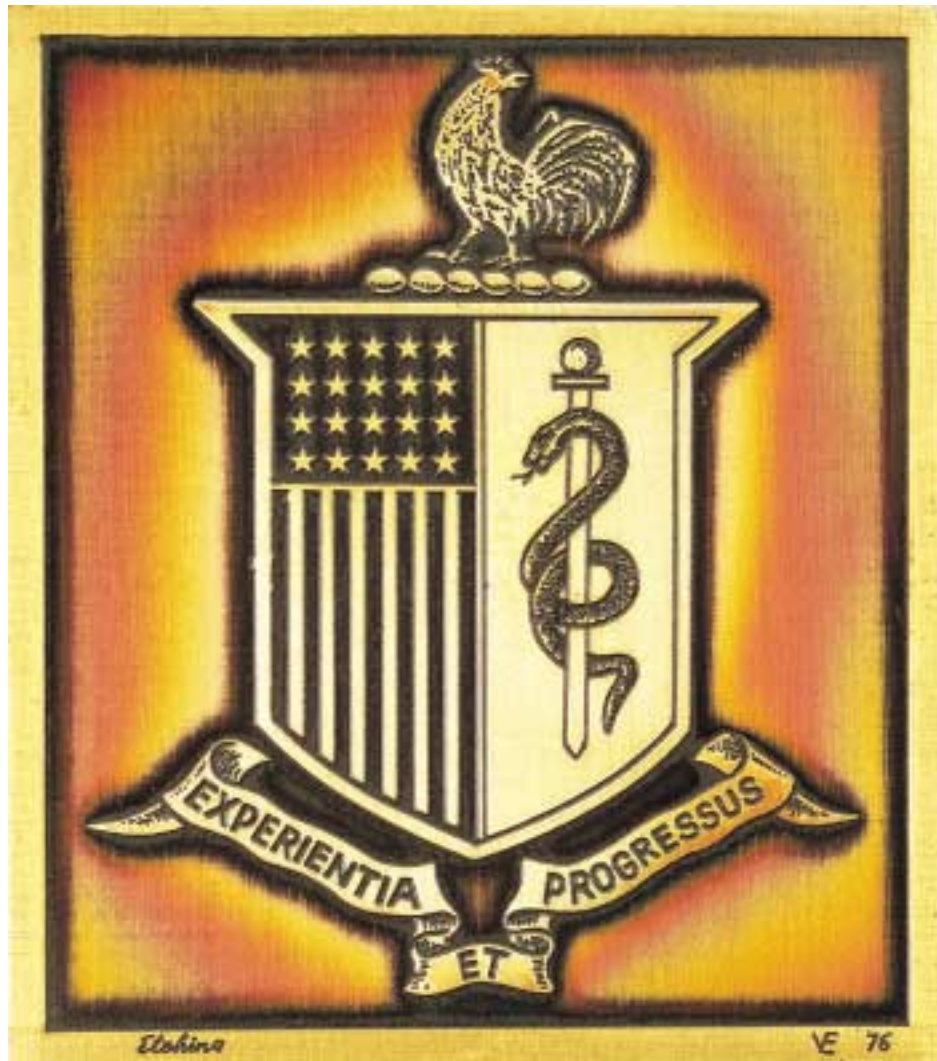

MEDICAL ASPECTS OF HARSH ENVIRONMENTS
Volume 1



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

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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The environments that face combatants on modern battlefields.

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MEDICAL ASPECTS OF HARSH ENVIRONMENTS VOLUME 1

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Foreword

Earth's environments have always influenced the planning and conduct of military operations. Past campaigns have been impacted by heat, cold, and altitude, as well as the changes in barometric pressure that divers face in special operations. During the 20th century alone, US armed forces have been involved in terrestrial military operations in hot climates in the North African campaign and Pacific theater operations during World War II, the Vietnam and Persian Gulf wars, and military and humanitarian operations in Panama, Haiti, Grenada, Rwanda, and Somalia. Our major military operations involving cold climates during the past century include World War I and World War II, the Korean War, and most recently in Bosnia and Kosovo. *Medical Aspects of Harsh Environments, Volume 1*, treats the major problems caused by fighting in heat and cold.

The topics of *Medical Aspects of Harsh Environments, Volume 2*, are the effects of altitude, especially as experienced in mountain terrain and by aviators, and the complex interactions between humans and the special environments created by the machines used in warfare. Our warfighters were exposed to mountain terrain during World War II, the Korean War, in military and humanitarian efforts in South America, and most recently in the Balkans. Military action has also occurred in some of the environments considered "special" (eg, on and below the water's surface) in every war that this country has fought, whereas other special environments (eg, air—flights not only within Earth's atmosphere but also beyond it, in space) have become settings for the havoc of war only as a result of 20th-century technology. The second volume also contains a discussion of the personal environment within the protective uniforms worn by service members against the fearsome hazards of chemical and biological warfare. This microenvironment—created by the very encapsulation that protects the wearer—is in some ways different from but in others similar to all closely confined, manmade environments (eg, the stresses that divers face in coping with the changes in barometric pressure). Whatever the environment, this point needs to be kept in mind: indifference to environmental conditions can contribute as much to defeat as the tactics of the enemy.

