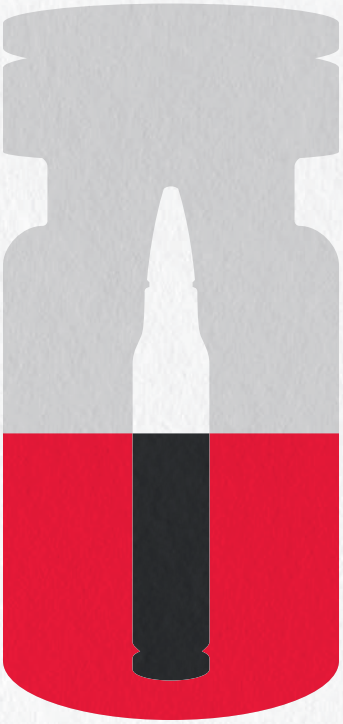

Chemical Heroes

Pharmacological Supersoldiers in the US Military

ANDREW BICKFORD

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For Arwen

Heroism is endurance for one moment more.

» **George F. Kennan**, Letter to Henry Munroe Rogers, July 25, 1921

It is impossible to strive for the heroic life. The title of hero is bestowed by the survivors upon the fallen, who themselves know nothing of heroism.

» **Johan Huizinga**, *The Spirit of the Netherlands*, 1968

Death is but a moment; cowardice is a lifetime of affliction.

» **Steve Coogan**, *The Trip*

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Terms and Abbreviations

AFRICOM	United States Africa Command
AIT	Advanced Individual Training
AMEDD C&S	Army Medical Department Center and School
API	active pharmaceutical ingredient
ARCIC	Army Capabilities Integration Center
ARL	Army Research Laboratory
ASA (ALT)	Assistant Secretary of the Army (Acquisition, Logistics and Technology)
ASTMP	*Army Science and Technology Master Plan*
BAR	Browning Automatic Rifle
BDU	Battle Dress Uniform
Bio-MOD	Biologically Derived Medicines on Demand (DARPA program)
BRICS	Biological Robustness in Complex Settings (DARPA program)
BTO	Biological Technologies Office (DARPA)
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance
CBRN	Chemical, Biological, Radiological, and Nuclear
CCCRP	Combat Casualty Care Research Program
CHPPM	Center for Health Promotion and Preventive Medicine
CIA	Central Intelligence Agency
COMFUT	Combatiente del Futuro (Spanish military, enhanced soldier system)
CRISPR	clustered regularly interspaced short palindromic repeats
CWM	Chemical Warfare Material

DARPA	Defense Advanced Research Projects Agency
D-IX	World War II German experimental military performance enhancement drug
DoD	Department of Defense
DSO	Defense Sciences Office (DARPA)
F2025B	Force 2025 and Beyond (US Army)
FCS	Future Combat System
FELIN	Fantassin à Équipements et Liaisons Intégrés (French military, enhanced soldier system)
FFW	Future Force Warrior
F-INSAS	Futuristic Infantry Soldier as System (Indian military, enhanced soldier system)
FIST	Future Integrated Soldier Technology (United Kingdom, enhanced soldier system)
FOB	Forward Operating Base
FRAMR	Feedback Regulated Automatic Molecular Release (DARPA)
GI	Government Issue (US soldier)
Gladius/IdK	Infanterist der Zukunft (German military, "Future Soldier" system)
Go Pills	US military term for dextroamphetamines
HPOE	Human Performance Optimization and Enhancement
HD	Human Dimension
IED	improvised explosive device
IFF	Identification Friend or Foe
IMESS	Integrated and Modular Engagement System for the Swiss Soldier
ISIS	Islamic State of Iraq and Syria
IVN	In Vivo Nanoplatforms (DARPA program)
IVN:Dx	In Vivo Diagnostics (DARPA program)
IVN:Tx	In Vivo Therapeutics (DARPA program)
JBAIDS	Joint Biological Agent Identification and Detection System
LSD	lysergic acid diethylamide
LW	Land Warrior
MDB	Multi-Domain Battle
MIA	missing in action
MIPOE	medical intelligence preparation of the operational environment

MOAB	Massive Ordnance Air Bomb
MOMRP	Military Operational Medicine Research Program
MOOTW	Military Operations Other than War
MOS	Military Occupational Specialty
MPE	military performance enhancement
NAAFI	Navy, Army, Air Force Institutes (United Kingdom)
NATO	North Atlantic Treaty Organization
NAVMED	Navy Medicine
NBC	nuclear, biological, chemical
NCO	Noncommissioned Officer
NHGRI	National Human Genome Research Institute
No-Go Pills	US military term for sleep aids
NORMANS	NORwegian Modular Arctic Network Soldier (Norwegian military, enhanced soldier system)
NSRDEC	US Army Natick Soldier Research, Development, and Engineering Center
NPY	neuropeptide Y
NVA	Nationale Volksarmee (East German National People's Army)
OFW	Objective Force Warrior
PB pills	pyridostigmine bromide
Pervitin	World War II German methamphetamine
PoD	Pharmacy on Demand (DARPA program)
PTSD	post-traumatic stress disorder
PX	Post Exchange
Ratnik	Warrior (Russian military, enhanced soldier program)
RDECOM	Research, Development and Engineering Command (renamed in 2019 as Combat Capabilities Development Command)
RMA	Revolution in Military Affairs
RPG	rocket-propelled grenade
RT-PSM	real-time physiological status monitor
S&T	science and technology
SBCT	Stryker Brigade Combat Team
SOCOM	Special Operations Command
SS	Schutzstaffel
TALOS	Tactical Assault Light Operator Suit
TFF	Total Force Fitness
TICS/TIMS	toxic industrial chemicals / toxic industrial materials

TRADOC	United States Army Training and Doctrine Command
TRL	technology readiness level
UCMJ	Uniform Code of Military Justice (United States)
USACHPPM	United States Army Center for Health Promotion and Preventive Medicine
USAMRD-A	US Army Medical Research Directorate-Africa
USAMRIID	US Army Medical Research Institute of Infectious Diseases
USAMRMC	United States Army Medical Research and Materials Command
USARIEM	United States Army Research Institute for Environmental Medicine
WRAIR	Walter Reed Army Institute of Research

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And most important of all, I'd like to thank my family, Gabrielle and Arwen, for their love, support, and ridiculous humor.

Prologue

Supersoldier Bob Writes Home

What follows is a fictionalized letter included in a 2001 United States military report titled *Objective Force Warrior: "Another Look—The Art of the Possible . . . A Vision*," written by scientists and researchers at the Oak Ridge National Laboratory (National Security Directorate Oak Ridge National Laboratory 2001, 28–31; see also Stouder 2002). The Objective Force Warrior program was a US military supersoldier program designed to internally and externally armor soldiers and improve their combat performance. The letter lays out how military researchers and designers imagined the new supersoldier, his capabilities, and the potential threats—medical, environmental, and enemy—the new soldier would face and overcome through the application of internal and external technologies. It is a crystallized version of a particular kind of military imagination and vision of technology, anticipation, protection, and violence.

OCTOBER 30, 2007

Dear Mom & Dad,

Yesterday I finished my last technical school and was fitted for my new uniform. It's an OFW mark 3, that's Army lingo for an Objective Force Warrior Battle Dress, third version. They won't let me send you a picture of it for some security reasons, but I can tell you what it looks like and the many things it does. I know you were hurt when I joined the Army, especially after you told me about my great uncle Jack who died on the beach at Normandy, and my uncle Fred who died in a rice paddy in Vietnam, and my older brother Bill who was

injured in Afghanistan. But they didn't have technology working for them like I do. I understand the risks I'm taking, a soldier is supposed to get in harm's way, and many soldiers will still be injured and killed protecting our freedoms. But with the *OFW* Mark 3, I will have lots of advantages that Jack, Fred, and Bill didn't have.

My suit has the ability to stop a rifle bullet. It is made of a material that is as flexible as my football jersey, but gets hard as steel when a bullet or knife is pushed into it. The material has some kind of chemical in it that lets fresh air pass through it, but stops and destroys chemical warfare agents. The material is also filled with some kind of foam that cools me on hot days and warms me on cold nights. If I do get injured the suit automatically inflates over the wound, stopping the bleeding and applying medicine to the injury until our medic can come help me.

The medicine and medical care provided by the medic is part of the *OFW* Mark 3 too. It somehow measures my health and notifies my squad leader when I need to take a rest or get a drink. Remember when I got all those muscle cramps in the 3rd quarter [of] each football game? That doesn't happen now because the suit and my leaders look out for my electrolytes.

Remember how you used to tell me that playing all those videogames wouldn't get me anywhere in life? You have to see my helmet to believe it, it's like an *IMAX* movie right before my eyes. All I have to do is whisper "show me my battery reserves" and a little gas gauge is projected in front of me and I can see that my power pack has 2 more days of energy in it. I can ask how much ammo I have and the number of rounds [is] projected on my visor. If I see the enemy my visor tells me how far away the target is and the probability that my first shot will kill him. There are special modules that I plug into the side of my helmet that gives me other capabilities. A laser can shine on the enemy and if he has chemical weapons protective clothes on he shows up in my visor with a green glow around him. Remember the depression Bill had when he had to kill the women in Afghanistan because they all looked alike, but under their long dresses and hoods they had *RPGS*? Well, mistakes like that can still happen, but my visor outlines anyone who has gun cleaning oil or *CWM* clothing on and it gives me a chance to sort out the refugees from the terrorists. If Bill had this technology, he would know if those women were terrorists or friendlies in the wrong place.

When Bill was faced with danger he didn't have any options, he had to shoot to kill and he had to shoot a bunch of rounds because with little time to aim he had to just cover the vicinity with lead. My *OFW* Mark 3 rifle has steerable bullets which means any target I look at I hit the first time, even if it's moving. And, I have the option of using nonlethal bullets. I just ask my helmet, "What is the probability that the person in my sights wants to kill me?" The battle computer compares the images from the video, laser, microwave and acoustic sensors and recommends the safest action for me. Some of the microwave sensors on my helmet can see guns and knives under someone's clothes, and the laser can measure the gun cleaning fluids and gunpowder that gets on your clothes when you shoot a gun. If these are present, my visor recommends that a lethal round be chambered. If I Say "Yes" my rifle is loaded and the target range and velocity is downloaded into the bullet. . . .

