

## **Greek Fire, Poison Arrows & Scorpion Bombs: Biological and Chemical Warfare in the Ancient World**

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[http://www.amazon.com/Poison-Arrows-Scorpion-Bombs-Adrienne/dp/1590201779/ref=sr\\_1\\_4?ie=UTF8&s=books&qid=1227395024&sr=1-4](http://www.amazon.com/Poison-Arrows-Scorpion-Bombs-Adrienne/dp/1590201779/ref=sr_1_4?ie=UTF8&s=books&qid=1227395024&sr=1-4)

### **New Introduction**

Not long ago, Italian archaeologists excavating a Roman villa near Pompeii discovered a large vat containing the residue of whatever had been stored in the container since AD 79. Tests of the residue, published in 2007, revealed a mixture of powerful medicinal plants, including opium poppy seeds, along with the flesh and bones of reptiles. Was this an ancient witch's poisonous brew? Quite the contrary; according to the archaeologists, the vat may have been used to prepare a secret "universal antidote" believed to counteract all known poisons.

This concoction, a combination of small doses of poisons and their antidotes, called *Mithridatium*, had been invented by King Mithridates VI of Pontus, a brilliant military strategist and master of toxicology, about one hundred years earlier. His recipe was perfected by the Emperor Nero's personal physician and became the world's most sought-after antidote, long prescribed for European royalty. The original formula is lost, but

ancient historians tell us that the ingredients included opium and chopped vipers.

In our own time, beset by threats of biological warfare and terrorism, Mithridates' dream of achieving immunity to toxic weapons wielded by one's enemies still beckons scientists. In 2003, when this book first appeared, fears of biological and chemical "weapons of mass destruction" in the Middle East and a series of unsolved anthrax attacks in the United States had everyone on edge. As a historian of ancient biochemical warfare, I was invited to attend the international Biosecurity 2003 summit in Washington, DC. I was also interviewed on History Channel's "Global View" about the origins of biochemical warfare. Another guest that day was *New York Times* reporter Judith Miller, a survivor of the 2001 anthrax attacks. The third guest was Serguei Popov, former top biological weapons researcher in the Soviet Union's massive *Biopreparat* program, who defected to the United States in 1992. After our TV interviews, I spoke and corresponded with Serguei Popov about his new research at the National Center for Biodefense. I learned that after decades of developing extremely dangerous, genetically engineered superviruses intended as bioweapons against Russia's enemies, Dr. Popov now devotes his life to seeking a kind of modern *Mithridatium*, a "universal

antidote” for our times. He and his colleagues hope to invent a vaccine to counter the most commonly weaponized pathogens.

Working with virulent pathogens—whether to create bioweapons or formulate biodefenses—entails the potential for grave “boomerang” effects and raises a Hydra’s Head of unintended consequences. Indeed, as the following chapters will show, the decision to use biological and/or chemical tactics in warfare is a double-edged sword. “Blowback,” “friendly fire,” collateral damage, and self-injury—these are recurring themes in attempts to control poison weapons in antiquity and today.

Two entertaining and educational media events inspired by the original edition of this book underscore the ever-present threat of self-injury when handling toxic armaments.

The dread scorpion bomb of antiquity (described in Chapter 6, “Animal Allies”) was selected for *National Geographic’s* poison issue, “Twelve Toxic Tales” (2005). To illustrate the story, the editors decided to make a real scorpion bomb to be photographed and X-rayed. An expert in ancient pottery created an authentic replica of a terracotta pot like those found at the desert fortress of Hatra near modern Mosul, Iraq, where scorpion bombs had successfully repulsed Roman besiegers in AD 198. After some searching, six deadly Iraqi Death Stalker scorpions were

obtained from an exotic pet shop. But now, in the National Geographic studio, photographer Cary Wolinsky and his scorpion wranglers found themselves facing the same threat of “blowback” that the defenders of Hatra had somehow overcome. How does one go about stuffing deadly scorpions into a jar without getting stung? In antiquity, there were several techniques for handling scorpions “safely”—none of them all that safe. The National Geographic team hit on a method unavailable to the desert dwellers of Hatra: the wranglers placed the scorpions in a refrigerator to slow them down before each photo shoot.

