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**MEDICAL ASPECTS OF CHEMICAL AND BIOLOGICAL WARFARE**

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The Coat of Arms  
1818  
Medical Department of the Army

A 1976 etching by Vassil Ekimov of an original color print that appeared in *The Military Surgeon*, Vol XLI, No 2, 1917

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The first line of medical defense in wartime is the combat medic. Although in ancient times medics carried the caduceus into battle to signify the neutral, humanitarian nature of their tasks, they have never been immune to the perils of war. They have made the highest sacrifices to save the lives of others, and their dedication to the wounded soldier is the foundation of military medical care.

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# Textbook of Military Medicine

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**Editor in Chief**

**Brigadier General Russ Zajtchuk, MC, U.S. Army**

*Director, Borden Institute*

*Commanding General*

*U.S. Army Medical Research and Materiel Command*

*Professor of Surgery*

*F. Edward Hébert School of Medicine*

*Uniformed Services University of the Health Sciences*

*Bethesda, Maryland*

**Managing Editor**

**Ronald F. Bellamy, M.D.**

*Colonel, MC, U.S. Army (Retired)*

*Borden Institute*

*Associate Professor of Military Medicine*

*Associate Professor of Surgery*

*F. Edward Hébert School of Medicine*

*Uniformed Services University of the Health Sciences*

*Bethesda, Maryland*

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....  
Gas! GAS! Quick, boys!—An ecstasy of fumbling,  
Fitting the clumsy helmets just in time;  
But someone still was yelling out and stumbling  
And flound'ring like a man in fire or lime . . .  
Dim, through the misty panes and thick green light,  
As under a green sea, I saw him drowning.  
  
In all my dreams, before my helpless sight,  
He plunges at me, guttering, choking, drowning.<sup>1</sup>

....  
—Wilfred Owen

The poetry, excerpted from *Dulce et Decorum Est*, was written by Lieutenant Wilfred Owen of the Royal Army, who was killed in action in France on 4 November 1918.

“Gassed,” the frontispiece painting, shows the horror of chemical warfare in World War I as perceived by the artist, Gilbert Rogers.<sup>2</sup> As Keegan and Darracott observed, “Rogers was an officer of the Royal Army Medical Corps commissioned to record medical work during the First World War. The subtitle to this painting, “In Arduis Fidelis” (Faithful in Hardships), suggests the subject is a stretcher-bearer who has succumbed to gas while transporting wounded.”<sup>3</sup>

1. Excerpted from Wilfred Owen. *Dulce et decorum est*. In: *The Collected Poems of Wilfred Owen*. Copyright © 1963 by Chatto & Windus, Ltd. Reprinted by permission of New Directions Publishing: New York, NY.
2. Painting: Printed with permission from Imperial War Museum, London, England.
3. Keegan J, Darracott J. *The Nature of War*. New York, NY: Holt, Rinehart and Winston; 1981: 222.

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*Specialty Editors*

**FREDERICK R. SIDELL, M.D.**  
*Chemical Casualty Consultant*

**ERNEST T. TAKAFUJI, M.D., M.P.H.**  
*Colonel, Medical Corps, U.S. Army*

**DAVID R. FRANZ, D.V.M, PH.D.**  
*Colonel, Veterinary Corps, U.S. Army*

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*Borden Institute  
Walter Reed Army Medical Center  
Washington, D. C.*

*Office of The Surgeon General  
United States Army  
Falls Church, Virginia*

*United States Army Medical Department Center and School  
Fort Sam Houston, Texas*

*United States Army Medical Research and Materiel Command  
Fort Detrick, Frederick, Maryland*

*Uniformed Services University of the Health Sciences  
Bethesda, Maryland*

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**Editorial Staff:** Lorraine B. Davis  
Senior Editor  
Colleen Mathews Quick  
Associate Editor/Writer

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Interested readers can also find up-to-date information on the medical aspects of chemical and biological warfare at the following internet locations:

