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OPERATION DELIRIUM

Decades after a risky Cold War experiment, a scientist lives with secrets.

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Colonel James S. Ketchum dreamed of war without killing. He joined the Army in 1956 and left it in 1976, and in that time he did not fight in Vietnam; he did not invade the Bay of Pigs; he did not guard Western Europe with tanks, or help build nuclear launch sites beneath the Arctic ice. Instead, he became the military's leading expert in a secret Cold War experiment: to fight enemies with clouds of psychochemicals that temporarily incapacitate the mind—causing, in the words of one ranking officer, a "selective malfunctioning of the human machine." For nearly a decade, Ketchum, a psychiatrist, went about his work in the belief that chemicals are more humane instruments of warfare than bullets and shrapnel—or, at least, he told himself such things. To achieve his dream, he worked tirelessly at a secluded Army research facility, testing chemical weapons on hundreds of healthy soldiers, and thinking all along that he was doing good.

At an Army research facility, a soldier given a powerful mind-altering drug said, "I feel like my life is not worth a nickel here."
Photographs by Stills from "The Longest Weekend" / US Army Chemical Research & Development Laboratories / Courtesy James Ketchum

Today, Ketchum is eighty-one years old, and the facility where he worked, Edgewood Arsenal, is a crumbling assemblage of buildings attached to a military proving ground on the Chesapeake Bay. The arsenal's records are boxed and dusting over in the National Archives. Military doctors who helped conduct the experiments have long since moved on, or passed away, and the soldiers who served as their test subjects—in all, nearly five thousand of them—are scattered throughout the country, if they are still alive. Within the Army, and in the world of medical research, the secret clinical trials are a faint memory. But for some of the surviving

test subjects, and for the doctors who tested them, what happened at Edgewood remains deeply unresolved. Were the human experiments there a Dachau-like horror, or were they sound and necessary science? As veterans of the tests have come forward, their unanswered questions have slowly gathered into a kind of historical undertow, and Ketchum, more than anyone else, has been caught in its pull. In 2006, he self-published a memoir, "Chemical Warfare: Secrets Almost Forgotten," which defended the research. Next year, a class-action lawsuit brought against the federal government by former test subjects will go to trial, and Ketchum is expected to be the star witness.

The lawsuit's argument is in line with broader criticisms of Edgewood: that, whether out of military urgency or scientific dabbling, the Army recklessly endangered the lives of its soldiers—naïve men, mostly, who were deceived or pressured into submitting to the risky experiments. The drugs under review ranged from tear gas and LSD to highly lethal nerve agents, like VX, a substance developed at Edgewood and, later, sought by Saddam Hussein. Ketchum's specialty was a family of molecules that block a key neurotransmitter, causing delirium. The drugs were known mainly by Army codes, with their true formulas classified. The soldiers were never told what they were given, or what the specific effects might be, and the Army made no effort to track how they did afterward. Edgewood's most extreme critics raise the spectre of mass injury—a hidden American tragedy.

Ketchum, an unreconstructed advocate of chemical warfare, believes that people who fear gaseous weapons more than guns and mortars are irrational. He cites approvingly the Russian government's decision, in 2002, to flood a theatre in Moscow with a potent incapacitating drug when Chechen guerrillas seized the building and took eight hundred theatregoers hostage. The gas debilitated the hostage takers, allowing special forces to sweep in and kill them. But many innocent people died, too. "It's been looked at by some skeptics as a kind of tragedy," Ketchum has said. "They say, 'Look, a hundred and thirty people died.' Well, I think that a hundred and thirty is better than eight hundred, and it's also better, as a secondary consideration, not to have to blow up a beautiful theatre."

Not long ago, while debating critics of Edgewood on a talk-radio show, Ketchum argued that the tests were a sensible response to the threats of the Cold War: "We were in a very tense confrontation with the Soviet Union, and there was information that was sometimes accurate, sometimes inaccurate, that they were procuring large amounts of LSD, possibly for use in a military situation." The experiments, he has said, were no more problematic in their conduct than civilian drug testing at the time.

But Ketchum is an unpredictable apologist. His default temperament is that of an unbiased scientist, trying to solve a stubborn anomaly that just happens to be his life's work. He accepts criticism of Edgewood thoughtfully and admits the possibility that he is seeing the experiments through a prism of benign forgetfulness. At the same time, as Edgewood's sole public defender, he must relive history under an unforgiving spotlight. Ketchum often hears from aging test subjects looking for information about what the Army did to them. "I need to know everything that happened to me because it could give me some peace and fewer nightmares," one veteran wrote to him. In such cases, Ketchum responds with a mixture of defensiveness and empathy. "Well, Mike," he wrote to another veteran, "I guess some people find it satisfying to look back and condemn what doctors and others did half a century ago, especially if it lends itself to sensationalized movies, and entitles them to disability pensions." Many of his Edgewood colleagues are far less sanguine about what they did; one told me, "I want to see something happen so this doesn't happen again." But Ketchum often wins over skeptics. After many e-mails, Mike told him, "I am certain you did the work for the same reason most of us

volunteered. It needed to be done."

Now retired in northern California, Ketchum has built friendships with psychedelic pioneers, who must also wrestle with the legacy of their work: the bad trips, the personalities misshapen by drugs. In 2007, Ketchum went to Burning Man with his friend Alexander Shulgin, known for promoting the drug Ecstasy. Before they met, Shulgin thought that Ketchum's research methods were immoral. "To bring a human subject into a psychological storm of this type without preparing him for what might happen, and at the end of his experience to release him to his own devices without having counselled him of the strengths and weaknesses of what did happen, shows a complete disregard of the value of that person," he had said. But Ketchum evidently convinced him that he was not beyond redemption; in a foreword to Ketchum's memoir, Shulgin wrote, "It is a pleasure to be able to contribute to this story."

"I was working on a noble cause," James Ketchum said of his chemical–weapons tests. Still from untitled test video / Courtesy James Ketchum

Earlier this year, I visited Ketchum in Santa Rosa, where he lives with his fifth wife, Judy Ann Ketchum, in a modest, one-story house in a quiet suburban enclave. Ketchum answered the door in a beige tracksuit. He has the trim stature of an aging athlete, and is tall enough to fill a doorframe, but he is not imposing—his temperament is too readily open, his blue eyes too gently inquisitive. Judy, a retired nurse, is a photographer and artist. In the living room, one of her projects, a platinum-blond mannequin dressed in sequins, stands next to an upright piano, which Ketchum plays. Large closeups of flowers that she has photographed are in every room. The Ketchums are a political hybrid:

right-leaning but bohemian, religious but not dogmatic, conservative but open to drug use.

We retreated to a small office to talk. In person, Ketchum projects the image of a man so lost in abstraction that he is easily taken in. As we sat down, he said, "I give money to people who never give it back." He once gave twenty thousand dollars to a German teacher who said that he was starting a charity; the man took the money and vanished: "He used it to go visit a woman, got drunk with her for four days. I never got it back." Another swindler took his money for good works in Argentina, which never materialized. "I don't think about that stuff," Ketchum told me.

Rows and rows of binders belonging to his archive towered beside us. The trove—including hundreds of pages of sensitive government documents—was an armamentarium of sorts, which Ketchum had been using to inoculate the arsenal's achievements against obscurity or ill repute, or perhaps just to stir up a little trouble. Lawyers had been arguing over the papers; the C.I.A. had been pressuring him to turn them over. He glanced at the volumes. "They contain a lot of data, with names, doses, graphs of what we did," he said. "That is definitely something the government would not want to spread around." When Ketchum left the arsenal, the archive left with him. "It could have been shredded," he told me. "It could have been locked away."

The collection seemed to be a living thing, metamorphosing over time as he organized it and re-organized it. I picked up a binder and found a description of the records as he began to save them: "The accumulating volumes stood in rows at first, and then merited their own file cabinet, and eventually, years later, exceeded the capacity of two four-drawer, legal-width, fireproof safes, the unsorted backlog being packed in boxes in the attic, the garage, and a rented storage room." At times, Ketchum regarded the trove as a vehicle for self-study, but in pessimistic moments he has thought of Jacob Marley—Dickens's ghost, consigned to purgatory because he had hurt people and lacked the requisite regret to make amends—and wondered if his archive "would eventually become like Marley's chains, dragging and clanking behind him in a hideous snakelike procession."

When the lawsuit was filed, in federal court four years ago, a lawyer from the San Francisco firm Morrison & Foerster came calling. He asked Ketchum if he had saved many primary sources. Ketchum turned over the entire trove. "Be open with someone and he'll reward you," he told me. Later, during a fifteen-hour deposition, Ketchum answered questions freely, often over his attorney's objections. He seemed ready to testify—ready for the authority and attention bestowed upon a star witness, ready to put to rest questions about the experiments.