My helmet has night vision enhancement, on a totally dark night I can see by star light just as well as if it was mid-day. The infrared detector makes the animals and people and machines all show up as white outlines because they give off heat. It's like the heads-up display on Dad's car, except I can look at anything and ask my helmet "What is this thing?" and the battle computer will display what the image most likely is. It can actually tell me, in total darkness if it is a Toyota pickup truck or a Ford *F*-150. This could be important information if our spies have told us that the terrorists have been seen in a Toyota pickup, and the nuns drive an old *F*-150. . . .

Next year they will issue me an *OFW* Mark 4. It's supposed to have some mechanical assist machine built in that will let me jump 7 feet up, run at 20 mph and carry over 200 pounds of equipment. It will be an improvement because as nifty as the Mark 3 is, it is a little cumbersome, and it's impossible to lift a wounded soldier because he weighs too much in the Mark 3. The Mark 4 will have a better fuel cell power pack, making more electricity and weighing less. The suit is supposed to have some elementary camouflage capability. I saw one in Tech School. The suit looks behind you and then changes the fabric colors on your front side to look like what's behind you. From a distance if you don't move, you really disappear into the weeds. It's like the rope oversuits the snipers wear, up close it looks like a person in a rope suit, but at 50 yards you totally miss the sniper and only see the leaves and weeds. The camouflage suit takes a lot of power which

is why it isn't on my Mark 3, my power unit is too small. The new *OFW* Mark 4 also sends and receives battle information to the officers who are watching the battle and changing the strategy. The Mark 4 also has special "*TAGS*" on it so the artillery guys won't target us—if the incoming round sees our *TAG*, it won't arm itself. This should reduce the number of "friendly fire" accidents we used to have! I've heard that the Mark 4 can also support the new directed energy weapons that fire laser bursts and microwaves to disable or kill the enemy. It's sort of like a Star Trek phaser on "stun"; it makes your brain stop working. The new directed energy weapons make it possible to engage the enemy further away with more accuracy.

Well, I have to go to dinner now. We get special meals for several days before a mission so we will have the stamina to wear the Mark 3 for 2 or 3 days straight. I'll call when I get back from wherever we're going.

Give my love to my sister and grandma.

Love,
Bob

Chemical Heroes

We do not know what the body can do.

» **Baruch Spinoza**, 1677

The component man is the one that fails most often.

» **Marion B. Sulzberger**, "Progress and Prospects in Idiophylaxis," 1962

A military is about making soldiers—that is, "bodies"—do things: fight, think (or not), sit still, stand up, walk, run, march up and down the square, sleep, work, mow the lawn, pull up weeds, paint rocks, collect cigarette butts, get a haircut, iron uniforms, mop the barracks, clean toilets, kill, wound, survive, die. Michel Foucault (1979) riffed on this in *Discipline and Punish*, examining how soldiers are to be compelled to act and "be" according to new ideas and needs of the body by the state. Indeed, military service is a long act of compulsion. But the first act in this line of compulsion is making sure soldiers are ready to be compelled. Bodies of soldiers will be made to do things in accordance with plans and policies, strategies and tactics, necessity and contingency, and will have to react to the other side's attempts to make their bodies and "our" bodies do things. Before any deployment or battle, the military must ask: What can our soldiers do, what can they withstand, and for how long? Is their training sufficient, and, perhaps more importantly, are they medically prepared for the upcoming battle? These are practical questions of great importance, as the backbone of a military—the soldier—needs to be manipulated and made ready, suitable, and pliable for the task at hand. But the fact is, militaries think soldiers are never quite up to the tasks at hand and are liable to fail at any moment.

When I entered United States Army Basic Training in 1984—like everyone else there, having volunteered for college money; a stable paycheck; a chance to learn a skill; a way to take care of a family; to protect freedom and the US against the Soviets, the Cubans, and the Nicaraguans; or simply as a way to escape something—one of the first things done to me was a series of vaccinations. Heads freshly shaved, and standing in line in our T-shirts, we were shuffled along between two lines of medics. Each medic had a hypodermic injection gun, and we were ordered to march between the medics to our right and left, roll up our T-shirt sleeves, and stand still while they gave us an injection in each arm (see figure I.1). This was designed to make the immunizations go as quickly and efficiently as possible, but as I have thought about it over the years, there was much more going on than I imagined at the time.

Ideally, the medics would have each pulled the trigger and given us the injections in our arms at the same time, but each time we moved forward, one pulled before the other, causing us to jerk to either our right or our left, just as the other medic was pulling the trigger on his inoculator. This caused small gashes in each arm, and by the time it was done (we received ten inoculations in the space of about one minute), all of us were bleeding—some more, some less—from our arms. While we were getting the shots, the medics kept telling us, "This will protect you—it's dangerous over there, and you never know what you'll catch" (this is something I heard again when I received another round of vaccinations prior to being sent to Berlin in 1986). We were then marched outside and given two small pieces of gauze to staunch the bleeding. We stood mutely in a parking lot outside the medical facility, arms crossed, holding the gauze to our arms to soak up the blood, already slightly dizzy from the vaccines beginning to course through our bodies.

In the space of a minute or two, our "health" had been protected from the dangers lurking "over there"—an unidentified but deadly and diseased place—and protected against specific but unknown threats, threats we might encounter based on predictions and past experiences to protect us for fighting in the future. We had also been enhanced in order to make us deployable, and the military had put its stamp on our bodies. This banal ritual transformation of our bodies and group bloodletting, the first step in a rite of passage that was to transform us from civilian to soldier, was also an initial exposure to mass protection and mass wounding (albeit on a very minor scale) that was to demonstrate that our health was no longer our own concern. Mass vaccinations dramatically make the point to the

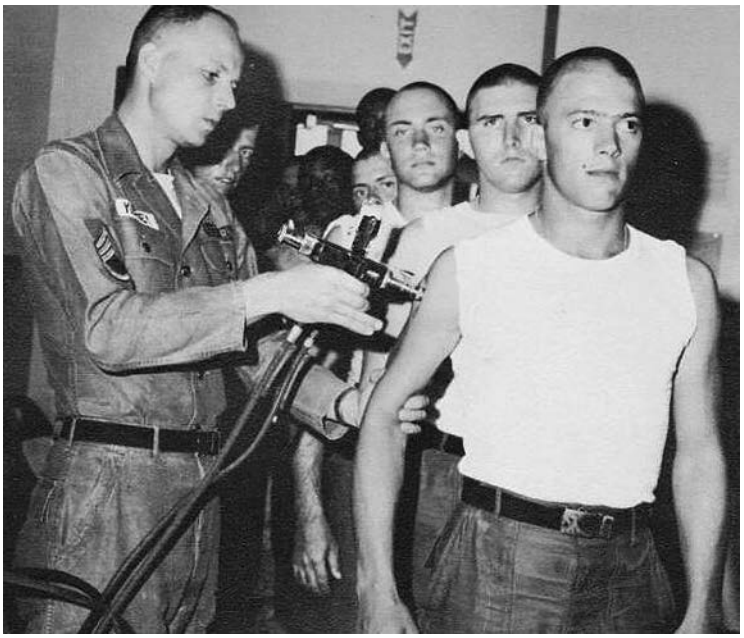


Figure I.1 Soldier enhancement via hypodermic jet injection gun, 1960s–1970s.

new recruits that the military will alter their bodies—internally and externally—to fit the needs of the military for combat. Vaccinations make the soldier militarily useful and enhance the soldier's ability to engage in combat. As mundane as it was, it was nonetheless quite remarkable: we had taken the first steps in being enhanced to fight and survive.

In *Chemical Heroes*, I examine the US military's attempts to imagine and design new kinds of biomedically enhanced and protected soldiers—soldiers who are commonly thought of and imagined in popular culture as "supersoldiers." These new soldiers will be more than they were before they entered the military, be able to do things and survive things normal soldiers cannot, and address the military's anxiety around future conflict, cowardice, and performance. And if the military is successful in its visioning and design, these new soldiers may very well prove to be kill-proof. Imagined and designed in the present, these new soldiers represent a kind of "armored" life protected against imagined future threats, a new kind of life on the battlefield that will preserve itself while more easily taking the lives of its enemies.

Chemical Heroes is an analysis of US military performance enhancement technologies, the militarization of biotechnology and pharmacology, and attempts to make the pharmacological "supersoldier," based on unclassified, open-source materials. Analyzing military performance enhancement (which I will sometimes refer to as MPE) requires a series of questions: What exactly is military performance enhancement? How does the military determine which attributes need to be enhanced? How are the US military and its various governmental and private research branches and partners going about creating new forms of enhancement technologies or modifying existing technologies? What are the operational and technological "stressors" that shape the contexts for imagining enhancements and new kinds of soldiers? And how do they imagine and design protective technologies that will allow the soldier to survive war and emerge unscathed or at least still useful?

In *Chemical Heroes*, I pay close attention to what the US military hopes to achieve through performance enhancement technologies. If we look at the supersoldier as a completely constructed entity, the question becomes: to what end? (Hacking 1999). We can lose focus when we lose sight of what the military actually wants from these technologies and from attending to their intentions instead of ours. The goals and intentions of this kind of research speak volumes about how we think about soldiers, the body, war, violence, biotechnology, and ethics. For example, much of the focus of current US military biomedical performance enhancement programs is on the impact of environmental threats and infectious disease on US soldiers, and how soldiers break down due to these stressors; the military increasingly views the battlefield as a dangerous pharmacological environment, with a focus on chemical and biological stressors and the need for "sensing the battlefield environment" (National Research Council 2001, 16–25). Analyses of soldiers and the military often do not take into account the nexus of medical and environmental threats, military medicine and prevention, and operational planning. We need to examine how the military is thinking about and planning for the emerging pharmacological battlefield of future warfare; we generally do not think of war as competing pharmacological regimes or a contest of pharmacological technologies, but increasingly, this is a possibility and concern for military planners. Biological warfare or chemical warfare is just part of the issue; we now need to consider how the US military is planning for the use of performance enhancing drugs to make soldiers "better," coming up with ways to degrade enemy forces through pharmacological means

(pharmacological landmines, etc.), and the potential for warfare to become a molecular contest.

