration announced that U.S. variola stocks would not be destroyed until scientists had developed two antiviral drugs and a vaccine that all Americans could safely take (including those with suppressed immune systems) and voted a $3.7 billion increase in the National Institutes of Health (NIH) budget for the next fiscal year.

The United States stopped vaccinating its military population in 1989 and civilians in the early 1980s. These populations are now susceptible to variola major, although recruits immunized in 1989 may retain some degree of immunity.

Signs and Symptoms

The incubation period of smallpox averaged 12 days, although it could range from 7-19 days following exposure. Clinical manifestations begin acutely with malaise, fever, rigors, vomiting, headache, and backache; 15% of patients developed delirium. Approximately 10% of light-skinned patients exhibited an inflamed rash during this phase. Two to three days later lesions appear which quickly progress from spots to pus filled poxes, which will scab and leave pox marks. They are more abundant on the extremities and face.

Diagnosis

Smallpox is contracted by inhalation of variola virus particles. Lesions in the throat and mouth release large amounts of virus into the saliva, which are spread into the air by coughing. Smallpox is spread via saliva during face-to-face contact or by inhalation of virus particles from pus and scabs encountered on bed sheets and other places.

Upon inhalation, variola implants itself in the lining of the throat and nasal cavity, and then migrates to the lymph nodes and the blood. By the eighth day after contraction, the virus has undergone intense multiplication. Variolae localize in blood vessels in the skin and inside the mouth and throat. After about 12-14 days of incubation, high fever, headache, backache, and other flu-like symptoms appear. A rash appears in the mouth and throat and on the face, arms, trunk, and legs. After one or two days, the rash turns into deeply imbedded pustules, or pox, which become scabby after about a week.

At this point, the poxes do not itch, but they cause excruciating, fiery pain. Sometimes the pox are so numerous and close together that they cannot be distinguished from one another.

In the early stages it can be difficult to distinguish smallpox from other diseases accompanied by skin eruptions, such as chickenpox, redness, or allergic contact dermatitis. A particular problem for infection control measures would be the failure to recognize relatively mild cases of smallpox in persons with partial immunity. An additional threat to effective quarantine is the fact that exposed persons may shed virus from the back of the throat without ever manifesting disease. Therefore, quarantine and initiation of medical countermeasures should be promptly followed by an accurate diagnosis so as to avert panic.

The usual method of diagnosing smallpox is to look at the RNA and DNA taken from smallpox pustules under an electron microscope. Under light microscopy, groups of smallpox virus particles, called Guarnieri bodies can be found. Unfortunately, none of the laboratory tests are capable of discriminating variola from other viruses such as vaccinia, monkeypox or cowpox. This requires isolation of the virus and monitoring of its growth on egg membrane.

The development of better diagnostic techniques using polymerase chain reactions promises a more accurate and less cumbersome method of discriminating between variola and other *Orthopoxviruses*.

Treatment

At present there is no effective cure, the only treatment is supportive therapy while the disease runs its course

Antidote

Immediate vaccination or revaccination should be undertaken for all personnel exposed.

A smallpox vaccine (vaccinia virus) is most often administered by under the skin inoculation with a bifurcated (two-pronged) needle, a process that became known as scarification because of the permanent scar that resulted. Vaccination after exposure to weaponized smallpox or a case of smallpox may prevent or ameliorate disease if given as soon as possible and preferably within 7 days after exposure. A blister typically appears at the vaccination site 5-7 days post-inoculation. The lesion forms a scab and gradually heals over the next 1-2 weeks.

Side effects include low-grade fever. Very rarely, first-time vaccine reactions include secondary inoculation of the virus to other sites such as the face, eyelid, or other persons (6/10,000 vaccinations).

Vaccination is not recommended in the following conditions: immunosuppression, HIV infection, history or evidence of eczema, or current household, sexual, or other close physical contact with person(s) possessing one of these conditions. In addition, vaccination should not be performed during pregnancy. Despite these caveats, most

authorities state that, with the exception of significant impairment of systemic immunity, there are no absolute contraindications to *post-exposure* vaccination of a person who experiences exposure to variola.

Vaccinia Immune Globulin (VIG) is generally indicated for treatment of complications to the smallpox (vaccinia) vaccine, and should be available when administering vaccine. Limited data suggests that vaccinia immune globulin may be of value as a post-exposure antidote to smallpox when given within the first week following exposure, and concurrently with vaccination. Just the vaccination alone is recommended for people without contraindications to the vaccine. If more than one week has elapsed after exposure, administration of both products, if available, is reasonable.

Quarantine

Droplet and Airborne Precautions (see Appendix) should be followed for a minimum of 17 days following exposure for all contacts. Patients should be considered infectious until all scabs separate and remain in quarantine during this period.

Contacts who have not developed any symptoms should check their temperatures daily. Any fever above 101 **degrees**F during the 17-day period following exposure to a confirmed smallpox victim would suggest the development of smallpox. The contact should then be isolated immediately, preferably at home, until smallpox is either confirmed or ruled out and remain in isolation until all scabs separate.

Venezuelan Equine Encephalitis (VEE)

Between 1969 and 1971, an epidemic in a population of wild animals was recorded of a "highly pathogenic strain" of VEE, which emerged in Guatemala, moved through Mexico, and entered Texas in June 1971. This strain was virulent in both equine species and humans. In Mexico, there were 8,000-10,000 equine deaths, "tens of thousands" of equine cases, and 17,000 human cases although no human deaths were recorded. Over 10,000 horses in Texas died. Once the Texas border was breached, a national emergency was declared and resources were mobilized to vaccinate equine species in 20 states (95% of all horses and donkeys were vaccinated; over 3.2 million animals); to establish equine quarantines; and to control mosquito populations with broad-scale insecticide use in the Rio Grande Valley and along the Gulf Coast. A second VEE outbreak in 1995 in Venezuela and Columbia involved over 75,000 human cases and over 20 deaths.

VEE was tested as a bio warfare agent during the U.S. offensive program in the 1950s and 1960s. Other countries are also suspected of having weaponized this agent. In compliance with President Nixon's National Security Decision No. 35 of November 1969 to destroy the biochemical microbial stockpile, all existing stocks of VEE in the U.S. were publicly destroyed.

Bio warfare threat

These viruses could theoretically be produced in large amounts in either a wet or dried form by relatively unsophisticated and inexpensive systems. This form of the VEE virus complex could be intentionally disseminated as an aerosol and would be highly infectious. It could also be spread by the purposeful dissemination of infected mosquitoes, which can probably transmit the virus throughout their lives. The VEE complex is relatively stable during the storage and manipulation procedures necessary for weaponization.

In natural human epidemics, severe and often fatal encephalitis in Equidae (horses, mules, burros and donkeys) (30-90% mortality) always precedes disease in humans. However, a biological warfare attack where the virus is intentionally disseminated as an aerosol would most likely cause human disease as a primary event or simultaneously with the horse population. During natural epidemics, illness or death in wild or free ranging Equidae may not be recognized before the disease hits humans, thus a natural epidemic could be confused with a bio warfare event, and data on the onset of disease should be considered with caution. A more reliable method for determining the likelihood of a bio warfare event would be the presence of VEE outside of its natural geographic range.

The Venezuelan equine encephalitis (VEE) virus complex is a group of eight mosquito-borne alphaviruses that are endemic in northern South America and Trinidad and cause rare cases of human encephalitis in Central America, Mexico and Florida. These viruses can cause severe diseases in humans and horses. Natural infections are acquired by the bites of a wide variety of mosquitoes.

The human infective dose for VEE is considered to be 10-100 organisms, which is one of the principal reasons that VEE is considered a militarily effective bio warfare agent. Neither the population density of infected mosquitoes nor the aerosol concentration of virus particles has to be great to allow significant transmission of VEE in a bio-attack. There is no evidence of direct human-to-human or horse-to-human transmission. Natural aerosol transmission is not known to occur. VEE particles are not considered stable in the environment, and are thus not as persistent as the bacteria responsible for Q fever, tularemia or anthrax. Heat and standard disinfectants can easily kill the VEE virus complex.

Signs and Symptoms

The incubation period is between 1-6 days. Acute fever with encephalitis developing in a small percentage of those affected (4% children; less than 1% for adults). Typical symptoms include feeling ill, spiking fevers, chills, shivering, severe headache, light sensitivity and sore muscles for 24-72 hours. Nausea, vomiting, cough, sore throat, and diarrhea may follow. Full recovery from malaise and fatigue takes 1-2 weeks. The incidence of central nervous system disease and associated mortality would be much higher after a bio warfare attack.

Diagnosis

Virus isolation may be made from serum, and in some cases throat swab specimens.

Therapy

Treatment is supportive only. VEE infections are treated with pain relievers to relieve headache and aching muscles. Patients who develop encephalitis may require anticonvulsants and intensive supportive care to maintain fluid and electrolyte balance, ensure adequate ventilation, and avoid complicating secondary bacterial infections. Ideally this would be done in a hospital.

Vaccine

A live vaccine is available as an investigational new drug. A second, killed vaccine is available for boosting antibody levels in those initially receiving the first vaccine. No post-exposure vaccine exists.

Isolation and Decontamination

Patient isolation and quarantine is not required. There is no evidence of direct human-to-human or horse-to-human transmission. The virus can be destroyed by heat (80^{o}C for 30 min) and standard disinfectants.

Viral hemorrhagic fevers

Viral hemorrhagic fevers (VHFs) refer to a group of illnesses that are caused by several distinct families of viruses. In general, the term "viral hemorrhagic fever" is used to describe a severe multisystem syndrome (multisystem means that multiple organ systems in the body are affected). Characteristically, the overall vascular system is damaged, and the body's ability to regulate itself is impaired. These symptoms are often accompanied by hemorrhage (bleeding); however, the bleeding is itself rarely life-threatening. While some types of hemorrhagic fever viruses can cause relatively mild illnesses, many of these viruses cause severe, life-threatening disease.

The viral hemorrhagic fevers are a diverse group of illnesses caused by RNA viruses from four viral families:

- The *Arenaviridae* include the etiologic agents of Argentine, Bolivian, and Venezuelan hemorrhagic fevers, and Lassa fever.
- The *Bunyaviridae* include the members of the *Hantavirus* genus, the Congo-Crimean hemorrhagic fever virus from the *Nairovirus* genus, and the Rift Valley fever virus from the *Phlebovirus* genus;
- The *Filoviridae* include Ebola and Marburg viruses;
- The *Flaviviridae* include dengue and yellow fever viruses.

