

## THE NATURAL DEFENSE OF A SCIENTIFIC PEOPLE: THE PUBLIC DEBATE OVER CHEMICAL WARFARE IN POST-WWI AMERICA

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On April 22, 1915 the German army released 168 tons of chlorine gas from 5,730 cylinders that had been laboriously transported to the front at Ypres (1). There were 15,000 injuries and 5,000 deaths. The German army pushed through a wide hole created in the front line, only to have their attack falter because of heroic resistance and a lack of reserves (2). The attack set off a race on all sides to produce protective measures and more potent chemical agents. This search drew in large numbers of chemists and other scientifically trained men to the war effort. In an editorial as early as May 1915 it was stated, "...that we of old heard of 'soldier's battles' and 'general's battles' but it remains for the present war to produce a new sort, the 'chemist's battle'.(3)" The 'chemists' war' was the first conflict in which it was popularly believed that science would have a significant effect on the outcome of the struggle.

On June 25, 1918 President Wilson authorized the creation of the Chemical Warfare Service (CWS), and the Service came into being as an independent branch of the military by War Department General Order 82, on June 28, 1918 (4). Major General William L. Sibert was appointed the first Director of the CWS (5). Sibert began an aggressive enlistment drive among chemists and by the end of the year some 1,294 scientists and engineers were officers in the CWS (6). These men were granted significant resources for research and development of both defensive and offensive equipment, tactics and training.

The late entry of America into the war limited actual CWS participation in combat. Despite limited mili-

tary operations, by war's end, the US had the largest chemical warfare research establishment in the world, a complete production infrastructure, and a significant stockpile of chemical weapons. By the end of the war, the CWS had produced some 6,215 tons of war gases and used 1,812 tons (7). The CWS produced or oversaw the production of the largest supply of war chemicals of any of the combatants, on the order of 100 tons per day. The comparable figures for German production are uncertain, but the likely peak in German production was between 30 and 50 tons per day (8).

The activity of the CWS was extremely expensive, and from its inception to April 1919, the CWS had expended just over \$83 million. While this represented only 0.6% of the total expenditure for the war, the CWS represented less than 0.1% of the military force of the National Army (9). For the chemists at the American University Research Station, the CWS offered the biggest, best funded and best staffed laboratories in North America, which were comparable to or better than most European facilities. With the end of hostilities there was strong pressure to reduce the US military and to close facilities like the Research Station, but the scientists were not willing to see the dissolution of the CWS without a protest.

Peyton March, Chief of Staff of the Army from 1918 to 1921, who was opposed to chemical warfare on humanitarian grounds, acted to disband the CWS, advocating the demobilization of the Service and the transfer of its remaining elements to the Corps of Engineers

(10). John J. Pershing, Douglas MacArthur, and Malin Craig, who succeeded March, all objected to chemical warfare to a greater or lesser degree. This led to a major dispute between the CWS and the other sectors of the military, particularly the various Chiefs of Staff and the Army. Brigadier-General Amos A. Fries, who returned from command of the European forces of the CWS to replace General Sibert after the war, quickly realized that to save the CWS he would have to go outside the military. He did not hesitate to recruit anyone he could to the cause.

Fries organized a two-tiered campaign to preserve the CWS. His first concern was to directly lobby members of Congress in 1919, when the government was considering the post-war role of the military. After the war, pride in the American military and the residue of war mentality carried the CWS along, but the American people were opposed to a large military and the expense that such an organization required. Demobilization and reduction of the war effort, combined with an increasingly isolationist policy, made supporters of the CWS look like spendthrifts and war mongers.

The efforts of Fries and the enthusiasts for the CWS were partially successful. The March-Baker Bill (Senate Bill 2715) to disband the CWS was defeated, but the National Defense Act (June 1920) limited the CWS to 100 officers and 1,200 other ranks (11). Despite the reduced resources, the CWS remained responsible for research, manufacturing, training of the military, and organizing special gas troops. This was an impossible task, especially when the budget was slashed from its wartime annual level of over \$40 million to \$2 million in 1920-21 (12). Nevertheless, Fries triumphantly managed to maintain the CWS as a continuing part of the military in the face of serious opposition at the highest levels.