All militaries try to develop a winning edge in warfare. More often than not, these attempts focus on new weapons systems and weapons platforms, on new ways of maximizing the offensive capabilities of soldiers and a military through firepower. These attempts can also involve a focus on the training and development of soldiers, of coming up with enhancements to make soldiers fight better, longer, and smarter than the enemy. But soldiers are fragile, and if there is one thing that the history of warfare shows us, it is that military commanders, planners, researchers—and soldiers themselves—know this. Soldier-authors who glorified warfare in the early twentieth century—Ernst Jünger in Germany, Filippo Tommaso Marinetti in Italy, and Nikolai S. Gumilev in Russia—discuss the fragility of the body-in-combat, even as they spin out dreams and fantasies of internally armored bodies and the beauty of war and destruction (Bickford 2010; Gumilev [1916] 1972; Jünger [1920] 2003; Marinetti 1971; Rainey, Poggi, and Wittman 2009; Segel 1998; Theweleit 1987–89). From a military planning and implementation standpoint, the stress point of all military operations is the soldiers themselves. Throughout the history of warfare, groups and nation-states have attempted to develop superior warriors to meet these demands, to armor their soldiers against the enemy and their own fears and weakness. Soldiers are supposed to be made into, and then embody and project, an ideal of steely resolve and fortitude, an ideal of unwavering bravery and compliance.

In *On War*, Carl von Clausewitz glosses these qualities as "boldness" and discusses how "the noble capacity to rise above the most menacing of dangers" is an important factor in the fortunes of war (1976, 190). "Boldness" is a way to think about combat and how militaries and states imagine soldiers who can be "made" bold in a predictable and reliable fashion. The opposite of boldness is timidity, weakness, and fragility. What is important to understand is how exactly militaries go about trying to solve the problem of fragile soldiers—of fragile humans—who are never quite up to the dreams of 100 percent certainty and 100 percent performance demanded by those in charge, soldiers who mentally and physically "break" in combat from wounds, trauma, and illness. In *On War*, Clausewitz also writes, "All war presupposes human weakness and seeks to exploit it" (256; see also Singer 2008). This can be read as exploiting the weakness of your enemy. However, what if the weakness you want to identify and exploit is not simply the weakness of your enemy but that of your own soldiers, in

order to turn them into the warriors you want? What if you can develop novel technologies to locate, exploit, and overcome weaknesses in the body of the soldier in order to protect them, extract more combat power and labor from them, and make them more readily deployable? These concerns have long held the interest of the US military (Ford and Glymour 2014; Singer 2008; Tracy and Flower 2014).

War has always changed soldiers: the rapid advances in firepower and operational tempo in warfare demand new ways of enabling soldiers to keep up and fight better, stronger, faster, and longer, and drugs and medicines have long played a role in sustaining soldiers in combat. They also play a role in internally armoring soldiers for the battlefield—and after. Whether through war magic or technology, those concerned with warfare and violence have tried to devise ways to make their soldiers or warriors better than their enemies, or at least make their soldiers or warriors think they are better armed and armored than their enemies. Tellingly, one of the founding myths of the West—Homer's *Iliad*—is about a warrior, Achilles, dipped at birth into the river Styx by his mother, Thetis, in order to protect him in combat and allow him to fight and perform as a hero, to endure the rigors and stresses of war (see Burgess 1995 for a full discussion of Achilles's birth). We can think of Achilles as perhaps the first chemical hero (see figure I.2).

Just as mythology and folklore bring us tales of men and women made seemingly invincible through the application of magic or enchantment, the US military also trades in ideas and portrayals of the mythic warrior and hero but now protected through biomedicine and biotechnology. For example, a US Marine Corps recruiting video in the late 1980s portrayed a medieval knight, wielding a sword and fighting an array of evil chess pieces, ultimately defeating the evil king and then morphing into a modern US Marine, and a Marine recruiting ad from 1998 showed a young man defeating a lava monster with a sword and then turning into a US Marine.

As such, these attempts are comments on the relationship between the body and war, conflict and fragility, technology and protection, and all speak to issues of embodiment and representation, to the somatization and portrayal of strength and invincibility. As the history of warfare shows, groups, cultures, and nation-states have attempted to develop superior warriors or "supersoldiers," to better train and armor their soldiers against the enemy, and to make them more resilient and useful. We can think about the history of weapons and armaments as a reciprocal history of defense and armor. "Armor" comes in many forms: material, ideological,

Figure I.2 Peter Paul Rubens, *Thetis Dipping the Infant Achilles into the River Styx*, ca. 1630–35.

psychological, and, increasingly in the US military, biomedical (Bickford 2008, 2011, 2018). While others have looked at the experience of wearing external body armor (MacLeish 2012; Scharre and Fish 2018)—a "skin-out solution" to soldier protection in US military medical parlance—I examine a kind of armor embedded in the body, not worn on the body, a kind of biomedical armor that in a sense "makes" the military body and is always with the soldier. This "belief armor" is often unseen and "built-in."

US military biomedical and psychopharmacological research programs are tasked with developing built-in armor for the soldier via new forms of medicines, immunizations, and performance enhancements. In *Chemical Heroes*, I trace the development of unseen and built-in biotechnical and pharmacological armor by the US military. This is not an analysis of the science behind the idea of the supersoldier per se, but an analysis of the sociocultural implications of military performance enhancement, how soldiers are imagined and designed based on anticipation, and an inquiry into the political economy of military biotechnology and psychopharmacology. At play are conceptions and linkages between technology and health, between material advantage, ideological/psychological motivation, and physical preparedness for combat; the latter two are concerned directly with the body and health of the soldier and the increasing manipulation of both

in order to gain advantage in war. I look at US military research projects, programs, and policies focused on combat enhancement through military medicine, biotechnologies, psychopharmacology, synthetic biology, and other forms of technology designed to improve and enhance soldiers' combat capabilities and ability to resist trauma, both during and after combat.

The US Military and Biotechnology

An increasing number of scholars are focusing their attention on war and the embodied experiences of military service, violence, and trauma (Chua 2018; Dyvik and Greenwood 2016; Finley 2011; Hautzinger and Scandlyn 2014; Howell 2014, 2015; MacLeish 2015; McSorley 2012, 2014; Messinger 2010; Terry 2017; Wool 2015). But that is not exactly what I am interested in here. Rather, my focus is on what happens *before* embodiment, on how "embodiment" is imagined, planned, and designed: military planners and researchers might not know what a body can do, but they can very easily imagine what they would like it to be able to do.

Preparing the body for war is a biomedical, biopolitical process of research, imagination, history, and ethics, of thinking through what the soldier will have to be able to withstand and respond to. Military medicine and biotechnologies are key components of this planning and imagining, of trying to ensure that the "component man" does not fail.

Biomedical innovations allow for areas of the body to be exploited in ways that were previously considered impossible or barely feasible. The soldier can (possibly) be made to do things and withstand things previously unimaginable, and can do so in a (hopefully) controlled, predictable, and survivable way. For the military, the "body" is not necessarily an existential or philosophical problem to solve. It is a material problem rooted in the needs of war and combat. Fundamentally, the military's "body problem" is a labor issue: how can the military extract as much labor power—or "combat capability"—from the soldier as possible without actually harming the soldier?

My focus in *Chemical Heroes* is on some of the past, recent, and current military research projects focused on imagining and designing "supersoldiers," programs that are designed to use biotechnology, psychopharmacology, and other forms of technology for this purpose, such as Robert B. Rigg's "Soldier of the Futurarmy" of the 1950s, Marion B. Sulzberger's "Idiophylactic Soldier" of the 1960s, and more recent and current projects like the US military's "Land Warrior," "Objective Force Warrior," "Future

Force Warrior," and "Future Combat Systems" programs, and DARPA's "Inner Armor" program of 2007 (see table I.1). All of these programs can be seen as an interplay between imagination, anxiety, anticipation, biotechnology, and concerns with the inherent weakness of soldiers in and out of combat.

The US military takes a "nuts and bolts" approach to defining and imagining biotechnology. An early report on the future uses of biotechnology for the US Army defines biotechnology as a technology that "uses organisms, or tissues, cells, or molecular components derived from living things, to act on living things" and "[it] acts by intervening in the workings of cells or the molecular components of cells, including their genetic material" (National Research Council 2001, 10). Ongoing developments in biomedicine offer new ways to understand, see, and imagine soldiers and promise to expand and enhance the body's ability to overcome and survive the battlefield and its myriad stressors.

The overall goals of military performance enhancement projects cover a broad suite of desirable traits and abilities for improvement and show an interest in examining and improving all areas of a soldier's biology:

- battlefield endurance and combat capabilities
- trauma-blocking drugs / trauma prophylaxis
- neuroenhancements/neuroimplants
- enhanced metabolism ("Peak Soldier Performance")
- enhanced wound healing
- enhanced pain management
- vaccinations for readiness/deployments
- protection against environmental threats
- concentration and enhanced decision-making
- possible legacy genetic lines

In what follows, I argue that a key component in the creation and training of soldiers is a conception of health that is different from civilian conceptions of health, a conception that harnesses rather than explicitly heals, one that sees biology as something to overcome and manipulate in order to make it useful. Through the mobilization and instrumentalization of health, states manipulate the bodies of soldiers while claiming that this manipulation is to protect the well-being and health of the soldier. This follows from my earlier book, *Fallen Elites: The Military Other in Post-Unification Germany* (2011), where I examined how soldiers are imagined, made, and unmade through policy and ideology. Here, I look at how a different kind of ideology is developed and employed to make and unmake soldiers, an

Table I.1 Selected US Military "Supersoldier" and Performance Enhancement Projects, 1956–Present

Project	Date	Developer/Sponsor	Location
Soldier of the Futurarmy	November 1956	Robert B. Riggs	N/A
Idiophylactic Soldier	May 1962	Marion B. Sulzberger	US Army Medical Research and Materiel Command, Washington, DC
Land Warrior	1994	US Army	US Army Infantry Center, Fort Benning, GA
Objective Force Warrior	1998; unveiled October 1999	US Army	Natick Soldier Support Center / Oak Ridge National Laboratory / US Armor Center, Fort Knox, KY
"Augmented Cognition"	2001	DARPA	Arlington, VA
Future Force Warrior	2001	US Army	Natick Soldier Support Center, Natick, MA / Fort Bliss, TX
Metabolically Dominant Soldier	2002	DARPA	Arlington, VA
Future Combat System	2003–9	US Army	Natick Soldier Support Center, Natick, MA
Inner Armor	2007	DARPA; project manager Michael Callahan	Approved in Arlington, VA
Biological Control	2016	DARPA; project manager Dr. Paul Sheehan	Approved in Arlington, VA

Project	Date	Developer/Sponsor	Location
Living Foundries	2016	DARPA; Project manager Dr. Renee Wegrynz	Approved in Arlington, VA / Workshop in Arlington, VA
Safe Genes	2017	DARPA	Arlington, VA

ideology that is based on biology and that can be literally implanted and modulated in the body of the soldier. Military ideology without an explicit biological underpinning depends upon "will," an almost fanatical belief in one's superiority, one's ability to overcome all odds and adversaries, and a tenacious ability to continue on with the mission, regardless of pain or personal cost. "Will" is a kind of political and psychological training and armor, cultivated to make the soldier believe he is invincible and unstoppable, whatever the odds. Military ideology based on biology is intended to circumvent the slipperiness and uncertainty of "will" and go straight to the source of bodily ability. "Will" is fine, but an enhanced "will" is hopefully even better and more reliable on the battlefield.