All of the VHF agents (except for dengue virus) are infectious by aerosol in the laboratory. These viruses could conceivably be used by an adversary as biological warfare agents, in view of their aerosol infectivity, and, for some viruses, high lethality. However, the overall risk that hemorrhagic fevers will be used in bio warfare is low as they are so hazardous to work with. They are also fast acting and virulent, so people will die before they pass them on.

The real issue would be the level of panic that would occur if such a disease were released into America.

Background

Because these viruses are so diverse and occur in different geographic locations, their full history is beyond the scope of this book. However, there are some significant events that may provide insight into their possible importance as biological threat agents.

Arenaviridae: Argentine hemorrhagic fever (AHF), caused by the Junin virus, was first described in 1955 in corn harvesters. From 300 to 600 cases per year occur in areas of the Argentine pampas. Bolivian, Brazilian, and Venezuelan hemorrhagic fevers are caused by the related Machupo, Guanarito, and Sabia viruses. Lassa virus causes disease in West Africa. These viruses are transmitted from their rodent reservoirs to humans by the inhalation of dusts contaminated with rodent excreta.

Bunyaviridae: Congo-Crimean hemorrhagic fever (CCHF) is a tick-borne disease that occurs in the Crimea and in parts of Africa, Europe and Asia. It can also be spread by contact with infected animals, and in healthcare settings.

Rift Valley fever (RVF) is a mosquito-borne disease that occurs in Africa. The hantaviruses are rodent-borne viruses with a wide geographic distribution. Hantaan and closely related viruses cause hemorrhagic fever with renal syndrome (HFRS), (also known as Korean hemorrhagic fever or epidemic hemorrhagic fever). This is the most common disease due to hantaviruses.

Nephropathia epidemica is a milder disease that occurs in Scandinavia and other parts of Europe, and is caused by strains carried by bank voles. In addition, newly described hantaviruses cause Hantavirus Pulmonary Syndrome (HPS) in the Americas. The hantaviruses are transmitted to humans by the inhalation of dusts contaminated with rodent excreta.

Filoviridae: Ebola hemorrhagic fever was first recognized in the western equatorial province of the Sudan and the nearby region of Zaire in 1976. A second outbreak occurred in Sudan in 1979, and in 1995 a large outbreak (316 cases) developed in Kikwit, Zaire, from a single index case. Subsequent epidemics have occurred in Gabon and the Ivory Coast. The African strains cause severe disease and death. It is not known why this disease appears infrequently. It remains is one of the most virulent viral diseases known to humankind, causing death in 50-90% of all clinically ill cases. The disease has its origins in the jungles of Africa and Asia.

A related virus (*Ebola Reston*) was isolated from monkeys imported into the United States from the Philippines in 1989, and subsequently developed hemorrhagic fever. While subclinical infections occurred among exposed animal handlers, Ebola Reston has not been identified as a human pathogen. Marburg epidemics have occurred on six occasions: five times in Africa, and once in Europe. The first recognized outbreak occurred in Marburg, Germany, and Yugoslavia, among people exposed to African green monkeys, and resulted in 31 cases and 7 deaths. Filoviruses can be spread from human to human by direct contact with infected blood, secretions, organs, or semen. *Ebola Reston* apparently spread from monkey to monkey, and from monkeys to humans by the respiratory route.

Flaviviridae: Yellow fever and dengue are two mosquito-borne fevers that have great importance in the history of military campaigns and military medicine. Tick-borne flaviruses include the agents of Kyanasur Forest disease in India, and Omsk hemorrhagic fever in Siberia.

Signs and Symptoms

Within a few weeks of exposure, Ebola victims suffer from headaches and muscle aches. They may also experience nausea, chest pain and profuse bleeding. More than half of all Ebola sufferers die from the disease.

With Marburg fever, after an incubation period of 5-10 days, the onset of the disease is sudden and is marked by fever, chills, headache, and muscle ache. Around the fifth day after the onset of symptoms, a rash, most prominent

on the trunk (chest, back, stomach), may occur. Nausea, vomiting, chest pain, a sore throat, abdominal pain, and diarrhea then may appear. These symptoms become increasingly severe and may include jaundice, inflammation of the pancreas, severe weight loss, delirium, shock, liver failure, massive bleeding, and multi-organ dysfunction. Because many of the signs and symptoms of Marburg hemorrhagic fever are similar to those of other infectious diseases, such as malaria or typhoid fever, diagnosis of the disease can be difficult, especially if only a single case is involved.

Dispersion

The Ebola virus is transmitted by direct contact with the blood, secretions, organs or semen of infected persons. Transmission through semen may occur up to seven weeks after clinical recovery, as with Marburg hemorrhagic fever. Transmission of the Ebola virus has also occurred by handling ill or dead infected chimpanzees. Health care workers have frequently been infected while attending patients. In the 1976 epidemic in Zaire, every Ebola case caused by contaminated syringes and needles died.

After the first case-patient in an outbreak is infected, humans can transmit the virus in several ways. People can be exposed to Ebola virus from direct contact with the blood and/or secretions of an infected person.

This is why the virus has often been spread through the families and friends of infected persons: in the course of feeding, holding, or otherwise caring for them, family members and friends would come into close contact with such secretions. People can also be exposed to Ebola virus through contact with objects, such as needles, that have been contaminated with infected secretions.

Diagnosis

VHFs are febrile illnesses that can feature flushing of the face and chest, petechiae (a small purplish spot on a body surface, such as the skin or a mucous membrane, caused by a minute hemorrhage), bleeding, fluid filled swellings, hypotension, and shock. Malaise, muscle pains, headache, vomiting, and diarrhea may occur in any of the hemorrhagic fevers.

A detailed travel history and a high index of suspicion are essential in making the diagnosis of VHF. Patients with arenavirus or hantavirus infections often recall having seen rodents during the presumed incubation period, but since the viruses are spread to man by aerosolized excreta or environmental contamination, actual contact with the host animals is not necessary.

Large mosquito populations are common during Rift Valley fever or flavivirus transmission, but a history of mosquito bites is too common to be of diagnostic importance. Tick bites are of some significance in suspecting Congo-Crimean HF.

Large numbers of military personnel, or members of the public, presenting with VHF manifestations in the same geographic area over a short time period should lead treating medical care providers to suspect either a natural outbreak in an endemic setting, or a biowarfare attack, particularly if this type of disease does not occur naturally in the local area.

Treatment

Treatment is available for some, but not all, VHFs. In the event of an outbreak, routine infection control procedures, isolation, and decontamination are usually enough to stop transmission. Patients receive supportive therapy, but generally speaking, there is no other treatment or established cure for VHFs.

Vaccine

The only licensed VHF vaccine is yellow fever vaccine. Prophylactic ribavirin may be effective for Lassa fever, Rift Valley fever, CCHF, and possibly HFRS

Isolation and Decontamination

Contact isolation, with the addition of a surgical mask and eye protection for those coming within three feet of the patient, is indicated for suspected or proven Lassa fever, CCHF, or filovirus infections. Respiratory protection should be upgraded to airborne isolation, including the use of a fit-tested HEPA filtered respirator, a battery powered air purifying respirator, or a positive pressure supplied air respirator, if patients with the above conditions have prominent cough, vomiting, diarrhea, or hemorrhage. Decontamination is accomplished with bleach or phenolic disinfectants.

Persons with skin exposure to blood, body fluids, secretions, or excretions from a patient with suspected VHF should immediately wash the affected skin surfaces with soap and water. Mucous membranes should be irrigated with copious amounts of water or saline. No carrier state has been observed for any VHF, but excretion of virus in urine (e.g., Lassa fever) or semen (e.g., Argentine hemorrhagic fever) may occur during convalescence. Should the patient die, there should be minimal handling of the body, with sealing of the corpse in leak-proof material for prompt burial or cremation.

Biological Toxins

These four toxins are considered to be the most likely to be used against U.S. military and civilian targets:

Botulinum

Ricin

Staphylococcal Enterotoxin B

T-2 Mycotoxins

Toxins are harmful substances produced by living organisms (animals, plants, microbes). Features that distinguish them from chemical agents, such as VX, cyanide, or mustard gases, include being not man-made, non-volatile (no vapor hazard), usually not active on the skin (mycotoxins are the exception), and generally much more toxic per weight than chemical agents. Their lack of volatility is very important and makes them unlikely to produce either secondary or person-to-person exposures, or be a persistent environmental hazard.

A toxin's utility as an aerosol weapon is determined by its toxicity, stability, and ease of production. The bacterial toxins, such as botulinum toxins, are the most toxic substances by weight known. Less toxic compounds, such as the mycotoxins, are thousands of times less toxic than botulinum, and have limited aerosol potential. The relationship between aerosol toxicity and the quantity of toxin required for an effective open-air exposure is important; for some agents, such as the mycotoxins and ricin, very large quantities (tons) would be needed for an effective open-air attack. Stability limits the open-air potential of some toxins. For example, botulinum and tetanus toxins are large molecular weight proteins, and are easily denatured by environmental factors (heat, desiccation, UV light), thus posing little downwind threat. Finally, some toxins, such as saxitoxin, might be both stable and highly toxic, but are so difficult to extract that they can only feasibly be produced in minute quantities.

As with all biological weapons, the potential to cause incapacitation as well as killing people must be considered. Depending upon the goals of an adversary, incapacitating agents may actually be more effective than lethal agents due to the overwhelming demand on the medical and evacuation infrastructure, or the expected panic in the population. In fact, several toxins, such as SEB, cause significant illness at doses much lower than that required for death, and thus poses a significant incapacitating threat because so many resources would be taken up in caring for the sick.

Most toxins are ingested, however in warfare they can be dispersed by aerosols. Toxins are frequently as potent or more potent when inhaled than by any other method. Mucous membranes, including conjunctivae in the eyes, are also vulnerable to many biological warfare agents. In the battlefield soldiers would use of full-face masks equipped with small-particle filters, like the chemical protective masks, assumes a high degree of importance. Domestically, if you know you're in a target zone – get inside. Turn off the air conditioning or heating. Get into your emergency room or area.

If you're on the street and run into a building you want to be away from windows or doors. This could be a good time to get in a closet and sit it out. Don't act foolishly. Putting yourself at risk of crushing, suffocation, etc. is counterproductive.

Large proteins such as botulinum are easily denatured by environmental conditions. The toxins are detoxified in air within 12 hours. Sunlight inactivates the toxins within 1-3 hours. Heat destroys the toxins in 30 minutes at 80 ^{O}C and in several minutes at 100^{O}C. In water, more than 99.7% are inactivated by 20 minutes exposure to 3 mg/L free available chlorine (FAC), similar to the military disinfection procedure; and 84% inactivated by 20 minutes at 0.4% mg/L FAC, similar to municipal water treatment procedures. So bleach will kill these toxins if they are exposed to a concentrated enough solution for long enough.