It was clear that without public support the opponents of the CWS would eventually prevail. Thus, the second tier of Fries' offensive was a publicity campaign to convince the public that chemical warfare was the way of the future in warfare and that any further curtailment of the CWS would leave America unprepared for future conflicts. Fries hired Thomas R. Shipp, Inc., a professional Washington publicist, to aid in this work (13). Fries began speaking publicly at every opportunity and co-authored a book with Clarence J. West in 1921 (14). *Chemical Warfare* was both a handbook for chemical warfare and a promotional piece aimed at a popular audience. They state in the preface, "The present

work was undertaken by both authors as a labor of patriotism and because of their interest in the Service (15)" and conclude, "It is hoped that the facts here presented may further increase interest in Chemical Warfare, for there is no question but that it must be recognized as a permanent and very vital branch of the Army of every country (16)."

Fries was aided in his efforts to publicize the CWS by many of its former members and by chemists from the large industrial base that had supplied the Service. The role call of the officer corps of the CWS reads like a who's who of American chemistry, and many scientists who were not in the Service had worked on war projects sponsored by the CWS or the Military Committee of the National Research Council. A number of these chemists formed the National Chemical Defense Association as part of the lobbying effort. The board of directors represented some of the most important chemists of the day. Notable among this group were J.F. Norris, President of the American Chemical Society; Wilder Bancroft, owner and editor of the *Journal of Physical Chemistry*; and William J. Hale, head of the chemical branch of the National Research Council.

While certain members of Congress were persuaded by Fries, convincing the public on chemical warfare was a more difficult task. The public was generally horrified by the thought of gas attacks. The press, both in newspapers and popular magazines, had run many stories on the horror of gas warfare, including a number of detailed personal accounts by survivors. After the war there were numerous articles about the future of warfare, some by important military leaders such as General Eugene Debenet, Commander of the French First Army. Debenet argued that poison gas was already superior to explosives, and that new and more powerful gases would be discovered, some of which could be fired onto the battlefield by machine gun (17).

In order to shape public opinion, the public had to hear about the importance of the CWS, particularly from those people with technical or scientific training. Fries' initial strategy was to spread a positive message about the CWS as widely as possible. One of the most important positive arguments presented to defend chemical warfare was that chemical warfare was a humane weapon. Supporters argued that it killed very few people and that those wounded by gas frequently made a complete recovery, as opposed to the injuries caused by projectiles and explosives. This argument was frequently supported by references to the relative levels of destruc-

tion and death caused by various weapons. As was pointed out in a short article in *Scientific American*, the “humanity of gas warfare” is (18):

...tied up with that of the preparedness of the enemy against this form of attack; but the statistics of the war, contrary to general belief, have shown that the casualties and permanent injuries due to gas attack against troops that are adequately prepared against it, are far less than those suffered from shrapnel and high explosive shell.

The low rate of mortality appeared in the public debate as early as 1922 when Rear Admiral William S. Sims argued in a *New York Times* letter to the editor that gas resulted in 27.3% of American casualties, but only 1.87% died of their exposure (19). The issue of casualties was initially confused in the post-war period by the variety of figures presented to the public. The figure of 88,980 gas casualties, of which 38,396 were by mustard gas, as presented in the *New York Times*, was based on admissions to hospitals (20). In 1937 August Prentiss listed admissions as being 70,552 of which only 27,711 were caused by mustard gas (21). In the end, the initial claim of 1.87% mortality was rounded out to 2%; and this figure was repeated continually by both supporters of the CWS and other commentators (22).

Prentiss provided the most comprehensive analysis of the effects of gas attack, compiling tables that showed that gas was not particularly deadly. For example, 26.8% of American casualties were caused by gas, but only 2% died from their exposure, while 25.8% of non-gas wounded died of their injuries (23). Prentiss gave similar figures for French, English, and German forces, but notably the Russians were not included. This comes in part from a lack of information, but it also demphasizes the effect of gas on an unprepared enemy. In one attack at Barnowitschi on September 7, 1916 the Russians suffered an estimated 6,000 injuries and 3,000 deaths (24), producing about a 33% mortality rate. This was close to the level of mortality (25%) suffered at Ypres in 1915. The far higher death rate for the unprepared forces at Ypres and the mortality rate for the ill-equipped and untrained Russians seem closer to what a civilian population might experience.