In the late 1990s and into the following decade, I conducted fieldwork with former East German Army and Border Guard officers (Bickford 2011). One afternoon, during a discussion about East German, Soviet, and US military technology and tactics, a former Nationale Volksarmee (NVA, National People's Army) lieutenant colonel said to me: "Technology is just an example of American cowardice. We would have used real men to accomplish what you use technology to do." His comment stuck with me long after I left Berlin, prompting me to think about the links between technology, war, masculinity, and cowardice. Of course, the NVA officer was trying to tell me that East German soldiers were simply superior men and soldiers to US soldiers and did not need all the high-tech weaponry and military technology that US soldiers had to use to prop themselves up and keep them going in the field. The East German military would have relied on "real" men with innate mental and physical strength and willpower—"natural" heroes—to fight and win on the battlefield. But he was also onto something bigger, and this has made me look at US military performance

enhancement research and biomedical technologies in a new light: on the new and evolving pharmacological battlefields of the twenty-first century, enhancements are seen as antidotes to natural cowardice. This is not a battlefield for the "real," normal, soldier but for the chemical hero.

Pharmaceuticals, Assemblages, and the Soldier System of Systems

Recently anthropologists have turned their attention to the study of pharmaceuticals and chemicals (see, e.g., Dumit 2012; Hardon and Sanabria 2017; Hayden 2007, 2012; Petryna 2003; Petryna, Lakoff, and Kleinman 2006; Shapiro and Kirksey 2017; Sunder Rajan 2006, 2017). While opening up a number of important insights and areas of research, this interest in pharmaceuticals and "chemical cultures" around the world highlights a surprising blind spot: there is little to no work on the connections between the military and pharmacology in anthropology or on the military's interest in pharmaceuticals, synthetic biology, or genomics, despite the military's interest and role as a driver of funding and research.

US military interest in pharmaceuticals for care, curing, and performance enhancement goes back decades, and the use of licit and illicit drugs by soldiers has shaped all US military engagements around the world since World War II. The military's current interest in and use of pharmaceuticals as a way to simultaneously protect and compel soldiers is part of the ongoing "Revolution in Military Affairs" (RMA), the hoped-for paradigm shift in US military research and development, strategy and tactics, and understanding of the world as "threat." This is reminiscent of Orin Starn's (1991) observations about anthropology, fieldwork, and revolution in Peru, but this time with a twist: the RMA is going on all around us, yet we are often strangely blind to it and to the influence it exerts on our research. While there has been a welcomed increase in interest in the military, militarization, and military cultures in anthropology, for the most part anthropology has remained uninterested in these changes and developments, even though most of what contemporary anthropologists study and where they study is impacted by military affairs. This most definitely includes biotechnology and pharmacology.

As Anita Hardon and Emilia Sanabria write, a "broad range of institutional rationalities underpin the management of therapeutic agents" (2017, 121); for the US military, these rationalities include health, protec-

tion, enhancement, and offensive and defensive planning for the emergent pharmaceutical battlefield. Rather than thinking about US military performance enhancement projects as a rational, singular, unified whole, we need to think about them as more akin to an assemblage, as constantly changing and emerging, made up of myriad shifting goals, ideas, scientists, security experts, technologies, laboratories, experiments, and drugs (Bell et al. 2018; Bigo 2009; Nail 2017). The military's term for the new vision of the combination of the soldier with new forms of technology and biotechnology—the soldier as a "system of systems"—is a surprisingly good way of describing the multiple and overlapping areas of concern that go into imagining and making the new soldier. Of course, the common goal is the "enhanced soldier," but the field of research and funding is much more open, fluid, and contingent. Chemical infrastructures bring together, though in disjointed ways, experts, disciplinary knowledges, and ways of knowing and assessing such infrastructures (Hardon and Sanabria 2017, 125). Performance enhancement projects form structures, groups, and nodes of researchers at military and nonmilitary research sites that imagine soldiers of the future and future threats and imagine forms of production to make material these ideas of the future through pharmaceuticals and biomedical technologies.

The supersoldier does not necessarily represent a single soldier or individual but a technological community and commonality of effort—a kind of technical-political-economic effort that wraps around the soldier. Of course, the soldier appears to be a unified whole, but from a different angle, the soldier—the system of systems—is composed of a vast array of technologies and medicines designed and created by thousands of researchers and workers, spread across all fifty states. The soldier might not be autochthonous, but the technologies seem to spring from everywhere (see table I.2). For example, the US Army Natick Soldier RD&E Center's "Warfighter Directorate" (WD) "partners with numerous Department of Defense (DoD) agencies, industry, academia and the international community to achieve mission success. The WD operates over 70 laboratories and testing facilities" (NSRDEC 2014). The military is very clear about the fact that it cannot necessarily do this research on its own, and it is not in the position to produce the required and desired drugs and biotechnologies.

One of the key recommendations of a National Academies Press report titled *Opportunities in Biotechnology for Future Army Applications* focuses on the Army's need to work with private industry and develop new forms of partnership agreements.

Table I.2 Selected US Military Research Organizations and Research Sites

Facility	Location
Natick Soldier Research, Development, and Engineering Center (NSRDEC)	Natick, MA
United States Army Research Institute for Environmental Medicine (USARIEM)	Natick, MA
Oak Ridge National Laboratory	Oak Ridge, TN
Defense Advanced Research Projects Agency (DARPA)	Arlington County, VA
Military Operational Medicine Research Program (MOMRP)	Fort Detrick, MD
United States Army Center for Health Promotion and Preventive Medicine (USACHPPM)	Aberdeen Proving Ground, MD

> To keep pace with the unprecedented rate of discovery and the anticipated increase in biotechnology developments, the Army will have to establish new, effective partnerships with the emerging biotechnology industry, participate in research, leverage research and developments in the commercial sector, and develop its internal capabilities (organization and personnel) to act on opportunities as they arise. . . . The biotechnology industry is much less dependent on the military for its existence than other industries with which the Army and other services have routinely interacted. Therefore, the Army will have to use different mechanisms for involving industry in meeting Army needs. (National Research Council 2001, 3)

The military must partner with industry and academia to achieve its goals of developing performance enhancement drugs or it must use preexisting drugs in counterindicated ways to achieve the effects and results it wants (for information on military/industry research and partnerships, see, e.g., Jacobsen 2015 and Weinberger 2017). Kaushik Sunder Rajan (2017) writes that there has been a progressive capture of health by the market; the military long ago captured "health" as an organizing principle and logic, and has long sought to develop and use new forms of biotechnology and pharmacology to protect soldiers and enhance their abilities on the

battlefield. Sunder Rajan also analyzes the "state-market nexus" of pharmaceutical research and development (2006; see also Hardon and Sanabria 2017). Military and state security needs for pharmaceuticals and vaccines are part of the bigger picture of pharmaceutical production, whether for the production of new kinds of pharmaceuticals or for the continued production of existing drugs for counterindicated uses by the military. What is important to track is the increasingly close connections and coordination between the military and "big pharma," the "military-pharmacology complex" that continues to grow as the military increases its focus on preparing to dominate the pharmacological battlefield. As the biomedical and pharmacological revolutions move forward and pick up speed, so too will the revolution in biomilitary affairs move apace and find purchase in ever-greater and expanding areas of military and civilian life. The mistake is to think of "supersoldier" projects as fringe science or simply as science fiction; rather, these projects represent a significant moment in the relationship between the military and science and the military and private industry. Military performance enhancement projects represent a distinct way of thinking about combat and trauma and a concern for both the soldier and the future of combat operations. They also represent a significant investment in soldier technologies and soldiering, as they encompass a myriad of subprojects, related research areas, and a wide range of research centers and sites.

The Double-Bind of the Military Biomedical Imagination

A central theme of *Chemical Heroes* is the dream and the double-bind of military biotechnology and pharmacology: military performance enhancing drugs can and do in fact save soldiers' lives, but in so doing enable the military to deploy soldiers in areas and environments previously considered too dangerous or somehow off limits, and deploy them at ever-faster rates between missions and for new types of missions. US military biomedical and pharmacological interventions bind soldiers to a form of medicine that protects, on the one hand, and compels, on the other. This all comes down to the following questions: What do we want from our soldiers, and what are we prepared to do to them in order to make them conform to this desire? Just how far are we willing to go to alter their bodies in order to make them fit the desire or perceived need for supersoldiers as a way to counter perceived threats and insecurities, both before and after conflict?

Rather than focusing strictly on the cultural, legal, and political dimensions of anticipation, preemption, and "potentiality," one of the things I want to do here is analyze what the materiality of military anticipation, preemption, and concerns with "potential" look like, how they are made in practice, and how the military's concerns with these issues are literally productive. As such, I examine what Ian Hacking (2002) refers to as the "historical ontology" of soldiers; Andrew Lakoff (2017) uses Hacking's idea to good effect in his examination of global health emergencies. Hacking's idea of historical ontology traces how things are imagined and come into being through scientific research and language. Lakoff, summarizing Hacking's approach, writes that historical ontology "asks how taken-for-granted objects of existence . . . are brought into being through contingent and often-overlooked historical processes" (2017, 7). Working through a historical ontology of the soldier, I look at how the often-overlooked imagining and making of US soldiers is accomplished through military medicine and biomedical research, with the goal of making new kinds of militarized life, on and off the battlefield.