Before I left, Ketchum promised to send me a full digital copy of his archive. A week or so later, a binder arrived at my office, decorated with a photograph of the two of us, which Judy had taken. Inside, Ketchum had constructed a meticulous index to the papers, and for months afterward the raw material came in waves. There were technical reports and scientific tables, lists of soldier volunteers and their test data. There were memos and letters. There were personal items, too: golf scorecards, family photographs, college essays, data on the sale of a house. "I made a list of all the jobs I had in my green notebook, which is the kind of thing I carried around," Ketchum had told me. "I also made a list of all the drugs I've taken." Tens of thousands of pages of scanned material began to fill up my hard drive. "This is me," he seemed to be saying. "This is what I did. You be the judge."

II

"This shall be the story of the fall of a human soul—a fall which is great," Ketchum wrote when he was a freshman at Dartmouth, working on a play. "Daily, souls are broken. Great men—not great in accomplishment, but great potentially—are rendered forever impotent. This is the tragedy of lost aspiration, defeat, despair." Ketchum envisioned his protagonist as a young man much like him: a bright student, full of potential, but lost in an institution that was against him, and suffering from a tragic flaw. "The fact is," he wrote, "he is too ardent, too intense, too uncompromising in his ambitions."

When Ketchum was eight, his ambition was "to become a scientist and help struggling humanity." Born in Manhattan during the Depression, and brought up in Brooklyn and in Forest Hills, he was academically inclined, competitive, enthralled with tennis. His mother was a secretary, and his father, who went to college at the age of sixteen and was fluent in many languages, managed two hundred operators for the New York Telephone Company. "He was very religious," Ketchum says. "Not in a harsh, demanding way but in a reverential sense." Ketchum's father was the right-hand man of Norman Vincent Peale, the pastor of Manhattan's Marble Collegiate Church and the author of "The Power of Positive Thinking." Peale believed that suffering was largely a thing of the mind, and that faith and "right thinking" could eliminate it. "Truth always produces right procedures and therefore right results," he wrote.

At Dartmouth, Ketchum was easily distracted. He settled on a double major, psychology and philosophy, but he was not a natural philosopher. "It is a mistake to ask unanswerable questions," he wrote in one assignment. He became obsessed with his high-school sweetheart, an aspiring actress in New York, and impulsively persuaded her to marry him and run off to Africa or Latin America. They made it only as far as Florida before they returned to Dartmouth—where they found that the marriage voided Ketchum's scholarship, and had to move into a repurposed barracks near campus. The following year, Ketchum changed paths again: he transferred to Columbia University and, later, enrolled in Cornell University Medical College, to study psychiatry. In New York, he and his wife, living in a rented room with no heat, decided to split up. Ketchum began taking ten milligrams of Dexedrine, first intermittently, then three times a day—a habit that he maintained for decades—and he studied in bouts, memorizing swaths of information. Still, he says, "I couldn't get awards. They wouldn't give me cum laude, even."

Perennially broke, Ketchum decided to join the Army. "It was too much to resist," he wrote in his memoir. "No longer would breakfast consist of an old pickle jar half-filled with black coffee." In 1958, having graduated from Cornell, he took a job at the Walter Reed Army Institute of Research. He often woke up at four-thirty in the morning to study cybernetics, and once filled half a room with a gravity-operated "computer" built from soda straws and Tinker Toys. "It produced nothing," he later wrote, "yet it illuminated that which could not be seen—a logical process." When the computer did not impress his mentor, he launched another project. During a Thanksgiving holiday, when Walter Reed's laboratories were empty, he opened up a cat's brain and embedded electrodes in it, to see if he could give the animal a new way to communicate. He left to play tennis, thinking that a veterinarian would care for the animal, and returned, a week later, to find the cat half-dead from an infection. He tried to nurse it to health in his bathtub, but it had sustained permanent brain damage.

Ketchum's mind was whirring. He submitted articles to *The New Yorker* and other magazines, and sent an essay, titled "Sex in Outer Space," to *Playboy*. He began to bring a manual typewriter into sessions with patients, typing up every word they said in a maelstrom of clicks and clacks. He showed his notes to a superior, David McKenzie Rioch, the chief

of neuropsychiatry at the institute, who suggested that he be more discriminating. But Ketchum was fascinated less by the patients than by the process. Ultimately, he wanted to conduct research, and so in 1960, when Rioch pulled him aside and said, "There is a situation at a place called Edgewood Arsenal," he listened intently.

Edgewood had been built in a fit of urgency during the First World War, when weaponized gas—chlorine and, later, mustard—was used to devastating effect in the trenches of Europe. Fritz Haber, the German scientist who pioneered the rise of chemical weapons, proclaimed, "In no future war will the military be able to ignore poison gas. It is a higher form of killing." The U.S. Army took the threat seriously, and launched a program to study the chemicals, building laboratories and gas chambers in order to test human subjects. "We began to hear about the terrors of this place," a private wrote in 1918. "Everyone we talked to on the way out here said we were coming to the place God forgot! They tell tales about men being gassed and burned."

After the Second World War, intelligence reports emerged from Germany of chemical weapons far deadlier than mustard or chlorine. The new compounds, which had evolved out of research into insecticides, were called nerve gases, because they created a body-wide overflow of the neurotransmitter acetylcholine, often triggering organ failure and near-sudden death. The Reich had invested primarily in three—tabun, soman, and sarin—and the victorious powers rushed to obtain them. The Soviet Union secretly dismantled an entire nerve-gas plant and relocated the technology behind the Iron Curtain. The American government, for its part, acquired the Nazi chemical formulas—and, in some cases, the scientists who developed them—and brought them to Edgewood.

The Army decided to pursue sarin. The chemical was about twenty-five times as deadly as cyanide, and readily made into an aerosol. It was virtually impossible to handle without casualties; in one year, seven technicians required immediate treatment following accidental exposure. As the vapor was released after tests, birds passing over the flue of the gas chambers fell dead, and had to be cleared off the roof. In experiments that the arsenal contracted at Johns Hopkins University, researchers gave sarin to healthy volunteers in cups of water over three days. Some of the subjects were severely poisoned; they twitched, vomited, and had trouble breathing.

Early nerve-gas experiments focussed on the extreme lethality of the chemicals, and on antidotes, but researchers at Edgewood also began to take note of the chemicals' cognitive side effects. Subjects often felt giddy at first, then deeply anxious. Some had nightmares or lost sleep and became depressed. A secret 1948 study on the poisoned Edgewood technicians noted that "the outstanding feature of these cases appears to be the psychological reactions," and its author wondered how "young men having no experience or knowledge" of the chemicals would react. A senior official at the arsenal had observed that men exposed to highly diluted tabun "were partially disabled for from one to three weeks with fatigue, lassitude, complete loss of initiative and interest, and apathy."

I spoke to a former Edgewood test subject who was given the nerve agent VX, which, when applied to the skin, is a hundred times as deadly as sarin. An officer came to his bedside to draw a small circle on his arm, and then a doctor with a syringe squirted on a drop of liquid. The effect was rapid. The subject heard other people groaning—one man said, "Oh, shit"—but he felt only a calm disassociation from his environment. There was a radio on in the room, but the words made little sense. When he was given food, he didn't know what to do with his utensils. "I was not in control," he told me. "It was incredible. This tiny drop had rendered me helpless." As the test continued, he was seized by an

agonizing wave of tension, as if each nerve ending were being crushed in a vise. "It was intense," he told me. "My body was clenched. All of my nerves were tight, physically and mentally."

In 1949, L. Wilson Greene, Edgewood's scientific director, typed up a classified report, "Psychochemical Warfare: A New Concept of War," that called for a search for compounds that would create the same debilitating mental side effects as nerve gas, but without the lethality. "Throughout recorded history, wars have been characterized by death, human misery, and the destruction of property; each major conflict being more catastrophic than the one preceding it," Greene argued. "I am convinced that it is possible, by means of the techniques of psychochemical warfare, to conquer an enemy without the wholesale killing of his people or the mass destruction of his property."

In its broad strokes, "Psychochemical Warfare" fit within the evolving ethos at Edgewood: better fighting through chemistry. The first commanding general of the Army's Chemical Warfare Service had extolled the "effectiveness and humaneness" of gases: they killed quickly, and kept infrastructure intact. Psychochemical warfare certainly promised a form of conflict less deadly than clouds of sarin—even more humane, in that sense, perhaps. But Greene did not want to elevate consciousness; he wanted to debilitate, in ways that would inspire terror. As he put it, "The symptoms which are considered to be of value in strategic and tactical operations include the following: fits or seizures, dizziness, fear, panic, hysteria, hallucinations, migraine, delirium, extreme depression, notions of hopelessness, lack of initiative to do even simple things, suicidal mania."

Greene drew up a list of chemicals to investigate, ranging from barbiturates to carbon monoxide, and he urged a deeper inquiry into the psychological effects of nerve gas. Enoch Callaway, a Navy psychiatrist who arrived at Edgewood in 1950, recalled, "I was told that I needed to measure 'nervousness,' because nerve gas was supposed to make you nervous." So he designed a test: people given sarin were blasted with noise to measure how much they jumped. "We figured out that nerve gas actually reduced anxiety in doses that did not cause convulsions." The work, he insisted, was conducted responsibly, with a sense of urgency now hard to understand: "We didn't know that chemical warfare was going to disappear so thoroughly."

