

RESEARCH INTO THE EFFECTIVENESS OF WEAPONS OF MASS DESTRUCTION DURING THE 20TH CENTURY: BETWEEN THE TWO WORLD WARS AND THE COLD WAR

Abstract: The article is devoted to the methodology used to study chemical, biological and nuclear weapons of mass destruction introduced during the 20th century. The authors studied various methods utilized to test the effectiveness of such armaments both at the time of the two World Wars as well as during the standoff of the Cold War between the so called West and the Soviet Union. The sudden leap of civilization which occurred in the 20th century significantly influenced the revolutionary changes within the arms industry and, at the same time, introduced new possibilities concerning the testing and development of weapons of mass destruction. War had always been used as a "testing ground" allowing the practical assessment of the effectiveness of new weaponry.

Keywords: chemical weapons, biological weapons, nuclear weapons, weapons of mass destruction.

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Introduction

The article is devoted to the methodology used to study chemical, biological and nuclear weapons of mass destruction introduced during the 20th century. The authors studied various methods utilized to test the effectiveness of such armaments both at the time of the two World Wars as well as during the standoff of the Cold War between the so called West and the Soviet Union. The sudden leap of civilization which occurred in the 20th century significantly influenced the revolutionary changes within the arms industry and, at the same time, introduced new possibilities concerning the testing and development of weapons of mass destruction. War had always been used as a "testing ground" allowing the practical assessment of the effectiveness of new weaponry.

The final verification of the capabilities presented by various weapons occur through warfare, however, prior to initiating mass production of such armaments it is necessary to try them under conditions which are as close as possible to those presented on the battlefield. The less predictable the effects of a new weapon the more tests and research is required. However, the results of WMD's are very difficult to anticipate. Our efforts have been concentrated on the investigation of the history of research concerning three main types of weapons of mass destruction: chemical, biological and nuclear.

During the process of gathering and interpretation of historical materials devoted to matters being examined we have formulated a research question concerning the methodology used to study the effectiveness of weapons of mass destruction. Currently most of this type of research is completed using very advanced technology and computer modeling systems. At the time in question such solutions did not exist but the two World Wars preceding the long period of the Cold War created a need to seek new types of weapons as well as necessitated the continuous testing of previously unknown possibilities for mass extermination. Another circumstance favoring this course was the change in the approach to human and citizens' rights and, through this, the understanding of ethics or morality. During our work on the article we utilized non-fictional literature, accounts and reports presenting the scale and progression of research as well as providing detailed descriptions of separate

incidences of individual studies concerned with the effects produced by the use of weapons of mass destruction. Theoretical methods included analysis, synthesis and comparison with the examination of original texts being the only empirical method. The subject concerning the research addressed by the article has been the object of many studies but there has not been a publication which looks at the similarities and differences in the methodology used by the West and the Soviet Union to test these types of armaments. Within this context the reference to the World War II experiences of Japan is also not without significance. The fact that this work draws on Polish sources, both originating from Soviet Russia as well as from Western Europe which have not been previously known in the West or in Eastern Asia, is an additional benefit proving the value of this article. Thanks to that this work may present an interesting new approach especially in the context of comparing the experiences of so many culturally diverse communities.

Research into chemical weapons of the 20th century done before World War II

Professor Fritz Haber from the Friedrich Wilhelm University and Professor Walther Nernst from the University of Berlin, who, as early as 1913, conducted the first tests with an agent of chemical warfare, are considered to be the fathers of modern chemical warfare. Chlorine gas, used on April 22nd of 1915 in the vicinity of the town of Ypres in Belgium was the first chemical agent used on a field of battle (Coleman, 2005).

The events from Ypres caused the governments of countries dubbing themselves the Allies to set their scientists two main objectives: 1) devise a method for protecting the troops from chemical weapons; 2) invent an agent which would be at least as effective as the one used near Ypres and which could be used to conduct a counterattack upon an enemy who did not hesitate to use these types of weapons. Similar objectives were later established for scientists performing research on biological and nuclear weapons.

Numerous scientific centers whose goal was to perform experiments with weapons of mass destructions were established to realize these objectives. The operations of such centers were kept secret and even today public opinion has no idea as to the existence of some of these facilities. At the beginning of the 1980's a few western countries (mostly the United States and Great Britain) started to gradually declassify some of the information concerning the operations of scientific facilities performing research on chemical and biological weapons. No information related to this subject matter had been revealed in countries of the Eastern Bloc. First (scientifically valid) Polish language publications referring to the subject became available in 1999 (Charpak, Garwin, 1999; Parker, 1999; Alibek, 2000).

On the basis of available source materials it can be assumed that one of the first such centers, one which has the longest traditions and which can boast the greatest achievement in research done in the field of chemical and biological weapons, is the British military science park in Porton Down (WO33/1014 to WO233/1231).

The scientists' foremost objective was the development of protective clothing, particularly gas masks, which could safeguard the wearer against chemical agents used in those days. For the first time, as part of the realization of this goal, people, six members of a miners' rescue team trained in the use of respirators, were used in experiments checking the effects of chemical weapons on live organisms. They were in the front rank of a long line of "guinea pigs" or people who were used in tests over the several decade long history of Porton Down (Carter, 1992).

It was easy to justify the use of people in research meant to find effective protection from chemical weapons used by the enemy. What did the lives or health of a few men mean in the endeavor to save the lives of hundreds of thousands of our own soldiers waiting in the trenches at the front for

successful completion of this task? It was more difficult, however, to explain putting at risk even single individuals in experiments connected with the development of new poisons which would be more effective than those used by the enemy. But in the last two years of World War I researchers from Porton Down, working day and night, tested 147 different toxic substances for their suitability to destroy the enemy (Carter, 1992: 16-31). Initially, for reasons listed above, these types of experiments were done on rats. After the rats came time for little white mice, guinea pigs and rabbits. This was how extensive use of animals in trials performed in Porton Down began.

Goats turned out to be particularly useful in such experiments since their respiratory system is very similar to that of humans. After medical and toxicological research became a permanent part of the war effort goats were urgently required for this type of trials so a farm where 600 animals awaited their turn was established in Porton.

The suitability of goats as test subjects in studies on chemical weapons was extensive but only experiments on people could completely verify the conclusions reached by scientists after tests on animals. The researchers' determination sometimes was so great that more than once they conducted these trials on their own bodies.

One documented case of such sacrifice became declassified at the British National Archives. The research team lead by Joseph Barcroft, the head of the department of physiology in Porton, had a disagreement with its French counterpart in regard to the effectiveness of hydrogen cyanide or prussic acid (Dudkiewicz, 1968: 174-178). The French tried the gas out on dogs which all died. Porton conducted similar experiments on goats and they all lived. Barcroft decided to reach for the truth himself. Late one evening, after everyone left the laboratory, he performed the following test: charging a corporal to act as a witness, without a mask and accompanied by a dog, he entered the gas chamber and filled it with the lowest concentration of hydrogen cyanide. After 55 seconds the dog died but Barcroft lived despite having remained in the chamber for 90 seconds (Parker, 1999: 56; WO188/373). Barcroft's dedication to science was recognized by Lloyd George, the serving Prime minister of Britain, who congratulated him for his *bravery and sacrifice [...] thanks to which it was possible to gain information of the highest importance* (Parker, 1999: 57).

