# The End of the World: the science and ethics of human extinction

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## Chemical and biological warfare

In World War One, above a million soldiers were casualties of chlorine, phosgene and mustard gas, over ninety thousand dying. The nerve gases tabun, sarin and soman, discovered but not used during World War Two, were deadly in far smaller quantities, while the yet more effective VX -- the United States had four thousand tons of it in 1967 -- killed when just a few milligrams reached one's skin. Still, an amount sufficient to destroy all the people in China, supposing that they lined up to receive their doses, could in practice "neutralize" only a square kilometer of battlefield.(*44) [A cynic might say that this is why many nations recently proved willing to sign a Convention banning manufacture of chemical weapons --- adding, though, that sixty-five nations must ratify it before it comes into force.] Natural toxins, now manufacturable inexpensively through gene cloning, are far more lethal: three hundred tons might replace the eighty thousand tons to which the chemical warfare arsenal of the superpowers had at one stage grown.(*45) Shiga toxin manages to be over a million times deadlier than tabun. The gene for it was cloned by the U.S. Army, officially "to create a vaccine" and thus "for peaceful purposes", while the same army had earlier cloned the gene for diptheria toxin "to create a new therapy to treat melanoma, a type of skin cancer".(*46)

Properly protected troops, however, would merely be slowed down by the bulky clothing and respirators needed to counter such agents. And while civilians could suffer heavy casualties, the extermination of the human race would seem to require agents of a self-reproducing kind: the bacteria, rickettsiae, viruses and fungi of biowarfare. A single inhaled organism can lead to death from Q-fever. Just one mutant virus started the influenza pandemic of 1918-1919. Its offspring infected at least two thirds of a billion people, killing more than the world war had done.

In 1346 besieging Mongols hurled plague-infected corpses into the city of Caffa, its fleeing inhabitants then helping to spread the Black Death.

Twenty-five million people perished, about thirty per cent of Europe's population.

In 1763 the British made gifts of blankets from smallpox hospitals, with the intended effect on North American Indians.(*47)

There were several allegations of germ warfare during World War One.

During World War Two the British developed anthrax bombs. They then ordered half a million from the United States "for use", Prime Minister Churchill wrote, "should this mode of warfare be employed against us".(*48) Britain's Joint Planning Staff received instructions, all the same, to study whether the Allies could reach victory more quickly by first use of such warfare.(*49) In 1945 a 500-pound British bacteriological bomb was at an advanced stage of development, it being estimated that forty thousand such bombs could deliver death by anthrax to half the citizens of Aachen, Berlin, Frankfurt, Hamburg, Stuttgart and Wilhelmshafen.(*50)In the United States a force which grew to four thousand persons worked on anthrax, yellow fever, plague, botulism and dozens of other diseases, including those of crops and farm animals. The manufacturing plant in Indiana, ready to operate in 1945 but never actually used, was capable of producing half a million anthrax bombs a month, and crop disease bombs were produced for the U.S. Air Force six years after the war.(*51)

In 1935, reacting to alleged Russian attacks on their water supplies with cholera bacteria, the Japanese began major work on cholera and also on plague, typhus, typhoid, hemorrhagic fever and smallpox.(*52) They developed bombs for anthrax and gas gangrene. During their invasion of China they attacked at least eleven cities experimentally, their aircraft dropping plague-infected paper, cotton, wheat and rice.(*53) In addition they distributed one hundred and thirty kilograms of anthrax and paratyphoid bacteria.(*54) Several thousand prisoners of war became their experimental subjects, perhaps as many as three thousand dying, but the United States overlooked the deaths in return for the experimental data, then continuing to deny Russian reports of the whole affair for the next quarter

century. The Russians may have regarded all this as an invitation to pursue their own research, for in 1979 a U.S. Congressional Committee reported that an anthrax outbreak in Sverdlovsk had been caused by an explosion at a biological weapons factory.(*55)

Post-war U.S. activities included producing designs for a plant able to breed one hundred and thirty million mosquitoes a month, for spreading yellow fever. Fleas, ticks and flies are said to have been bred at Fort Detrick as possible vectors for plague, tularemia, anthrax and dysentery. Strains of brucellosis, psittacosis, Rocky Mountain spotted fever, Rift Valley fever, Q-fever, encephelomyelitis, and so on, were also developed for possible use in warfare.(*56) In 1952, during the Korean war, an international scientific commission made the firm statement -- the United States was equally firm in its denial -- that "the people of Korea and China did actually serve as targets for bacteriological weapons". Many years later, the statement's British co-author commented that "mostly it was experimental work, as far as we could see," work which "didn't seem to be very successful".(*57) However, secret pseudo-attacks by the U.S. military on San Francisco, New York and Winnipeg had been depressingly effective. In one of them, in 1950, wind blowing over two minesweepers sent at least five thousand harmless bacteria into the lungs of virtually every San Franciscan. Secret British experiments from 1948 to 1959 were similarly alarming. Caged on rafts off the Bahamas and the west coast of Scotland, thousands of animals were exposed to wind-driven bacteria, while harmless zinc cadmium sulphide was poured from aircraft flying around the British coast. The results are said to have shown that Britain would be virtually defenceless against germs in aerosol form.(*58)