Botulism

Botulinum toxins have caused numerous cases of botulism when eaten in improperly prepared or canned foods. Many deaths have occurred secondary to such incidents. It is feasible to deliver botulinum toxins as an aerosolized biological weapon, and several countries and terrorist groups have weaponized them.

The botulinum toxins are a group of seven related neurotoxins produced by the spore-forming bacillus *Clostridium botulinum* and two other *Clostridia* species. These toxins, types A through G, are the most potent neurotoxins known; interestingly, they have been used therapeutically to treat spastic conditions (strabismus, blepharospasm, torticollis, tetanus) and cosmetically to treat wrinkles (Botox).

The spores germinate into vegetative bacteria that produce toxins during anaerobic incubation. Industrial-scale fermentation can produce large quantities of toxin for use as a bio warfare agent.

There are three main kinds of botulism:

- Foodborne botulism is caused by eating foods that contain the botulism toxin.
- Wound botulism is caused by toxin produced from a wound infected with Clostridium botulinum.
- Infant botulism is caused by consuming the spores of the botulinum bacteria, which then grow in the intestines and release toxin.

All forms of botulism can be fatal and are considered medical emergencies. Food borne botulism can be especially dangerous because eating a commonly contaminated food can poison many people.

Botulism is considered to pose a major bioweapons threat because of its extreme potency together with its ease of production, transport, and misuse. Another advantage from a terrorist's point of view is that it causes a need for prolonged intensive care among affected persons.

Development and use of botulinum toxin as a possible bio weapon began at least 60 years ago. It has been estimated that a single gram of crystalline toxin, evenly dispersed and inhaled, would kill more than one million people.

The Japanese developed botulinum toxin during WW11. Interestingly, the first recorded use of botulism as a bioweapon occurred in Japan. On at least three occasions between 1990 and 1995, aerosol-borne botulism was dispersed at multiple sites in downtown Tokyo, and at US military installations in Japan by the Japanese cult Aum Shinrikyo. These attacks failed, possibly because of faulty microbiological technique, deficient aerosol-generating equipment, or internal sabotage. The cult claimed that they obtained their *C. botulinum* from soil they had collected in northern Japan

Cases per year

In the United States an average of 110 cases of botulism are reported each year. Of these, approximately 25% are food borne, 72% are infant botulism, and the rest are wound botulism. Outbreaks of food borne botulism involving two or more persons occur most years and usually caused by eating contaminated home-canned foods. The number of cases of food borne and infant botulism has changed little in recent years, but wound botulism has increased because of the use of black-tar heroin, especially in California.

Dispersion

Botulism is caused by eating or inhaling the bacterial toxin; it cannot be spread from person to person. If used as a biological weapon, the toxin could be sprayed as an aerosol - it is colorless and odorless - or used to contaminate food.

Characteristics

The botulinum toxins are the most toxic compounds, per weight of agent, known to man. Just 0.001 microgram per kilogram of body weight will kill 50 percent of those infected. Botulinum toxin type A is 15,000 times more toxic by weight than VX gas and 100,000 times more toxic than Sarin, two of the well-known organophosphate nerve agents.

Signs and Symptoms

The onset of symptoms of inhalation botulism usually occurs from 12 to 36 hours following exposure, but can vary according to the amount of toxin absorbed, and could be reduced following a biowarfare attack. The signs and symptoms may not appear for several days when a low dose of the toxin is inhaled versus a shorter time period following ingestion of toxin or inhalation of higher doses.

Symptoms usually begin with cranial nerve palsies, including ptosis (abnormal drooping of the upper eyelid caused by muscle weakness or paralysis), blurred vision, double vision, dilated pupils, dry mouth and throat, difficulty in swallowing, and hoarseness. This is followed by body paralysis, which descends in a symmetrical manner. Collapse of the upper airway may occur due to weakness of the oropharyngeal muscle at the back of the throat. As the descending motor weakness involves the diaphragm and accessory muscles of respiration, respiratory failure may occur abruptly. Progression from onset of symptoms to respiratory failure has occurred in as little as 24 hours in cases of severe foodborne botulism. Symptoms begin as early as 12-36 hours after inhalation, but may take several days after exposure to low doses of toxin.

Physical examination usually reveals an alert and oriented patient with no signs of a fever. Mucous membranes may be dry and crusted and the patient may complain of dry mouth or sore throat. There may be difficulty with speaking

and swallowing. The gag reflex may be absent. Pupils may be dilated and even fixed. Variable degrees of skeletal muscle weakness may be observed depending on the degree of progression in an individual patient. With severe respiratory muscle paralysis, the patient may become cyanotic or exhibit narcosis from carbon dioxide retention.

Infant botulism manifests itself when patients appear lethargic, feed poorly, are constipated, and have a weak cry and poor muscle tone. These are all symptoms of the muscle paralysis caused by the bacterial toxin. If untreated, these symptoms may progress to cause paralysis of the arms, legs, trunk and respiratory muscles.

In food borne botulism, symptoms generally begin 18 to 36 hours after eating a contaminated food, but they can occur as early as six hours or as late as 10 days.

Diagnosis

Diagnosis is primarily a clinical one. Biowarfare attack should be suspected if multiple casualties simultaneously report paralysis. Lab confirmation can be obtained by testing the patient's serum.

Treatment

The respiratory failure and paralysis that occur with severe botulism may require a patient to be on a breathing machine (ventilator) for weeks, plus intensive medical and nursing care. After several weeks, the paralysis slowly improves. If diagnosed early, foodborne and wound botulism can be treated with an antitoxin that blocks the action of the toxin circulating in the blood. This can prevent patients from worsening, but recovery still takes many weeks. Physicians may try to remove contaminated food still in the gut by inducing vomiting or by using enemas.

Wounds should be treated, usually surgically, to remove the source of the toxin-producing bacteria. Good supportive care in a hospital is the mainstay of therapy for all forms of botulism.

Botulinum could be delivered by aerosol or used to contaminate food or water supplies. When inhaled, these toxins produce symptoms very similar to foodborne intoxication, although the time to onset of paralytic symptoms after inhalation may actually be longer than for foodborne cases, and may vary by type and dose of toxin. The clinical syndrome produced by these toxins is known as "botulism".

Supportive care, including prompt respiratory support, can be lifesaving. Respiratory failure due to paralysis of respiratory muscles is the most serious effect and, generally, the cause of death. Reported cases of botulism prior to 1950 had a mortality rate of 60%. With tracheotomy (making an incision in the neck to help breathing) or endotracheal intubation (bagging) and modern ventilators, fatalities are less than five percent today.

Intensive and prolonged nursing care may be required for recovery, which may take up to three months for initial signs of improvement, and up to a year for complete resolution of symptoms. If untreated, the disease can eventually lead to respiratory failure and paralysis. It is fatal in five to 10% of cases. Survivors do not usually develop an antibody response due to the very small amount of toxin necessary to produce clinical symptoms.

Vaccine

The military are testing a vaccine. The vaccine is recommended for selected individuals or groups judged at high risk for exposure to botulinum toxin aerosols. There is no indication at present for use of botulinum antitoxin as a prophylactic modality except under extremely specialized circumstances.

Post-exposure vaccination, using the heptavalent antitoxin has been demonstrated effective in animal studies; however, human data are not available, so it is not recommended for this indication.

Botulism is a rare but serious paralytic illness caused by a nerve toxin that is produced by the bacterium *Clostridium botulinum*.

Antidote

Early administration of botulinum antitoxin is critical, since the antitoxin can only neutralize the circulating toxin in patients with symptoms that continue to progress. When symptom progression ceases, no circulating toxin remains, and the antitoxin has no effect. Antitoxin may be particularly effective in food-borne cases, where presumably toxin continues to be absorbed through the gut wall. Animal experiments show that after aerosol exposure, botulinum antitoxin is very effective if given before the onset of clinical signs. If the antitoxin is delayed until after the onset of symptoms, it does not protect against respiratory failure.

Three different antitoxin preparations are available in the U.S. A licensed trivalent (types A, B, E) equine antitoxin is available from the Centers for Disease Control and Prevention for cases of foodborne botulism. This product has all the disadvantages of a horse serum product, including the risks of anaphylaxis and serum sickness.

Currently, antitoxin is not routinely given for treatment of infant botulism.

Isolation and Decontamination

Standard Precautions for healthcare workers. (See Appendix). Botulinum toxin is not skin active and secondary aerosols, i.e coughing, breathing and sneezing are not a hazard from patients. Decontaminate with soap and water. As mentioned above, botulinum toxin is inactivated by sunlight within 1-3 hours. Heat and bleach will also destroy the toxin.

Ricin

Ricin's significance as a potential biological warfare toxin is partly due to its wide availability. Worldwide, one million tons of castor beans are processed annually in the production of castor oil; the waste mash from this process is 5% ricin by weight. The toxin is also quite stable and extremely toxic by several routes of exposure, including through breathing.

Ricin was apparently used in the assassination of Bulgarian exile Georgi Markov in London in 1978. Markov was attacked with a specially engineered weapon disguised as an umbrella, which implanted a ricin-containing pellet into his body. This technique was used in at least six other assassination attempts in the late 1970's and early 1980's. In 1994 and 1995, four men from a tax-protest group known as the "Minnesota Patriots Council," were convicted of possessing ricin and conspiring to use it (by mixing it with the solvent DMSO) to murder law enforcement officials. In 1995, a Kansas City oncologist, Deborah Green, attempted to murder her husband by contaminating his food with ricin. In 1997, a Wisconsin resident, Thomas Leahy, was arrested and charged with possession with intent to use ricin as a weapon. In 2004, letters purportedly containing ricin were sent to the offices of Senator Fisk. Later, some doubt was cast on the contents but at the time the Senate Building closed and causing serious disruption to the work done on the Hill.

Ricin has a high terrorist potential due to its ready availability, relative ease of extraction, and notoriety in the press.

Ricin is a potent protein cytotoxin derived from the beans of the castor plant (*Ricinus communis*). The toxin is fairly easy to extract. When inhaled as a small particle aerosol, this toxin may produce pathologic changes within eight hours and severe respiratory symptoms followed by respiratory failure in 36-72 hours. When ingested, ricin causes severe gastrointestinal symptoms followed by vascular collapse and death.

Ricin can be produced relatively easily and inexpensively in large quantities in a fairly low technology setting. Ricin can be prepared in liquid or crystalline form, or it can be lyophilized to make a dry powder. It could be disseminated as an aerosol, injected into a target, or used to contaminate food or water on a small scale.