The Medical NBC Information Server	<a href="http://www.nbc-med.org">http://www.nbc-med.org</a>
Medical Research and Materiel Command	<a href="http://mrmc-www.army.mil">http://mrmc-www.army.mil</a>
Medical Chemical Defense	<a href="http://mrmc-www.army.mil/chemdef.html">http://mrmc-www.army.mil/chemdef.html</a>
Medical Biological Defense	<a href="http://mrmc-www.army.mil/biodef.html">http://mrmc-www.army.mil/biodef.html</a>
Medical Research Institute of Chemical Defense	<a href="http://chemdef.apgea.army.mil">http://chemdef.apgea.army.mil</a>
Medical Research Institute of Infectious Diseases (numeric)	<a href="http://www.usamriid.army.mil">http://www.usamriid.army.mil</a> <a href="http://140.139.42.105">http://140.139.42.105</a>

# Foreword

The thought of chemical and biological warfare terrifies us. What is it in the human psyche that makes being attacked with conventional weapons—that kill and maim—more acceptable than being attacked with molecules that alter the body chemistry or with organisms that cause disease? For some, the wearing of chemical protective clothing seems to exemplify our fear of an unknown agent that we cannot see, do not understand, and think must be immoral.

World events have conspired to increase the threat of the use of chemical and biological weapons. The end of the Cold War brought not only the hoped-for change of swords into plowshares but also political and economic turbulence in the former Soviet Union, unemployed and disenchanting weapons specialists and scientists, the rise of religious fundamentalism in southwest Asia, state-sponsored terrorism, and blurring of the lines between terrorism and traditional warfare.

In addition, the nature of war is changing. We no longer expect a war to last years, as World War II did, but rather days, as we saw with the Persian Gulf War. Worse, the weapons of war have also changed. Many countries do or could possess chemical and biological agents—bypassing the tremendous financial outlay required to acquire conventional weapons.

Until this decade, our military forces had not faced chemical and biological weapons since World War I, and the prevailing attitude has been “out of sight, out of mind.” The Persian Gulf War changed all that. Just the *threat* that such weapons would be used was itself an effective weapon, as it required us to expend tremendous logistical resources to supply our troops in the desert. Now we know that we must master all relevant aspects of defense against chemical and biological warfare. The Biological Weapons Convention, ratified in 1975, did not slow the massive Soviet program, which continued until early 1992, nor did it prevent the buildup in Iraq between 1985 and 1990. At this time, experts are severely questioning whether verification of compliance with the treaty can be certain. Similar concerns delayed ratification of the Chemical Weapons Convention by the U.S. Senate; nevertheless, the senate ratified the treaty on 24 April 1997.

A primary value of the *Textbook of Military Medicine* series is to preserve the lessons of past wars and, by so doing, demonstrate how current doctrine is built on knowledge that was gained at so high a cost. Medical officers should read this volume, *Medical Aspects of Chemical and Biological Warfare*, and learn its lessons well. Civilians expect that we in the military will know how to manage chemical and biological casualties. Indeed, if we do not, then who will? The nation expects us to be prepared to defend against all attacks and will be unforgiving of any incapacity on our part.

Lieutenant General Ronald R. Blanck  
The Surgeon General  
U.S. Army

May 1997  
Washington, D. C.



# Preface

Until recently, we in the United States have not given much thought to the specter of chemical and biological warfare. Our fathers and grandfathers who fought in World War I are almost all gone now, and the poet's image of gassed soldiers fumbling for their helmets has been considered merely a historical footnote—if it is remembered at all. But forgetting is a luxury we can no longer afford. In 1917, the Army War College stated:

The employment of poisonous gases as a means of offensive warfare has made it imperative that medical officers should have some knowledge of the action of the various gases that are likely to be met with and of rational lines of treatment which may be adopted in cases of gas poisoning.<sup>1(p5)</sup>

Nothing has changed except the increased availability of chemical and biological weapons; now more than ever we must be able to both defend against attack and manage chemical and biological casualties.