As consultant and interviewee for a History Channel episode, “Ancient Weapons of Mass Destruction” (2006), I had to caution the production crew that toxic armaments of 2,500 years ago are still mighty dangerous today. They wanted to reproduce the spectacular incendiary weapon devised by the Spartans during a protracted siege at Plataia in 429 BC, during the Peloponnesian War. But it would not be a good idea to toss lumps of actual sulphur onto a blazing hot bonfire of resinous pine logs without issuing gas masks to everyone in the vicinity (Chapter 7 explains why). Likewise, one should be very careful when crushing pretty but highly toxic hellebore plants in a mortar and pestle, to recreate

another famous siege-breaking bioweapon used in Greece in 590 BC (Chapter 3).

Keen interest in the origins and early practice of biological and chemical warfare keeps pace with today's advances in biochemical weapons and defenses. To date, this book has been translated into six languages (Japanese, Turkish, Korean, Chinese, Greek, and Polish); it is assigned for university courses and cited in military and public health manuals, international arms control materials, and as evidence in court cases involving attack dogs and Agent Orange. *Greek Fire, Poison Arrows & Scorpion Bombs* has become a favorite reference book among fantasy- and war-gamers and military history buffs around the world. Several best-selling novelists have found inspiration in my collection of insidious, ingenious bioweapons from classical antiquity. For example, the fictionalized historical characters in Margaret George's *Helen of Troy* (2006) discuss various fiendish poison tactics described here. Brad Thor's thriller *Blowback* (2005) imagines a secret bioterror weapon devised by Hannibal and discovered by modern terrorists (drawn from recipes in Chapters 1 and 4), and C. J. Sansom's medieval mystery *Dark Fire* (2005) turns on a lost formula for Greek Fire (from Chapter 7). I myself was inspired by my research into ancient biological warfare to begin my

next book, *Poison King: The Life and Legend of Mithradates the Great, Rome's Deadliest Foe* (Princeton, 2009).

After an Introduction revealing the mythological roots of biological warfare, Chapters 2-7 are organized according to type of weaponry used in historical battles: poison arrows; poison water, food and air; germs and pathogens; intoxicants and hypnotics; zoological weapons; and incendiaries. Nearly every advanced biochemical weapon today has an ancient prototype. Since 2003, new evidence has come to light about unconventional ancient warfare and modern biochemical weapons research has progressed. Here is a brief survey of developments since 2003 of biochemical weapons with precursors in antiquity, along with some examples of recent research on biochemical warfare in the ancient world. References detailing the sources of information will be found at the end of this introduction.

**Poison Projectiles.** An important book about the use of toxic arrows by indigenous peoples of the Americas appeared in 2007, *Poison Arrows: North American Indian Hunting and Warfare*, by David E. Jones. New evidence has also emerged about poisons in warfare in Asia. Perhaps the earliest mention of biological weapons in China (arrows tipped with aconite, monkshood) appeared in the *Pen Ts'ao*, attributed to the father

of Chinese medicine Shen Nung (2735 BC, although it may have been compiled in about 300 BC). Victor Mair's new translation of *The Art of War: Sun Zi's Military Methods* (2007) has information on poison and fire projectiles in ancient China, and numerous references to poison weapons are found in Ralph Sawyer's excellent *The Tao of Deception: Unorthodox Warfare in Historic and Modern China* (2007).

According to ancient legend, the Greek warrior Odysseus was killed by an extremely rare poison weapon—a spear tipped with a sting ray spine (Chapter 2). This manner of death was unique to Greek myth, until a tragic event was reported 3,000 years later. In 2006, the famous environmentalist, Crocodile Hunter Steve Irwin, died by the same exotic poison that killed the great Homeric hero, when his heart was pierced by the venomous barb of a sting ray.

**Poisoning water and food supplies.** Polluting an adversary's wells and crops is one of the oldest biological warfare tricks in the book. Forcing enemies to camp in unhealthy sites and compelling besieged cities to resort to eating foul or toxic substances was another ancient biological strategy. To Chapter 3's examples can be added incidents in the Byzantine era Gothic War (AD 535-555). Under siege by the Goths, the

Romans were forced to eat human feces, toxic nettles, and acidic acorn flour, which caused mass fatal poisonings.