In addition to lobbying efforts, the supporters of the CWS were aided in their efforts to keep chemical warfare in the news by the international situation. First, there was a series of disarmament conferences and the ongoing discussions of the League of Nations; and second, regular reports of continued gas research and production by the European powers kept the issue alive.

In 1921, the Washington Conference on Disarmament began to create a treaty to outlaw chemical warfare. The American delegation was in favor of the treaty, as was stated in a typical editorial (25):

The only way to make sure that war will not again be ruthless is to make it certain in advance that ruthless war will not pay, and that those guilty of it will be condemned to fearful punishment.

The response to this was swift. J. E. Zanetti, Professor of Chemistry at Columbia University and former Lieutenant Colonel in the CWS, wrote to the editor to say that there was no way of controlling gas warfare short of outlawing all of the chemical industry, so international treaties were useless (26). In the same edition a speech by Fries before the American Institute of Chemical Engineers was reported. Defending the CWS, he argued that “Warfare by chemicals is the natural means of defense of a scientific people (27).” Fries closed by calling upon the members of the Institute to write to Congress opposing the abolition of the CWS.

Despite the efforts of the pro-CWS side, in 1921 the Washington Conference formulated the Five Powers Treaty, which was a “Treaty between the United States of America, the British Empire, France, Italy, and Japan, to protect neutrals and noncombatants at sea in time of war and to prevent the use in war of noxious gases and chemicals. (28)” The treaty mirrored popular feeling. In a *New York Times* poll, 366,795 respondents voted for the abolishment of gas warfare, while only 19 supported it (29). The ratification of the Five Powers Treaty by Congress was a serious setback for the CWS. Using the spirit of the Treaty as a guide, the War Department (following General Pershing’s directive), modified the terms of CWS so that it was to work on only defensive aspects of chemical warfare (30). As it happened fate took out some of the sting of the Treaty. France, despite being a signatory at the conference, later refused to ratify the treaty; lacking this ratification, the Treaty never officially came into force.

With the French failure to ratify, the battle for public opinion became even more important. In addition to the effort to portray chemical warfare as humane, the pro-CWS faction used two other strategies to shape public opinion. The first was continued reporting of the manufacturing and research on chemicals by foreign powers. As early as 1922 Fries had told reporters that Britain and France were continuing to research war gases (31). The other strategy was to present the positive and peacetime uses of war chemicals. The most frequent idea was to use war gas as a pesticide, particularly against

the boll weevil (32). War gases were also suggested for use against diseases such as grip, influenza, and pneumonia; but the most novel application (33) was to cure paresis, a form of partial paralysis that was often diagnosed in 'insane hospitals.'

At the Conference on the Supervision of the International Trade in Arms in 1925 the issue of chemical warfare was again introduced. As with the earlier disarmament conference, the American delegation was instrumental in negotiating an agreement. This agreement was the Geneva Protocol, which prohibited the use of chemical and biological weapons. The Protocol was signed by the United States and then sent to Congress for ratification. Fries quickly organized an anti-Geneva Protocol campaign directed at members of Congress. Leading the antirratification faction was Senator James W. Wadsworth, who argued the CWS line that gas was a humane weapon and that the United States should not limit its military options (34). However, what led to the failure to ratify was a letter and telegram campaign organized by Fries through the National Chemical Defense Association. John Thomas Taylor, the secretary to the NCDA, was also vice-chairman of the national legislative committee of the American Legion (35). He introduced a motion at the annual national convention of the Legion condemning the Geneva treaty, which the Legion passed. A flood of letters against the treaty followed from Legionnaires and Legion posts to government members and officials. In addition to the Legion, letters and telegrams came from the Veterans of Foreign Wars, the Association of Medical Surgeons, the American Chemical Society, and the American Institute of Chemical Engineers. In the face of this protest, and despite personally approving of the treaty, Senator Borah, Chairman of the Senate Foreign Relations Committee, withdrew it from Senate consideration (36).