The good news is that the development of passive countermeasures for chemical and biological defense (pretreatments, therapies, timely detectors, effective protective equipment) has significantly reduced the threat to our military forces. Although the biological defense countermeasures program is not yet as advanced as its chemical counterpart, new developments in biotechnology have allowed us to take tremendous strides forward. In the meantime, we can educate our healthcare providers now, at minimal cost and with great potential benefit. One of the reasons that chemical and biological weapons are considered so dangerous is that we medical officers, in our daily clinical practice, hardly ever see patients whose conditions have any similarity to casualties of chemical and some of the more exotic biological agents.

This textbook focuses on the management of casualties. Its publication may be even more timely than we had expected, especially considering the increased threat of terrorism—both foreign and domestic. Terrorist attacks at home and abroad have heightened the interest of civilian healthcare providers and first-responders, and of other governmental agencies such as the Federal Emergency Management Agency and the Public Health Service that would be required to respond in case of an attack on our own soil. These nonmilitary healthcare providers will also find this textbook to be extremely useful.

The scientists who organized and are responsible for this textbook are recognized worldwide as the foremost experts in the medical aspects of chemical and biological warfare. Their overriding goal is this: to produce a force that understands the threats of chemical and biological weapons and how to respond to them, and, by understanding the threats, sustains fewer casualties.

Brigadier General Russ Zajtchuk  
Medical Corps, U.S. Army

May 1997  
Washington, D. C.

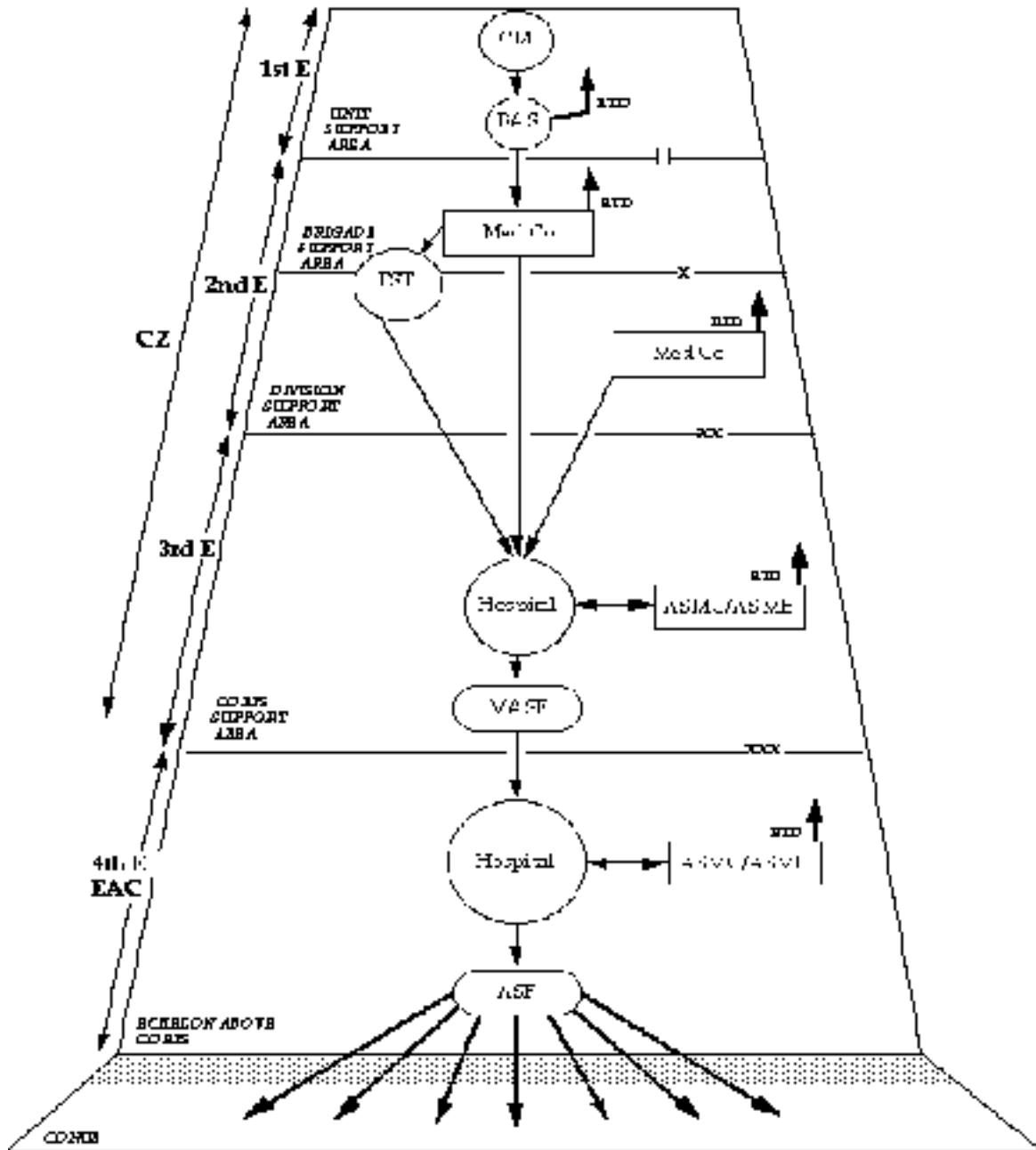
1. Army War College. *Memorandum on Gas Poisoning in Warfare, With Notes on its Pathology and Treatment*. Washington, DC: Government Printing Office; 1917: 5.