However, not everyone managed to survive experiments performed on their own bodies. So, for example, the death of two colonels who succumbed to such tests was recorded in the history of Porton as an example of the highest level of courage "demanded by the war". Looking back we can ask ourselves whether it really was heroic or maybe – to put it mildly – only reckless.

Another dangerous experiment was conducted in Porton on twenty people whose suffering was to help find the limits of human tolerance to arsenic gas. These individuals were placed for ten minutes in a chamber filled with this poison. As stated in the experiment's documents they experienced severe pain at the roots of their teeth, jarring pains throughout their faces, numbness of the body, the feeling of intense cold in their digits, a dry throat, vomiting and nausea. They were severely ill and *lay on the floor groaning and twitching pitifully, rolling from side to side in an attempt to find a position which would bring them relief*.

The above mentioned declassified sources detailing the early operations of Porton Down include justification for these experiments: *tests on people and animals are vital in the assessment of the indicators of mortality resulting from coming in contact with the gas, whose concentration as well as the time of being exposed to its effects are significant, and are necessary to gain the full understanding of the processes occurring in organisms so stricken by the gas as well as the proper ways of treating them*. This official formula was very often "called upon" at later times (Carter, 1992: 64-78).

The realistic estimate of loss of life connected to the operations of Porton Down, especially as it relates to those people who may have died few years after being exposed to a chemical agent is impossible. During that time no one wanted to stand against science in defense of the health and life

of people who served as the most sensitive of sensors and recorders of the effects the gas had on the human body. Who could worry about risking the lives of a handful when the lives of thousands were at stake?

Work on chemical weapons similar to that being done in Porton Down in Britain was also performed in the United States, at Edgewood, Maryland, in France, at Atelier de Pyrotechnic de Bouchet near Paris and in Italy, at Servizio Chimico Militare north of Milan (Macksey, 1986: 21-47).

During this time (1935) Germany possessed at least six centers for chemical weapons research. People and animals were likewise used there to test these types of munitions. Tests on the accidentally discovered agent tabun are a good example of such research (Hass, Mrzigod, Nowakowski, 2004). Trials were ordered on *several chosen animals*. The animals were exposed to a small amount of the gas and *the fascinated observers looked in silent wonder as the animals, one after the other, drop dead*. At that time it was decided that an additional series of tests will be conducted on chimps and baboons. These animals, without exception, *first lost control of their motor movements and bodily functions, unwittingly urinating and defecating, vomiting and foaming at the mouth*. They died in convulsions within 15 minutes of being exposed to the poison (Parker, 1999: 72-73).

Another agent, a paralyzing gas related to tabun named *sarin*, particularly frightened scientists testing it. In their notes they described the results of the effects of this gas as "shocking". Not much more than one thousandth of a gram of this poison inhaled into the lungs kills a human being in less than half an hour. Sarin reacts chemically within neurotransmitters connecting the brain to the muscles. It causes the entire nervous system to start to vibrate disrupting the working of smooth muscle aiding breathing and excretion. It makes the death of its victim excruciating. It, therefore, was used first to cause the death of numerous animals and then it killed men – prisoners of concentration camps who, upon orders issued by Hitler himself, were transported to Spandau where the experiments with this deadly weapon were carried out (Parker, 1999: 74).

Research into biological weapons prior to World War II

The outbreak of World War II intensified the operations of research centers dealing with weapons of mass destruction. Dangers posed by chemical weapons, used as early as World War I, became even greater through the addition of many others, ones which could not be seen with the naked eye but were extremely insidious and dangerous – those resulting from biological weapons. The knowledge possessed at that time in Western Europe about the use and effectiveness of biological agents (pathogens causing various dangerous diseases) was very modest.

However, at the same time, the issue of biological weapons was treated as very important in Russia and Japan. As early as 1934 the Japanese established a research facility for biological weapons located at Pingfan in Southern Manchuria (Volkman, 2003: 194-211). This occurred in answer to operations carried out by Russian saboteurs who through cholera caused the death of five thousand Japanese and, using anthrax, killed two thousand horses.

In Pingfan pathogenic microorganisms were tested on British, American and Australian prisoners of war obtained from the Mukden prison camp located approximately 50 kilometers from Pingfan. This was confirmed in 1947 by autopsies carried out on bodies exhumed from mass graves in Mukden.

Autopsy reports show that 31 people died from anthrax, 60 from cholera, 12 from dysentery, 20 as a result of mustard gas poisoning, 16 due to tetanus, 106 from the bubonic plague, 22 from typhoid fever, 41 from tuberculosis and 9 due to typhus. Some historians also credit scientists from Pingfan with the deaths of 200 thousand Chinese soldiers and civilians which resulted from *open air trials of biological weapons*. As part of these tests the Japanese distributed chocolates "filled" with anthrax to children. Personnel from Pingfan were also accused of performing autopsies on live

people anesthetized with large amounts of morphine to observe the progression of diseases within a living body. For a long time the American government as well as its Japanese counterpart maintained that there was no evidence to support these claims. So called Mukden files including a 137 page counterintelligence report describing the capture and interrogation of general Ishii (the head of the facility in Pingfan) and the experiments performed on prisoners of war did not become available until 1994. The Mukden files are kept at the National Archives in Washington D.C. (Parker, 1999: 132-138).

The existence of the facility in Pingfan as well as the fact that it conducted experiments using biological weapons is confirmed by K. Alibek in his book *Biohazard*, who writes: *The facility headed by general Shiro Ishii oversaw tests using anthrax, dysentery, cholera and the plague and supervised experiments on American, British and Commonwealth prisoners of war* (Alibek, 2000: 38-39).

This turn of events required that scientists of Western Europe intensify their efforts directed at defining the dangers posed by biological weapons and the development of protection from them especially as it related to the discovery of vaccines against those diseases which could be caused by such armaments. This of course did not mean that experiments with chemical weapons were abandoned.

One type of research, routinely done in Porton at this time, was a series of tests performed on people and rabbits meant to assess the recovery time of eyes exposed to mustard gas (Kasperek, 1999; Carter, 2000).

In 1941, during one of such series of studies, liquid mustard gas was administered as drops into the eyes of 64 rabbits to determine the level of permanent eye damage. Similar experiments were carried out on numerous human volunteers. For a period of several weeks their eyes were photographed at various stages of recovery. The report concluded with the following statement: *The exposure of the eye to mustard gas does not produce any immediate sensations [...], only after two to six hours the eyes begin to burn [...] and sometimes bleed [...] but within eight hours the eyes close and cannot be reopened [...] remaining closed for a period of seven weeks [...] after which there is a possibility for recurring ulceration* (Parker, 1999: 86-87).