While some Americans regarded the failure to ratify and the Legion's role in this as a moral victory, it was decried by others. The Legion's position was satirized

in a cartoon in *The Nation*, and Representative Hamilton Fish, Jr., who was the chairman of the committee that created the preamble to the Legion constitution commented (37):

I deplore the fact that the last American Legion should have permitted itself to be rushed into the adoption of a hasty and ill-considered resolution...The Legion is a civilian organization composed of veterans to make right the master over might and to "promote peace and good-will on earth." It was not organized for purposes of war and trying to prevent humane agreements among nations to mitigate the horrors of war.



The international impact of the efforts to outlaw chemical and biological warfare did not stop. The Geneva Gas Protocol as formulated in 1921 was slowly ratified, so that by 1936 39 nations had agreed to its conditions. A significant number of nations did not sign on, including the United States, Brazil, Czechoslovakia, and Japan. The failure to ratify created a tension both between the supporters of the CWS and the public and the CWS and the military. Rejecting the Geneva Protocol was defended as militarily pragmatic by the supporters of the CWS, since many believed that chemical and biological weapons would

be used in any future war. However, given the public outcry against gas, the dislike of chemical warfare by various Presidents and the objection of the central military command to the very existence of the CWS, failure to ratify did not signal support for 'scientific war' but a reluctance to submit American military policy to international control. In essence, the US followed the Protocol but did not ratify it, while other nations ratified it but did not abide by its restrictions (38).

Even among the signatories, there was a constant stream of reports and accusations about violations. France and Germany accused each other of producing war gases in the interwar period, probably with justification. Italy used chemical weapons against the Ethiopians in 1935. Japan, not having ratified the Protocol, became the most active developer of chemical and biological weapons starting in 1932. Although it was kept

secret at the time, Japan began human tests and used chemical and biological weapons in China starting in 1933, with much of the work being carried out by Unit 731 (39). Chemical and biological weapons continued to be an area of research in many countries. With weak support for the Geneva Protocol and lack of surveillance, international control was ineffective. Rather it was traditional military reluctance and tactical and strategic limitations that controlled their use. In all cases in the period, chemical weapons were used only on people who could not defend themselves or retaliate in kind.

The supporters of chemical warfare, rather than benefiting from the success of the antiratification campaign, were being placed more and more on the defensive. In the face of the popular image of gas warfare, there were increasing efforts by supporters of the CWS to convince the public that gas was not as dangerous as it was portrayed. An example is a 1928 article by Dr. Harry N. Holmes, a board member of the NCDA and a former member of the CWS. Holmes argued that the public would be less afraid of chemical warfare if it could be demonstrated scientifically that defense against attack was an easy matter. He suggested that tear gas be dropped on a small city to test the effectiveness of gas defense training (40):

Every citizen should have first been provided with a gas mask supplied by the War Department and he should have been educated in methods of quickly adjusting the mask and in a knowledge of the very great protection obtained in a house with closed windows and doors. It would be most interesting to see how quickly a population of ten thousand, for example, could protect itself from the tear gas....From such experiments on a large scale we might arrange for a thoroughly tested conclusion as to the real merits of gas warfare. In the meantime, the public bases its opinions upon prejudice and unreasoning fears.

Dr. Holmes found no volunteers to undertake his experiment, and such suggestions did little to reassure the public as to the humanity of the supporters of the CWS. The ease with which Holmes argued that gas warfare was not a serious threat can be directly contrasted with a 1919 article about Lewisite (41):

...Now the latest American gas, produced in commercial quantities although not used at the front, was a great many more times as toxic as mustard gas and belonged to the same class of poison gas [causing injury by contact as well as inhalation]...We have reason to believe that American scientists developed superior skill in gas warfare which should be a comforting thought in view of the possibility that in another war gas will be the important weapon.

Anyone reading about the triumphs of American gas warfare in 1919 might well find Holmes' argument difficult to accept. A gas mask and a bit of training could not effectively protect the public in the face of the new chemical weapons which would challenge even well prepared soldiers on the battlefield.

