

If there's a hero in this case—beyond forensic science, which made the case against Rubenstein—it's Allen Applewhite, the Mississippi highway patrolman who refused to let this case die. He bulldogged this case for years, even when it appeared there was no hope of a trial. He dug up a mountain of evidence against Rubenstein, a man he later told me he came to regard as "pure evil." Allen was so struck by the dark depths of menace and depravity he unearthed in Rubenstein that he still carries a photo of him in his police car, to remind him just how much can be at stake in building a case against a killer. Allen had wept when the first jury deadlocked and the judge declared a mistrial; when the second jury found Rubenstein guilty, he went home and held his own four-year-old daughter tightly in his arms.

## CHAPTER 19

### *Ashes to Ashes*

LOYD HARDEN—"CHIGGER," his family and friends called him—was an East Tennessee farmer. He and a bunch of other Hardens were born and raised on Harden Road in Birchwood, the name given to a handful of farmhouses sprawled across the broad, fertile floor of the Tennessee River Valley halfway along its hundred-mile run from Knoxville to Chattanooga.

Chigger's eight brothers and sisters scattered out across the valley like a handful of windblown seeds, but Chigger stayed put on Harden Road. His life wasn't an easy one. In school, he never made it past seventh grade; when he was seventeen he learned a hard lesson that he carried with him the rest of his life: He and his nineteen-year-old brother argued over a poker hand and Chigger lost, catching a .22-caliber bullet in the chest from a gun in his own brother's hand. He survived, but the bullet was

too close to his heart to be safely removed. He kept it inside him for another twenty-seven years, a reminder of the perils of cards, the precariousness of life, and the crucial difference one inch can make when it involves the relationship between a bullet and a heart.

By the spring of 2000, a life of farm labor had made a burly man of Chigger—not just his muscles but his bones, too, which had grown thicker and stronger to bear the loads they carried year in, year out. He must have looked almost comically oversized, planting strawberry seedlings, pinching the tiny plants between strong, stained fingers and a broad thumb. Now, at age forty-four, Chigger wasn't a young man anymore. His back ached, and he had other, deeper hurts too. On the night of April 17, 2000, Chigger took some painkillers. I don't know how many, but it must have been more than a couple. Instead of killing the pain, the pills killed him.

Chigger had once told his siblings he wanted to be cremated, as his older brother who had shot him (accidentally, the family says) a quarter-century before had been. His sister Suzy asked a nearby funeral home to arrange it, and she bought a fancy brass container to hold his ashes. Chigger's girlfriend was pregnant, and Suzy wanted Chigger's child to have the ashes someday.

The family mourned Chigger's passing at a memorial service; afterward his body was taken to a waiting hearse and driven to a crematorium. The funeral service and cremation cost \$3,110.59, including almost \$800 for a combustible, cloth-covered coffin. A few weeks later a plastic bag of ash, cremated remains—"cremains," they're called in the funeral industry—was sent back, and a funeral-home employee transferred them to the brass box. Suzy kept them on her mantel for a while, then gave them to Chigger's girlfriend.

Twenty-two months later, his family watched with horror as a macabre story unfolded on national television. Bodies—unburned, decaying human bodies—were being discovered in Noble, Georgia, on the grounds of Tri-State Crematory. Tri-State was where Chigger's body had been sent to be cremated nearly two years before.

The troubles at Tri-State first became public on February 15, 2002. Inspectors from the Environmental Protection Agency, tipped off by a phone call, inspected the Tri-State property and spotted a human skull on the grounds. The EPA inspector called in the cavalry, and soon dozens of sheriff's deputies and Georgia Bureau of Investigation (GBI) agents were swarming over the grounds. Within hours they found dozens of bodies; in the gruesome days that followed, they found hundreds more: 339 in all, buried in shallow pits, stuffed into metal burial vaults, stacked in the surrounding forest like cordwood, even rotting inside broken-down hearses.

The tip to authorities had come, by a roundabout path, from the truck driver who kept Tri-State's propane tanks filled. During the course of a routine delivery, the driver spotted human bodies on the property. But apparently he couldn't conceal his curiosity (or his shock), because the next time he made a delivery, he was told to get off the property and mind his own business.

Tri-State was a family business. Ray and Clara Marsh opened the crematorium in 1982, and it quickly began drawing business from Georgia, Alabama, and Tennessee, the three states whose borders converge about twenty miles to the northwest of Noble. Tri-State consistently charged less than other crematoriums, and its services—unlike that of most competitors—included picking up bodies from the funeral homes it contracted with, then returning to deliver the cremains a day or two later.