All this activity had occurred despite first one and then another treaty: the 1925 Geneva Protocol which prohibited actual warfare with gas or germs, and the Convention of 1972 which in addition banned development and stockpiling of biological weapons. For a start, many countries failed to sign these treaties or else failed to ratify them. The first was ratified by

Japan only in 1970, and by the United States not until 1975. In 1985 half the developing countries had accepted neither of them. Next, ratifications of the Protocol were often with two qualifications: that only first use would be prohibited (first use being something very hard to verify) and that countries which hadn't ratified could be attacked at will. Again, the Convention permitted unlimited research, plus production "for protective or other peaceful purposes" --- so that huge amounts could be produced "for making vaccines", some then being available for actual vaccination of the home population and the remainder for launching an attack. Moreover studies of verification methods began only in 1991, perhaps understandably since treaty violations would be nearly impossible to detect. Against such a background, even saintly governments could appear in need of biowarfare research to evaluate threats from others, to develop vaccines and antibiotics, and to deter by making it plain that weapons could be constructed quickly. In 1994 the United States claimed that as many as twenty-five nations, including North Korea, Iran and Iraq, were developing biological weaponry, and that the Russians had pursued a vigorous offensive programme in violation of the Convention.(*59)

The arrival of genetic engineering was at first judged to make little difference. As recently as 1983 a spokesman for the U.S. military said the world was already full of fine biological weapon agents, for instance anthrax. Such a reaction sounds foolish today. Techniques of gene manipulation have advanced so rapidly that lethal, highly infectious viruses are no longer regarded as too dangerous to handle. [Anthrax vaccine has reduced mortality rates to twenty per cent or less, and anthrax is not particularly infectious.] Essentially new diseases can be produced by "site-directed mutagenesis" in which chemicals, delivered to chosen regions of an organism's DNA or RNA, alter genes which wouldn't ordinarily mutate, or by "splicing" which combines genes from different organisms. In 1985 Prime Minister Thatcher stated that biological weapons had become as potentially dangerous as nuclear ones.(*60)

Normal germs "don't want to kill"; there is an evolutionary penalty to be paid for murdering one's host, so that new varieties of plague, for example, tend to become less and less deadly as they spread; but toxin-producing genes can be deliberately added to remedy this. Thus, the harmless E. coli bacteria of everybody's digestive tract might be changed so as to produce botulinus toxin.(*61) Natural resistance and vaccines can be thwarted by changing the surface structures of virulent organisms, making them "unrecognizable". The unrecognizability can be maintained through genes which confer hypervariability of the kind already found in the influenza and AIDS viruses. A country might vaccinate its own troops against bacteria, or even some viruses, which it intended to use in an attack. Its population too could be secretly vaccinated by wind-blown aerosols.(*62) But attempted defences would be futile unless one knew exactly which organisms the attacker was going to use --- whereas in fact one would probably first learn of an attack only several days after it had taken place.

"Ethnic" biological weapons have been proposed. Among victims of Valley Fever, whites are ten times less likely to die than blacks, while Epstein-Barr virus causes cancers in black Africans and in South-east Asians, not in whites.(*63) A nation attacking with such diseases, or with new ones produced by genetic engineering, might deny that there was anything unnatural in high death rates in enemy territory combined with low ones in its own.

Similar "deniability" could of course be had in the case of any disease endemic to the territory targeted. A lethal new strain produced by genetic engineers could be called a natural mutation.

The difficulties of verification have been worsened by advances in production methods. Small peaceful installations for making antibiotics and vaccines can readily be converted to making germs instead. Production times have been reduced several thousandfold and, now that mammalian cells can be grown on the surfaces of tiny beads, one small bottle can

produce virus yields which previously required large production facilities.(*64) Germs are fast becoming the poor man's atom bomb, available to small terrorist organisations or to criminals wishing to hold the world to ransom.

What is there in all this to exterminate the human race? In World War Two fowl plague was intensively studied and the British manufactured five million anthrax-filled cattle cakes, but humans can survive as vegetarians. In contrast, the viruses, bacteria and fungi investigated for attacking rice, wheat, maize, potatoes, etc., could produce widespread famine. It seems unlikely, though, that sufficiently many crops would be destroyed to wipe out humankind. The main danger surely lies in germs specifically directed against humans. An attacking nation's vaccines to protect itself might all too easily fail. "Ethnic" biowarfare agents could mutate, then slaughtering all races equally. Ingenious safety measures, for instance engineering of organisms so that they would die off after a small number of cell divisions, might again be nullified by mutation or by exchange of genetic material with unengineered organisms.(*65) Terrorists, or criminals demanding billions of dollars, could endanger the entire future of humanity with utterly lethal organisms which mutated so rapidly that no vaccines could fight them.

In *Man's Means to His End* Sir Robert Watson-Watt, after surveying the possibilities of nuclear and biological warfare, concluded that humans could enjoy a long future only if they established "a unique World Police Force", to be "the only force in the world with armament exceeding that required for the maintenance of internal order in individual nations".(*66) These were words written in 1961. Today it can seem that the threat to the human race from terrorists and criminals (let alone governments) could be removed only by very intrusive policing. One's own privacy is worth a great deal. Still, it mayn't be worth a major risk of dying, in company with everybody else, because some people have been using their privacy for perfecting a new disease.