In the mid-nineteen-fifties, psychochemical warfare was formally added to Edgewood's clinical research, and approval was granted to recruit soldiers from around the country for the experiments, in a systematic effort called the Medical Research Volunteer Program. The Army assured Congress that the chemicals were "perfectly safe" and offered "a new vista of controlling people without any deaths"—even though early efforts to make weapons from mescaline and LSD were dropped, because the drugs were too unsafe or too unpredictable. Congressional overseers, terrified of Soviet military superiority, were ready to lend support. The Red Army had an extensive chemical-warfare program, and evidence suggested that it had an interest in "psychic poisons," used to trigger mental illness. "Some foreign enemy could already be subjecting us in the United States to such things," one panicky legislator proclaimed during a hearing. "Are we the ones receiving it now? Are we the rabbits and guinea pigs?"

Edgewood began reviewing hundreds of chemicals, many provided by pharmaceutical companies. One officer remarked, "The characteristics we are looking for in these agents are in general exactly opposite to what the pharmaceutical firms want in drugs, that is the undesirable side effects." Starting in 1959, the arsenal aggressively pursued phencyclidine—or PCP—which Parke, Davis & Company had marketed as an anesthetic but abandoned because patients were having

hallucinations and delusions. Edgewood doctors tested it as an aerosol and surreptitiously gave it to soldiers to see if they could then "maintain physical security over simulated classified material." One subject—who had been exposed to sarin gas a week earlier—was handed a glass of whiskey laced with twenty milligrams of PCP. "Manic reaction and much hostility," a doctor observed. The subject passed out, and began breathing in a pattern associated with neurological trauma or cardiac stress.

Rioch told Ketchum that another volunteer had ended up in the hospital for six weeks. "He had a paranoid reaction that didn't go away after the drug wore off," Ketchum recalled. The trials with PCP were eventually dropped, but stories of other problem cases circulated. A military advisory council decided that the arsenal was ill equipped for the newer line of research. "It seems important to undertake immediately a program to develop sound, fundamental techniques of assessing abnormal behavior," its members noted. "The services of people trained in this field, such as psychologists, psychiatrists and neuro-physiologists should be obtained." Edgewood, in other words, needed young doctors just like Jim Ketchum.

III

In October, 1960, Ketchum drove out to the secluded arsenal, to meet with Colonel Douglas Lindsey, its chief medical officer. Lindsey, a veteran of the Korean War and a storied Army surgeon, was an athletic, small-framed man, with dash-mark lips. He was known for his affectations, including a pink convertible—which he drove with the top down, rain or shine—and a silver-tipped swagger stick made of a human fibula. A master parachutist, he sometimes jumped out a second-floor window after lunch.

"Captain Ketchum, I presume," Lindsey said. "You must be the psychiatrist we've all been waiting for." Right away, Ketchum noticed that the arsenal was a different kind of military outfit. "He led me across the parking lot to some wooden barracks, where World War II Chemical Corps soldiers had once resided," Ketchum wrote in his memoir. "It wasn't very impressive-looking—several cantonment style claptrap wooden buildings joined together by one long narrow hallway."

As they approached, another doctor walked over, and Lindsey made an introduction. "You've come on a good day," the doctor said. "We're running another test with a drug called EA 2277." No one explained what the chemical was, and Ketchum did not ask, sensing that it was a secret. They entered a hospital-like ward, and headed toward one of the bunks, stopping near a delirious soldier who was maniacally struggling to stuff a pillow into a pillowcase. "He's a bit out of it right now," the doctor said. "So I don't think I can introduce you. He wouldn't understand who you are."

Ketchum was introduced to Van Murray Sim, an internist, who had set up the Medical Research Volunteer Program. Sim was an intense, towering figure, a former football player, who at one point weighed nearly three hundred pounds. Born in central Washington State, in a remote town called Cashmere, he maintained the sensibility of a pioneer. He made a point of trying drugs before they were tested on soldiers; the Army had even granted him its highest civilian award, in part "for volunteering to be the first to expose himself to several new chemical agents at the risk of grave personal injury." At such moments, Edgewood doctors would crowd around Sim, tending to his gargantuan supine body. "I am trying to defeat the compound," he once declared. Sim conceived the arsenal's work as a kind of mini-

Manhattan Project, arguing that a nerve-gas attack was even less forgiving than atomic fallout. "If we inhale minute doses of nerve gas for a few seconds, we shall be dead in a few minutes unless adequate treatment is afforded on the spot," he had warned. "There is no time."

Without seeing much more, Ketchum knew that he would return. These people, he sensed, were like him: Army nonconformists who were curious about the new science of the brain and relatively untethered by military formality. "There was no doubt in my mind that working in this strange atmosphere was just the sort of thing that would satisfy my appetite for novelty," Ketchum wrote. By February, 1961, he had remarried; his first child had just been born, and he moved to Edgewood with his family, confident that an opportunity to conduct new, ambitious research was at hand.

Edgewood was a citadel of secrets. A sign on a door in the Medical Research Laboratories read, "What you see here, hear here—when you leave here, leave it here!" Ketchum was given an office in an annex for physicians. "I remember coming in at night and feeling a spooky 'Twilight Zone' sensation, when walking alone through its deserted halls," he wrote. It was possible to socialize with other scientists and have no idea what they did. Not all the work had to do with weapons: Edgewood technicians were the first to design protective vests from Kevlar, and mustard experiments provided the basis for early cancer chemotherapies. The physiologist John Clements made a discovery about how surfactants behaved in the lungs which later saved the lives of hundreds of thousands of children.

The psychochemical-warfare program was a small part of the over-all research, and in many respects it was the strangest. Once, Ketchum walked into his office and found a barrel the size of an oil drum standing in a corner. No one explained why it was in his office, or who had put it there. After a couple of days, he waited until evening and opened it. Inside, he found dozens of small glass vials, each containing a precisely measured amount of pure LSD; he figured there was enough to make several hundred million people go bonkers—and later calculated the street value of the barrel to be roughly a billion dollars. At the end of the week, the barrel vanished just as mysteriously as it had appeared. No one spoke about it. He never learned what it was for.

After receiving a security clearance, Ketchum was told that EA 2277 was 3-quinuclidinyl benzilate, or BZ—a pharmaceutical, intended as an ulcer therapy, that was rejected after tests found it unsuitable. Infinitesimal amounts could send people into total mental disorder. BZ is an anticholinergic, similar to atropine or scopolamine, which are used in medicine today. At high doses, such drugs trigger delirium—a dreamlike insanity usually forgotten after it subsides. Sim, one of the first doctors to try BZ, later proclaimed that it "zonked" him for three days. "I kept falling down," he said. "The people at the lab assigned someone to follow me around with a mattress."

One night, Ketchum was observing soldiers on BZ when Sim wandered into the ward. "What are you doing here?" Sim asked. From the waist down, he was wearing only underwear.

Ketchum tried to size up his superior; in addition to his self-experiments, Sim habitually took Demerol. "I sometimes come in late at night to check on the guys," Ketchum told him. "They get pretty interesting around midnight. What are you doing?"

Sim had a watch faceplate taped to his wrist. "I'm trying to see if LSD has any effect through the skin," he said. "I've got it in some ethylene glycol under this watch glass. So far, it hasn't had any particular effect."

For years, Sim had been overseeing secret intelligence experiments at Edgewood. At one point, he did research for the C.I.A. on a BZ-type drug, called the Boomer, that causes delirium for as long as two weeks. The agency wanted to know if it could be administered through the skin. Could a Soviet agent brush some on silverware at a diplomatic party and cause an American official to go crazy? Could an operative dose an adversary with a handshake? Sim initiated trials at the arsenal and at Holmesburg Prison, in Pennsylvania, with which Edgewood had contracted to conduct experiments on inmates.

Testing psychochemicals for intelligence purposes, Sim appeared to believe, required a uniquely loose protocol: the goal was to control the mind, and the subject's expectations of the drug's effect mattered. He often gave LSD to people without warning. Not long after arriving at Edgewood, Ketchum took to playing tennis with a commanding officer at the arsenal, who, after a match one day, described how Sim had spiked his morning coffee with LSD. "He was pissed off as hell," Ketchum told me. LSD had been mixed into cocktails at a party, and into an Army unit's water supply. Some men handled it fine; some went berserk. A test subject in 1957 exhibited "euphoria followed by severe depression, anxiety, and panic—feeling he was going to die," according to his chart. Another test involved intelligence specialists who were blindfolded and placed in an isolation chamber. "Only one subject was in a condition to undergo extended interrogation," a report concluded. "A second subject fled from interrogation in panic."