Ricin is stable under ambient conditions, but is detoxified by heat (175^{O}F for 10 min., or 120^{O}F for about an hour at pH 7.8) and very strong chlorine (99.4% inactivation in 20 min.). Lower chlorine concentrations, and weak iodine solutions will have no effect on ricin.

An enemy would need to produce it in large quantities to cover a significant area on the battlefield, thus potentially limiting large-scale use of ricin by an adversary.

Signs and Symptoms

Ricin is very toxic to cells. It acts by inhibiting protein synthesis. Acute onset of fever, chest tightness, cough, shortness of breath, nausea, and joint pain occurs four to eight hours after inhalation. Airway necrosis and pulmonary capillary leak resulting in the lungs filling with fluid would likely occur within 18-24 hours, followed by severe respiratory distress and death from lack of oxygen in 36-72 hours.

Diagnosis

Acute lung injury affecting a large number of geographically clustered cases should raise suspicion of an attack with a pulmonary irritant such as ricin, although other pulmonary pathogens could present with similar signs and symptoms. Other biological threats, such as SEB, Q fever, tularemia, plague, and some chemical warfare agents like phosgene, need to be included in the differential diagnosis. Ricin-induced pulmonary edema (lungs filling with fluid) would be expected to occur much later (one to three days post exposure) compared to that induced by SEB (about 12 hours post exposure) or phosgene (about six hours after exposure). Ricin intoxication would be expected to progress despite treatment with antibiotics, as opposed to an infectious process. There would be no inflammation of the chest cavity as seen with inhalation anthrax. Ricin patients would not be expected to plateau clinically as occurs with SEB intoxication.

Treatment

Management of ricin-intoxicated patients depends on the route of exposure. Patients with pulmonary intoxication are managed by appropriate respiratory support (oxygen, intubation, ventilation, etc.) and treatment for pulmonary edema, as indicated. Gastrointestinal intoxication is best managed by vigorous gastric lavage (washing), followed by use of purgatives such as magnesium citrate. Eating superactivated charcoal is of little value for large molecules such as ricin. Volume replacement of gastrointestinal fluid losses is important. In skin exposures, treatment would be primarily supportive.

Vaccination

There is currently no vaccine or prophylactic antitoxin available for human use, although immunization appears promising in animal models. Use of the protective mask is currently the best protection against inhalation.

Isolation and Decontamination

Ricin is not transmitted by coughing and sneezing. Decontaminate with soap and water. Hypochlorite bleach solutions (0.1% sodium hypochlorite) can inactivate ricin.

Staphylococcal Enterotoxin B

Staphylococcal Enterotoxin B (SEB) is one of several exotoxins produced by *Staphylococcus aureus* (golden staph). It can be used in aerosols or used to sabotage food supplies.

A bioterrorism attack with aerosol delivery of SEB to the respiratory tract would cause significant illness and some death. The sabotage of food and/or water with SEB is also thought to be a possibility for terrorist attack. Although an attack with SEB, especially by food contamination, may not cause many fatalities, it could incapacitate 80% of the public in the area of attack. In rare cases, especially with an aerosol attack, the effect of the toxin may be more severe, leading to shock and death.

Staphylococcus aureus produces a number of exotoxins, one of which is Staphylococcal enterotoxin B, or SEB. SEB commonly causes food poisoning in humans after the toxin is produced in improperly handled foodstuffs and subsequently ingested. SEB has a very broad spectrum of biological activity. This toxin causes a markedly different clinical syndrome when inhaled than it characteristically produces when ingested. Significant disease is produced in individuals who are exposed to SEB by either portal of entry to the body.

SEB is the second most common source of outbreaks of food poisoning. Often these outbreaks occur in a setting such as a church picnic or other community event, due to common source exposure in which contaminated food is consumed. Although an aerosolized SEB toxin weapon would not likely produce significant mortality, it could render 80 percent or more of exposed people clinically ill and unable to perform their mission for 1-2 weeks. The demand on the medical and logistical systems could be overwhelming.

SEB is inactivated after a few minutes at 212^{O}F. SEB causes symptoms when inhaled at very low doses in humans. This toxin could also be used to sabotage food or small volume water supplies.

Dispersion

As a toxin, SEB acts directly on the person who inhales or ingests it and is not an "infection" which is reproduced inside the body. It cannot be passed from person to person, so isolation of affected people is not necessary

Signs and Symptoms

Symptoms of SEB intoxication begin after a latent period of 3-12 hours after inhalation, or 4-10 hours after ingestion. Symptoms include nonspecific flu-like symptoms (fever, chills, headache, muscle aches), and specific features dependent on the route of exposure. Oral exposure results in predominantly gastrointestinal symptoms: nausea, vomiting, and diarrhea. Inhalation exposures produce predominantly respiratory symptoms: nonproductive

cough, chest pain, and difficulty breathing. Patients may also present with nausea, vomiting, and diarrhea if they swallow the toxin. Presumably, higher exposure can lead to septic shock and death.

The fever may last up to five days and range from 103—106 degrees F, with variable degrees of chills and prostration. The cough may persist up to four weeks, and patients may not be able to return to duty for two weeks.

Diagnosis

Large numbers of patients presenting in a short period of time with typical symptoms and signs of SEB pulmonary exposure would suggest an intentional attack with this toxin.

Treatment

Currently, therapy is limited to supportive care. Close attention to breathing and hydration is important. Acetaminophen for fever, and cough suppressants may make the patient more comfortable. Most patients would be expected to do quite well after the initial acute phase of their illness, but generally would be unfit for duty for one to two weeks. Severe cases risk death from pulmonary edema and respiratory failure.

Vaccination

Although there is currently no human vaccine for immunization against SEB intoxication, several vaccine candidates are in development. Preliminary animal studies have been encouraging. A vaccine candidate is nearing transition to advanced development for safety and immune testing in man. Experimentally, passive immunotherapy can reduce mortality in animals, but only when given within 4-8 hours after inhaling SEB.

Isolation and Decontamination

SEB is not dermally (skin) active and secondary aerosols are not a hazard from patients. Decontaminate with soap and water and make sure that any food that may have been contaminated is destroyed,

T-2 Mycotoxins

The trichothecene (T-2) mycotoxins are a group of over 40 compounds produced by fungi of the genus *Fusarium*, a common grain mold. They are small molecular weight compounds, and are extremely stable in the environment. They are the only class of toxin that is dermally active, causing blisters within a relatively short time after exposure (minutes to hours). Dermal, ocular, respiratory, and gastrointestinal exposures would be expected after an attack with mycotoxins.

The potential for use as a bio warfare toxin was demonstrated to the Russian military shortly after World War II when flour contaminated with species of *Fusarium* was unknowingly baked into bread that was ingested by civilians.

Some developed a protracted lethal illness called alimentary toxic aleukia (ATA) characterized by initial symptoms of abdominal pain, diarrhea, vomiting, prostration, and within days fever, chills, muscle pains and bone marrow depression, blood disorders and infections. Survival beyond this point allowed the development of painful throat ulcers and diffuse bleeding into the skin, bloody diarrhea, blood in the urine, vomiting blood, nose bleeds and vaginal bleeding.

The trichothecene mycotoxins are produced by molds of the genera *Fusarium*, *Myrotecium, Trichoderma, Stachybotrys* and others. These substances are relatively insoluble in water but are highly soluble in ethanol, methanol and propylene glycol. They are extremely stable to heat and ultraviolet light inactivation. They retain their bioactivity even when autoclaved; heating to 1500^{o} F for 30 minutes is required for inactivation. Hypochlorite solution alone is does not effectively inactivate the toxins. Rather, the addition of Sodium Hydroxide to a 1% hypochlorite solution, with one hour contact time is required. Soap and water will remove this oily toxin from exposed skin or other surfaces.

These products are more biopoisons than diseases as such, but they are included as they can be used in much the same way as biodiseases. Aflatoxin is a naturally occurring mycotoxin produced by two types of mold: *Aspergillus flavus* and *Aspergillus parasiticus*.

Aspergillus flavus is common and widespread in nature and is most often found when certain grains are grown under stressful conditions such as drought. The mold occurs in soil, decaying vegetation, hay and grains undergoing microbiological deterioration and invades all types of organic substrates whenever and wherever the conditions are favorable for its growth.

Favorable conditions include high moisture content and high temperature. At least 13 different types of aflatoxin are produced in nature with aflatoxin B1 considered as the most toxic. While the presence of *Aspergillus flavus* does not always indicate harmful levels of aflatoxin it does mean that the potential for aflatoxin production is present.

Aflatoxin B1 frequently turns up in molds that grow on nuts, such as peanuts. Iraq and Iran are two of the world's largest producers of pistachio nuts which are also a successful host, but the toxin can also be cultivated from molds that grow on corn and other crops.

Aflatoxin is listed as a possible carcinogen, and has been shown to cause liver damage, some of which may be cumulative in many mammals that ingest sufficient quantities of it. In most species, aflatoxin cannot be detected in the liver 14 days after it has been withdrawn from the animals' diet, though some of its effects may still be present.

Animals affected by aflatoxicosis show reduced feed intake, and even mortality, if sufficient amounts of aflatoxin are ingested for a sufficient period of time. Sensitivity, however, seems to vary not only by species, but also by individual animals.

Both of these toxins destroy the immune system in animals, and are carcinogenic over the long term in humans—one reason why peanut farmers and peanut-butter makers around the world are looking for ways to eliminate aflatoxins out of their products.

To date little data exists demonstrating aflatoxins' effectiveness on the battlefield. However that hasn't stopped some from trying.

All of the above conditions are generally adaptations of existing illnesses. By far the biggest threat comes from manufactured illnesses whose potency is likely to be much more virulent.

Signs and symptoms

In a bio warfare attack the toxin(s) can adhere to and penetrate the skin, be inhaled, and can be ingested. Contaminated clothing can serve as a reservoir for further toxin exposure. Early symptoms beginning within minutes of exposure include burning skin pain, redness, tenderness, blistering, and progression to leathery blackening and sloughing of large areas of skin. Upper respiratory exposure may result in nasal itching, pain, sneezing, nosebleeds, and nasal discharges. Pulmonary toxicity produces shortness of breath, wheezing, and cough. Mouth and throat exposure causes pain and blood tinged saliva and sputum. Loss of appetite, nausea, vomiting and watery or bloody diarrhea with cramping abdominal pain occurs with gastrointestinal toxicity. Eye pain, tearing, redness, foreign body sensation and blurred vision may follow exposure to the eyes. Skin symptoms occur in minutes to hours and eye symptoms in minutes. Systemic toxicity can occur via any route of exposure, and results in weakness, fainting, dizziness, and loss of coordination. Tachycardia, hypothermia, and hypotension follow in fatal cases. Death may occur in minutes, hours or days. The most common symptoms are vomiting, diarrhea, skin involvement with burning pain, redness and itching, rash or blisters, bleeding, and breathing difficulties.