Following from this, I also engage with what Sheila Jasanoff and Sang-Hyun Kim refer to as the "sociotechnical imaginary," the "collectively imagined forms of social life and social order reflected in the design and fulfillment of nation-specific scientific and/or technological projects" (2015, 120). Jasanoff and Kim further define their arguments around sociotechnical imaginaries to include "collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology" (2015, 4).

The ways in which we imagine both anticipation and soldiers are directly related to how we imagine soldiers being "used"; they make the links between sociotechnical military imaginaries and practice (Jasanoff and Kim 2015, 323). US supersoldier projects are a sociotechnical imaginary and a vision of a dangerous and uncertain future, a future we can only control by focusing on intensive biomedical research into military performance enhancement technologies in the present. The idea of the supersoldier is embedded in our everyday lives through a concern with "supporting the troops"; this support includes doing everything possible to protect the soldier.

My starting points are the biomedical and biotechnical imagination of warfare and what happens before embodiment and violence; these are primarily questions of anticipation and preemption (V. Adams, Murphy,

and Clarke 2009; Lakoff 2015, 2017; Masco 2014; Massumi 2015; Manzocco 2019). While attentive to post-traumatic stress disorder (PTSD), questions of "moral injury" (Finley 2011; Shay 1995; Sherman 2015; Terry 2017; Wool 2015), and current trends in resiliency training (Howell 2015; Jauregui 2015; Picano 2017; Simmons and Yoder 2013), my interest is in the larger question of how the military conceives of solutions for preventing combat trauma through psychopharmacological and biotechnical interventions *before* combat rather than the current solutions or treatments for postcombat trauma. In this sense, I am interested in the discussions of trauma and combat in the military; how military officials, military medical professionals, and other researchers discuss, imagine, and conceive of ways to make "supersoldiers" who can better withstand combat and combat trauma; and how they attempt to make the experience of war trauma a thing of the past. How is military medical policy formulated, for example, and how are soldier enhancements conceived of, designed, implemented, and funded? What kinds of investments is the United States making into these research programs, and what is the scope of these projects? And what might it ultimately mean to be a "medicalized" soldier in the US military?

As anthropologist Catherine Lutz (2007) writes, militarization, while concerned with the material reshaping of society in preparation for war, is also a discursive process, designed to change societal values in order to legitimate the use of force and violence. As I have argued elsewhere (Bickford 2011), militarization is also a statement on the ethical implications of warfare, a comment on the "moral imaginary" of politicians, and the military—and in this case, military doctors and medical researchers—about how soldiers should be and how they should be created, trained, and prepared. Military medicine, psychopharmacology, and biotechnology, and their promises of protection, not only impact soldiers but also help shape the policy, political, and cultural landscapes of military service and military deployment by promising "positive" health interventions for our soldiers. The internal regulation of the soldier becomes the external protection of the state: what might seem like a positive, life-saving measure could also be another way—despite possibly being a positive medical intervention that saves a soldier's life—of making soldiers fight, of ensuring compliance and deployability, and of harnessing a "resource" for national security and policy purposes in a more effective and predictable manner.

A question that often does not come up in discussions of "supersoldiers" or "enhanced" soldiers is: How did we get here? What is the history—or the multiple histories or research trajectories—of the

US soldier-as-supersoldier and the development and emergence of the sociotechnical imaginary of supersoldiers in US military thinking (Taylor 2004)? We can think about the projects, budgets, programs, and ethics of soldier enhancement, but we also need to think about the various iterations of the "American soldier," and how cultural ideals and imaginings of the "good" or "unbeatable" US soldier came into being. The ways in which we imagine soldiers are directly related to ways in which we imagine soldiers being "used."

One reason for the need to think about performance enhancements and trauma blockers is the fact that the US military is an all-volunteer force. A watershed moment occurred in 1973 for the US military, as the Abrams Doctrine brought about the end of the draft and the conscript military in the United States, forcing the military to rely solely on volunteers to fill the ranks. Throughout the mid to late Cold War, this did not necessarily present much of a problem, as economic downturns ensured a steady supply of volunteers entering the military. With the exception of Vietnam (and the Korean War, which lasted from 1950 to 1953), there were no other long-term military engagements during the Cold War, and the US military did not have to confront multiple deployments into combat zones. However, with the beginning of the second Gulf War in 2003, and the ongoing "forever war" (to use Dexter Filkins's [2009] felicitous phrase), the military has had to face the fact that its volunteers routinely face two, three, four, or more combat deployments. In short, there is no longer a steady supply of conscripts to take up the slack as physical and psychiatric casualties mount, and the US military is forced to think about ways to keep volunteer soldiers on the front lines for extended and repeated periods of time. The US military must figure out how to make do with volunteers, all that means, and all that they can be made to be. Uttered in frustration to a group of soldiers confronting him about the military's lack of armor and equipment during the early days of the war in Iraq, Donald Rumsfeld's quip about going to war with the Army you have at the time speaks in many ways to the military's desire to have the Army of the future.

As the US military increasingly sees the entire world as a battlefield, it must anticipate, imagine, and design new ways to protect soldiers in order to make them deployable anywhere in the world. Zeroing in on this trend, I bookend current US military performance enhancement projects with two US military biomedical "armor" projects intended to protect soldiers against the environment and disease. Employing a kind of anticipatory military biomedicine—which forms a central focus of this book—both projects called for the embedding of built-in and unseen biomedical technolo-

gies and prophylaxes in the body of the soldier, and view environmental stressors and infectious disease as major factors in soldier breakdown and mission failure: Marion B. Sulzberger's 1962 proposal to create soldiers for the US military who had their own built-in, unseen, biomedical armor—what he termed *Idiophylaxis*—and the Defense Advanced Research Projects Agency's (DARPA) 2007 "Inner Armor" program, designed to create "kill-proof" US soldiers. The arc of Idiophylaxis and Inner Armor graphically displays and covers the modern US military's quest to develop internally armored, "kill-proof" soldiers through advances in military biotechnology and psychopharmacological research. Within this arc we can see the drives and attempts to develop the technologies—both "skin-in" and "skin-out"—that will create the fully protected soldier who provides 100 percent certainty on and off the battlefield. Sulzberger's Idiophylaxis and today's plans for enhanced soldiers equipped with their own inner armor are part of a genealogy of ideas and dreams of the soldier who can resist any and all battlefield and environmental conditions, who will be possibly "kill-proof" and physically and mentally impervious to the horrors of war (Bickford 2018). They are also part of a genealogy of military biomedical research and the increasing importance of biology in military planning, research priorities, and funding. If, as the saying goes, physics was the key military science of the Cold War, biology and various forms of biomedical research will be the key military sciences of the twenty-first century (Hammes 2010, 5) and create possibilities for soldier performance that simply did not exist during the Cold War.

"Spinning and Grinning": Grunts, REMFs, NAAFI, and Enhanced Performance

Between 1984 and 1989, I spent five years on active duty in the US Army. After Basic Training at Fort Leonard Wood, Missouri; intensive language training at the Defense Language Institute in San Francisco and Monterey, California; and signals intelligence intercept and analysis training in Texas, I was assigned to a signals intelligence unit located in Berlin. I spent three years assigned to Field Station Berlin, situated atop Teufelsberg ("Devil's Mountain")—a three-hundred-meter-tall mound of rubble from World War II, built on top of a former *Wehrmacht* training facility—in Berlin's Grünewald Forest. Arriving in 1986 and leaving in 1989, I was stationed there before the fall of the Berlin Wall and the dissolution of the German

Democratic Republic and, subsequently, the Warsaw Pact and the Soviet Union. As a signals intelligence linguist (specifically, an "Electronic Warfare Signals Intelligence Cryptologic Voice Interceptor, German Integrated Systems Specialist"), I sat for eight to ten hours per day (sometimes longer), listening to and translating intercepted communications.

I was perhaps the quintessential late–Cold War "REMF" (Rear-Echelon Motherfucker), a military slang term differentiating REMFs from "Grunts"—the "real" combat troops of the military (the recent designation for a REMF is a "POG": "People other than Grunts"; some soldiers are also known as "Fobbits"—soldiers deployed to a forward operating base but who somehow always remain in the FOB; this might come close to being a REMF, though there is a difference). Despite my supreme REMF-ness (which in hindsight was kind of strange, given that we were all surrounded in Berlin, and which shows that being a REMF did not have as much to do with being near the front lines as it did with one's job), I did have to periodically train and practice for combat. In the event of a war, if we were somehow not at the field station, we would have formed a "provisional rifle company" (e.g., cannon fodder) or driven ammunition trucks (again, cannon fodder). We knew that Field Station Berlin would have been one of the first targets attacked in any conflict with the Warsaw Pact, as we were a giant electronic "ear" sitting in the middle of Soviet and East German forces. The rumor was that the Soviets would attack the field station with chemical weapons in order to kill us but preserve all the sophisticated computer and other technologies located in the field station. The other rumor was that our own artillery would then attack us, to make sure the same sophisticated computer and other technologies did not fall into Soviet or East German hands. We also heard whispers that the Military Police were to shoot any of us who survived the first two attacks; this always struck me as excessive. In any event, we were all fairly certain that our war would have been nasty, brutish, and short.

I have no recollection of any discussions of taking drugs in combat, or any kind of enhancements we would use. But in hindsight, and working through this project, I have asked myself: Would I have taken enhancement drugs? Cogniceuticals—drugs that improve attention span and cognition and help prevent mental exhaustion—are a key focus of military performance enhancement research. Would I have taken a drug that would allow me to forget what I had done in combat? Or something that would at least block my initial fear of going into combat? Or helped me translate better and faster, and stay focused for longer periods of time? I would like to say that I would not have taken any drugs offered, but the honest

answer is: I don't know. When Max Weber wrote about "life chances and life choices" (Weber 1978, 926–38) when thinking about how people experience class, he was probably not thinking about military performance enhancement drugs. But what does it mean to be in a position to have to make this choice about such drugs that affect life chances and choices, willingly or not? Who will have to make this choice, and how does the nexus of military biomedicine and class help us understand what military performance enhancement will be and mean in the future? Perhaps these are the questions that this book really revolves around. What if? I don't know. I simply don't know what I would have done, and maybe most soldiers are not really sure either. Maybe you don't have the benefit of choice to make decisions about your future when you know you soon might not have a future. Or maybe the only way you can have a future (regardless of your fears about that future) is to take the drugs the military offers—or orders you to take.