Ketchum later wrote of Sim's "hare-brained experiments" and his "lack of scientific (and ethical) judgment." The Army had apparently reached the same conclusion. In 1959, responsibility for the volunteers was taken from Sim—who was eventually given the new title of chief scientist—and transferred to Lindsey, a more capable leader, though not immune to bouts of recklessness himself. To demonstrate the effects of VX, he was known to dip his finger in a beaker containing the lethal agent, then rub it on the back of a shaved rabbit; as the animal convulsed and died, he would casually walk across the room and bathe his finger in a Martini to wash off the VX. "I thought they were crazy," a doctor who served under him told me. "I was going to New York, and Colonel Lindsey tells me, 'How about taking a vial of nerve gas to New York to make a demonstration.' And I am looking at the guy and thinking, If I have an accident on the Thruway, I could kill thousands of people—*thousands* of people. I said, 'No. It's that simple.' "

Nonetheless, Lindsey was more circumspect than Sim. He had tried LSD and thought it impractical. In 1960, he told an audience of military doctors, "It may be possible to so dose a man that he would describe an enemy soldier as green-and-purple-striped, cuboid, and nine feet tall, but this is not incapacitation so long as he can still recognize this apparition as an enemy, and can shoot him or impale him on a bayonet." When Army brass requested demonstrations of LSD's effects on the volunteers, Lindsey refused, risking insubordination.

The differences between Lindsey and Sim reflected deeper tensions that the Cold War imposed upon the doctors at Edgewood: men who sought to remain ethical as they advanced the frontier of military research. Sim appeared to believe that personally sampling every chemical agent made him free to circumvent conventional standards; "I have to live with myself," he once said. Lindsey had an officer's protectiveness for the enlisted men. Many of the Army doctors —draftees, like the volunteers—who worked under both men strove to reconcile their military obligations with their medical commitments. "As doctors, we are used to treating people who are sick, not making them sick," one told me. "I did not like the idea of what I was doing with individual human beings. But I understood what I was doing in the context of the defense of this country."

For Ketchum, questions about the morality of chemical-weapons research rested in the details of its execution. He hoped to bring to Edgewood the rigors of civilian science, even if the questions asked were strictly military. The Army wanted to know to what degree an "incapacitating agent" could incapacitate, and how its effects could be reversed. Ketchum accepted the goal, and decided to make the trials as systematic, and as precise, as possible. He became an architect of mental debilitation. He enjoyed the work.

Ketchum enlisted Lindsey's support to bring order to the psychochemical experiments, and insists that he discontinued Sim's practice of giving drugs to men without their knowing. Medical records on test subjects had been kept haphazardly; some of the doctors even departed with them, making it impossible to know exactly what had been done to previous volunteers. Ketchum campaigned to have data centralized, and hired nurses.

He also took over the study of BZ. The drug fascinated him. Exposed soldiers exhibited bizarre symptoms: rapid mumbling, or picking obsessively at bedclothes and other objects, real or imaginary. "Subjects sometimes display something approaching wit, not in the form of word-play, but as a kind of sarcasm or unexpected frankness," he wrote in a report for Sim. The drug's effect lasted for days. At its peak, volunteers were totally cut off in their own minds, jolting from one fragmented existence to the next. They saw visions: Lilliputian baseball players competing on a tabletop diamond; animals or people or objects that materialized and vanished. "I had a great urge to smoke and, when I thought about it, a lit cigarette appeared in my hand," a volunteer given a drug similar to BZ recalled shortly after the experiment. "I could actually smoke the cigarette."

Soldiers on BZ could remember only fragments of the experience afterward. As the drug wore off, and the subjects had trouble discerning what was real, many experienced anxiety, aggression, even terror. Ketchum built padded cells to prevent injuries, but at times the subjects couldn't be contained. One escaped, running from imagined murderers. Another, on a drug similar to BZ, saw "bugs, worms, one snake, a monkey and numerous rats," and thought his skin was covered in blood. "Subject broke a wooden chair and smashed a hole in the wall after tearing down a 4-by-7-ft panel of padding," his chart noted. Ketchum and three assistants piled on top of the soldier to subdue him. "He was clearly terrified and convinced we were intending to kill him," his chart said.

One night, Ketchum rushed into a padded room to reassure a young African-American volunteer wrestling with the ebbing effects of BZ. The soldier, agitated, found the air-conditioner gravely threatening. After calming him down, Ketchum sat beside him. Attempting to see if he could hold a conversation, Ketchum asked, "Why do they have taxes, income taxes, things like that?"

The soldier thought for a minute. "You see, that would be difficult for me to answer, because I don't like rice," he said.

"Yeah," Ketchum said.

The soldier peered forward, and suddenly seemed to be addressing an imaginary person. "If you want the pack, I'll cut the pipe," he said, using his hands to emphasize what he would do. "Then we'd put it in a vise, cut it to the inch you want. That's three different ways."

"Right," Ketchum said, and thought up another question. "If you had three wishes—you could wish for anything you wanted—what would your three wishes be?" he asked.

The man took a second to consider this. “No. 1,” he said. “I wish that the world would stop acting like kids, and act like grown people.” Then he went silent.

“No. 2?” Ketchum asked.

“No. 2, where I would like to be?” the man said. “Cause I feel like my life is not worth a nickel here anyway, I think I would rather go back to Massachusetts, back to my home unit.”

“Are you in danger here?” Ketchum asked.

“I feel that I am, sir,” the soldier said.

“What’s the danger here?” Ketchum said.

“The danger to me is—a man don’t have to cheat me, or stick me, he can just frighten me,” the soldier said. Gesturing to a spot of bare floor in the padded room, he said, “It could make a person fall down those steps if they do it at the right time—and I just don’t feel that I am safe, here, in the house.”

IV

By the time Lindsey’s term as chief medical officer ended, in the early sixties, he had grown disenchanted with the Medical Research Volunteer Program. “These soldiers are not really informed at all,” he told Malcolm Bowers, an Edgewood medical officer who later became a professor at Yale. Little was known about the long-term effects of the experiments, and yet the volunteers, after a stay at the arsenal, were blindly pushed back into the Army at large, with no follow-up care. In a self-published memoir, “Men and Poisons,” Bowers recalls Lindsey wondering if the lack of follow-up stemmed from the Army’s fear that such a program would disclose concern about lasting health effects. Sim later offered a more mundane reason: insufficient funding.

For many doctors at Edgewood, the memory of the Second World War, and the horrific experiments carried out by Nazi scientists, remained potent. After the war, the Nuremberg Code established an ethical framework for medical experiments, and its principles were incorporated into Army doctrine. The code begins with a clear premise: “The voluntary consent of the human subject is absolutely essential.” That consent must flow from an “enlightened decision,” shaped by a true understanding of the test’s medical risks. Moreover, human experiments must be preceded by animal studies, and conducted in pursuit of a greater social good—with risks never exceeding “the humanitarian importance of the problem.” If a subject is unable to endure the experiment, or if a researcher believes there is a probability of injury, the test must end.

For decades, Ketchum has contested the idea that soldiers were tricked into participating in the tests. In “Chemical Warfare: Secrets Almost Forgotten,” he addresses the question head on. “Unwitting guinea pigs?” he writes. “Naïve young men taken in by Army propaganda? Mentally marginal soldiers who could not make good decisions? Ignorant individuals who didn’t know what they were getting into because of tight secrecy? In my view, none of the above!” In another passage, Ketchum describes giving the sedative Seconal to a sergeant. “He proudly informed me beforehand

that this was his sixth visit and he would no doubt be back again next year," he wrote. "I had to tell him that this was unlikely—it would be unfair to all the other soldiers who wanted to be part of the program."

In fact, the Medical Research Volunteer Program initially had difficulty attracting volunteers, so monthly quotas were established to insure a steady supply of research subjects. Recruiters fanned out to Army facilities across the country; some commanders even ordered men to attend the sessions. Ketchum insists that there was never any ambiguity about the drug experiments during the recruitment process, but people who attended the sessions came away with an uncertain sense of what they were being asked to do. A number of them told me that recruiters advertised the program in vague terms, as human behavioral studies, or equipment testing, or medical research. Inducements were offered, too. Soldiers could spend time near several large East Coast cities, and would be given three-day weekend passes to explore them. There would be extra pay, and few responsibilities, aside from showing up at a test. Many men spent much of their stay playing Ping-Pong and watching movies. When it came time for volunteers to leave—at first, they were asked to serve for a month, later two months—a letter of commendation would enter their file. In the sixties, the arsenal offered an even more powerful incentive: time away from Vietnam.