Diagnosis

High attack rates, dead animals of multiple species, and physical evidence such as yellow, red, green, or other pigmented oily liquid are suggestive of mycotoxins. Rapid onset of symptoms in minutes to hours supports a diagnosis of a chemical or toxin attack. Mustard gas must be considered but it has an odor and is visible. Inhalation of staphylococcal enterotoxin B or ricin aerosols can cause fever, cough, dyspnea, and wheezing but does not involve the skin.

Serum and urine should be collected and sent to a reference lab for antigen detection. The mycotoxins and metabolites are eliminated in the urine and feces; 50-75% is eliminated within 24 hours, however, metabolites can be detected as late as 28 days after exposure. Pathologic specimens include blood, urine, lung, liver, and stomach contents. Environmental and clinical samples can be tested using a gas liquid chromatography-mass spectrometry technique. This system can detect as little as 0.1-1.0 ppb of T-2, which is sensitive enough to measure T-2 levels in the plasma of toxin victims.

Treatment

There is no specific antidote. Treatment is supportive. Soap and water washing, even 4-6 hours after exposure can significantly reduce dermal toxicity; washing within 1 hour may prevent toxicity entirely. Superactivated charcoal should be given orally if the toxin is swallowed. Respiratory support may be necessary. The eyes should be irrigated with normal saline or water to remove toxin.

Vaccine

The only defense is to prevent exposure by wearing a protective mask and clothing (or topical skin protectant) during an attack. No specific immunotherapy or chemotherapy is available for use in the field.

Isolation and Decontamination

Coughs and sneezes will not pass on the toxin, however, contact with contaminated skin and clothing can produce secondary dermal exposures. Contact Precautions (See Appendix) are warranted until decontamination is accomplished. Then, Standard Precautions (see Appendix) are recommended for healthcare workers. Environmental decontamination requires the use of a bleach.

Distinguishing between natural and intentional disease outbreaks

With a sneak biological agent attack, the most likely first indicator of an event would be an increased number of patients presenting with clinical features caused by the disseminated disease agent. Therefore, health care providers must use epidemiology to detect and respond rapidly to a biological agent attack.

A sound epidemiologic investigation of a disease outbreak, whether natural or human-engineered, will assist medical personnel in identifying the pathogen, as well as instituting the appropriate medical interventions. Documenting the affected population, possible routes of exposure, signs and symptoms of disease, along with rapid laboratory identification of the causative agents, will greatly increase the ability to institute an appropriate medical and public health response. Good epidemiologic information can guide the appropriate follow-up of those potentially exposed, as well as assist in risk communication and responses to the media.

Many diseases caused by weaponized biological agents present with nonspecific clinical features that could be difficult to diagnose and recognize as a biological attack. The disease pattern that develops is an important factor in differentiating between a natural and a terrorist or warfare attack. Epidemiologic clues that can potentially indicate an intentional attack are listed in Table 1. While a helpful guide, it is important to remember that naturally occurring epidemics can have one or more of these characteristics and a biological attack may have none.

Once a biological attack or any outbreak of disease is suspected, the epidemiologic investigation should begin. The conduct of the investigation will not differ significantly whether or not the outbreak is intentional. The first step is to confirm that a disease outbreak has occurred. A case definition should be constructed to determine the number of cases and the attack rate. The case definition allows investigators who are separated geographically to use the same criteria when evaluating the outbreak. The use of objective criteria in the development of a case definition is very important in determining an accurate case number, as additional cases may be found and some cases may be excluded, especially as the potential exists for hysteria to be confused with actual disease. The estimated rate of illness should be compared with rates during previous years to determine if the rate constitutes a deviation from the norm.

Once the attack rate has been determined, the outbreak can be described by time, place, and person. These data will provide crucial information in determining the potential source of the outbreak. The epidemic curve is calculated based on cases over time. In a point-source outbreak, which is most likely in a biological attack or terrorism situation, the early parts of the epidemic curve will tend to be compressed compared with propagated outbreaks. The peak may be in a matter of days or even hours. Later phases of the curve may also help determine if the disease

appears to spread from person to person, which can be extremely important for determining effective disease control measures.

Well before any event, public health authorities must implement surveillance systems so they can recognize patterns of nonspecific syndromes that could indicate the early manifestations of a biological warfare attack. The system must be timely, sensitive, specific, and practical. To recognize any unusual changes in disease occurrence, surveillance of background disease activity should be ongoing, and any variation should be followed up promptly with a directed examination of the facts regarding the change.

It is important to remember that recognition of and preparation for a biological attack is similar to that for any disease outbreak, but the surveillance, response, and other demands on resources would likely be of an unparalleled intensity. A strong public health infrastructure with epidemiologic investigation capability, practical training programs, and preparedness plans are essential to prevent and control disease outbreaks, whether they are naturally occurring or otherwise.

Signs of a biologic warfare or terrorist attack

- The presence of a large epidemic with a similar disease or syndrome, especially in a localized population
- Many cases of unexplained diseases or deaths
- More severe disease than is usually expected for a specific pathogen or failure to respond to standard therapy
- Unusual routes of exposure for a pathogen, such as the inhalational route for diseases that normally occur through other exposures
- A disease that is unusual for a given geographic area or transmission season
- Disease normally transmitted by a vector that is not present in the local area
- Multiple simultaneous or serial epidemics of different diseases in the same population
- A single case of disease by an uncommon agent (smallpox, some viral hemorrhagic fevers)
- A disease that is unusual for an age group
- Unusual strains or variants of organisms or antimicrobial resistance patterns different from those circulating
- Similar genetic type among agents isolated from distinct sources at different times or locations
- Higher attack rates in those exposed in certain areas, such as inside a building if released indoors, or lower rates in those inside a sealed building if released outside
- Disease outbreaks of the same illness occurring in noncontiguous areas
- A disease outbreak with zoonotic impact

- Intelligence of a potential attack, claims by a terrorist or aggressor of a release, and discovery of munitions or tampering

Characteristics of biological weapons and warfare

In the military there is a 10-step process for medical personnel to use when evaluating a situation where biological warfare is suspected. It contains advice concerning many useful identification techniques and sound medical practices which might be of use in a real emergency .

1. Maintain an index of suspicion. The health-care provider on the modern battlefield must first possess a high index of suspicion regarding the potential employment of biological weapons. This is due to the fact that, with many of the biological warfare (BW) diseases, very early treatment is mandatory if patients are to be salvaged. Anthrax, botulism, plague, and smallpox are readily prevented if patients are provided with proper antibiotics, antisera, and/or immunization promptly following exposure. Conversely, all of these diseases may prove fatal if therapy or vaccination is delayed until classic symptoms develop. Unfortunately, symptoms in the early phase of illness are non-specific, making diagnosis difficult. Moreover, many potential bio warfare diseases, such as Brucellosis, Q-fever, and Venezuelan Equine Encephalitis (VEE), may never present as more than non-specific fevers. Without a high index of suspicion, it is unlikely that the battlefield provider, especially at lower levels, removed from sophisticated laboratory and preventive medicine resources, will promptly arrive at a proper diagnosis and institute appropriate therapy.

II. Protect thyself. Before medical personnel approach a potential biological casualty, they must first take steps to protect themselves. These steps may involve a combination of physical, chemical, and immunologic forms of protection. On the battlefield, physical protection typically consists of a protective mask. Designed primarily with chemical vapor hazards in mind, the M-40 series mask certainly provides adequate protection against all inhalational BW threats. In fact, a HEPA-filter (or even a simple surgical) mask will afford adequate protection against BW (although not against chemical) threats. Chemical protection refers, in general, to the pre- and/or post-exposure administration of antibiotics; immunologic protection principally involves active immunization and, in the present climate, applies mainly to protection against anthrax.

III. Assess the patient. Check airways, breathing and circulation problems before attention is given to any other conditions. The initial assessment is conducted before decontamination is accomplished and should thus be brief. Historical information of potential interest to the clinician might include information about illnesses in other unit members, the presence of unusual munitions, food and water procurement sources, vector exposure, immunization history, travel history and occupation. A physical exam at this point should concentrate on the pulmonary and neuromuscular systems, as well as unusual dermatologic and vascular findings.

IV. Decontaminate as appropriate. Decontamination plays a very important role in the approach to chemical casualty management. The incubation period of biological agents, however, makes it unlikely that victims of a bio attack will know they need medical care until days after an attack. At this point, the need for decontamination is minimal or non-existent. In those rare cases where decontamination is warranted, simple soap and water bathing will usually suffice. Certainly, standard military decontamination solutions (such as hypochlorite), typically employed in cases of chemical agent contamination, would be effective against all biological agents. In fact, even 0.1% bleach reliably kills anthrax spores, the hardiest of biological agents. Routine use of caustic substances, especially on human skin, however, is rarely warranted following a biological attack.

V. Establish a diagnosis. With decontamination (where warranted) accomplished, a more thorough attempt to establish a diagnosis can be carried out. Nasal swabs (important for culture and PCR, even if the clinician is unsure *which* organisms to assay for), blood cultures, serum, sputum cultures, blood and urine for toxin analysis, throat swabs, and environmental samples should be considered.

Respiratory Casualties	
Rapid-Onset	**Delayed-Onset**
Nerve Agents	**Inhalational Anthrax**
Cyanide	**Pneumonic Plague**
Mustard	**Pneumonic Tularemia**
Lewisite	**Q Fever**
Phosgene	**SEB Inhalation**
SEB Inhalation	**Ricin Inhalation**
	Mustard
	Lewisite
	Phosgene
Neurological Casualties	
Rapid-Onset	**Delayed-Onset**
Nerve Agents	**Botulism-peripheral symptoms**
Cyanide	**VEE-CNS symptoms**

Diagnostic matrix: Chemical & biological casualties.

While awaiting laboratory confirmation, a diagnosis must be made on clinical grounds. Chemical and biological warfare diseases can be generally divided into those that present "immediately" with little or no incubation or latent period (principally the chemical agents) and those with a considerable delay in presentation (principally the biological agents).

Moreover, biological warfare diseases are likely to resemble one of a limited number of clinical syndromes. Plague, Tularemia, and SEB disease all may look like pneumonia. Botulism and VEE may present with peripheral and central neuromuscular findings, respectively.