References to research using soldiers – often without their knowledge or consent, are made more often in regard to the times of war than peacetime. Documents declassified in Australia in 1989 prove that between 1942 and 1945 British, American and Australian soldiers were used in tests carried out in the harsh conditions of the scorching Australian climate to verify their level of resistance to mustard gas (Parker, 1999: 317). One of such trials is described by a former Australian commando Tommy Mitchell: *in heavy protective clothing and gas masks we were told to move to the interior of the island. A short time later six American B-24 Liberators carpeted the island with mustard gas bombs [...] and after a few hours, along with another soldier, I was told to move further on but this time without protective clothing or respirators [...] and when they finally came for us my friend had severe burns. I don't know if he survived this. I had burns on my face and arms and my lungs were full of gas.* The report from this test offers an unemotional description of one of the cases: *Seven hours after exposure strong nausea occurred, twenty four hours after the exposure the entire body was covered by a red rash. The penis, scrotum and the undersides of the knees swelled up [...] and on day 17 – the complete destruction of the epithelium of the genitals occurred – leaving a thin layer of grayish dead tissue covering the foreskin and the testicles* (Parker, 1999: 91).

This experiment and numerous others were unequivocally justified saying that through the suffering of the few the good of the majority was protected. Although the use of people to test chemical and biological weapons by the allies was miniscule in comparison to that uncovered in Germany and Japan the fact that the claims of the victims of these experiments remain (with very few exceptions) unrecognized seems to border on incomprehensible cruelty.

The greatest burden resulting from this new challenge caused by the dangers posed by biological weapons tested by, among others, Russia and Japan, fell on the shoulders of scientific and medical personnel of existing European facilities which until then concerned themselves with research related to chemical weapons. According to the documents from Porton Down the main objective concerning biological weapons was the selection of those pathogens which were the most effective and the easiest to disperse through air (Carter, 1992: 98).

After a series of test on various animal species it was determined that anthrax, a contagious disease attacking mostly animals but also dangerous to humans, was the most effective. The mortality rate after infection through the digestive system reached level of 80%. Gruinard, an island off the shore of Scotland, was chosen as the site for further tests involving this pathogen (Parker, 1999: 317).

One of the inhabitants of the Scottish coast who observed the island through a telescope normally used to follow the wanderings of his sheep delivered a following report: *I saw them tie the sheep to posts next to a black stone on a hill on the Western end of the island. The next time I looked the animals lay unmoving on the ground and later were lifted by the tide and thrown onto the shore* (Parker, 1999: 98).

The experiments were discontinued before the end of World War II but the island remained contaminated with anthrax for the next several decades. A chemical agent which could destroy anthrax pathogens was finally discovered in 1986 and the area was finally disinfected and the British army allowed the island to again be used by civilians in 1990.

Anthrax was also related to a problem involving people who were kept unaware of the dangers they were subjected to while they worked with these pathogens. Twenty nine women from British soap factories were delegated to Porton Down to realize a plan to produce a million of so called "cattle cakes" containing anthrax pathogens. The women were enticed to accept for this three month long assignment by an offer of 5 shillings per week more than what they usually got. They filled 250 thousand anthrax containing "cakes" per week without ever being aware of the final purpose of their production and were never told of the dangers resulting from working with this deadly pathogen (Carter, 1992: 114-163).

Chemical and biological weapons research after World War II

Research into new types of weapons did not stop after World War II and the information gained after uncovering the secrets of the defeated Nazi Germany provided a new impulse for their continuation. Additional motivation for the intensification of these studies came from the fear that a significant part of German scientific and industrial potential related to chemical and biological weapons may have fallen into the hands of the Soviet Union, a former ally and current adversary of the West. A new chapter in the research into these weapons had begun, one which could not be completed without its share of "guinea pigs".

The facility in Porton opened a new branch in Nacekuke where the captured parts of German chemical and biological weapons factories were gathered. Along with the intensification of research the need for animals to be used in the experiments including: goats, sheep, pigs, rabbits, rats, mice, guinea pigs and hamsters increased. However, it was monkeys and apes from the wilds of Africa which held the greatest value for scientists. The smaller animals were killed in cages and the larger ones were tied up outside and subjected to poisonous fogs created by shooting projectiles filled with paralyzing agents at them or into the air above them. The "victims" were then collected and moved to autopsy chambers. Those animals which survived because the administered dose did not turn out to be deadly were kept under observation to see the effects of contamination especially as it related to the ears and eyes (Sigmund, 1980: 28-40).

The above mentioned Gruinard Island, previously contaminated with anthrax resulting from experiments done during World War II, turned out to be too close to land for carrying out research on newer and more powerful types of biological weapons. A decision was made, therefore, to initiate tests on the open sea where: *apart from the crew of this floating scientific station, the ships also took on board a large number of animals* (Harris, Paxman, 1982: 165-169).

At about the same time the Russians conducted intensive research into bacterial warfare agents on Voizrozhdeniya Island located on the Aral Sea. It is described by Ken Alibek, a microbiologist who led the work for biological weapons program. Prior to 1992 (and his defection to the United States) he was the first deputy to the head of "Biopreparat", a Soviet pharmaceutical institution whose main purpose was the development of biological weapons. In 1999 he published his recollections in a book entitled *Biohazard* which, under the same title, appeared in Poland in November of 2000. Ken Alibek confirms that: *the final stadium of research into the effectiveness of these weapons required the use of animals and that they (the experiments) were conducted on the Aral Sea. We utilized various experimental animals such as rabbits and guinea pigs but monkeys and apes whose respiratory system is the most similar to that of humans constituted the best material for these studies. [...] 500 apes were imported from Africa for tests involving Tularemia* (Alibek, 2000: 26-31).

Alibek recalls one of the experiments conducted during his time as the head of research on the island: *a hundred apes chained to straight rows of posts look toward a place where a moment ago there was a dull thud. [...] Above the ground, at a height of approximately 20 meters, a cloud the color of dark mustard begins its slow descent. The apes strain their chains, scream. Some hide their heads between their legs but it is already too late – their terrible agony has begun* (Alibek, 2000: 9).

Biological weapons experiments were also not free of human casualties. In 1972 two fishermen from the Aral Sea died as a result of an unforeseen wind change which exposed them to a cloud containing the plague (Alibek, 2000: 23).

One of the largest accidents connected to the production of biological weapons occurred on March 30th of 1979 in Sverdlovsk. A military facility producing biological weapons was built in Sverdlovsk after World War II on the basis of plans captured in Manchuria. Because of the plant staff's non-compliance regarding changing filters a very fine dust containing, among others, anthrax pathogens was released through ventilation shafts into the atmosphere. *Within the next few days all employees working in a ceramic factory located across the street which, as luck would have it, was downwind that night, fell ill. Within a week nearly all of them died* (Alibek, 2000: 66). The official statement regarding the accident contains information about 66 casualties with the cause determined to be the consumption of contaminated meat. K. Alibek believes that at least 105 people died but personally believes that *we will probably never know the full story.* (Alibek, 2000: 66-75).

Research into the effectiveness of nuclear weapons

Nearly all information concerning the use of people and animals in trials of the newest weapons of mass destruction – nuclear arms, is kept under strict secrecy. A fraction of those secrets jealously guarded by the world's nuclear powers has been disclosed in the 1990's. At a press conference held on December 7th of 1993 the United States Secretary of Energy Hazel O'Leary was the first to admit that US government agencies conducted dangerous secret nuclear weapons trials on American citizens.