Once the volunteers arrived at Edgewood, they were given medical and psychological examinations, and were divided into four groups. The least healthy would be used to test equipment. The top twenty-five per cent—the Astronaut Class, as Ketchum once called them—would typically be prepared for the most dangerous chemicals. Doctors informed the volunteers in generalities and asked them to sign a consent form—usually long before any specific test was announced. The forms were designed to offer few details; as one version was drafted, the words "mental disturbance or unconsciousness" were replaced with "discomfiture." Sometimes a little more information would be provided just before the test began, but not always. Van Sim later confessed that researchers testing nerve gas would tell volunteers that the drug might give them a "runny nose" or a "slight tightness of the chest." In 1961, a volunteer from Kansas, named John Ross, was given soman, a highly persistent nerve agent. Only when the needle was in his arm did he overhear the doctors saying that he had been given something lethal. "I started having convulsions," he told me. "I started vomiting. One of the guys standing over me said, 'We gave you a little too much.' They told me to walk it off. I started to panic. I thought I was going to die." Ross became rigid and was rushed to Walter Reed. For years afterward, he suffered from insomnia and depression.

Test subjects had a right to decline an experiment—assuming that they knew they were part of one—but they almost never did. "There was no question that they would participate," Bowers recalled. Withdrawing from a test required backing down from a commitment to one's superior, which was anathema in the Army. "In the military, if you don't do something you will be ostracized," a soldier given LSD in 1958 told me. "I believe they did give us the option to leave, at first, but you didn't really have a choice once you were in."

The ambiguities of the recruitment process, the classified nature of the research, and the highly selective way that doctors followed Army policy has left behind irreconcilable memories. Gerald Elbin, one of Ketchum's first BZ test subjects, told me that he did not know exactly what he was signing up for when he volunteered, but he enjoyed his time at Edgewood. "It was O.K. to say no," he said. "There wasn't any hammer coming down on you."

The same day Elbin was given BZ, Ketchum gave the drug to Teddie Osborne, who had been stationed at the Yuma Test Center, in Arizona, where he was using a crude detector and a caged rabbit to look for chemical leaks. Osborne

thought that his work would not change much at Edgewood. "It wasn't really explained," he told me. At the arsenal, he was assigned to help manage the recruits; he liked the work and volunteered again. The second time, he was told that he was going to be a subject. He felt tricked. "I could not have said no," he told me. "You are dealing with professionals. We were very gullible." One Wednesday, Osborne was injected with BZ, and ushered into a padded room. He had no idea what the drug was or what it would do. "I don't remember anything until Saturday," he told me. "That was so disturbing. Later, it still haunted me."

Before Ketchum wrote his memoir, he had tried to sort out his experiences in a series of half-finished manuscripts, variously titled "Aerosol One" or "LSD Forever" or "The Black Drum" or, simply, "Jim." Most of them are romans à clef, though that term suggests too great a departure from reality, as many people in them are named, and all of the events are genuine. In these early attempts at telling his story, the volunteers—the men he drugged—barely figure. Instead, Ketchum's focus is himself, under different pseudonyms: Peter (Micro) Hansen ("competent and charismatic and soon aggressively takes over, with impressive results"), James McFarley ("a moderate thirst for opponents, human and inanimate"), Dr. McSorley ("nothing if not a man of action—impulse, if the truth be known").

Ketchum's manuscripts—often written in a faux-hardboiled style—document his ambitions and grandiosity, his insecurities and ambivalence. "Why was a kook like him picked for a politically delicate, high profile, security headache?" he wrote of himself. "Here he was cranking literally hundreds of unblemished, freshly washed and combed, bright-eyed young men through a drug machine. Making them nuts for a few hours or a few days, and then, like calves who had been branded, watching them for a short time to be sure they were okay, and sending them back to their pastures. It was such a risk, if you looked at it objectively."

By Ketchum's second year, the arsenal's drug machine was spinning at high velocity. "I was working on a noble cause," he later explained. "The purpose of this research was to find something that would be an alternative to bombs and bullets." But, clearly, he also saw in the experiments a vehicle for attaining greatness. In an outline for "Jim," he spoke of his ambition "to create a tapestry of accomplishment, including the development of a small empire of research, the intellectual defeat of naysayers and rivals in the establishment, a reputation as a creative genius, a thriving and happy family, a chemically enhanced sense of well-being, a throng of admirers." He began to build his archive, and he worked with audiovisual specialists to turn his research into raw cinematic material.

In May, 1962, while testing BZ's effect on soldier performance, Ketchum oversaw the construction of an entire Hollywood-style set in the form of a makeshift communications outpost. The plan was to confine four soldiers to the outpost for three days. Except for one man, who would be given a placebo, the soldiers would be administered varying doses of BZ. Then, as if in a scene from the TV show "Lost," they would be radioed a stream of commands and messages, based on a fictional scenario.

Technicians built a small room out of plywood. Cots and a table were brought in, and a handheld radio and switchboard were positioned against the green walls. To help achieve realism, Ketchum added a large switch with a sign that warned "Danger—Do Not Touch." Cameras were installed behind wall panels. "It was a nervy operation, no matter how you looked at it," Ketchum wrote. "Even with an inch of padding on the walls and a two-inch foam rubber carpet to minimize the chance of injury."

Outside the door, Ketchum and several technicians crowded around monitors. After the BZ took effect, they triggered an alarm indicating a chemical attack. The men rushed to put on gas masks, but the soldier who had been given a delirium-producing dose—Ronald Zadrozny, a young Army intelligence officer—was too confused to protect himself. Zadrozny was a small, bespectacled, mild-mannered soldier, "all of which were factors in his selection for the delirium-producing dose," Ketchum later recalled. "If he panicked at some point, the others could no doubt subdue him. Assuming, of course, that the lower dosages would not render them too incompetent to react appropriately."

Zadrozny's drug-induced madness lasted for thirty-six hours. He saluted imaginary officers, at one point believing that a drape partitioning the toilet was a group of men. He became panicky, and stayed up nights, pacing and mumbling, trying to escape, either by the door or through a medicine cabinet. At one point, as Zadrozny began to improve, he sat in front of the switchboard, pencil in one hand, receiver in the other, ready for a communiqué.

"You can't hear anything unless you have the telephone up to your ear," another soldier explained.

"It wasn't working with electrodes," Zadrozny mumbled.

Two hundred phony tactical messages, warnings of chemical attacks, and intelligence were fed to the men in the room. At one point, Ketchum and the others ran out of script. "In an urgent brainstorming session, we put our heads together and came up with an agonizingly improvised scenario," he recalled in his memoir. "We told the military communicators to start sending new intelligence to the group inside the room—in a simple code. The messages informed the men that enemy forces were planning to move a train loaded with chemical weapons along a certain route." Eventually, Ketchum and the technicians resorted to gibberish, using poker terms, referring to "the dealer" and a "full house," as the BZ-addled soldiers struggled to interpret their code.

By this time, the Army was running a "crash program" to turn BZ into an operational weapon. The test with Zadrozny may have demonstrated that BZ could render a unit ineffective, but in battle the chemical would need to be sprayed, and aerosols are difficult to control, even in test conditions. Ketchum estimated that the "incapacitating dose" was forty times lower than the lethal dose. Yet some soldiers in wind-tunnel tests were getting more than intended. What would happen if a volunteer sensitive to the chemical received too much of it? Psychochemical warfare was based on the idea that the drugs had no meaningful effect on the body. But, as Ketchum's tests progressed, the results began to suggest that BZ might be more dangerous than had been imagined.

In 1962, Walter Payne, a decorated reservist from Helena, Arkansas, was instructed to inhale a cloud of BZ in a wind tunnel. Three hours later, he was totally unresponsive. Henry Ralston, now an emeritus professor of anatomy at the University of California at San Francisco, examined Payne and noted that he "exhibited signs of decerebrated rigidity with hyperextension of the back, neck and limbs, accompanied by irregular twitching movement of limbs." When I asked Ralston to interpret those symptoms, he told me, "Major head trauma, huge damage to the brain." (Ketchum made an assessment, too, noting that Payne's delirium was "moderately severe.") Payne was treated with an antidote, and was examined twenty-six days later. After an EEG test that was "essentially a normal record for his age," he was released from the arsenal and given no further follow-up.

The incident was alarming enough to delay the BZ program. Senior Army officials grew concerned that the lethal dose

of the chemical might be lower than previously thought. "We had no way to control how they breathed," Ketchum told me. He designed an apparatus to help: soldiers were attached to an oscilloscope; as they breathed, they watched a wave form, and used it to inhale a regular amount. Even so, in 1963 another volunteer, Jason Butler, Jr., went into critical condition after breathing in BZ in a wind tunnel; his temperature spiked to 103.6°, and his head started shaking spastically. He was sponged with ice and alcohol, and given antidotes. After six days, doctors released him, noting that he "appeared quite normal."

Even as it became reasonable to suspect that BZ could cause serious injury on the battlefield, the military was pushing to put it into use. In November, 1964, an Army major travelled to Edgewood on an urgent mission from Lieutenant General William Dick, the chief of Army research. Soviet trawlers had been spotted off the coast of Alaska, and Dick wanted to know if a projected cloud of BZ could disable the crew. Senior officers at the arsenal told the major that such a thing was out of the question—the chemical had not even been field-tested. Eventually, the major came to see Ketchum, who was leading a newly created group called the Psychopharmacology Branch. "The plan didn't make a whole lot of sense, and it offended me on a rational level," he wrote in his memoir. "On the other hand, the challenge ruthlessly tickled my imagination."