**Weaponized pathogens.** New evidence was published in 2007 elaborating on the earliest documented case of biological warfare in the Near East, which I describe in Chapter 4. In the Anatolian War of 1320-1318 BC, the Hittites—even though militarily weaker than their enemies the Arzawans—won victory with a secret bioweapon. They drove rams and donkeys infected with deadly tularemia (known as the “Hittite plague”) into Arzawan lands. The lethal plague was transmitted to humans via ticks and flies. Today, artificially manufactured plague germs are possible—a concept first described by ancient Romans as *pestilentia manu facta*, man-made pestilence (Chapter 4).

**Intoxicants, hypnotics.** Chapter 5 introduces the world’s first military commander who was also adept in pharmacology. The general was a witch named Chrysame, who used drugs to cause temporary insanity in the enemy, during the Greek colonization of Ionia in about 1000 BC. Mithridates stands out as a rare example of a general who was also an expert toxicologist; another is Kautilya, a military strategist who was also a scientist, in India at the time of Alexander the Great.

Today, scientific military research demands similar combinations of skills. It is interesting to learn that the general in charge of the Soviet DNA-hybrid bioweapons program was a trained molecular biologist. In the future, based on the sophisticated principles of recombinant gene splicing, nightmarish possibilities loom. For example, a bioweapon of neurotransmitter endorphins piggybacking on bacteria could target the central nervous system, changing the enemy's perceptions and behavior, causing psychosis, insomnia, passivity, confusion. In theory, enemies could some day create an aerosolized bioweapon of mass destruction by inserting, say, cobra venom into the DNA of an infectious virus.

**Insects and animals as weapons.** Venomous insects may have been some of the earliest zoological weapons in human history. The full history and disturbing future of insects as military munitions is now admirably covered in *Six-Legged Soldiers: Using Insects as Weapons of War* (2008). Recently, DARPA, the Pentagon's military research unit, announced new advances in their Vivisystems program, developing "rat-bots," "remote-control" primates, and "insect cyborgs" for use in warfare, as described in Chapter 6. As of this writing, the US Navy continues to deploy sea lions and dolphins in the Mideast and US harbors.

In 2003, the wildly popular, historically accurate new 3D video game “Rome: Total War” was released. The game featured realistic war elephants. Then, in 2004, inspired by my description of the best defense against war elephants in antiquity (Chapter 6), a new zoological weapon was introduced by the game’s developers. One reviewer wrote about the exciting demonstration of the new feature on GameSpy.com: “I had waited 12 months for this! I was on the edge of my seat. The elephants came pounding down the hillside toward my legions. ‘All right, let's send in the pigs!’ the developers hollered. I was sweating with anticipation. At long last! Our superweapon unveiled! ‘*Cry Havoc and Let Slip the Pigs of War!*’ I bellowed.”

But, he continued, “Here's the thing, the thing to remember about a flaming pig. *It doesn't go where you tell it to . . .* [the pigs] ran through my lines of troops, causing them to break formation. Men were running around, screaming, catching on fire, and howling with pain. The pigs went everywhere, everywhere except toward the elephants, who continued their charge unfazed, then rammed into our panicked troops like freight trains. How many strategy games offer THAT? *I must have this game.*”

Again, this time vividly played out on modern war gamers’ screens, the lesson is that biological weapons are notoriously hard to control and

aim; they tend to take on a diabolical life of their own, creating havoc in one's own forces and killing innocent bystanders. Storage of devastating bioweapons is also an ancient problem that has not yet been solved. The Greek hero Hercules buried his deep underground—just as the Department of Defense hopes to do at Yucca Mountain (Chapter 1 and Afterword).

**Chemical incendiaries and heat rays.** In Chapter 7, I cited the unpublished discovery and chemical analysis of a fireball hurled by defenders during Alexander's siege of a fort in Pakistan in 327 BC. That paper has now been published as "Southern Asia's Oldest Incendiary Missile." To the references for the history of Chinese fire weapons, flame-throwers, and toxic smoke clouds in Chapter 7, I recommend an older but comprehensive work by Wang Ling, "On the Invention and Use of Gunpowder and Firearms," *Isis* 37 (July 1947); 160-78.