In the late 40's and early 50's American scientists were leading research into radiation weapons which used radioactive isotopes to cause sickening of enemy soldiers and civilians. The experiments utilized patients who were injected, without their knowledge or consent, with plutonium at levels 10 to 100 times the acceptable norms (Charpak, Garwin, 1999: 172). Thankfully, an idea developed in 1950 by J.D. Hamilton from the University of California in which he proposed contaminating enemy water supplies with radioactive isotopes was never realized. His suggestions also included experiments on

volunteers which would involve administering large doses of radioactive substances using sprays (Moss, William, Eckhardt, Roger, 1995: 177-223).

Studies aimed at determining the psychological reaction of soldiers to situations connected to the use of tactical nuclear arms were performed on a mass scale by the American Army (Ostaszewski, 2010). From among 200 thousand soldiers taking part in the tests approximately 1,200 were exposed to a level of radioactivity significantly exceeding permissible norms. It is estimated that it could have lead to 160 mortal cases of cancer. In 1988 the Congress of the United States introduced legal measures which made it possible for army veterans who in the past were subjected to tests involving nuclear weapons to demand compensation without the necessity to prove that their illness was the result of such experiments. In these situations the diagnosis that their illness was related to radiation became a sufficient basis for filing such a claim. The passing of this law could be seen as a direct admission that American soldiers were used in testing of nuclear weapons.

Experiments endangering the health of participating volunteer officers were conducted to determine the effects of the light emitted by the "fireball" produced by a nuclear explosion on human eyesight. Twelve subjects observed the explosion from a distance of 16 kilometers with half of them wearing dark glasses and the other half without any eye protection. *The tests were discontinued when two of the participants got retinal burns* (Charpak, Garwin, 1999: 173-174).

Massive use of soldiers for testing nuclear weapons was also done by the Russians who, after the political transformation of the 90's admitted to having carried out one such experiment. This admission could have been the result of pure calculation in the belief that further concealment of secrets already discovered by their former allies just did not make sense since the military exercises in question were observed by ministers of defense from China, Poland and Yugoslavia. On September 14th, 1954 in order to obtain data regarding the exposure to radiation of soldiers protected by various forms of military equipment operations using nuclear weapons were conducted in the Ural Mountains. These exercises, initiated with the detonation of a 40 kiloton hydrogen bomb, included 45 thousand soldiers equipped with 600 tanks, 500 guns and mortars, 600 armored transporters, 300 airplanes and 6000 tractor trailers and trucks (Charpak, Garwin, 1999: 173-174).

It can be assumed that information which has been made public regarding these types of experiments employing people and animals, just like declassified cases of similar trials involving the use of chemical and biological agents, is only the "the tip of the iceberg".

In summing up the gathered information related to the use of people and animals in experiments connected to the testing of new types of weapons it should be stressed that the fact that people were subjected to such testing without their consent as well as without being informed about how particular agents affected the human body and their possible effects on them deserves to be severely condemned.

Personality profile of research staff engaged in research into the effects of weapons of mass destruction on animals and people

Especially intriguing is the fact that many of the scientists leading the experiments described above were doctors and should have been particularly sensitive to human suffering. The goals of such research, to create new weapons of mass destruction, should have justified a more profound consideration. However, as recollected by K. Alibek this problem either did not warrant deeper reflection or these deliberations came much too late: *Before I became an expert in biological weapons I finished medical school. The government for whom I worked did not see a conflict between the Hippocratic Oath and the preparation for the mass annihilation of human beings and, for a long time, I did not either. [...] That young doctor, the idealist from Tomsk who experienced a moral dilemma connected to the difference between saving lives and taking them, just stopped existing* (Alibek, 2000: 10, 87).

Even scientists like Alibek had their moments of doubt, however, they did not seem to last very long: *But the transformation was not complete and sometimes I still got chills looking at the vats full of bacteria and thought how they could take the lives of millions. However, the atmosphere within our secret labs changed my outlook at life. My parents would not have recognized their son in the man which I became* (Alibek, 2000: 87).

Official reports from the experiments do not mention any facts showing that the scientists working on them had any special concerns for the health or lives of the animals or people on whom they were performed. Literature mentions very few cases of scientists expressing unease about the fate of animals undergoing these tests. For example, some employees working in Porton were sent to see a psychologist on account of experiencing depression. Sometimes the staff of the center even protested against performing experiments on animals. They found having to *watch chimpanzees and baboons that had chemicals rubbed into their eyes, ears, noses and shaved patches of skin or had toxic substances smeared on their genital* especially painful (Carter, 1992: 43-57). This, however, happened very rarely since most often both the animals as well as the people were treated instrumentally. For most of the researchers (doctors) the successful results of their experiments were much more important.

It was also not seen as worthwhile to show interest in the health of people (often soldiers) who were unwitting subjects of experiments using chemical, biological or nuclear weapons. There are many documented claims from people who were able to connect their years of health problems to such experiments only after (very often partial) information regarding them did finally get published. Hazel O'Leary after her press conference detailed above ordered that a special help line meant for those people who suspected that they may have been used as guinea pigs in experiments employing weapons of mass destruction be opened. *It was necessary to employ 30 phone operators and they received a lot of calls* (Charpak, Garwin, 1999: 171-172).

It is possible that this problem occurred on account of the fact that very often it was not only volunteers but also (or maybe mostly) it was people who were unaware or prisoners of war who were subjected to tests using chemical, biological and nuclear weapons. There were cases where countries tested toxic and radioactive battle agents on their own soldiers. It was also common to use large numbers of various animals whose "participation" in these experiments usually ended in a grisly death preceded by excruciating suffering.

Even in cases where volunteers were used the studies included many violations. From the point of view of ethics the scientists, the army and the politicians can be accused of the following:

- Participants were not informed of the experiments' possible long-term future health effects;
- The difficult circumstances in which frontline soldiers found themselves as well as their long-term separation from their families was used to recruit volunteers for this research by offering them, for example, additional leave;
- The offer of easier work and higher compensation in the production of chemical and biological agents was used to recruit civilians who were unaware of the dangers they posed to their health and life;
- People who underwent medical experiments could not obtain their medical records from those periods which covered their stay in research facilities even in cases where, many years later, they were experiencing severe danger to life or health;
- All victims' requests for documents proving their participation in experiments with the use of chemical, biological and nuclear weapons were ignored making it impossible for them to apply for disability benefits needed as a result of health loss;

- Keeping secret information connected to the possible foreseeable results of toxic and radioactive warfare agents prevented many doctors from making correct diagnoses in respect to patients who were used in tests involving weapons of mass destruction.

In contrast to experiments with conventional weapons where the effectiveness of explosives and firearms can be assessed without using live organisms, even the smallest aspect of how a chemical and biological agent works must be tested on some living creature. That is exactly how the need to use people and animals in research into chemical, biological and nuclear weapons was justified. If it was indeed necessary than it warrants a number of questions: Did national defense require the experiments to be done on a scale this grand? Were other possibilities to assess a given agent, for example, an in depth analysis of its chemical composition, exhausted prior to utilizing tests on live organisms? Shouldn't the volunteers enlisting for the tests (often driven by their patriotism) be informed about previously known dangers threatening their life and health? Shouldn't they, after being subjected to such risky experiments, be closely and continuously monitored by both the military and the civilian medical services in respect to the appearance of complications to their health in the near as well as the more distant future?