Although material promoting chemical warfare continued to be published, in particular Haldane's 1925 piece "Chemistry and Peace" (42) published in both *Atlantic* and *Current Opinion* and subsequently expanded into a book *Callinicus: A Defense of Chemical Warfare* (1925), the debate was more frequently spurred on by the publication of antiwar pieces. Nicholas Murray Butler, the President of Columbia University, published *The Path to Peace* (1930), in which he made predictions of what a future war would be like. Bertrand Russell's *Which Way to Peace* (1936) was even more specific (43):

Take, for example, mustard gas, which was used in the Great War. This has the advantage of poisoning the ground, which remains dangerous for days. At first it produces no noticeable effects, but within a few hours symptoms appear. If the exposure is slight, the patient usually recovers; if severe, after some days of intolerable agony the patient dies — if he is fortunate.

A far wider audience learned about chemical warfare from popular fiction. A number of novels appeared after the war in which the devastation caused by gas warfare was a major element, usually as part of some future war. Will Irwin's *The Next War* (1921) described 'Lewisite bombs.' Charlotte Haldane wrote *Man's World* (1926), M. S. Southwold *The Gas War of 1940* (1931); and M. Dalton *The Black Death* (1934). All shared the conviction that gas would play a major and devastating part in any future war, especially for civilians.

The best known of the fictional accounts of gas war was H.G. Wells' *The Shape of Things to Come* and the later hit movie "Things to Come." In a particularly lurid passage a flock of goats was exposed to an unnamed future gas as a test (44):

All succumbed to the effect of the gas except three, which dashed their brains out against the enclosure.

James Kendall, Professor of Chemistry in the University of Edinburgh and former Lieutenant-Commander in the United States Naval Reserve and the Liaison Officer with the Allied Services on Chemical Warfare, wrote a book attacking the antichemical side and arguing that chemical warfare was both humane and neces-

sary. In *Breathe Freely!* (1938) he specifically targeted Russell and Wells for attack, calling Russell an ultrapacifist, whose inaccurate pronouncements fostered panic, while Wells was not only inaccurate but "...lets his imagination fairly run riot...(45)" Kendall argues that (46):

One who misinterprets the past and the present of chemical warfare in such an obvious way is scarcely a reliable guide to its future, and it is to be feared that Mr. Wells has allowed what we may call his 'uncritical humanitarianism' to lead him temporarily into the ranks of the sensationalist.

Of the two, Wells is the more significant offender, but Kendall seemed unaware of the irony of accusing a writer of science fiction of being a sensationalist.

Despite the staunch defense of chemical warfare by Kendall, Haldane and most of all Fries, by the mid-1930s, the issue was largely moot. The first serious blow to the CWS had been Pershing's new Standing Order in 1922 that removed the offensive element of the CWS mandate. No gas shells had been filled since 1922. By 1930 the CWS was conducting little research and training no one in chemical offense or defense (47).

In practical terms, the combined effect of long term objections to the CWS within the military, popular opposition, and the Depression damaged the Service so badly it had no chance of returning to the status and stature of the war years. In 1934 the CWS submitted a budget request for \$1,255,000 (plus \$275,000 carried over from the previous year), but was granted only \$448,000. Lobbying efforts restored some funding so that the budget was settled at \$748,378. Further lobbying of Congress resulted in a restoration of the CWS budget to \$1.2 million in 1935. However, this was enacted by the Military Subcommittee of the House Appropriations Committee, not by the War Department (48). Once again, the CWS had gone outside the military to lobby Congress. In the tight budget times of this era this was not appreciated.

In 1937, the War Department tried to change the name of the Chemical Warfare Service to the Chemical Corps. The CWS favored this change, and the War Department felt that it might lead to a decrease in interservice tension. However, President Roosevelt vetoed the bill, stating (49):

It is my thought that the major functions of the Chemical Warfare Service are those of a "Service" rather than a "Corps." It is desirable to designate as a Corps only those supply branches of the Army which are

included in the line of the Army...I am doing everything in my power to discourage the use of gases and other chemicals in any war between nations. While, unfortunately, the defensive necessities of the United States call for study of the use of chemicals in warfare, I do not want to aggrandize or make permanent any special bureau of the Army or the Navy engaged in these studies. I hope the time will come when the Chemical Warfare Service can be entirely abolished.