VI. Render prompt treatment. Unfortunately, it is precisely in the first phase of many diseases that therapy is most likely to be effective. Table 3 is constructed by eliminating from consideration those diseases for which definitive therapy is not warranted, not available, or not critical. Treatment of respiratory casualties who might have first stage anthrax, plague, or tularemia would all be managed in a similar manner. Doxycycline, for example, is effective against most strains of *B. anthracis, Y. pestis,* and *F. tularensis,* as well as against *C. burnetii*, and the *Brucellae*. Other tetracyclines and fluoroquinolones might also be considered in a battlefield scenario.

VII. Practice good infection control. Standard precautions provide adequate protection against most infectious diseases, including those potentially employed in bio warfare. Anthrax, Tularemia, Brucellosis, Glanders, Q-Fever, VEE, and the Toxin-Mediated diseases are not generally contagious, and victims can be safely managed using standard precautions. Such precautions should be familiar to all clinicians. Under certain circumstances, however, one of three forms of transmission-based precautions would be warranted. Smallpox victims should, wherever possible, be managed using airborne precautions. Pneumonic Plague warrants the use of droplet precautions, and certain VHFs require contact precautions.

VIII. Alert the proper authorities. In any military context, the command should immediately be appraised of casualties suspected due to chemical or biological agents. This is true out in the civilian world, too.

IX. Assist in the Epidemiologic Investigation. All health care providers require a basic understanding of epidemiologic principles. Clinicians should, at the very least, ask patients about potential exposures, ill family members or co-workers, food/water sources, unusual spray devices, and develop a line listing of potential cases. Such early discovery might minimize casualties and fatalities.

X. Maintain proficiency. Fortunately, the threat of biowarfare has remained a theoretical one for most medical personnel. Inability to practice casualty management, however, can lead to a rapid loss of skills and knowledge. It is imperative that the medic maintains proficiency in dealing with this low probability, but high consequence problem. It is important, too, that as a civilian, you do whatever you can to help the authorities. By being informed about the nature of biological illnesses and the ways they are spread you can do your bit to minimize the effects of a terrorist attack.

Appendix 1

Standard Precautions

Standard precautions are employed in the care of all patients. These are the military precautions used to nurse infected patients. In the event you have to nurse an infected victim at home you should follow them exactly to minimize the risk of transmitting the infection to other people.

- Wash hands after patient contact.
- Wear gloves when touching blood, body fluids, secretions, excretions and contaminated items.
- Wear a mask and eye protection, or a face shield during procedures likely to generate splashes or sprays of blood, body fluids, secretions or excretions
- Handle used patient-care equipment and linen in a manner that prevents the transfer of microorganisms to people or equipment.

Use care when handling sharps and use a mouthpiece or other ventilation device as an alternative to mouth-to-mouth resuscitation when practical.

Airborne precautions

Biothreat Diseases requiring Airborne Precautions: Smallpox.

Standard Precautions plus:

- Place the patient in a private room that has monitored negative air pressure, a minimum of six air changes/hour, and appropriate filtration of air before it is discharged from the room.
- Wear respiratory protection when entering the room.
- Limit movement and transport of the patient. Place a mask on the patient if they need to be moved.

Droplet Precautions

Biothreat diseases requiring Droplet precautions: Pneumonic plague.

Standard Precaution plus:

- Place the patient in a private room or cohort them with someone with the same infection. If not feasible, maintain at least three feet between patients.
- Wear a mask when working within three feet of the patient.
- Limit movement and transport of the patient. Place a mask on the patient if they need to be moved.

Patient Isolation Precautions:

Standard Precautions plus:

- Place the patient in a private room or with someone with the same infection.
- Wear gloves when entering the room. Change gloves after contact with infective material.

- Wear a gown when entering the room if contact with patient is anticipated or if the patient has diarrhea, a colostomy or wound drainage not covered by a dressing.
- Limit the movement or transport of the patient from the room.
- Ensure that patient-care items, bedside equipment, and frequently touched surfaces receive daily cleaning.
- Dedicate use of noncritical patient-care equipment (such as stethoscopes) to a single patient, or cohort of patients with the same pathogen. If not feasible, adequate disinfection between patients is necessary.

Appendix 2

Bio warfare Agent Characteristics

Disease	Transmit Man to Man	Infective Dose (Aerosol)	Incubation Period	Duration of Illness	Lethality (approx. case fatality rates)	Persistence of Organism	Vaccine Efficacy (aerosol exposure)
Inhalation anthrax	No	8,000-50,000 spores	1-6 days	3-5 days (usually fatal if untreated)	High	Very stable - spores remain viable for > 40 years in soil	2 dose efficacy against up to 1,000 LD_{50} in monkeys
Brucellosis	No	10 -100 organisms	5-60 days (usually 1-2 months)	Weeks to months	<5% untreated	Very stable	No vaccine
Cholera	Rare	10-500 organisms	4 hours - 5 days (usually 2-3 days)	≥ 1 week	Low with treatment, high without	Unstable in aerosols & fresh water; stable in salt water	No data on aerosol
Glanders	Low	Assumed low	10-14 days via aerosol	Death in 7-10 days in septicemic form	> 50%	Very stable	No vaccine
Pneumonic Plague	High	100-500 organisms	2-3 days	1-6 days (usually fatal)	High unless treated within 12-24 hours	For up to 1 year in soil; 270 days in live tissue	3 doses not protective against 118 LD_{50} in monkeys
Tularemia	No	10-50 organisms	2-10 days (average 3-5)	≥ 2 weeks	Moderate if untreated	For months in moist soil or other media	80% protection against 1-10 LD_{50}
Q Fever	Rare	1-10 organisms	10-40 days	2-14 days	Very low	For months on wood and sand	94% protection against 3,500 LD_{50} in guinea pigs
Smallpox	High	Assumed low (10-100 organisms)	7-17 days (average 12)	4 weeks	High to moderate	Very stable	Vaccine protects against large doses in primates
Venezuelan Equine Encephalitis	Low	10-100 organisms	2-6 days	Days to weeks	Low	Relatively unstable	TC 83 protects against 30-500 LD_{50} in hamsters
Viral Hemorrhagic Fevers	Moderate	1-10 organisms	4-21 days	Death between 7-16 days	High for Zaire strain, moderate with Sudan	Relatively unstable - depends on agent	No vaccine
Botulism	No	0.001 μg/kg is LD_{50} for type A	1-5 days	Death in 24-72 hours; lasts months if not lethal	High without respiratory support	For weeks in nonmoving water and food	3 dose efficacy 100% against 25-250 LD_{50} in primates
Staph Enterotox	No	0.03 μg/person	3-12 hours after inhalation	Hours	< 1%	Resistant to freezing	No vaccine

in B		incapacitation					
Ricin	No	3-5 μg/kg is LD_{50} in mice	18-24 hours	Days - death within 10-12 days for ingestion	High	Stable	No vaccine
T-2 Mycotoxins	No	Moderate	2-4 hours	Days to months	Moderate	For years at room temperature	No vaccine

Disease	**Transmit Man to Man**	**Infective Dose (Aerosol)**	**Incubation Period**	**Duration of Illness**	**Lethality (approx. case fatality rates)**	**Persistence of Organism**	**Vaccine Efficacy (aerosol exposure)**
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Smallpox	High	Assumed low (10-100 organisms)	7-17 days (average 12)	4 weeks	High to moderate	Very stable	Vaccine protects against large doses in primates

Venezuelan Equine Encephalitis	Low	10-100 organisms	2-6 days	Days to weeks	Low	Relatively unstable	TC 83 protects against 30-500 LD_{50} in hamsters
Viral Hemorrhagic Fevers	Moderate	1-10 organisms	4-21 days	Death between 7-16 days	High for Zaire strain, moderate with Sudan	Relatively unstable - depends on agent	No vaccine
Botulism	No	0.001 µg/kg is LD_{50} for type A	1-5 days	Death in 24-72 hours; lasts months if not lethal	High without respiratory support	For weeks in nonmoving water and food	3 dose efficacy 100% against 25-250 LD_{50} in primates
Staph Enterotoxin B	No	0.03 µg/person incapacitation	3-12 hours after inhalation	Hours	< 1%	Resistant to freezing	No vaccine
Ricin	No	3-5 µg/kg is LD_{50} in mice	18-24 hours	Days - death within 10-12 days for ingestion	High	Stable	No vaccine
T-2 Mycotoxins	No	Moderate	2-4 hours	Days to months	Moderate	For years at room temperature	No vaccine

Appendix 3

Differential Diagnosis of Chemical Nerve Agent, Botulinum Toxin and SEB -- Intoxication following Inhalation Exposure

	Chemical Nerve Agent	**Botulinum Toxin**	**SEB**
Time to Symptoms	Minutes	Hours (12-48)	Hours (1-6)
Nervous	Convulsions, Muscle twitching	Progressive paralysis	Headache, Muscle aches
Cardiovascular	Slow heart rate	Normal rate	Normal or rapid heart rate
Respiratory	Difficult breathing, airway constriction	Normal, then progressive paralysis	Nonproductive cough; Severe cases; chest pain/difficult breathing
Gastrointestinal	Increased motility, pain,	Decreased motility	Nausea, vomiting

	diarrhea		and/or diarrhea
Ocular	Small pupils	Droopy eyelids, Large pupils	May see “red eyes” (conjuntival infection)
Salivary	Profuse, watery saliva	Normal; difficulty swallowing	May be slightly increased quantities of saliva
Death	Minutes	2-3 days	Unlikely
Response to Atropine/2PAM-CL	Yes	No	Atropine may reduce gastrointestinal symptoms

Appendix 4 Comparative Lethality of Selected Toxins &Chemical Agents in Laboratory Mice

AGENT	LD_{50} (µg/kg)	MOLECULAR WEIGHT	SOURCE
Botulinum toxin	0.001	150,000	Bacterium
Shiga toxin	0.002	55,000	Bacterium
Tetanus toxin	0.002	150,000	Bacterium
Abrin	0.04	65,000	Plant (Rosary Pea)
Diphtheria toxin	0.10	62,000	Bacterium
Maitotoxin	0.10	3,400	Marine Dinoflagellate
Palytoxin	0.15	2,700	Marine Soft Coral
Ciguatoxin	0.40	1,000	Marine Dinoflagellate
Textilotoxin	0.60	80,000	Elapid Snake
C. perfringens toxins	0.1 – 5.0	35-40,000	Bacterium
Batrachotoxin	2.0	539	Arrow-Poison Frog
Ricin	3.0	64,000	Plant (Castor Bean)
alpha-Conotoxin	5.0	1,500	Cone Snail
Taipoxin	5.0	46,000	Elapid Snake
Tetrodotoxin	8.0	319	Puffer Fish
alpha-Tityustoxin	9.0	8,000	Scorpion
Saxitoxin	10.0 (Inhal 2.0)	299	Marine Dinoflagellate
VX	15.0	267	Chemical Agent
SEB (Rhesus/Aerosol)	27.0 (ED_{50}~pg)	28,494	Bacterium

Anatoxin-A(s)	50.0	500	Blue-Green Algae
Microcystin	50.0	994	Blue-Green Algae
Soman (GD)	64.0	182	Chemical Agent
Sarin (GB)	100.0	140	Chemical Agent
Aconitine	100.0	647	Plant (Monkshood)
T-2 Toxin	1,210.0	466	Fungal Myotoxin

Appendix 5 Glossary of Medical Terms

Adapted from Stedman's Electronic Medical Dictionary, Williams & Wilkins, Baltimore, MD, 1996 and Principles and Practice of Infectious Diseases, Mandell et al, Third Edition.