The need to use people and animals in experiments involving chemical, biological and nuclear weapons was usually justified with the necessity to develop effective methods of protection in case of an enemy attack. However, the fact that this research was conducted in order to gain military supremacy over that enemy through the creation of new and more effective types of weapons of mass destruction was mentioned much less frequently.

Experiments carried out on prisoners of Nazi concentration camps

The pseudo-medical experiments carried out during World War II in concentration camps established by the Nazis are an especially shameful chapter within the history of military science and medicine. Literature discussing medical experiments performed in concentration camps uses the term war time medicine for treatments required to address the needs of soldiers fighting at the front (Sterkowicz, 1983: 111). On account of the illegal nature and exceptional cruelty of these experiments legal literature most often uses the term pseudo-medical experiment. According to Sterkowicz one of the definitions used for such experiments describes them as: *medical experiments (having scientific assumptions) which were done using criminal or immoral methods.* A document prepared by the government of West Germany and delivered to the International Red Cross defines these experiments as: *procedures of an experimental nature conducted by doctors in concentration camps as mass tests meant to improve the skills of those doctors but being in clear violation of principles of human dignity.* To meet the needs of criminal enforcement agencies the Main Commission for the Study of Nazi War Crimes in Poland defined a forbidden pseudo-medical experiment as: *every procedure or medical or surgical activity performed or ordered by a doctor as a means to increase his knowledge carried out on a person who was held against his will being, therefore, defenseless, without regard for any damage or dangers as well as temporary or permanent loss of health which it could cause them* (Sterkowicz, 1981: 5-12).

Nazi doctors as well as their supervisors and assistants were fully aware of the criminal character of the experiments being performed which is why they very carefully concealed their activity from public opinion. Through fear of responsibility for their deeds these tormentors destroyed evidence of their crimes and got rid of witnesses. The victims were, therefore, sentenced to death regardless of the results of the experiment (Jaron, 1999: 78). This is also the reason it remains impossible to uncover all the facts and to discover a full list of experiments carried out on prisoners of concentration camps.

The increasingly complicated conditions of warfare at the front lines of World War II forced German scientists to address a whole plethora of new challenges. A significant number of these concerned war time medicine and were mainly connected with the introduction of new types of armaments (airplanes or submarines) as well as with the fact that the Nazi army had to simultaneously fight in a wide range of climates (Africa, Scandinavia and Russia). The above mentioned challenges included but were not limited to (Sterkowicz, 1983: 111-169):

- The definition of limits to the tolerance of the human body to pressure changes and lack of sufficient amounts of oxygen at very high altitudes;
- The limits of the ability of humans to survive at very low temperatures or in conditions lacking sufficient quality drinking water;
- The acceleration of the healing process of wounds, ulcers and burns caused by agents of chemical warfare;
- Determination of the effectiveness of poisonous agents which could be used to fill bullets.
- The effects of poisonous agents, especially nerve gases, on the human body.

Many Third Reich doctors were ready to tackle the challenges listed above and all they required was the delivery of "materials" upon which these experiments could be carried out. It must be said that many researchers had the intention to not only meet the needs of war time medicine but also (or maybe mainly) to gain notoriety through achieving interesting results in their studies. There was also no lack of doctor-murderers who performed experiments on people only to cause suffering and death (Sterkowicz, 1996: 12-31).

The problem connected to the lack of "research material" was quickly resolved with the role of guinea pigs assigned to the prisoners of concentration camps. Hitler's' criminal plan for the biological eradication of all opponents lead to the change in the character of these camps from places meant to isolate into true factories of death. If we assume that the main aim of concentration camps was to kill people than the answer to the question why Nazi doctors had no problems with obtaining "material" for their experiments becomes obvious.

One of the more important reasons for carrying out experiments on prisoners was connected to the sudden developments made in air warfare. Airplanes were reaching greater altitudes and speed and there was a need to test the boundaries of the tolerance of the human body to thinner, oxygen poor air. An equally significant problem was to produce results which could become the basis for the construction of a device which would save the crew in the event of a fall from a high altitude. In this event it concerned the reaction of the body to the change of air pressure during a fall from 8 to 20 kilometers and the determination of the optimal altitude at which the parachute should open. This research was initiated on February 22nd of 1942 at the Dachau concentration camp and made use of a low pressure chamber. This chamber consisted of two separated compartments which could contain from 10 to 12 people. The smaller compartment which could fit two people was situated in the center of the larger one. Both compartments were linked with a special airtight valve, had observation ports and a telephone enabling communication. The speed of the fall was imitated by appropriately regulating changes in air pressure in the compartments (Sterkowicz, 1983: 114-115).

The cruelest were the experiments during which the boundaries of human endurance were established and which concerned survival within the thin air existing at very high altitudes. It was tested, for example, whether gas blockages resulting from prolonged stays at low pressures lead to irreversible changes in the brain. These experiments assumed that its subjects would die. Very often the unconscious but still living people were drowned so that it would be possible to immediately conduct autopsies and take pictures of the gas blockages within their brains (Volkman, 2003: 194-195).

In a secret report sent on May 11th of 1942 to Heinrich Himmler Dr Siegmund Rascher who conducted such research described in detail both the course of these experiments as well as their

results: *The problem of gas blockages was recorded in 10 cases. Some of these people died as a result of the experiment simulating exposure to high altitudes, for example, after 30 minutes at an altitude of 12 kilometers. After the skull was opened under water there were numerous gas blockages of brain vessels.* Rascher also admits that some of the prisoners were killed despite real chances for their survival: *To clarify whether severe psychological and physical changes are connected with the occurrence of air blockages several subjects of parachute jumps, after a relative improvement of their overall state but before they returned to consciousness were euthanized underwater. At this time the opening of their skulls underwater showed the occurrence of massive gas blockages within the brain.* This result allowed the conclusion that denied the accepted theory that gas blockages always cause death: *Through this it has been proven that gas blockages which until now were believed to always cause death do not and are reversible. This has been proven through the return to a normal state of all other subjects of our experiments* (Mielke, Mitscherlich, 1963: 9-15).

In his report from these experiments made for the Luftwaffe Rascher did not remain as honest as he was with Himmler. He concealed some of the results and lied to German pilots that *throughout the entire series of test there were no cases of death and no permanent changes occurred due to oxygen starvation* (Mielke, Mitscherlich, 1963: 17). This is one of the many cases when the German soldiers were lied to and were not informed about the dangers related to the effects of war operations on their physical and psychological health.

Experiments performed within the low pressure chamber could not provide results which were fully objective since some parameters really occurring at high altitudes such as very low temperature could not be replicated. Additionally the experiments made use of people who were exhausted by their hard treatment at the camp and the reactions of their organisms could differ from those who were in good physical condition.