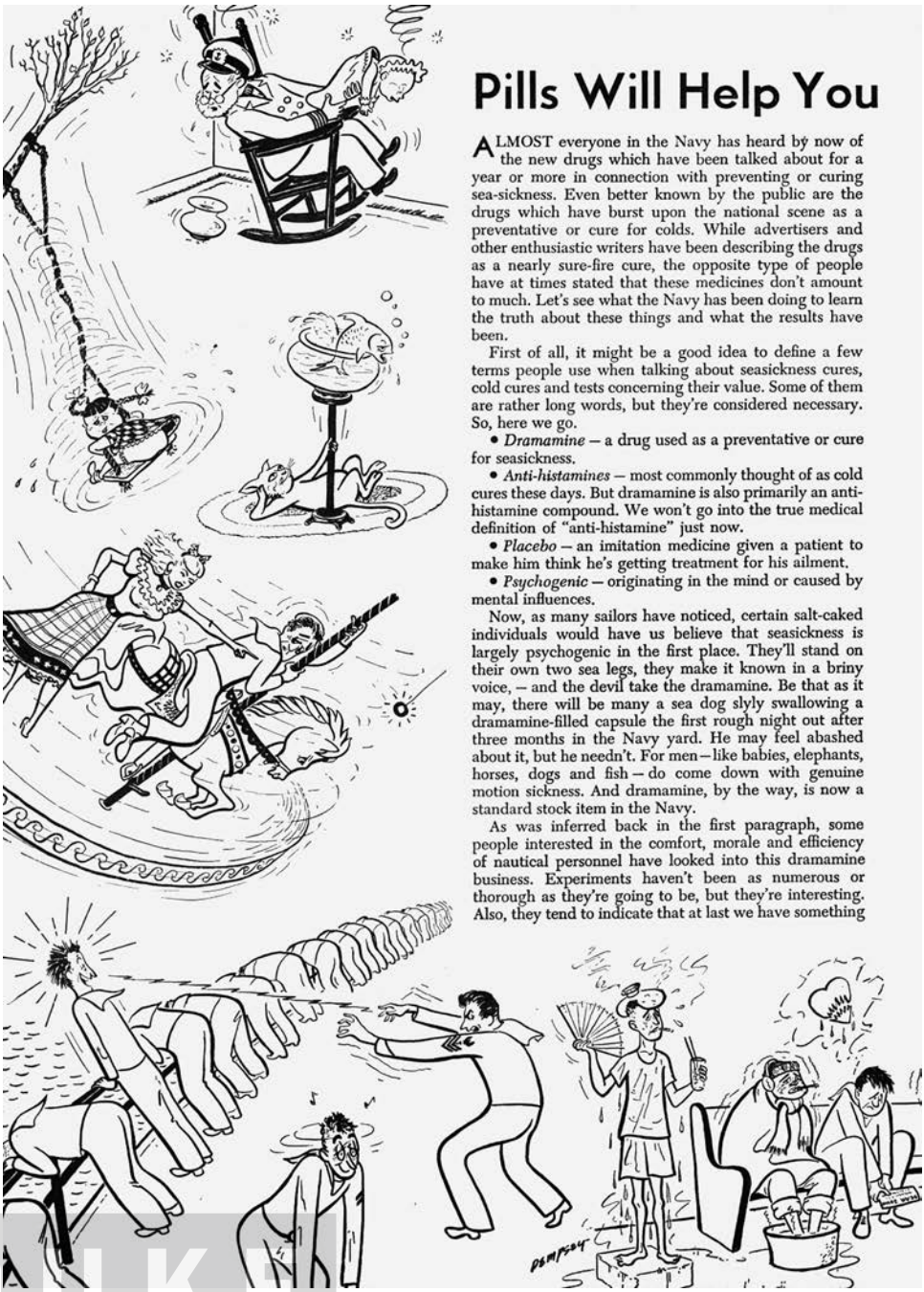
Performance enhancement drugs are potentially useful not only to the combat soldier but for all soldiers. While my job was not physically demanding, it was mentally taxing, as sitting and listening intently for long periods of time with headsets is exhausting, and the static, white noise, atmospheric squeaks, hisses, pops, and bounces take their toll on your ability to concentrate (not to mention causing intense headaches and earaches). Depending on the quality of the signal and the intercept, the sheer amount of static and garbling one had to somehow block out while listening to the message would often exhaust you after even a few minutes. But we had no cogniceuticals. We had coffee, tea, and tobacco; the Noncommissioned Officer (NCO) breakfast—black coffee and cigarettes—is something that many in the Army come to know quite well.

The highlight of the day at the field station was the arrival of the food truck from the British version of the post exchange (PX)—the Navy, Army, Air Force Institutes (NAAFI). The "NAAFI run" was a highly structured and choreographed event that often involved ordering and carrying forty or more cups of hot tea, stacked two or more tiers high, back through the halls to the section and often accompanied by the carriers singing the "Wesley House Song," sung to the tune of "Tequila" (and woe be to the poor sap who spilled or dropped the tea). The super strong, hot, sweet, milky tea sold by the NAAFI was a much-welcomed boost, and I would often drink four or five cups in the space of fifteen to twenty minutes. The jolt provided by the caffeine and sugar would keep me going for hours and help alleviate the stress and exhaustion of sitting with headphones on, "spinning and grinning" (watching the reel-to-reel tapes slowly spin around and around,

and sometimes becoming hypnotized by the spinning tapes) and listening to static at volumes that caused hearing loss. Of course, once the tea wore off, it was on to coffee.

Self-medicating to cope with one's job or career is a common occurrence in both licit and illicit economies (Hardon and Sanabria 2017). And of course, the use of drugs by corporations and in factories is a feature of the workplace that weaves its way through the history of capitalism (Haug 1986; Schivelbusch 1992). Caffeine, alcohol, and tobacco have always been used, and newer drugs like Ritalin and antidepressants—as well as opioids—are increasingly prevalent in the workplace and as a result of workplace conditions (Webster 2018). While the military is fine with soldiers having coffee and/or tea, it is increasingly concerned with tobacco use, and soldiers are not supposed to self-medicate to cope with the stress of military service or other issues, be they emotional or physical, but of course they do (though the military does use mandatory drug testing as a way to address this). Self-medicating can render a soldier less than useful in key situations and also means that the soldier's health as a site of intervention and control is not fully under the military's control.

As the cliché goes, war is 90 percent boredom and 10 percent terror. But so too is the everyday experience of military service, the daily labor of the soldier. How then does the military deal with soldiers who are bored 90 percent of the time? Of course, military service is not always boring, but it can be, compelling soldiers to come up with creative ways to deal with hours and hours of soul-crushing monotony. During advanced signals intelligence training in Texas, we were locked in a room for months on end from 11:30 p.m. until 7:30 a.m. for training purposes; given that it was a secure site, we were not allowed any books, writing paper, and so on. One morning around 3:30 a.m., we had finished our work for the day (night, really) but were still locked in the room until 7:30 a.m. With nothing to do, we improvised: we found a large, dead beetle in the room, stripped off part of the faux veneer on the side of a table, and began to play "Bug Ball," taking turns pitching the dead beetle and batting with the veneer strip, running around the room from base to base, laughing maniacally because of the sheer ridiculousness of the situation. We played for about an hour, until our training sergeant came in and caught us. From then on, we were given more training materials to keep us busy throughout the night. The bored soldier is one who can get into trouble; the actual supersoldier might be the soldier who is enhanced to better deal with boredom and the mundane aspects of military life, a soldier for whom even boredom becomes



Pills Will Help You

ALMOST everyone in the Navy has heard by now of the new drugs which have been talked about for a year or more in connection with preventing or curing sea-sickness. Even better known by the public are the drugs which have burst upon the national scene as a preventative or cure for colds. While advertisers and other enthusiastic writers have been describing the drugs as a nearly sure-fire cure, the opposite type of people have at times stated that these medicines don't amount to much. Let's see what the Navy has been doing to learn the truth about these things and what the results have been.

First of all, it might be a good idea to define a few terms people use when talking about seasickness cures, cold cures and tests concerning their value. Some of them are rather long words, but they're considered necessary. So, here we go.

- *Dramamine* – a drug used as a preventative or cure for seasickness.
- *Anti-histamines* – most commonly thought of as cold cures these days. But dramamine is also primarily an anti-histamine compound. We won't go into the true medical definition of "anti-histamine" just now.
- *Placebo* – an imitation medicine given a patient to make him think he's getting treatment for his ailment.
- *Psychogenic* – originating in the mind or caused by mental influences.

Now, as many sailors have noticed, certain salt-caked individuals would have us believe that seasickness is largely psychogenic in the first place. They'll stand on their own two sea legs, they make it known in a briny voice, – and the devil take the dramamine. Be that as it may, there will be many a sea dog slyly swallowing a dramamine-filled capsule the first rough night out after three months in the Navy yard. He may feel abashed about it, but he needn't. For men – like babies, elephants, horses, dogs and fish – do come down with genuine motion sickness. And dramamine, by the way, is now a standard stock item in the Navy.

As was inferred back in the first paragraph, some people interested in the comfort, morale and efficiency of nautical personnel have looked into this dramamine business. Experiments haven't been as numerous or thorough as they're going to be, but they're interesting. Also, they tend to indicate that at last we have something

Figure I.3 "Pills Will Help You." *All Hands: The Bureau of Naval Personnel Information Bulletin*, June 1950.

militarily useful and productive. The future soldier is a term not just of the fantastic but also of the mundane: a better worker, a soldier who can do the mundane training and chores of military service more efficiently, who is enhanced to better deal with boredom, and is a soldier for whom even boredom becomes militarily useful and productive. On a day-to-day basis, the supersoldier might be the nonbored, nonproblematic soldier: the perfect soldier/child—the infant/ry—on Ritalin.

It is not just the combat soldier who needs performance enhancement, which complicates our ideas and notions of what the supersoldier is. You can be a combat supersoldier, or you can be a superlinguist soldier, or a superlogistics soldier, or a superadmin soldier. All military occupations and specialties can be enhanced and made more useful through pharmacology (see figure I.3). This is not that different from the increasing use of cognition-enhancing stimulants on campus or in the business world. What is different is the potential degree of use, the tasks at hand, and how we think of the military as it performs its missions on drugs.