Acetylcholine (ACH, Ach) - The neurotransmitter substance at cholinergic synapses, which causes cardiac inhibition, vasodilation, gastrointestinal peristalsis, and other parasympathetic effects. It is particularly important in the stimulation of muscle tissue. The transmission of an impulse to the end of the nerve causes it to release neurotransmitter molecules onto the surface of the next cell, stimulating it.

Active immunization -The act of artificially stimulating the body to develop antibodies against infectious disease by the administration of vaccines or toxoids.

Adenopathy - Swelling or morbid enlargement of the lymph nodes.

Aleukia - Absence or extremely decreased number of leukocytes in the circulating blood.

Analgesic - 1. A compound capable of producing analgesia, i.e., one that relieves pain by altering perception of nociceptive stimuli without producing anesthesia or loss of consciousness. 2. Characterized by reduced response to painful stimuli.

Anaphylaxis - The term is commonly used to denote the immediate, transient kind of immunologic (allergic) reaction characterized by contraction of smooth muscle and dilation of capillaries due to release of pharmacologically active substances (histamine, bradykinin, serotonin, and slow-reacting substance), classically initiated by the combination of antigen (allergen) with mast cell-fixed, cytophilic antibody (chiefly IgE).

Anticonvulsant - An agent which prevents or arrests seizures.

Antitoxin - An antibody formed in response to and capable of neutralizing a biological poison; an animal serum containing antitoxins.

Arthralgia - Severe pain in a joint, especially one not inflammatory in character.

AST - Abbreviation for aspartate aminotransferase, a liver enzyme.

Asthenia - Weakness or debility.

Ataxia - An inability to coordinate muscle activity during voluntary movement, so that smooth movements occur. Most often due to disorders of the cerebellum or the posterior columns of the spinal cord; may involve the limbs, head, or trunk.

Atelectasis - Absence of gas from a part or the whole of the lungs, due to failure of expansion or resorption of gas from the alveoli.

Atropine - An anticholinergic, with diverse effects (tachycardia, mydriasis, cycloplegia, constipation, urinary retention) attributable to reversible competitive blockade of acetylcholine at muscarinic type cholinergic receptors; used in the treatment of poisoning with organophosphate insecticides or nerve gases.

Bilirubin - A red bile pigment formed from hemoglobin during normal and abnormal destruction of erythrocytes. Excess bilirubin is associated with jaundice.

Blood agar - A mixture of blood and nutrient agar, used for the cultivation of many medically important microorganisms.

Bronchiolitis - Inflammation of the bronchioles, often associated with bronchopneumonia.

Bronchitis - Inflammation of the mucous membrane of the bronchial tubes.

Brucella - A genus of encapsulated, nonmotile bacteria (family Brucellaceae) containing short, rod-shaped to coccoid, Gram-negative cells. These organisms are parasitic, invading all animal tissues and causing infection of the genital organs, the mammary gland, and the respiratory and intestinal tracts, and are pathogenic for man and various species of domestic animals. They do not produce gas from carbohydrates.

Bubo - Inflammatory swelling of one or more lymph nodes, usually in the groin; the confluent mass of nodes usually suppurates and drains pus.

Bulla, gen. and pl. bullae - A large blister appearing as a circumscribed area of separation of the epidermis from the subepidermal structure (subepidermal *bulla*) or as a circumscribed area of separation of epidermal cells (intraepidermal *bulla*) caused by the presence of serum, or occasionally by an injected substance.

Carbuncle - Deep-seated pyogenic infection of the skin and subcutaneous tissues, usually arising in several contiguous hair follicles, with formation of connecting sinuses; often preceded or accompanied by fever, malaise, and prostration.

Cerebrospinal - Relating to the brain and the spinal cord.

Chemoprophylaxis - Prevention of disease by the use of chemicals or drugs.

Cholinergic - Relating to nerve cells or fibers that employ acetylcholine as their neurotransmitter.

CNS - Abbreviation for central nervous system.

Coagulopathy - A disease affecting the coagulability of the blood.

Coccobacillus - A short, thick bacterial rod of the shape of an oval or slightly elongated coccus.

Conjunctiva, pl. conjunctivae - The mucous membrane investing the anterior surface of the eyeball and the posterior surface of the lids.

CSF - Abbreviation for cerebrospinal fluid.

Cutaneous - Relating to the skin.

Cyanosis - A dark bluish or purplish coloration of the skin and mucous membrane due to deficient oxygenation of the blood, evident when reduced hemoglobin in the blood exceeds 5 g per 100 ml.

Diathesis -The constitutional or inborn state disposing to a disease, group of diseases, or metabolic or structural anomaly.

Diplopia -The condition in which a single object is perceived as two objects.

Distal - Situated away from the center of the body, or from the point of origin; specifically applied to the extremity or distant part of a limb or organ.

Dysarthria - A disturbance of speech and language due to emotional stress, to brain injury, or to paralysis, incoordination, or spasticity of the muscles used for speaking.

Dysphagia, dysphagy - Difficulty in swallowing.

Dysphonia - Altered voice production.

Dyspnea - Shortness of breath, a subjective difficulty or distress in breathing, usually associated with disease of the heart or lungs; occurs normally during intense physical exertion or at high altitude.

Ecchymosis - A purplish patch caused by extravasation of blood into the skin, differing from petechiae only in size (larger than 3 mm diameter).

Eczema - Generic term for inflammatory conditions of the skin, particularly with vesiculation in the acute stage, typically erythematous, edematous, papular, and crusting; followed often by lichenification and scaling and occasionally by duskiness of the erythema and, infrequently, hyperpigmentation; often accompanied by sensations of itching and burning.

Edema - An accumulation of an excessive amount of watery fluid in cells, tissues, or serous cavities.

Enanthem, enanthema - A mucous membrane eruption, especially one occurring in connection with one of the exanthemas.

Encephalitis, pl. encephalitides - Inflammation of the brain.

Endotoxemia - Presence in the blood of endotoxins.

Endotracheal intubation - Passage of a tube through the nose or mouth into the trachea for maintenance of the airway during anesthesia or for maintenance of an imperiled airway.

Enterotoxin - A cytotoxin specific for the cells of the intestinal mucosa.

Epistaxis - Profuse bleeding from the nose.

Epizootic - 1. Denoting a temporal pattern of disease occurrence in an animal population in which the disease occurs with a frequency clearly in excess of the expected frequency in that population during a given time interval. 2. An outbreak (epidemic) of disease in an animal population; often with the implication that it may also affect human populations.

Erythema - Redness of the skin due to capillary dilatation.

Erythema multiforme - An acute eruption of macules, papules, or subdermal vesicles presenting a multiform appearance, the characteristic lesion being the target or iris lesion over the dorsal aspect of the hands and forearms; its origin may be allergic, seasonal, or from drug sensitivity, and the eruption, although usually self-limited (e.g., multiforme minor), may be recurrent or may run a severe course, sometimes with fatal termination (e.g., multiforme major or Stevens-Johnson syndrome).

Erythrocyte - A mature red blood cell.

Erythropoiesis - The formation of red blood cells.

Exanthema - A skin eruption occurring as a symptom of an acute viral or coccal disease, as in scarlet fever or measles.

Extracellular -Outside the cells.

Extraocular - Adjacent to but outside the eyeball.

Fasciculation - Involuntary contractions, or twitchings, of groups (fasciculi) of muscle fibers, a coarser form of muscular contraction than fibrillation.
Febrile - Denoting or relating to fever.

Fomite - Objects, such as clothing, towels, and utensils that possibly harbor a disease agent and are capable of transmitting it.

Formalin - A 37% aqueous solution of formaldehyde.

Fulminant hepatitis - Severe, rapidly progressive loss of hepatic function due to viral infection or other cause of inflammatory destruction of liver tissue.

Generalized vaccinia - Secondary lesions of the skin following vaccination which may occur in subjects with previously healthy skin but are more common in the case of traumatized skin, especially in the case of eczema (eczema vaccinatum). In the latter instance, generalized vaccinia may result from mere contact with a vaccinated person. Secondary vaccinial lesions may also occur following transfer of virus from the vaccination to another site by means of the fingers (autoinnoculation).

Glanders - A chronic debilitating disease of horses and other equids, as well as some members of the cat family, caused by *Pseudomonas mallei*; it is transmissible to humans. It attacks the mucous membranes of the nostrils of the horse, producing an increased and vitiated secretion and discharge of mucus, and enlargement and induration of the glands of the lower jaw.

Granulocytopenia -Less than the normal number of granular leukocytes in the blood.

Guarnieri bodies - Intracytoplasmic acidophilic inclusion body's observed in epithelial cells in variola (smallpox) and vaccinia infections, and which include aggregations of Paschen body's or virus particles.

Hemagglutination - The agglutination of red blood cells; may be immune as a result of specific antibody either for red blood cell antigens per se or other antigens which coat the red blood cells, or may be nonimmune as in hemagglutination caused by viruses or other microbes.

Hemagglutinin - A substance, antibody or other, that causes hemagglutination.

Hematemesis - Vomiting of blood.

Hemopoietic - Pertaining to or related to the formation of blood cells.

Hematuria - Any condition in which the urine contains blood or red blood cells.

Hemodynamic - Relating to the physical aspects of the blood circulation.

Hemolysis -Alteration, dissolution, or destruction of red blood cells in such a manner that hemoglobin is liberated into the medium in which the cells are suspended, e.g., by specific complement-fixing antibodies, toxins, various chemical agents, tonicity, alteration of temperature.

Hemolytic Uremic Syndrome - Hemolytic anemia and thrombocytopenia occurring with acute renal failure.

Hemoptysis - The spitting of blood derived from the lungs or bronchial tubes as a result of pulmonary or bronchial hemorrhage.