Meager results were paid for with a great deal of suffering which was described by one of the witnesses at the Nuremberg trials: *I personally saw through an observation port as the prisoner had to stand in the chamber until his lung ruptured. Some experiments using pressure caused changes in the head which made the subjects insane and caused them to pull out their hair, claw at their heads and face, pound their hands and heads on the walls and scream to release the pressure within their ear canals.* According to this witness these so called "ultimate experiments" lead to certain death and: *the chamber was used for executions rather than for research* (Sterkowicz, 1983: 116).

The expansion of war operations to countries with a very cold climate as well as a rise in cases where the soldiers died due to hypothermia (including the deaths of pilots and sailors in the icy waters of the sea) intensified the performance of the so called "freezing trials" on prisoners of concentration camps. In this case experimentation on people was justified through the significant differences in which the human body reacted to cold and the reaction of other animals (Sterkowicz, 1983: 124).

These tests were aimed at establishing the most effective method for saving people who became subjected to long lasting cold. Similar to altitude tests the experiments connected to hypothermia were conducted at the concentration camp at Dachau by the same doctor – Siegmund Rascher. People subjected to these experiments were submerged for many hours in water having a temperature between 2.5 to 12° C or cooled using freezing cold air (Volkman, 2003: 194-195).

Experiments in water were mainly conducted to develop the most effective suits and life vests for the air force and the navy. Prisoners without clothes or wearing various types of summer and winter uniforms as well as equipped with life vests were submerged in water *usually until their body temperature reached 26.4°C measured with an electric thermometer placed in the stomach or the anus* (Sterkowicz, 1983: 125).

During these studies greater mortality was observed in people who had the back of their head submerged and the conclusions proposed that life vests should be equipped with a protective foam

collar which would keep the head above the water's surface. According to the testimony of Walter Neff given at the Nuremberg Trial these experiments used from 50 to 60 prisoners of which 15 to 18 died (Mielke, Mitscherlich, 1963: 271-312).

Some of the experiments had no scientific basis and were conducted merely to satisfy the curiosity of Nazi doctors. These experiments included studies concerning the warming up of prisoners cooled to the point of loss of consciousness using the body heat of naked women. This research was done at an order which came from Himmler himself who wanted to verify legends about how the wives of hypothermic fishermen brought back from the sea saved their husbands by warming them up with their own body heat. Himmler personally visited Dachau and observed the progress of these experiments: *The subjects of the experiments were submerged to cool them, clothed or nude, in cold water at a temperature between 4 and 9 degrees Celsius. They were removed from the water after their temperature measured in the anus reached 30°C. At those temperatures the subjects usually became unconscious. In eight cases these people were put in a wide bed between two naked women and were then covered with blankets.* The effects of these experiments were unsatisfactory. They only confirmed conclusions of earlier research that slow warming of such a person is less effective than quickly raising their temperature to above dangerous levels (Mielke, Mitscherlich, 1963: 5-53).

Cooling of people through submerging them in cold water did not reflect the real conditions occurring on land. Therefore, in winter of 1942 and 1943, experiments during which prisoners were cooled using freezing air were implemented at a large scale. These studies also had as their aim the determination of the way in which people who were freezing could be saved especially as it concerned whether they should be warmed up quickly or slowly.

Prisoners who were chosen for the experiments were most often stripped naked and left out in the freezing cold for several hours (most often overnight). *The experiments were usually conducted at night since this is the coldest time. Men were laid out on metal carts for periods lasting between 2 to 12 hours [...] and when one of the subjects passed out he was bundled up and thrown into a tank with water at room temperature. He was kept there until he either regained consciousness or died. Other experiments carried out with these half-frozen and unconscious people consisted of throwing them into near boiling water and studying their reactions after this transition from extreme cold to extreme hot. After such test the victims looked like cooked lobsters. Some survived but most died* (Sterkowicz, 1983: 131).

The enormity of suffering to which the prisoners were subjected to can be shown by the fact that the participants of these experiments, before they lost consciousness, had to be given painkillers because they screamed so loud. In the end a decision was made to move this research from Dachau to Auschwitz. In a letter to Himmler from February 17th of 1943 Rascher wrote: *Auschwitz is better for these types of serial tests than Dachau. The trials cause less commotion there since the area is larger. The subjects scream when they are subjected to extreme cold* (Sterkowicz, 1983: 131).

Experiments involving the extreme cooling of the human body caused the immense suffering of approximately 250 prisoners of concentration camps of whom about 80 died and over 100 became permanently disabled (Volkman, 2003: 195).

One of the most important objectives which war time medicine had to face was the treatment of various kinds of wounds. Especially important to the survival of a wounded soldier is the fast and effective stopping of bleeding, therefore, information concerning the possibility of producing a drug which accelerated blood clotting provoked a lot of interest at the highest military echelons.

Siegmund Rascher, the doctor mentioned above in the context of medical experiments, became interested in an idea proposed by one of the prisoners of Dachau, a Jewish chemist Robert Feix. The idea was to develop "Polygal", a drug which accelerated blood clotting. Its effects were supposedly based on utilizing pectin compounds used in the food industry for the production of jellies. Other than

pectin the drug was also supposed to contain, among other ingredients, defibrinated blood which was obtained from (already exhausted) prisoners. The assumption that pectin compounds introduced into the blood can promote coagulation was erroneous. The process of coagulation using these products occurs in acidic solutions while blood remains alkaline. If the attempt to coagulate blood using pectin did prove to be successful such a *process would probably be more dangerous than local bleeding* (Sterkowicz, 1983: 139).

In order to test the effectiveness of "Polygal" prisoners were shot in various organs which produced more or less severe bleeding. Next, the survival time of a person who took the drug was compared to that of a person to whom the drug was not administered. The experiments involving "Polygal" were, therefore, nothing more than brutal murders. One of the experiments was described in the following way: *One of the SS officers, standing on a chair, shot a Russian from above in the right shoulderblade. The exit wound was somewhere in the vicinity of the spleen [...] The Russian curled up in a ball and then sat down in the chair and, after 20 minutes, died.* The autopsy showed that *the sites in which the vessels were damaged were plugged up by hard blood clots.* This, according to Rascher, showed the effectiveness of the drug (Mielke, Mitscherlich, 1963: 59).

It cannot be confirmed today whether Rascher truly believed in the effectiveness of "Polygal" or if his real goal was to become rich and famous. The small factory in which Rascher and his partner, Kurt Plotner, produced "Polygal" was earning significant profits. In the end, after the arrest of Rascher by the Gestapo, it was Plotner who ended up gaining the most since he *was able to extricate himself from the inferno of war with both his life and his property* (Sterkowicz, 1983: 139). Once again the claim put forth by Heraclitus that war makes some rich but leaves others with only death and suffering is confirmed.

Work to develop a drug to treat gunshot wounds went on at Dachau, but it was a different camp, Sachsenhausen, which became the site for experiments meant to create "poisoned" rifle ammunition aimed at improving the *destruction of the enemy's living force* (Sterkowicz, 1983: 139). The main intention of this research was to verify whether placing aconitine in bullets would result in death even in cases of insignificant wounds. To explain, aconitine is one of the most potent plant based toxins in the world. The effects of this poison include the paralysis of the respiratory system and cardiac arrest.