Enhancements, Common Sense, and the Mundane

We can use military performance enhancement projects to consider the debates occurring in military bioethics circles about what constitutes permissible enhancements to soldiers (Annas and Annas 2009; Ashcroft 2008; Beard, Galliott, and Lynch 2016; Braun, von Hlatky, and Nossal 2017; Ford and Glymour 2014; Frisina 2003; Gross 2006; Gross and Carrick 2013; Killion, Bury, de Pontbriand, and Belanich 2009; Lin, Mehlman, and Abney 2013; Lin, Mehlman, Abney, French et al. 2014; Mehlman and Corley 2014; Moreno 2012; Singer 2008; Tracy and Flower 2014). And we can begin to pose working hypotheses about why certain enhancements are chosen at specific times. For example, political, economic, and military rivalries and tensions drive military science and biomedical research; this much is well established. But what does this mean for the soldier or soldier-to-be and their families? What will this mean for military recruitment, and the race, class, and gender issues associated with joining the military? Do these political tensions ultimately end up as "translated" embedded technologies in the bodies of soldiers? What might it mean to be an enhanced, idiophylactic, "kill-proof" soldier? What if the enhancements and protections do not work as promised? Is it ethical for the military to directly shape a soldier's future through biotechnology and other forms of enhancement, even if the

soldier volunteers for it? And what happens to the "kill-proof" soldier after war and combat are over and they try to return to civilian life (Beard, Galliott, and Lynch 2016; Lin, Mehlman, and Abney 2013; Singer 2008)? We might be able to biomedically design, engineer, and manufacture "bold" soldiers and chemical heroes, but what then?

Enhancements are not just computer chips implanted in soldiers' brains (but these conceptions make good clickbait): they also constitute the mundane, the everyday, and things that we do not generally consider to be enhancements, as I will discuss later (see also Wong 2013). As I mentioned at the beginning of this chapter, I too was "enhanced" in Basic Training and periodically throughout my time in the Army, through militarily useful vaccinations. Not all of it is completely frightening and straight out of a bad science fiction film (though some proposals do seem like it). However, these aspects of the "mundane" constitute the slippery slopes of military performance enhancement and help keep it potentially out of public view, or at least public critique. Rather than something appearing in a military horror story, like droves of soldiers with brain implants, some of the most important enhancement programs and technologies might be quotidian and mundane but the most militarily important, useful, and cost-effective. A consideration of the "mundane enhancement" does not mean that I dismiss military enhancements as troubling. Far from it: the mundane means that enhancements can slide under the radar and perhaps be seen simply as positive, nonthreatening, or ethically acceptable interventions, when in fact they present all sorts of problems and issues of which we need to be aware. The importance of understanding the mundane, as Les Back (2015) and Jill Ebrey (2016) write, lies in the possibility of linking the "smallest story to the largest social transformation" (Back 2015, 834). The US military's research into soldier performance enhancement is one such social transformation.

The mundane can also be seen as leading into "common sense." Protecting soldiers through any means available is not only an ethical question but one of common sense (Herzfeld 2001). Within the present-day US socio-political-technical context, it might seem like common sense that "anything good" to protect our soldiers is OK. They fight to protect us and preserve our freedoms, so it is only common sense and right that we do everything to protect them. Thinking about performance enhancements in the military through the lens of common sense brings it back into the cultural and the everyday; it is not just something that bioethicists debate. A report produced by the US Army Natick Soldier Research, Development, and Engineering Center (NSRDEC) titled "Future Soldier 2030 Initiative"

sums up the desire, need, and possible problems facing the military's drive toward enhanced soldiers and the need to contend with emergent, commonsense ideas of acceptable enhancements: "Consumer demand and scientific exploration will yield an explosion in cognitive and physical enhancers, including nootropic (smart) drugs, neural prosthetics, and permanent physical prosthetics. These could yield dramatic enhancements in Soldier performance and provide a tremendous edge in combat, but will require the Army to grapple with very serious and difficult ethical issues. At the same time, if societal ethics change to embrace such enhancers, the Army will need to decide to use these types of systems" (NSRDEC 2009, 3). The military will have to pay close attention to new pharmaceutical enhancers as they enter development and the market. And it is very aware that it will have to pay close attention to cultural attitudes and perceptions of performance enhancement drugs. If ideas about performance enhancing drugs change, the military will have an easier time requiring soldiers to take them, and the opportunity to be enhanced could help increase recruitment.

Commonsense notions of soldiering and enhancements might be much more powerful and convincing to the military if it knows that the commonsense consensus on enhancements is that they are fine and to be tolerated, since we should do anything and everything we can to protect our soldiers. In many ways, it comes down to "Is it OK to drug soldiers?" versus "Is it ethical to drug soldiers?" "OK" is the everyday, mundane, folk/commonsense application of morality, ethics, and values. How will people understand and feel the "OK" versus the "ethical"? Will parents be OK with their children joining the military and becoming enhanced? How will they feel if they receive a letter like the one Supersoldier Bob sends home? As I will discuss in the coming chapters, projects like Idiophylaxis, the Objective Force Warrior, the Future Force Warrior, and Inner Armor might help a soldier survive war, but it is far from clear that these technologies will help a soldier survive peace. In the mythology of the heroic warrior, it is the hero who often finds it difficult or impossible to return home (Campbell 1973; Hautzinger and Scandlyn 2014; Shay 1995; Sherman 2015).

Biological Solutions to National Security Problems

Fundamentally, a military is about fighting and killing. All members of the military are made aware of this from day one of Basic Training, regardless of their Military Occupational Specialty (MOS in US Army parlance).

Of course, soldiers branch out and perform other kinds of missions, and combat is not the sole activity of the soldier, even if you are in the infantry or Special Operations. But the military needs you to know how to fight, and to be ready and prepared to fight when needed, which could be at any moment.

The need to fight at a moment's notice means that soldiers need to be physically and mentally ready to fight anytime, anywhere; this ability to fight on command underpins national security. We need to examine the biological underpinnings of national security: How do understandings and visions of biology and the ordering of biology influence national security, military policy and action, and how we imagine soldiers? How do we think about and analyze the strategic macrolevel of war and (in) security, and think about how it plays out at the microlevel of the biology of soldiers? I examine these links through military medicine and research efforts designed to enhance the performance of soldiers. While the US is moving ever closer to drones and other autonomous technologies like battlefield robots (Gusterson 2016; Scharre 2018), the soldier is still the linchpin of military success. Until soldiers are replaced with machines, we will try to make soldiers as predictable, reliable, and durable as machines.

Since states started making soldiers, two things have been obvious: soldiers are never up to the task, and the state needs to make them be up to the task. From the state's point of view, the soldier oscillates between cowardice and heroism, compliance and failure. The important thing to understand and consider when examining these projects is not whether these technologies will work—they may or may not—but that the desire to protect results in an unceasing attempt to protect. This goes for the desire to enhance as well—one drug or suite of drugs might not work, but there are always other paths to consider and other pharmacopeias to explore. The soldier may be both the beginning and the end points of enhancement and protection logics and rationales, but she is also the conduit and the enabler for these kinds of interventions. The soldier is both the prompt and the problem.

Lurking below the surface of the soldier's skin is the one battlefield the military cannot afford to ignore, the enemy the military and the soldier must face on a daily basis and which can cause the military to lose before it even begins: the biology of the soldier. The interior of the soldier is the new terrain of combat, the new battlefield, fought against and with anticipation and imagination, against all sorts of enemies, human, envi-

ronmental, bacterial, and viral, enemies the soldier might not be aware of but which can kill him in an instant, enemies that are faceless, heartless, unfeeling, and uncaring. This militarized interior becomes the ultimate proof of the state's love for the soldier: we love you so much and care about your welfare so much we will change you from the inside out, possibly forever. It is also proof positive that your safety is our number one concern. Skin-in solutions become—paradoxically—the most obvious, visible, and "seen" proof through intervention that the military will do all it can to protect soldiers.

Mark Burchell, a former UK Royal Marine Commando, explains what happens to the soldier on the battlefield, how the soldier's body starts to work against him in combat, and the amount of energy the soldier has to expend to stay alive and remain effective.

> During combat, his disciplined body is conditioned to move, to react, to respond, to overcome. Physiological actions and reactions are fast, and his body is burning an enormous amount of energy, that's why he is lean and muscular, because he subscribes to a life of willful labor. . . . The body will sweat profusely in an attempt to cool down, but every last muscle is being timeworn by a stream of adrenaline gushing through an inner system working ever harder to stay in the fight. . . . As air is heavily sucked into the lungs, blood is oxygenated and the muscles are fed so this war machine can continue to function. . . . The body's energy is being exhausted and absorbed by the same environment that once offered protection. (2014, 216)

All of this happens quickly, so the soldier is soon in danger in running out of energy, no matter how well trained and conditioned he is before combat. US Army recruiting slogans like "Army Strong" and "An Army of One" hint at the desire to have enhanced supersoldiers who are better than unenhanced soldiers and who have the firepower and combat capabilities of entire companies of soldiers. This same "body" could then be used for recruiting/promotional purposes in order to entice people to enlist in the military. Soldier augmentation offers the potential for obviating difficulties in military recruitment that the United States has experienced after the Iraq War that has compelled it to ease standards for enlistment, including lower standards of physical fitness and higher age ceilings (Schachtman 2007).

While vigorously exploring new and improved external protection technologies, the US military has long focused on ways to internally armor the soldier. Much of the vision and portrayal of the enhanced "supersoldier"

comes from US military medicine and biotechnology research. US military biomedical and performance enhancement research is intended to anticipate threats (however the military defines "threat" at a given time and place) and manipulate the bodies of soldiers to meet and counter these threats (Bickford 2008, 2018; Clarke et al. 2010, 4–6; Galliot and Lotz 2015; Lin, Mehlman, Abney, and Galliot 2014; Perkins and Steevens 2015; see also Terry 2017). Some of these internal protections might seem farfetched (such as making the soldier immune from nuclear flash burns) or quotidian and mundane (like making the soldier more resistant to bug bites and blisters) (Bickford 2018; Sulzberger 1962a; Wong 2013; see also Biljan, Pavić, and Šitum 2008; Brennan et al. 2012). Regardless, the biological makeup of the soldier is the site of intense research and design, imagination, and planning. Military environmental and performance enhancement research are not only about adapting or reacting at the level of combat systems, tactics, or strategy; they are also about reacting to and anticipating possible battlefields and environments at the level of the biology of the individual soldier.