Medical Aspects of Harsh Environments, Volume 3, emphasizes the need for a preventive approach to decrease attrition due to harsh environments, such as predicting the likelihood of its occurrence and stimulating awareness of how specific factors (eg, gender, nutritional status) are sometimes important determinants of outcome. The third volume concludes with reproductions of two of the classics of environmental medicine: the lectures given by the late Colonel Tom Whayne on heat and cold injury, respectively, at the Army Medical School in 1951; for decades these have been unavailable except as mimeographed handouts to students attending specialized courses.

Military and civilian experts from the United States and other countries have participated as authors of chapters in this three-volume textbook, *Medical Aspects of Harsh Environments*. The textbook provides historical information, proper prevention and clinical treatment of the various environmental illnesses and injuries, and the performance consequences our warfighters face when exposed to environmental extremes of heat, cold, altitude, pressure, and acceleration. The contents are unique in that they present information on the physiology, physical derangements, psychology, and the consequent effects on military operations together in all these harsh environments. This information should be a valuable reference not only for the physicians and other healthcare providers who prepare our warfighters to fight in these environments but also for those who care for the casualties. Military medical personnel must never forget that harsh environments are great, silent, debilitating agents for military operations.

Lieutenant General James B. Peake
The Surgeon General
U.S. Army

Washington, DC
December 2001

Preface

On 1 July 1941, as part of Hitler's attack of the Soviet Union, the XXXVI Corps of the German army crossed the Finnish–Soviet border and began what was planned as a rapid advance some 50 miles to the east, where lay the strategically important railroad that linked the Arctic Ocean port of Murmansk with the Russian hinterland to the south. The German soldiers in their heavy woolen uniforms were greeted not only by determined Soviet resistance, but also by an unexpected enemy: the day was hot, with temperatures in the high 80s (°F), and there were swarms of ferocious mosquitoes. During the next 3 weeks the temperature rose above 85°F on 12 days and twice reached 97°F, and it was soon obvious that military operations were possible only in the relative cool of the “night.” By the end of July, after advancing only 13 miles, the attack was called off, with the XXXVI Corps being denounced as “degenerate” by the German high command. Higher commanders obviously never considered that low combat effectiveness might result from the hazardous environmental factors: the heat, insects, and 24 hours of constant light. After all, who would have thought that heat stress might impair combat operations occurring 30 miles north of the Arctic Circle.¹

The German experience in northern Finland was anything but unique; military history is full of examples where weather conditions influenced the outcome of military campaigns. In fact, the earliest recorded instance of weather's having a direct effect on the outcome of a battle dates back to the Old Testament:

And it came to pass, as they fled from before Israel, and were in the going down to Beth-horon, that the Lord cast down great stones from heaven upon them unto Azekah, and they died: they were more which died with hailstones than they whom the children of Israel slew with the sword.²

The mission of the US Army Research Institute of Environmental Medicine, Natick, Massachusetts, is both to understand how soldiers react to military environmental and occupational stresses and to devise materiel and doctrinal solutions that are protective and therapeutic. The publication of the three volumes of *Medical Aspects of Harsh Environments* will ensure that both healthcare providers and military line commanders do not repeat the mistakes of countless commanders of the past who have underestimated the threats that harsh environments pose to their soldiers. I strongly recommend that all commanders and healthcare personnel become acquainted with the volumes of the *Textbooks of Military Medicine* dealing with harsh environments to better protect and preserve our sons and daughters during their deployments around the world.

The volumes of *Medical Aspects of Harsh Environments* became a reality because of the dedication and hard work of Kent B. Pandolf, PhD, and Robert E. Burr, MD, then a Lieutenant Colonel, Medical Corps, US Army, the specialty editors of this three-volume textbook. Dr. Burr was *primus inter pares* in the group that performed the critically important tasks of deciding on the subject matter and finding appropriate authors; when Dr. Burr left the Army, Dr. Pandolf brought the project to fruition. This first volume, which deals with hot and cold environments, owes its completion to the willingness of its section editors—C. Bruce Wenger, MD, PhD, and Robert S. Pozos, PhD—well-known experts in the fields of heat and cold stress, respectively, to perform the seemingly endless tasks necessary to assure the scientific accuracy of the text. In addition, the specialty and section editors wish to thank Rebecca Pincus for her invaluable help during this book's formation. The forthcoming second and third volumes deal with mountains and special operations environments, and sustaining health and performance during military operations. It is not too much to hope that the labors of the volumes' editors and many authors will lighten the burdens of our military personnel in the years to come.

December 2001
Washington, DC

Brigadier General Russ Zajtchuk
Medical Corps, US Army, Retired
Editor in Chief, *Textbooks of Military Medicine*

1. Ziemke EF. *The German Northern Theater of Operations 1940-1945*. Washington, DC: Headquarters, Department of the Army; 1959: 157–167. DA Pamphlet 20-271.
2. Joshua 10:11, *The Holy Bible*, King James version.

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 level. 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.