Similar to the many other experiments these also were more like executions than medical studies. Prisoners were shot in the thigh using specially prepared bullets after which the assessment of the symptoms of the poisoning and the process leading to death were conducted. Professor Joachim Murgowsky, one of the doctors evaluating the results of poisoned ammunition, wrote: *After 40 to 45 minutes severe salivation occurred [...] and was followed by choking and vomiting. With two of the subjects it was not possible to feel their pulse after 58 minutes. After 90 minutes one of the subjects regained normal breathing. However, the tendency for vomiting remained strong. [...] Death occurred after 121, 123 and 129 minutes after becoming wounded* (Sterkowicz, 1983: 148-149).

The death of prisoners subjected to these experiments did not add to medical knowledge since the toxic properties of aconitine had been known for a long time and whether it was introduced to the body using one method or another, the final results were always the same and meant death. In this event was it really so important to specify down to the exact minute how quickly that happens?

At the front lines of World War II memories from the previous Great War concerning the use of toxic agents were still strong. The Germans were afraid that the allies may use chemical weapons but did not exclude the possibility of using them themselves. This resulted in a two pronged approach to chemical weapons research. On the one hand it meant developing preventative measures for and treatment of their effects and on the other the search for the most effective means of using them against the Allies.

Experiments whose aim was to prevent phosgene poisoning were conducted at the Natzweiler-Struthofie concentration camp by Otto Bickenach. He advanced a theory that methenamine alleviates the effects of phosgene gas. The initial experiments were meant to confirm or deny this theory. Prisoners were, therefore, injected with methanamine intravenously or were given the drug orally and then taken to the gas chamber along with a control group who were not given anything. In the first series of tests there were no mortalities (Sterkowicz, 1983: 151).

The next step was to make the conditions "more real" approximating them to the situations which may happen at the front. The victims were subjected to much higher concentrations of phosgene for longer periods of time, as long as 25 minutes, and were forced to perform physical labor. *Experiments into the preventative administration of methenamine to counteract phosgene poisoning were carried out on 40 prisoners. Twelve of them received the drug orally, twenty of them were injected intravenously and eight composed the control group.* This particular series of tests resulted in the death of four people with twelve others suffering permanent health loss (Mielke, Mitscherlich, 1963: 172).

Attempts to find viable treatments for people with phosgene poisoning or mustard gas burns also were performed at the same camp. Experiments into therapies connected to phosgene poisoning involved at least 150 people of which nearly a third died. Prisoners were forced to remain for a particular period of time in a gas chamber and then, partially unconscious, they were transferred to the camp's hospital and subjected to undisclosed methods of treatment (Sterkowicz, 1983: 154-155).

Trials into the treatment of people with sulphur mustard burns were carried out by first administering vitamin A to selected prisoners and then smearing their skin with sulphur mustard to cause burns. These burns were then treated using dressings containing acriflavine. One such experiment occurred in the following way: *The prisoners were stripped naked [...] and then a drop of the liquid (sulfur mustard – author's note) was smeared on their arm above the forearm. They then had to move to an adjacent room and stand for over an hour with their arms extended to their sides. After approximately 10 hours or maybe a little more, they developed burns on their entire bodies. Places affected by the vapors were completely burned. Some of them became blind. The pain was excruciating. [...] After that the patients were photographed every day [...] with the first death occurring on the fifth or sixth day.* Seven more people died within the next several days. Their autopsies showed that the victims' *entrails, lungs and so on were completely riddled* (Mielke, Mitscherlich, 1963: 168-169).

Experiments from Natzweiler are connected to a certain shocking fact. The camp's commanding officer – Joseph Kramer – demanded to be paid forty marks per month for every prisoner who was used as a subject of experiments. That was the price which he put on immense human suffering which very often ended in death. It could be said that, according to Kramer, that was the worth of a human life (Sterkowicz, 1983: 158).

Experiments concerning the treatment of burns caused by sulfur mustard were also conducted at the Sachsenhausen concentration camp. They were supposed to verify the effectiveness of drugs designated as "H", "N" and "F-1001". Prisoners had various parts of their bodies smeared with sulfur mustard, then their wounds were treated using different methods and their effects were monitored. Some of the wounds were also infected using various pathogens: *On the third or fourth day the burns were infected using bacteria including streptococcus, staphylococcus and pneumococcus* (Sterkowicz, 1983: 156).

None of the methods of treatment produced satisfactory results. The confirmation that infected wounds healed slower than non-infected ones was nothing new and the suffering inflicted on a numerous group of prisoners was really for nothing. Especially heinous is the fact that after one of the experiments all five participants were murdered (Sterkowicz, 1983: 156).

Experiments connected with the treatment of phosphorus burns were carried out at Sachsenhausen as well as at Buchenwald. These were needed to protect the German people from allied bombing raids that were stepped up in the second half of 1943 and which used, among others, phosphorus and rubber incendiary munitions that were especially dangerous since the rubber in the mixture made the substance stick to the body. Extinguishing phosphorus, which burns without oxygen, was an additional problem that needed to be addressed. The most commonly occurring results these bombs produced were numerous, deep burns on the bodies of the population. The aims of research connected with the treatment of phosphorus burns included: 1) development of a substance which would make it possible to remove the incendiary mixture from the human body; 2) development of an effective treatment method of phosphorus burns and the discovery of pharmacological agents which could aid such treatment.

At the start of this research it was necessary to verify the effectiveness of agents designated as "R-13" and "R-17" produced by one German company. Eugen Kogon, a former prisoner at Buchenwald and a witness of these experiments, described one of them in the following words: *...a canister containing the incendiary material used in phosphorus bombs was brought in. The substance was smeared on the shoulders of four people from block 46 who survived other tests and then ignited. Subjects were treated in various ways. For one person water was used, for another a damp cloth and the third was treated with agent R-17. There were many trials involving these four people. In some cases R-17 was used right after the substance was ignited, in others after five minutes and in yet others after thirty minutes allowing the phosphorus to burn itself out on the arm. The trials caused deep burns which were then monitored for 14 days* (Sterkowicz, 1983: 162).

Experiments using other substances – ointments named "Echinaccin" and "Lacuprin" were done at Sachsenhausen. Selected prisoners *were tied to their beds and doused with liquid phosphorus* and the resulting burns were treated with the above mentioned medicaments (Sterkowicz, 1983: 163-164). Wartime seemed to justify the search for effective methods for the treatment of phosphorus burns but the question is whether the methods used to do it were appropriate.

Wartime operations, whether conducted on land or on the sea, often encountered the problem of inadequate supply of potable water. This situation prompted German scientists to look for methods of purifying contaminated drinking water or converting sea water into potable water. Experiments done on people were used to verify the effectiveness of devised methods and in particular to show whether the water obtained in this way was safe to drink. Research into the limits of the tolerance of the human body to water deprivation and the effects of drinking sea water were done as a kind of a side-study.