He typed up a plan for a large-scale experiment at the Dugway Proving Ground, in Utah. Up the chain of command, an officer with a wry sense of humor christened it Project DORK, but Ketchum, having got approval for the experiment, threw himself into it in a Dexedrine-fuelled whirlwind of activity. He spent weeks at Dugway, arranging technical details: a flatbed truck with an airtight observation booth and a platform for the volunteers to stand on; two inflatable hospital wards; a generator to create the cloud of BZ. Ketchum flew out the oscilloscopes and an audiovisual truck to document the test. "So what did I feel, as we sat in the sling seats that lined the sides of a giant fuselage, gazing at the mammoth TV truck tied down in the center bay?" he wrote. "Maybe just the way I felt in the fourth grade, sitting in a bus headed for the Wonder Bread Factory, where we would get to see fabulous machines, loading endless streams of fresh-baked bread onto conveyor belts. Then and now, I was excited and bedazzled!"

Project DORK began before dawn under a dark desert sky. Ketchum arrived with the volunteers, and helped them suit up. Covered head to toe in protective clothing and gas masks, the men looked like deep-space explorers. When the generator began to produce the cloud of BZ, spotlights tracked the chemical apparition drifting across the sky. The men stood in the haze for fifteen minutes, and then were flown by helicopter to the makeshift hospital.

Project DORK was a logistically complex experiment, and Ketchum considers it his most important military achievement; as he puts it, "A Hollywood producer might have had trouble throwing together all the features I wanted in less than a fortnight." Using footage of the experiment, he directed a film called "Cloud of Confusion," a unique artifact of Cold War propaganda, conveying in almost Kubrick-like surrealism the sublime strangeness of the experiment. It begins with shots of the large white cloud of BZ, with a narrator intoning, like a Hollywood Moses, "And on this desert / this cloud was unleashed / so men could measure / the dimensions / of its stupefying power." Bartók's "The Miraculous Mandarin" served as the score to a long opening montage, the music's spiralling scales and clanging intervals playing over footage of soldiers twisting their faces in confusion and frustration, unable to resolve phantom problems. Later segments show the men ordered to act as sentries, amid trees that had been planted for the

movie; they were hopelessly confused. Some of the volunteers saw hallucinatory bugs. "I don't know that I could describe the sickness," one of them told me. "You felt sort of punchy and spaced out." He felt odd after the test, but in a few days' time the effect vanished.

The film portrayed Project DORK in epic terms, but it also demonstrated the fundamental impracticality of psychochemical warfare. The test had to be run before dawn, or differences in temperature between the air and the ground would cause the cloud to drift away. The supply of BZ virtually ran out—even to intoxicate just eight men who were running in place, to insure that they breathed in enough, on a vehicle that was moving with the cloud. Certainly, launching billows of BZ across Arctic waters to attack moving Soviet trawlers would be futile—even if the crew was unprepared for them.

The Soviets were not ignorant of BZ, after all. Vil Mirzayanov, a chemist who conducted secret weapons research for the Soviet Union, told me that Moscow never had more than a halfhearted interest in LSD, and that its interest in BZ was strictly to keep up with Ketchum's program. "We knew the West had developed this weapon, and we were trying to copy it," he said. Soviet scientists, who called the formula Substance 78, conducted their own clinical trials with it and manufactured tons of the drug at a plant in Volsk. "But, for the military, it was absolutely useless," he told me. "Soldiers began to act like in a dream. They were not thinking; they don't need weapons—very nice, very good. The main problem was, How do you use it? For military people it was fantasy."

Ketchum took a different lesson from Project DORK. The experiment's limitations prompted him to strive for greater realism. He wanted to push the testing to its logical conclusion: a grand experiment with soldiers engaged in simulated combat while clouds of psychochemicals drifted on the battlefield. "I felt that if we are trying to sell this stuff to the military we better convince them that it could work," he told me. He told his superiors that, if such a test could not be run, then the program had no point to it.

Unsurprisingly, his proposal was rejected, and Ketchum began to think about leaving. His second marriage was in turmoil, and his work had clearly reached a ceiling; in May, 1965, he decided to apply for a two-year "sabbatical," arguing that a postdoctoral fellowship in neuropsychology at Stanford would allow him to help refine the Army's development of the new chemicals. "Any competent neuroscientist should have recognized the arguments I presented as sophomoric fantasy," he wrote in his memoir. "But I had somehow developed a reputation for being gifted within the military's higher psychiatric echelons."

Having been accepted at Stanford, Ketchum struggled with his reëntry into academia, accomplishing little. But he had ended up in the Bay Area during the Summer of Love, and after the Haight Ashbury Free Clinics opened, in 1967, he began volunteering there. Many people walking in were strung-out hippies, mistrustful of authority. While caring for them, Ketchum hid the fact that he was an officer in the U.S. Army.

Periodically, a colleague at Edgewood wrote to update him on life at the arsenal. Among the new doctors, he said, insubordination was "a big problem." Some of Ketchum's calculations documenting BZ were not adding up; aerosol tests that he had initiated with LSD—even though the Army was no longer pursuing LSD as a weapon—had resulted in overdoses, and some subjects had become extremely agitated, violent, or hypersexual. For one of the doctors involved,

the experience was "very traumatic." Ketchum thought that the overdoses were unfortunate, but that the tests were still worthwhile. "I'm glad it got pushed as far as it did," he wrote back.

In the fall of 1967, his marriage fell apart, and he moved into a Holiday Inn. By the end of the year, he wondered if he would return to chemical warfare. He considered staying at Stanford, or returning to Walter Reed, but worried that he might not be skilled or focussed enough. "They had Nobel Prize winners over there," he told me. "I was going to be in charge of *them*?" Still, he was hopeful. "I think my relative slump is only temporary," he told a friend. "I can feel a rebirth coming on." Edgewood had asked Ketchum to return as the head of the Clinical Research Department, overseeing all human experiments, and in 1968 he said yes.

V

By the late sixties, the high point of the Cold War had sloped into a murkier geopolitical condition; half a million Americans were in Vietnam, and though the Army had freely used defoliants and tear gas there, it decided not to use BZ. Popular sentiment was turning against the idea of deploying psychochemicals in war. "There are moral imponderables, such as whether insanity, temporary or permanent, is a more 'humane' military threat than the usual afflictions of war," E. James Lieberman, a psychiatric resident at Harvard, wrote in *The Bulletin of the Atomic Scientists*. In 1965, Sidney Cohen, a well-regarded LSD researcher, argued that "such degradation of a person's mind is worse than his physical death and can hardly be considered humane warfare."

When Ketchum returned to Edgewood, he was optimistic about achieving something meaningful, but he was frustrated by the growing insubordination among the doctors. "Many of them tried to stay out of the picture as much as possible, so that they wouldn't be assigned things to do," he told me. Concerns that Lindsey's generation had kept to themselves were now rushing to the surface. The new doctors tended to be older than their earlier counterparts, more invested in their nonmilitary work, more politically circumspect. They sought to slow down the research, and began to question Ketchum's methodology.

A physician named Mark Needle told me that he thought Ketchum's human experiments were run like the Keystone Kops. "There was nobody qualified," he said. "And the fact that they were allowed to do it without people who knew what they were doing was very, very scary. There was no humanity in it. There was no morality in it. If anything happened to the volunteers, we could say, 'You were offered an out,' but then we were also telling them, 'Listen, this is the Army, and we are at war.' Our view was that this was a terrible thing to do to these kids, because who the hell knew what could happen?"

When Ketchum sought to orchestrate a field test with a new version of BZ, four doctors wrote in dissent. He overruled them. Another version, called EA 3834, appeared to cause microscopic hematuria—tiny amounts of blood in urine—and other renal problems. One soldier was sent to Walter Reed. "This is a dangerous drug," a psychiatrist named George Leib insisted. Leib, who worked on the arsenal's annual budget, had come to think that tests of a baroque nature and questionable design were being funded merely to sustain the program. His office was across from the toxic-aid station, and he was sure that records were being manipulated to disguise problem cases. "Everyone I spoke to had misgivings," he told me. "I had a volunteer who just sailed through a forty-eight-hour test without problems, and then

soon afterward, while on leave, he was driving and crashed into the back of a truck and killed himself. I felt responsible. I felt like I had not done everything I could. But I certainly had done everything that I was allowed to do."

The testing of EA 3834 was suspended. There were more studies, more discussions; nothing could be conclusively determined. The arguing underscored the medical scrutiny given to the volunteers, but also illustrated important differences: physicians who saw no benefit to the experiments did not want to tolerate even minor risks. "Ketchum said it would be O.K. to continue," Leib told me. "To me, it made no sense." As the two men argued, Ketchum accused Leib —who occasionally consulted with the C.I.A. on chemical work—of being a spy, and blamed him for taking a secret codebook from a safe in his office. (Ketchum doesn't remember the dispute.) "My house and car were ransacked, seats were taken apart," Leib told me. "In the end, the book was in Ketchum's closet."