Archimedes' notorious heat-ray weapon—ranks of polished bronze shields reflecting the sun's rays at enemy ships—was deployed against the Roman navy in 212 BC (Chapter 7). This celebrated invention has fired the imagination of military scientists ever since. I mentioned a modern attempt to reconstruct Archimedes' weapon in 1975. After this book appeared in 2003, the popular TV show "MythBusters" failed to

reproduce the feat and declared the story a myth in 2004. But in 2005, a professor and his students at MIT took up the challenge. They recreated Archimedes' 2,200-year-old mirror weapon and caused a wooden fishing boat to combust in San Francisco harbor, impressing the MythBusters, who filmed the feat.

A modern version of a heat-ray weapon was DARPA's controversial long-range microwave ray-gun, mounted on a tank, unveiled in 2001. Designed to sweep "menacing crowds" from a safe distance, the ray causes excruciating pain without damage—as long as people could move out of the beam. The ray penetrates a victim's skin, heating it to 130 degrees F, creating the sensation that one is on fire. Amid criticism that the weapon was not really as harmless as claimed, the weapon was withdrawn from public scrutiny (Chapter 7). But in 2007, a new version of the ray gun was announced with great fanfare again, this time shooting electromagnetic radio-frequency beams at 500 yards. "Our warfighters need weapons like this, because distinguishing between combatants and non-combatants on the modern battlefield can be very difficult," said the head of DARPA's Non-Lethal Weapons Directorate.

Indeed, as the following chapters show, weapons that target human biological vulnerabilities are notoriously indiscriminating, capable of

harming civilians as well as soldiers. Trying to control weapons based on deadly poisons, volatile chemicals, windborne smoke, unquenchable flames, virulent pathogens, venomous creatures, and unpredictable animals and materials has always posed dangers not just to the victims but to the perpetrators themselves. As we shall see, these practical and ethical issues were first broached in ancient Greek myth and they show up again and again in real historical battles.

In nearly all cultures, both ancient and modern, “biological and chemical weapons are seen as more repugnant than conventional weapons,” remarked biochemical weapons expert Dr. Leonard Cole in the TV series “Avoiding Armageddon.” We should “nourish that sense of repugnance for out-of-bounds weapons” which should “have no place in civilized society.” “Every weapon that we can develop a cultural antipathy for, so much the better.” This, suggested Cole, could “create a model for how we might eventually minimize the use of all kinds of weapons” of war.

The evidence from ancient myth and history shatters the notion that there ever was a time when biological and chemical warfare was unthinkable. But the evidence also shows that doubts about the use of such weapons arose as soon as the first archer dipped the first arrowhead in poison. And that’s a reason for hope, I think. To delve into the long

history of humankind's ingenuity in weaponizing nature is a fascinating yet sobering undertaking. Once released from the genie's bottle, the horrors of biological and chemical war technologies are loosed on the world. Yet, like Pandora's Box, one can discover, embedded in the ancient Greek myths, a ray of hope that anticipates modern efforts to restrain the dark sciences of war.

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By 2004 it was evident that Iraq had no biochemical or nuclear weapons. In July 2008, Egyptian-born Al Qaeda biochemical weapons mastermind in Afghanistan, Abu Khabab al-Masri, was killed in Pakistan by US missile strike. As of this writing, the case of the anthrax letter attacks of 2001 remains unsolved, after the prime suspect, a US government anthrax/bioweapons researcher, committed suicide in August 2008.

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*Blowback*, Hannibal's secret weapon: "After reading Adrienne Mayor's book about chemical and biological warfare in the ancient world and John

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DARPA, Defense Advanced Research Program Agency, announced in March 2006 that the Hybrid Micro Electronic Mechanical Systems (HI-MEMS) program “seeks innovative proposals to develop technology to create insect-cyborgs, possibly enabled by intimately integrating microsystems within insects, during their early stages of metamorphoses.” Once these insect-machine hybrid “platforms are integrated, various microsystem payloads can be mounted on the platforms with the goal of controlling insect locomotion.”

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Archimedes' mirror weapon was reproduced successfully by Dr. David Wallace and his students from Massachusetts Institute of Technology, in San Francisco harbor, igniting a 1924 wooden fishing boat, on October 22, 2005, broadcast on Discovery Channel's "MythBusters" on January 25, 2006. For full technical details and photos, see [http://web.mit.edu/2.009/www/experiments/deathray/10\\_Mythbusters.html](http://web.mit.edu/2.009/www/experiments/deathray/10_Mythbusters.html).

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