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The current medical system to support the U.S. Army at war is a continuum from the forward line of troops through the continental United States; it serves as a primary source of trained replacements during the early stages of a major conflict. The system is designed to optimize the return to duty of the maximum number of trained combat soldiers at the lowest possible echelon. Far-forward stabilization helps to maintain the physiology of injured soldiers who are unlikely to return to duty and allows for their rapid evacuation from the battlefield without needless sacrifice of life or function.

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## Medical Force 2000 (MF2K) PATIENT FLOW IN A THEATER OF OPERATIONS



ASF: Aeromedical Staging Facility, USAF  
 ASMB: Area Support Medical Battalion  
 ASMC: Area Support Medical Company  
 BAS: Battalion Aid Station  
 CM: Combat Medic  
 CONUS: Continental United States  
 CZ: Combat Zone

E: Echelon  
 EAC: Echelon Above Corps  
 FST: Forward Surgical Team  
 MASF: Mobile Aeromedical Staging Facility, USAF  
 Med Co: Medical Company  
 RTD: Return to Duty

## **Medical Aftermath of the Persian Gulf War**

The editors of the *Textbook of Military Medicine* are mindful that some veterans of the Persian Gulf War (1990–1991) face continuing health problems. Although readers might have hoped to find a discussion in this textbook devoted to the illness known as Gulf War syndrome, the medical aftermath of that war is incompletely understood. A formal academic treatment now would not only be premature, it would soon be outdated.

One fact seems clear at this time (May 1997): the scientific community has not yet reached a consensus on the medical consequences of serving in the Persian Gulf. Most observers agree that some of the 697,000 U.S. soldiers who were deployed there are sick and have wide-ranging symptoms, but the cause, or causes, have not yet been established. Investigations into the etiology and epidemiology of these illnesses have reached inconclusive and contradictory conclusions. Even the popular name of the illness, Gulf War syndrome, is perhaps misleading because the array of signs and symptoms does not fit the usual medical definition of a syndrome: a set of symptoms that occur together; the sum of signs of any morbid state; the aggregate of signs and symptoms associated with any morbid process that constitute together the picture of the disease.

The level of scientific inquiry into the problem, already high, has increased in recent months; we hope that these questions (particularly those pertaining to etiology and epidemiology, and from there, treatment) can be answered soon. Subsequent editions of this or other textbooks in this series will give the medical aftermath of the Persian Gulf War the attention it deserves.