In early 1969, Ketchum told a superior that he thought the program was not "facing a very rosy future." As antiwar protesters gathered outside the arsenal's gates, the insubordination was giving way to overt acts of rebellion. Doctors leaked details about the research to the press; some even criticized the work publicly. One physician told me that he had come to believe that in many cases the arsenal had not done sufficient animal tests, and, fearing that he would have to violate the Hippocratic oath, he told Ketchum that he wanted a transfer, even if it meant being sent to Vietnam.

Edgewood was not all that had changed. "I was smoking dope and having sex every night," Ketchum told me. "After a while, it became obvious that I wasn't the same guy I was in 1966." He suggested that follow-up studies be conducted, he told me, but "nothing came back on that." He even sought to expand the arsenal's focus beyond weaponry, telling the technical director that the clinical research could be more than "a medical cog in the 'war machine.' " He hoped, for instance, that the Army could study marijuana for its possible therapeutic value. "For any medical laboratory to limit itself to weapons-oriented work would be most unacceptable to the great majority of physicians," he added.

Instead of reprimanding the recalcitrant doctors, Ketchum debated them. He frequently argued with Al Daniels, a newly drafted physician, who told me, "I said, 'I'm not going to do that kind of research.' I was, like, 'Fuck you, throw me in jail.' " Ketchum told Daniels that irresponsible science could happen in any context, and added, "I do not think it is fair or accurate to assume that this goes on in chemical and biological weapons research any more than it does, let's say, in cancer research." Daniels was far from convinced. Ketchum recalled, "He would say, 'Go to hell,' and I would say, 'No, let's talk about this.' "

Ketchum is a natural and genial debater, but he was also a colonel in the United States Army; he did not need to dispute or cajole, and it's hard not to see in these discussions a man arguing more intensely with himself than with his subordinates. Without informing his superiors, he invited a journalist to Edgewood, and when they sought to block the invitation he bashed out a fiery, insubordinate memo. "For Christ's sake give a senior science reporter for the AP credit for some brains," he wrote. "This is a medical research laboratory! This is not Buchenwald, not a prison, or a stockade, doing sneaky, poorly designed work for nefarious motives!"

In April, Matthew Meselson, a Harvard biologist, argued in congressional testimony that non-lethal chemical weapons would only make war more savage, because armies would use them to flush out enemies and then slaughter them. Ketchum wrote to him, "I cannot see how any chemical agent can compete with the macabre agony which projectiles,

flame and bayonets can produce." Like a protagonist in one of his Dartmouth creative-writing assignments, he described a mediocre institution thwarting his chance at real achievement. "I often ruminate, myself, upon the stupidity, cupidity and spiritual barrenness of the faceless bureaucracy in which I find myself enmeshed," Ketchum wrote. "I console myself with the fond illusion that somewhere in this faceless universe of orbiting bodies there must be a mind or two that is alive and aware and perhaps even creative." Meselson quickly ended the correspondence.

In November, the Nixon Administration announced that the United States would not offensively use the forty-nine tons of BZ that it had stockpiled, because of the chemical's "wide range of variability of effects, long onset time, and inefficiency of existing munitions." Not long afterward, Ketchum took an unusual step. He asked to be demoted, claiming that he wanted to return to research. "Mostly, my motivation was declining," he wrote in his memoir. But it was also clear that the program was going nowhere. "I felt like Benedict Arnold," he said. Ketchum was relocated from his large office into a cramped room that had been a janitorial-supply closet. He spent his time studying to practice psychiatry and teaching himself computer programming. Then, in 1971, an opening came up at Fort Sam Houston to help expand substance-abuse programs, and he took it. As he later put it, "The psychochemical empire was crumbling."

VI

Four years after Ketchum left Edgewood, the Medical Research Volunteer Program became engulfed in scandal. Former subjects complained of maltreatment, and in September, 1975, Van Sim, who had taken over once again, was brought before Congress and questioned by outraged legislators. When asked about the lack of follow-up care for the volunteers, there was little he could say, except, "Well, it is intolerable." Legislators and Army investigators descended upon the arsenal, and the remaining volunteers were given just hours to leave the facility. The medical-research laboratories were sealed, and documents were seized. A truck was required to haul away just a portion of the paperwork. "It's been a bad scene here," a friend of Ketchum's wrote to him. "Aren't you glad you're out of it?"

Before the media, Sim was willing to obfuscate and lie, as it suited him. As he stood at a lectern emblazoned with the Army seal, taking questions from reporters about the arsenal's experiments, his senses seemed deadened, his eyelids heavy. At the time, Sim was under investigation for his use of Demerol. He obsessively licked his upper lip, as if he were soothing a deep sore.

"How much of the work, then, was done for the Central Intelligence Agency?" he was asked.

"Absolutely none," he said, even though he had done such work himself.

"Did you have any bad cases?"

"We had none within the Army itself."

"Tell us about the adverse side effects."

"If I tell one, it will not be necessarily representative of the next one."

The Army launched an investigation, and agents struggled to make sense of what had happened at Edgewood.

Although they found no evidence of deaths or "serious injury"—a term that their report did not define—they were bluntly critical of the recruiting process. "There were indications that application of power of command, expert knowledge, and position were employed in a manner to suggest possible coercion," the report concluded. On the matter of informed consent, it found that Edgewood doctors had been selective about what they told the volunteers and, again and again, were willing to "dilute and in some cases negate the intent of the policy."

The lasting health effects of the research were difficult to judge. Records were either messy or incomplete, and no experiment had collected data to determine how a drug might affect lives in the long term. In 1980, the Army published a study that found that sixteen per cent of the volunteers given LSD later suffered psychological symptoms—flashbacks, depression, and suicidal ideation—associated with the drug; the authors concluded that most of these were benign, but they also acknowledged that the study had an "insuperable" design problem, in that obtaining adequate control subjects was impossible. A later study found that a significant number of subjects had been hospitalized for nervous-system or "sense organ" disorders.

In 1985, the National Academy of Sciences completed a study of BZ-type drugs and nerve agents. Because of funding constraints, the study was able to examine Edgewood's records for only a fraction of the exposed soldiers; the samples were selected by the Army and, for some drugs, were almost meaninglessly small. "I would say the committee was discouraged by a lack of detailed recorded assessments," one of the investigators told me. The academy sent out a crude questionnaire to all the Edgewood volunteers it could find. By then, though, some men had died, and some were impossible to reach or declined to respond—leaving forty per cent of the former subjects unaccounted for.

Ultimately, the study could not rule out any long-term effects from exposure to nerve agents, which have been associated with cognitive changes, depression, even suicide. "Whether the subjects at Edgewood incurred these changes and to what extent they might now show these effects are not known," the investigators concluded. The inquiry into the BZ-type drugs determined that there was no evidence of large-scale physiological harm, and, given what is known about such drugs, this is not unreasonable. The study's questionnaire, however, focussed on gross physical maladies, and was ill suited to register nuanced psychological aftereffects. Ketchum has taken comfort in these findings, but the results are unambiguous in only one way: no one really knows what the true impact of the tests has been.

As the investigations progressed, half a dozen former test subjects sought to sue the government. Their cases were dismissed, based on a Supreme Court precedent, called the Feres Doctrine, which grants the Army immunity to tort claims filed by soldiers for service-connected issues. For a while, no one else came forward; many soldiers claim that, upon leaving Edgewood, they were instructed to swear a secrecy oath, and some held themselves to it. But in the nineteen-nineties the Defense Department began to lift the oaths, and volunteers gradually found each other on the Internet. Several years ago, two of them gathered up a pile of documents about the arsenal, which they called the Bible, and mailed it to Morrison & Foerster, the law firm in San Francisco, which agreed to take their case. A lawyer at the firm told me that millions of dollars had been spent on the litigation, and that he thought the lawsuit could end up being the most expensive pro-bono case in history.

To circumvent the Army's immunity to tort claims, Morrison & Foerster has set aside the matter of damages. The plaintiffs—who call themselves the Test Vets—have four primary goals: to compel the Army to acknowledge that the experiments were unlawful; to inform all the former subjects what chemicals they received, and how; to explain the

drugs' health effects; and to provide care where needed. The Army, in its response to the Test Vets' complaint, broadly denied that the research violated ethical codes, and asked that the suit be "dismissed in its entirety."

In 2008, the British Ministry of Defence issued a statement to the subjects in its own drug-testing program: "The government sincerely apologizes to those who may have been affected." That the U.S. Army is unwilling to do such a thing is a source of pain for former subjects. John Ross, the soldier who was given an overdose of nerve agent, struggled for years to convince the Department of Veterans Affairs that he was even at Edgewood. "It's too late for me," he said. "I just want an official apology. It was like a con job."