Hepatic - Relating to the liver.

Heterologous - 1. Pertaining to cytologic or histologic elements occurring where they are not normally found. 2. Derived from an animal of a different species, as the serum of a horse is heterologous for a rabbit.

Hyperemia - The presence of an increased amount of blood in a part or organ.

Hyperesthesia - Abnormal acuteness of sensitivity to touch, pain, or other sensory stimuli.

Hypochlorite solution - 5% chlorine bleach solution used for decontamination.

Hypotension - Subnormal arterial blood pressure.

Hypovolemia - A decreased amount of blood in the body.

Hypoxemia - Subnormal oxygenation of arterial blood, short of anoxia.

Idiopathic - Denoting a disease of unknown cause.

Immunoassay - Detection and assay of substances by serological (immunological) methods; in most applications the substance in question serves as antigen, both in antibody production and in measurement of antibody by the test substance.

In vitro - In an artificial environment, referring to a process or reaction occurring therein, as in a test tube or culture media.

In vivo - In the living body, referring to a process or reaction occurring therein.

Induration - 1. The process of becoming extremely firm or hard, or having such physical features. 2. A focus or region of indurated tissue.

Inguinal - Relating to the groin.

Inoculation - Introduction into the body of the causative organism of a disease.

Leukopenia - The antithesis of leukocytosis; any situation in which the total number of leukocytes in the circulating blood is less than normal, the lower limit of which is generally regarded as 4000-5000 per cu mm.

Lumbosacral - Relating to the lumbar vertebrae and the sacrum.

Lumen, pl. lumina - The space in the interior of a tubular structure, such as an artery or the intestine.

Lymphadenopathy - Any disease process affecting a lymph node or lymph nodes.

Lymphopenia - A reduction, relative or absolute, in the number of lymphocytes in the circulating blood.

Macula, pl. maculae - 1. A small spot, perceptibly different in color from the surrounding tissue. 2. A small, discolored patch or spot on the skin, neither elevated above nor depressed below the skin's surface.

Mediastinitis - Inflammation of the cellular tissue of the mediastinum.

Mediastinum - The median partition of the thoracic cavity, covered by the mediastinal pleura and containing all the thoracic viscera and structures except the lungs.

Megakaryocyte - A large cell with a polyploid nucleus that is usually multilobed; megakaryocytes are normally present in bone marrow, not in the circulating blood, and give rise to blood platelets.

Melena - Passage of dark-colored, tarry stools, due to the presence of blood altered by the intestinal juices.

Meningism - A condition in which the symptoms simulate a meningitis, but in which no actual inflammation of these membranes is present.

Meningococcemia - Presence of meningococci (*N. meningitidis*) in the circulating blood.

Meninges - Any membrane; specifically, one of the membranous coverings of the brain and spinal cord.

Microcyst - A tiny cyst, frequently of such dimensions that a magnifying lens or microscope is required for observation.

Microscopy - Investigation of minute objects by means of a microscope.

Moribund - Dying; at the point of death.

Mucocutaneous - Relating to mucous membrane and skin; denoting the line of junction of the two at the nasal, oral, vaginal, and anal orifices.

Myalgia - Muscular pain.

Mydriasis - Dilation of the pupil.

Narcosis - General and nonspecific reversible depression of neuronal excitability, produced by a number of physical and chemical agents, usually resulting in stupor rather than in anesthesia.

Necrosis - Pathologic death of one or more cells, or of a portion of tissue or organ, resulting from irreversible damage.

Nephropathia epidemica - A generally benign form of epidemic hemorrhagic fever reported in Scandinavia.

Neutrophilia - An increase of neutrophilic leukocytes in blood or tissues; also frequently used synonymously with leukocytosis, inasmuch as the latter is generally the result of an increased number of neutrophilic granulocytes in the circulating blood (or in the tissues, or both).

Nosocomial - Denoting a new disorder (not the patient's original condition) associated with being treated in a hospital, such as a hospital-acquired infection.

Oliguria - Scanty urine production.

Oropharynx - The portion of the pharynx that lies posterior to the mouth; it is continuous above with the nasopharynx via the pharyngeal isthmus and below with the laryngopharynx.

Osteomyelitis - Inflammation of the bone marrow and adjacent bone.

Pancytopenia - Pronounced reduction in the number of erythrocytes, all types of white blood cells, and the blood platelets in the circulating blood.

Pandemic - Denoting a disease affecting or attacking the population of an extensive region, country, continent; extensively epidemic.

Papule - A small, circumscribed, solid elevation on the skin.

Parasitemia -The presence of parasites in the circulating blood; used especially with reference to malarial and other protozoan forms, and microfilariae.

Passive immunity - Providing temporary protection from disease through the administration of exogenously produced antibody (i.e., transplacental transmission of antibodies to the fetus or the injection of immune globulin for specific preventive purposes).

PCR - see below for polymerase chain reaction.

Percutaneous - Denoting the passage of substances through unbroken skin, for example, by needle puncture, including introduction of wires and catheters.

Perivascular - Surrounding a blood or lymph vessel.

Petechia, pl. petechiae - Minute hemorrhagic spots, of pinpoint to pinhead size, in the skin, which are not blanched by pressure.

Pharyngeal - Relating to the pharynx.

Pharyngitis - Inflammation of the mucous membrane and underlying parts of the pharynx.

Phosgene - Carbonyl chloride; a colorless liquid below 8.2°C, but an extremely poisonous gas at ordinary temperatures; it is an insidious gas, since it is not immediately irritating, even when fatal concentrations are inhaled.

Photophobia - Morbid dread and avoidance of light. Photosensitivity, or pain in the eyes with exposure to light, can be a cause.

Pleurisy - Inflammation of the pleura.

Polymerase chain reaction - An in vitro method for enzymatically synthesizing and amplifying defined sequences of DNA in molecular biology. Can be used for improving DNA-based diagnostic procedures for identifying unknown BW agents.

Polymorphonuclear - Having nuclei of varied forms; denoting a variety of leukocyte.

Polyuria - Excessive excretion of urine.

Presynaptic - Pertaining to the area on the proximal side of a synaptic cleft.

Prophylaxis, pl. prophylaxes - Prevention of disease or of a process that can lead to disease.

Prostration - A marked loss of strength, as in exhaustion.

Proteinuria - Presence of urinary protein in concentrations greater than 0.3 g in a 24-hour urine collection or in concentrations greater than 1 g/l in a random urine collection on two or more occasions at least 6 hours apart; specimens must be clean, voided midstream, or obtained by catheterization.

Pruritus - Syn: itching.

Ptosis, pl. ptoses - In reference to the eyes, drooping of the eyelids.

Pulmonary edema -Edema of the lungs.

Pyrogenic - Causing fever.

Retinitis - Inflammation of the retina.

Retrosternal - Posterior to the sternum.

Rhinorrhea - A discharge from the nasal mucous membrane.

Sarin - A nerve poison which is a very potent irreversible cholinesterase inhibitor and a more toxic nerve gas than tabun or soman.

Scarification -The making of a number of superficial incisions in the skin. It is the technique used to administer tularemia and smallpox vaccines.

Septic shock - 1. shock associated with sepsis, usually associated with abdominal and pelvic infection complicating trauma or operations; 2. shock associated with septicemia caused by Gram-negative bacteria.

Sequela, pl. sequelae - A condition following as a consequence of a disease.

Shigellosis - Bacillary dysentery caused by bacteria of the genus *Shigella*, often occurring in epidemic patterns.

Soman - An extremely potent cholinesterase inhibitor, similar to sarin and tabun.

Sterile abscess - An abscess whose contents are not caused by pyogenic bacteria.

Stridor - A high-pitched, noisy respiration, like the blowing of the wind; a sign of respiratory obstruction, especially in the trachea or larynx.

Superantigen - An antigen that interacts with the T cell receptor in a domain outside of the antigen recognition site. This type of interaction induces the activation of larger numbers of T cells compared to antigens that are presented in the antigen recognition site.

Superinfection - A new infection in addition to one already present.

Tachycardia - Rapid beating of the heart, conventionally applied to rates over 100 per minute.

Teratogenicity -The property or capability of producing fetal malformation.

Thrombocytopenia - A condition in which there is an abnormally small number of platelets in the circulating blood.

Toxoid - A modified bacterial toxin that has been rendered nontoxic (commonly with formaldehyde) but retains the ability to stimulate the formation of antitoxins (antibodies) and thus producing an active immunity. Examples include Botulinum, tetanus, and diphtheria toxoids.

Tracheitis - Inflammation of the lining membrane of the trachea.

Urticaria - An eruption of itching wheals, usually of systemic origin; it may be due to a state of hypersensitivity to foods or drugs, foci of infection, physical agents (heat, cold, light, friction), or psychic stimuli.

Vaccine - A suspension of attenuated live or killed microorganisms (bacteria, viruses, or rickettsiae), or fractions thereof, administered to induce immunity and thereby prevent infectious disease.

Vaccinia - An infection, primarily local and limited to the site of inoculation, induced in man by inoculation with the vaccinia (coxpox) virus in order to confer resistance to smallpox (variola). On about the third day after vaccination, papules form at the site of inoculation which become transformed into umbilicated vesicles and later pustules; they then dry up, and the scab falls off on about the 21st day, leaving a pitted scar; in some cases there are more or less marked constitutional disturbances.

Varicella - An acute contagious disease, usually occurring in children, caused by the varicella-zoster virus, a member of the family *Herpesviridae*, and marked by a sparse eruption of papules, which become vesicles and then pustules, like that of smallpox although less severe and varying in stages, usually with mild constitutional symptoms; incubation period is about 14 to 17 days. Syn: chickenpox

Variola - Syn: smallpox.

Variolation - The historical practice of inducing immunity against smallpox by "scratching" the skin with the purulency from smallpox skin pustules. The first inoculation for smallpox is said to have been done in China about 1022 B.C.

Viremia - The presence of virus in the bloodstream.

Virion - The complete virus particle that is structurally intact and infectious.

Zoonosis - An infection or infestation shared in nature by humans and other animals that are the normal or usual host; a disease of humans acquired from an animal source.

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Emergency Response Contacts

Sources of information:

National Response Center: **1-800-424-8802 or**

(for chem/bio hazards & terrorist events) **1-202-267-2675**

National Domestic Preparedness Office: **1-202-324-9025**

(for civilian use)

Domestic Preparedness Chem/Bio Helpline: **1-410-436-4484**

USAMRIID's Emergency Response Line: **1-888-872-7443**

CDC'S Emergency Response Line: **1-770-488-7100**

Johns Hopkins Center: **1-410-223-1667**

(Civilian Biodefense Studies)

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