The CWS was able to survive through the postwar years in large part because of the lobbying efforts organized by Fries among professional chemists and engineers, especially from the National Research Council and the American Chemical Society. The opinions of these scientists were taken seriously by the decision makers in Congress, but they largely failed to win public support. The CWS was transferred to the War Department General Staff as a technical staff division in 1939, and then later placed under the control of Services of Supply in 1942. Essentially nothing of the original organization remained by the end of World War II, and the CWS was officially abolished in 1962 (50).

A further problem for the pro-CWS side was the paradoxical argument that they were forced to make for the public. Within the military, the effectiveness of chemical warfare was discussed in terms of the ability of various substances to incapacitate or kill the enemy, and conversely how to protect friendly forces. Reflections of these discussions can be seen in the books by Fries and West, and Prentiss, with their tables and descriptions of toxicity and applications. Supporters ended up arguing in public that chemical warfare was necessary and useful but at the same time not a threat to civilians because it could be easily defended. This was an impossible conflict. If the chemicals were effective, then worries about civilian exposure seemed justified, and gas warfare could be as much of a threat to humanity as people like Wells suggested. If chemicals were not a serious threat, then why spend money supporting the CWS and an ineffective weapon? While the pro-CWS faction frequently characterized detractors as uninformed, misguided, or even hysterical, the actual tone of most published objections was similar to those expressed in "Fair Square:" "Let us keep faith [with disarmament treaties] and incidentally save the tax payers millions of dollars by abolishing the Chemical Warfare Service (51)."

For the scientists, the reason to continue the work of the CWS was partly a patriotic belief in readiness, but there was also direct benefit. Chemistry was the premier research area for American scientists in the in-

terwar years, so the CWS represented a major investment in basic and applied research. That science should be a part of a strong national defense was not a new idea, but it had rarely been put into practice. Even after the war, the pared down CWS represented one of the largest concentrations of scientists in a single organization. More scientists worked for the CWS Research Division than in the French, German, or British counterparts. For most of the scientists involved, the size of the projects and the funding available were on a scale never imagined in the prewar years. Those involved in the Service were not willing to let such a significant organization collapse.

The CWS established networks of scientists and showed what a large organization could produce. Those scientists had experienced the potential of large-scale work; and even with the CWS incapacitated, they continued to envisage the potential of science on a grand scale. After the war, the lobbying efforts brought scientists out of the laboratory and onto the political stage. In particular, the campaign to block the ratification of the Geneva Treaty demonstrated the power of collective action by scientists and their professional organizations. In general, the scientists lost the public debate over the fate of the CWS; but in a larger sense, they succeeded in making science a national issue. The CWS would serve as a template for the military use of scientific talent in the atomic era, when many chemists, in addition to the more conspicuous physicists, would again be called upon to bring science to war. Many of the same philosophical issues were placed before scientists and the public at the end of World War II, but the decision of the military and government was radically different.

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The Division of the History of Chemistry (HIST) of the American Chemical Society (ACS) solicits nominations for the 2003 Sidney M. Edelstein Award for Outstanding Achievement in the History of Chemistry. This award, first given to Dr. John Parascandola in 2002, honors the memory of the late Sidney M. Edelstein, who established the Dexter Award in 1956, and it also continues the outstanding tradition of the Dexter Award, which ended in 2001.

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Each nomination should consist of

- a complete curriculum vitae for the nominee, including biographical data, educational background, awards, honors, publications, presentations, and other service to the profession;
- a letter of nomination, which summarizes the nominee's achievements in the field of the history of chemistry and cites his/her unique contributions that merit a major award; and
- at least two seconding letters.

Copies of no more than three publications may also be included if they are available.

All nomination material should be sent *in triplicate* to Professor Roald Hoffmann, Chair of the Edelstein Award Committee, Department of Chemistry and Chemical Biology, Cornell University, Baker Laboratory, Ithaca, NY 14853-1301 (e-mail: rh34@cornell.edu), by December 31, 2002.