The case will have to wrestle with unsolvable questions. Test subjects were given many drugs, some of them in combination. One of the named plaintiffs, Tim Josephs, was involved in an experiment carried out by George Leib, who had given him scopolamine and Prolixin, to assess the combined effect. During the test, Josephs began to experience tremors and muscle spasms akin to symptoms of Parkinson's, and was rushed to the toxic-aid station. Shortly after leaving Edgewood, he felt unusually nervous. He was deployed to Thailand, where, he says, he worked near barrels of Agent Orange. Upon his return to the United States, he lived a healthy life until 2004, when he was given a diagnosis of Parkinson's. Specialists I contacted could not agree whether the test had helped cause the disease, and, in any case, Josephs was already receiving care; the V.A. presumes that any veteran who was exposed to Agent Orange, and who exhibits signs of Parkinson's, is entitled to treatment for the disease. But he was filled with hurt and frustration over the ambiguous cause of his illness. Perhaps, in the moral calculus of the Edgewood legacy, such ambiguity must be considered: to take a powerful drug, and then spend decades not knowing what it might have done to you, may be its own form of psychological trauma.

Some mysteries go deeper still. In 1995, Ronald Zadrozny, the mild-mannered soldier in one of Ketchum's BZ tests, fatally shot his third wife and then himself. Zadrozny's second wife told me that he had never seemed that bothered by his time at Edgewood. It is fair to believe that his violent meltdown, more than three decades later, had nothing to do with BZ. But can that be proved in a court of law?

This August, Ketchum, while sitting beside his archive, had a stroke, and he was rushed to the emergency room. He had never tried BZ, but in the hospital he experienced eight hours of delirium, in which he saw himself lecturing about Edgewood. "I awoke when the thirty-second PowerPoint slide got mixed up, and people came onstage to whisk me away," he told me. "I babbled for hours while tubes and catheters were installed all over, and then said to Judy, 'I can speak perfectly clearly,' as if I had not been acknowledged. I was soon fully normal, but was kept off food and drink for twenty-four hours, which angered me, thinking it was forty-eight hours."

As the fall wore on, Ketchum grew less interested in testifying in the lawsuit. He was coming to believe that the case was mainly an arena for venting anger. He once told me that he had a need to debate, but that he regarded debate as something like a scientific process, rather than an adversarial contest. "The truth remains my goal, even if it casts a shadow on my reputation," he said. And although he is a psychiatrist, he often appears to avoid deep self-reflection. In one of his manuscripts, he discussed his experience with therapy while he was a young doctor at Walter Reed. "He had tried the dark recesses for eighteen months of personal therapy in the office of a D.C. psychoanalyst and ended up in a stalemate," he wrote. "Apparently he still had a residual fear of the dark, and kept the lights of hyperactivity on."

The lawsuit had been keeping the lights of Ketchum's hyperactivity burning so brightly that perhaps he hadn't noticed how little he would still defend. Ketchum readily concedes that the lack of medical follow-up was wrong. He concedes that Van Sim's management and his experiments on unsuspecting subjects were unethical. He concedes that the research after Project DORK was mostly fruitless—"There wasn't much place to take it," he told me. Yet between 1968 and 1974 Edgewood investigators tested a hundred and fifty-six men with EA 3834—one of the newer versions of BZ. "It scrambled your brain," one soldier, who suffered years of flashbacks, told me. "They had to send a couple of guys to the hospital." I asked Ketchum about the tests, which continued years after Nixon decided that the United States would not use such chemicals. Were they worth even that one veteran's psychological hardship?

Ketchum responded defensively. "To be frank, I would consider it dishonest to claim regret simply to gain forgiveness by critics," he said. But a few days later he pursued the question. "This morning I pulled out my notebook containing lists for each BZ-like compound, and was stunned when I found 3834 was indeed given in one hundred and fifty-six cases!" he wrote. "Some were done while I was actively in charge, but many while I was not." He had searched his archive for more information. Some of the protocols, he said, were poorly designed. "I feel bad about what appears to be an inefficiency of testing," he said. "I can imagine a fair criticism for this sloppiness and its accordingly excessive stress in terms of number of volunteers required. I must take blame for at least a significant fraction of the suboptimal design."

More than anything, it seems, Ketchum had wanted to do something good and meaningful with his life, even something celebrated, but he never paused to consider if the limits of the Army's chemical-warfare program would allow for such a thing. After leaving Edgewood, he had opportunities. He took on an associate professorship at the University of Texas Medical School, but in both academia and private practice, he told me, he always chose at the last minute to back away from success. He considered this a character trait, but it was hard not to see in it the caution of a man who had pursued success without restraint and found himself in ethically contested territory. As he grew older, he came to live "with psychic pain, and a tendency to be depressed," he later confessed. Free-associating at his typewriter, he wrote, "I am about to be consigned to the junk heap of mediocrity and obscurity. So be it."

In a press release about the lawsuit, Morrison & Foerster called the experiments "diabolical." Whether such a term is accurate may ultimately come to rest on one question: were the rights of the test subjects abused? The precepts set forth in the Nuremberg Code are at the heart of the lawsuit. One long afternoon, Ketchum and I sat in his living room, embroiled in a discussion of the code. The Edgewood research had certainly violated parts of it—but so did a great deal of American research in the nineteen-fifties and sixties. When the Army contracted with Harvard to conduct clinical studies, demanding that the university conform to policies shaped by Nuremberg, the university insisted on looser strictures. Many doctors at the time held that the code, designed in the aftermath of Nazi barbarism, was inapt for ordinary science. In 1962, Henry Beecher, a Harvard anesthesiologist, argued that it would be folly to think that true informed consent would always be obtainable. He believed that the character of the investigator—"wisdom, experience, honesty, imaginativeness and sense of responsibility"—ultimately determined the morality of a clinical trial.

In his living room, Ketchum began to ponder whether the Nuremberg Code even applied to his work, since drugs, once administered, cannot easily be stopped. "I guess it comes down to how explicit the consent form is," he said. "That is

what is criticized—that the consent form doesn't give enough information." It almost sounded as if he had drifted back to Edgewood, to play out a discussion that should have occurred. "It could say, 'We're giving you a three-day test, and, if you agree now, then that is a permanent agreement,' " he suggested. "Or, 'Do you realize that once you get the drug you can't turn it off, unless it wears off, or unless we provide you the antidote?' Should it be saying something like that?"

As Ketchum designed and redesigned the imaginary consent form, I thought about a black-and-white film from his archive. The footage shows a young African-American soldier who has been given LSD and is experiencing intense physical distress. He is dressed in scrubs, and seated on a metal folding chair, his left arm clutching his stomach, his right hand constantly moving: rubbing his eyes, massaging his face, supporting his swaying head. Ketchum is seated beside him, urging the soldier to do a math problem, in order to judge how impaired he is. He tells the man to count backward by sevens, starting from ninety-eight.

"Subtract seven from ninety-eight, please," he begins.

"Ohh," the man gasps. He is holding his face, and looking downward, as if he could not attend to anything beyond his immediate agony. Ketchum, seated behind a table, tries to help: "Ninety-eight, ninety-one, then continue."

The soldier doubles over. "Ohh," he gasps, more forcefully. He bends low, seeming as if he might collapse.

"What would come next?" Ketchum asks.

The soldier raises his torso in two quick jerks, wincing with each gesture. "Ow," he says, with a pained exhalation. With his head in his hands, he whispers, "Jesus."

"Daryl," Ketchum says. "What would come next?"

In a sudden moment of lucidity, the soldier raises his head. "I feel incapacitated," he insists, then keels over again.

"Incapacitated," Ketchum says. "Well, I'll ask you more about that in a minute, but just try to subtract these sevens for me." The soldier bolts upright, still clasping his head and stomach. "From what?" he asks. Then a wave of pain overwhelms him, and his body curls in on itself. "Sh-h-h-h-h," he gasps.

"Well, you got ninety-one," Ketchum continues patiently. "What's next?" The soldier tries to sit up again; a stranger walking in might reasonably wonder if his appendix had burst.

"What's seven from ninety-one?" Ketchum asks again. The soldier cannot answer.

In Ketchum's living room, he was still pondering the issue of consent. What if the subject was too delirious to know that he was permitted to stop the test? How could the consent form prepare for that contingency? As the afternoon wore on, I asked him if perhaps these many distinctions missed a larger point about the Nuremberg Code—a document to be followed as much in spirit as in detail. "I think that's the whole point," Ketchum said. "The attitude of the tester has to be one of concern for the subject beyond his concern for the results." But which result was paramount: a safe country or a safe individual? At times, as Ketchum wrestled with ethical nuances—the old tensions between his responsibility as a doctor and his role as a soldier—it seemed as if he might be lost forever in the effort. Before I left, I said that these were admittedly complex issues. "It's tough, I know," he said. "I struggle with these things." He looked at

me, and added, "But I have always had the feeling that I am doing more the right thing than the wrong thing, here." ♦

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