One of the experiments carried out at the Dachau concentration camp included tests involving a substance called "Berkatite". The name was taken from its inventor, a German chemist – Berka. It was a mixture of sugar and vitamins which disguised the taste of sea water. Berka also believed that the vitamin supplements aided the kidneys in removing salt from the body (Sterkowicz, 1983: 140-146). The justification for conducting these tests at a concentration camp was characteristic to the thinking of German doctors at the time. They believed that: *Berka's method is dangerous and its use may lead to devastating and possibly mortal diarrhea*, hence the trials should be carried out on prisoners (Sterkowicz, 1983: 141).

Forty people, Gypsies sent to Dachau from Buchenwald, were used in the experiment. These were divided into five groups:

- The first group was not given anything to drink;
- The second group received sea water (any quantity they desired);
- The third group got sea water with the addition of Berkatite – 500 milliliters per day;

- The fourth group also drank sea water with the addition of Berkatite but the quantity was increased to 1,000 milliliters per day;

- The fifth group was the control and drank normal drinking water – 1,000 milliliters per day (later on normal drinking water was replaced by sea water purified using "Wofatite") (Sterkowicz, 1983: 140-143).

The experiment lasted 10 days and samples of blood and urine from each group were collected and tested. The experiment showed that Berkatite as a sea water purifier was completely useless.

Like many other experiments this one was also paid for with immense suffering connected to long-lasting thirst. *Even a layman could recognize the symptoms of starvation and water deprivation: nervousness or agitation at levels often leading to insanity. People who became thus agitated were tied to beds. Some people became apathetic and lost consciousness* (Sterkowicz, 1983: 144).

Experiments involving water contaminated with different chemical warfare agents and then decontaminated using various methods were performed at the Neuengamme concentration camp. These tests were done on 150 prisoners used to test the effectiveness of various filters and decontaminants (Sterkowicz, 1983: 168-169).

Experiments related to wartime medicine were only conducted on men, a fact which suggests that the results were indeed mainly meant to be used for the needs of the army. However, the ease of the decision to carry them out on people is astonishing. Was it really necessary? Maybe during wartime the human life becomes less valuable? There are many more such questions. A partial answer may be possible if we look at certain features which characterize most of these experiments:

- Some experiments were carried out without any scientific foundations – often it was just trial and error which was not mitigated by any theory;

- Most often tests performed on people were not preceded by tests on animals;

- Most often the experiments resulted in the death of the persons subjected to it;

- Doctors leading the experiments had a purely technical approach to the tests and did not consider the suffering of their subjects;

- The results of the tests usually did not bring the German army any measurable benefits and the value of the research was further diminished since it was carried out on concentration camp prisoners who were already extremely weak.

Although the experiments were conducted by doctors, people who are normally called on to save lives and help the sick and the suffering, all of them shared a common characteristic – their cruelty. Did these people forget the basics of their Hippocratic Oath: *I will apply dietetic measures for the benefit of the sick according to my ability and judgment; I will keep them from harm and injustice. I will neither give a deadly drug to anybody who asked for it, nor will I make a suggestion to this effect, [...] remaining free of all intentional injustice* (Dunn, 1977: 39).

The scope and course of the experiments described above makes them criminal and the people who performed them as well as those upon whose authority they were able to do so are, therefore, criminals. The revelation of these crimes after World War II was truly shocking to the international community. In 1948 the comprehension of what people are capable of, what doctors are capable of, doctors who under the influence of an ideology (in this case the Nazi ideology) renounced the principles of humanism in medicine (see previous chapter) resulted in the creation of the Universal Declaration of Human Rights. This set of documents charges all doctors with a vast number of responsibilities. One of them states: *...even under threat I will never use my medical knowledge against humanitarian law* (Chlap, Kuligowski, Norkowski, Litwak, Stach, 1999: 22-23).

Conclusion

The history of research into the effectiveness of chemical, biological and nuclear weapons of the 20th century does not incline toward optimism and belief in humanity. Considering that those dramatic events happened "only" a few decades ago we may still get the unpleasant feeling that history could repeat itself. Scientists, regardless of their country of origin, who within the last century concerned themselves with the subject matter discussed above very quickly found a solution for the problem of the lack of appropriate technology which would allow them to create reliable simulations and forecasts for the effects of weapons of mass destruction and without any ethical or moral qualms made use of deadly agents both on animals as well as on humans. The only limiting factors were the number of "study subjects" as well as their social status, culture or ethnic background. Scientists representing totalitarian regimes showed the least empathy. Instead of complicated algorithms estimating the scope of potential damages chemical agents were used directly on people. The effects of adverse climatic and weather conditions, often in combination with chemical, biological or nuclear weapons were similarly tested on "living bodies". Other than becoming a "platform" which could be used to obtain selected data human life did not represent any value. This type of research was not even preceded by extensive preliminary theoretical studies which, of course, had a negative impact on both the methods applied as well as the results. The fact that these means were used most often on prisoners who were physically and psychologically worn out also puts into question the reliability of these studies in comparison with the results of tests conducted on people not so severely used. These types of experiments, dubbed "scientific research" only to justify them to society, cannot be called anything else but a vulgar and barbaric crime against all of humanity. The only hope is that history will never get a chance to repeat itself.

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5. Folder No TWO188/265 at the National Archives in London.
6. Folder No WO188/189 at the National Archives in London: experiment documentation.
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then a company commander and finally a battalion commander while his educational experience was gained as an academic lecturer at the Military University of Technology. Between 2005 and 2008 he was the Head of Logistics for the Office of Ministry for National Defense. Between 2008 and 2012 he became a Deputy Rector of the Military University of Technology and since 2012 held the post of the Prorector for Military Matters. He attained his doctorate at the Maria Curie-Sklodowska University and his PhD at the Department for National Security of the National Defense Academy (changed into the War Studies University on 1 October of 2016). He is the author and a scientific editor of several monographs and nearly sixty other publications in which he addresses issues connected with crisis management, environmental protection or the use of technology in security operations. He is especially interested in non-military and paramilitary threats. Since June 1st of 2016 he has been appointed as the temporary Rector-Commander of the Military University of Technology in Warsaw. Through a Decree number 2663 of the Minister of National Defense from 19 September of 2016 he was appointed the Rector-Commander of the Military University of Technology in Warsaw for the 2016-2019 term.

Correspondence to: Marcin Górnikiewicz, Military University of Technology, Warsaw, Poland

Marcin Górnikiewicz - Second lieutenant, doctor of Security Sciences. A graduate of the University of Białystok where he obtained a Master's Degree in Law. After that he studied at the Department for National Security of the National Defense Academy (changed into the War Studies University on 1 October of 2016). During his academic career he lectured in several higher learning institutions including the Białystok School of Public Administration, the State School of Higher Professional Education in Suwałki or the War Studies University in Warsaw. He also participated as a speaker in numerous international conferences and symposiums held, for example, in Finland, Lithuania, Estonia, the Ukraine as well as in the Republic of China in Taiwan (in 2014 at an invitation from the National Cheng Chi University he spent several months as a Research Fellow in Taipei). He lead research both in Poland and abroad concerning issues within his area of scientific interest (soft power, psychological operations, subconscious and conscious codes of behavior, prognostics behind behavior at the international level). Since January of 2017 he has returned to military service and is serving at the War Studies University in Warsaw. He is the author of several dozen scientific works which have been published in Poland and abroad.