Enhancements intended to be embedded in the body of the soldier—"skin-in" enhancements—constitute the direct manipulation and militarization of the soldier's own biology for military purposes. The vast array of projects conducted and underway demonstrate the breadth of military performance enhancement research in the US: projects incorporating both skin-in and skin-out technologies like the Land Warrior, Objective Force Warrior, and Future Force Warrior suite of programs; and skin-in projects focused on biomedical enhancements and the "tweaking" of the soldier's biology such as Peak Soldier Performance and Metabolically Dominant Soldier; attention-enhancing drugs like Modafinil, designed to "enhance situational awareness" and prevent the "degradation of decision-making"; trauma-blocking drugs like Propranolol, intended to block traumatic memories and possibly prevent PTSD; attempts to harness the "sleep/wake cycle" and keep soldiers alert and in combat for days on end; "power dreaming" as a way to care for PTSD; specially designed performance enhancing foods; hyperhydration to reduce the logistics stress of carrying water into combat; and projects like Idiophylaxis and Inner Armor, concerned with mitigating environmental and disease threats to the soldier. All of these projects demonstrate the intensity of the military's focus on the interior of the soldier.

"Better Warriors through Chemistry": Bodies, Labor, and Warfare

Some like to argue that humans are wired for war, that it is in our DNA, and that it goes back to our "evolutionary past." But if we are wired for war—premade for war—why do states have to go to such great measures to get people to fight and kill, and why do humans have to be enhanced to conduct warfare? If warfare is somehow deeply encoded in our DNA, our bodies and DNA are not up to the task of the kind of warfare we have devised and are developing for the future. Our bodies are just not up to the tasks and rigors of combat we have dreamed up and set up for ourselves, so we must change our bodies—and possibly our DNA—to keep up with our imagination. Conceptions of the enhanced military body in many ways completely deny evolution and the physical limits of the body—anything is possible, and the body explodes into a fractal of possibilities and iterations based on military fear and anticipation. The military's concern with developing performance enhancement drugs and harnessing new trends in genetics and neurology is a way of trying to elude the genetic "fate" of weakness, the inherent weakness of the human body on the battlefield (Petryna 2003, 14). Military performance enhancement is concerned with the biomedical protection of soldiers and the risk management and modulation of weakness—and cowardice—for soldiers. It is the development of a new kind of institutional risk management for itself and its goals (Clarke et al. 2010). In a promotional video for its "Exoskeleton Integrated Soldier Protection System," Revision Military, a US military equipment and technology company, used the following tag line about human fragility to advertise its new technologies: "Rely on the human body alone, and you may need to pick between mission and safety. Combine innovation and the human body, and you have an unstoppable capability" (Revision Military 2015).

My concern here is not so much an analysis or theorization of biopower and communities (Esposito 2008, 2011; see also Petryna 2003); rather, I use "biopower" as a way to analyze and detail the history, plans, and ideas behind a suite of biomedical interventions that focus on the direct intervention by the military and the state in the biology of the soldier, and to think about the implications and bioethics of military performance enhancement and military medicine. As iterations of military biopower, US military biomedical research and performance enhancement projects are intended to manipulate and mediate the war/embodiment dialectic, shap-

ing it in "positive" and militarily useful ways (Bickford 2018; Clarke et al. 2010, 4–6; Foucault 1979, 1980; Hogle 2005; Scarry 1985; Terry 2017). As Jennifer Terry describes it, biomedicine in a military setting incorporates the "multiplying branches of modern biological sciences in their convergence with medical research, treatment, and profiteering" (2017, 3). She also adds that "national security, warfare, and biomedical logics form a nexus in which deliberate violence—war—is bound up with far-reaching aspirations about improving life" (27). As concerted methods of improvement and enhancement, US military projects like Idiophylaxis and Inner Armor reflect similar aspirations about life and fortitude; in their overlaps we see abiding values tied to life and its improvement. And yet they also signal something new: the ability to make these visions come to life in the bodies of soldiers themselves. Improving life in the abstract, to extend Terry's argument to these projects, depends on improving the life of war's most critical instrument—the body of the soldier. While biomedical logics are about anticipation, for military performance enhancement projects, they are not only about anticipating the "future as a salve for the present" (Terry 2017, 54). This anticipation is also about a future of military fear, uncertainty, and surprise, of threats unknown and possibly inexorable. Increasingly, the task of this kind of anticipation is to find solutions and embed them inside the bodies of soldiers *before* combat and deployment even take place in order to mitigate future military uncertainty. These attempted antidotes to future fears will literally be embodied in present soldiers.

My interest in this biomilitary dialectic is in how advances in biomedicine offer the military new ways to understand, imagine, and design soldiers, and how these advances promise to expand and enhance the soldier's ability to overcome and survive the battlefield and possibly all enemies and combat stressors. Though attentive to the discourse of improvement, my analysis of military biotechnology and performance enhancement nevertheless diverges from that of Terry in its point on the "arc" of soldiering. I examine military biomedical projects as interventions designed to keep the soldier "whole" and useful before and during combat rather than as interventions designed to help heal the soldier after combat. My focus on military biomedicine and performance enhancement is on how "improvement" and "enhancement" are anticipated, imagined, planned, and designed *before* combat, with a focus here on military pharmaceuticals as "inner armor." Biomedicine, genomics, and synthetic biology might make it possible to take all the images, dreams, and ideals of supersoldiers, all the discussions and ideas and arguments about "willpower" and inner

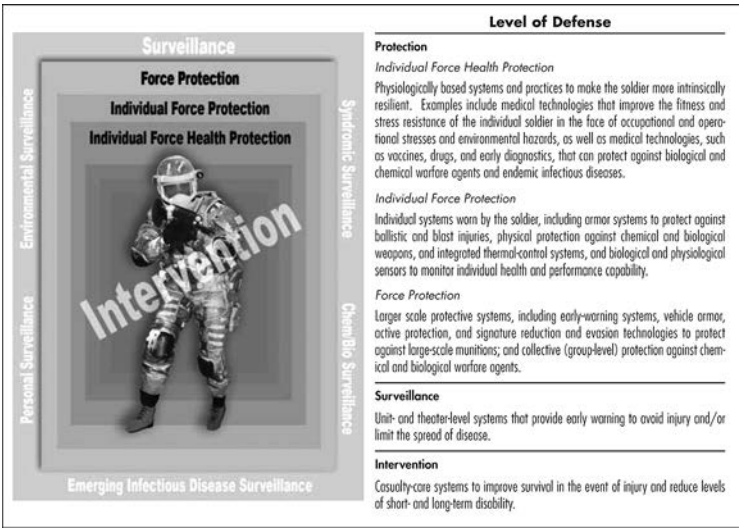


Figure I.4 "Level of Defense." Lester Martinez-Lopez: "Biotechnology Enablers for the Soldier System of Systems," 2004.

strength, and make them real, "things" that can be synthesized and transplanted into soldiers.

The ultimate goal of military performance enhancement is to create a new type of "supersoldier," a soldier with different expectations of performance, capabilities, and survivability from previous types of American soldiers. As stated in the "Army Medical Science and Technology Initiatives in Advanced Biotechnology Briefing," the problem of certainty of performance in combat is being addressed by "novel neuroprotective drugs" (Romano 2004, 12), and a "recurring finding" is that "biotechnology offers major payoffs to the military in improved soldier health and performance" (3). And according to the former chief of the US Navy's Operational Test and Evaluation Force, Rear Admiral Stephen Baker, "Futurists say that if anything's going to happen in the way of leaps in technology, it'll be in the field of medicine. . . . This 'better warrior through chemistry' field is being looked at very closely" (Knickerbocker 2002).

Unseen and built-in armor are ways of thinking about the connections, entanglements, and relations of power that bind the soldier to the military and remain unseen, and perhaps unfelt, but are nonetheless present in both the body and the medical records of the soldier as proof of protection (see figure I.4). The unseen armor of the soldier is also in some ways

the unforeseeable: we cannot necessarily foresee all threats that a soldier will face, but unseen, built-in armor will provide the soldier with ongoing protection. We can think about possible outcomes and the ethics of the permissible, but built-in, "skin-in" armor is the undiscovered country of military research.

By paying close attention to US military performance enhancement plans and directions, we can analyze how the military thinks about the future and the kinds of soldiers it thinks it will need. Imagining the "unknown unknowns" and the world as a system of systems of threats and potential threats and emergent threats provides the military with an unbounded system of fear—and opportunities. And viewing the body of the soldier as an endless system of systems of unknown unknowns, of frailty and weakness, "explodes" the body into a potentially endless system of systems of possibilities for enhancement and protection against the unknown unknowns.

New forms of pharmaceuticals and new ways of engineering human biology present the military with new ways of harnessing the biology and labor power of the soldier. *Chemical Heroes* is the juxtaposition of an intentional process—biomedical enhancement research—with that which is contingent and unpredictable. If capitalism is about anything—and particularly the convergence of capitalism and the military—it is about attempted predictability, standardization, immediacy, and regulation. Predictable, controllable heroism is just another component of human resource management and military Taylorism.

Performance enhancement is about the creation and extraction of evermore reliable and dependable military labor, but labor made to seem heroic and glamorous through the use of advanced technology to make the soldier seem and feel like a fearless mythological warrior. Today, the US soldier represents a capital investment, with each soldier often costing upward of $1 million per year to train, maintain, equip, deploy, and care for, according to a recent figure (Shaughnessy 2012, as cited in Lin, Mehlman, Abney, and Galliot 2014). Gone are the days of the soldier as cannon fodder; rather than thinking of the soldier as totally expendable, the politics of soldiers and soldiering now entail a concern with protection, of ensuring the survivability of the soldier. The politics of military protection in the US today dictate and drive a massive research and development regime designed to prevent US soldiers from suffering any casualties or injury—at least in theory. In an era of increasingly lethal weapons, we are to somehow believe that our soldiers will not suffer trauma or die in combat.

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