In 1996, Ray and Clara turned the business over to their son, Ray Brent. Business remained brisk; by early 2002, Tri-State had cremated some 3,200 bodies. At least, that's what everyone assumed. Then, on February 15, the awful truth began to emerge.

Within hours after their arrival, the EPA inspectors found several dozen bodies in varying stages of decay. The following day, Georgia's governor declared a state of emergency in Walker County, and authorities grimly predicted that the body count could reach the hundreds. In the first of a long series of legal proceedings, Ray Brent Marsh was

arrested and charged with five felony counts of "theft by deception," for accepting payment for cremation services he didn't actually perform. By the following Sunday, the body count was approaching one hundred, and Marsh faced additional criminal charges. Hundreds of investigators were converging on Tri-State, ranging from EPA and Georgia Health Department inspectors to county sheriffs, agents from the GBI and FBI, and disaster-management specialists from federal and state agencies.

One little-known emergency response program that falls under the auspices of the U.S. Public Health Service is a grim organization called D-MORT (pronounced "DEE-mort"): Disaster Mortuary Operational Response Team. Staffed by a wide range of volunteer specialists—medical examiners, forensic dentists, search-dog handlers, forensic anthropologists, morticians, and other professionals who deal in one way or another with death—D-MORT teams are summoned to scenes of mass death such as airliner crashes. (My Knoxville Police Department friend Art Bohanan did a research study at the Body Farm for D-MORT several years ago, as part of an effort to develop leakproof body bags. So far that effort still hasn't fully succeeded.)

One of D-MORT's toughest jobs came in April of 1995, when the Murrah Federal Building in Oklahoma City was destroyed by a truck bomb. Three of my graduate students went out to help D-MORT volunteers identify bodies pulled from the building's rubble. A far greater, sadder challenge for D-MORT, though, came in the wake of the terrorist attacks of September 11, 2001. Hundreds of volunteers risked injury to comb the wreckage of New York's World Trade Towers at Ground Zero; other D-MORT members helped locate and identify the dead at the Pentagon.

Five months after 9/11, as they scoured the pine woods behind Tri-State, members of the southeastern regional D-MORT team were stunned by what they were finding. On Sunday, February 17, one of my graduate students, Rick Snow, got a phone call from a D-MORT officer asking him to come to Georgia immediately. Rick, who had signed on as

a D-MORT volunteer some months before, possessed some particularly relevant experience: He had recently returned from a stint overseas, working for the United Nations war-crimes tribunal in Bosnia. For eight months in Bosnia, Rick excavated mass graves and helped identify the thousands of civilians murdered in the name of "ethnic cleansing." The politics and the motives weren't the same in Georgia—the only plausible explanations seemed to be some combination of laziness, sloppiness, and penny-pinching on propane costs—but the bodies and the scope of the task were similar to what Rick had experienced in the Balkans.

Rick arrived on Monday, February 18, to help recover and identify bodies. When he set foot behind the fence at Noble, he must have felt himself transported into a scene somewhere between the Balkans and the Twilight Zone. Bodies were scattered throughout the wooded property. Some were buried; some were stuffed into rusting vehicles and steel burial vaults; some were simply tossed beneath the trees and beside junked appliances, their decaying flesh covered only by rotting cardboard, leaves, and pine needles. On the day Rick got there, the body count reached 139, already 29 of those had been identified by distraught relatives. As the only person on-site with mass-burial expertise, Rick assumed a key role in guiding the search-and-recovery work. The task was greatly hindered by the trees and underbrush covering most of the property, so at Rick's suggestion, a crew with chain saws and bulldozers began cutting the trees and clearing the land, all the way down to the red Georgia clay.

The day after Rick joined the effort, the GBI searched Brent Marsh's house, located at the entrance to the crematorium complex, seeking records that could help shed light on the number of bodies that might be hidden on the property, as well as their identities. While searching the house, they spotted still more bodies in the backyard.

Meanwhile, calls from worried people were pouring into funeral homes across the Southeast. Had their loved one been sent to Tri-State?

If so, were these the genuine cremains on the mantel or in the cemetery, or was the dearly departed actually festering on the Tri-State grounds?

By Wednesday, just five days after the story broke, the cost of the investigation had soared to \$5 million, and the body count had reached 242. Aided by the chain saws and bulldozers, searchers found nearly 100 more bodies during the next six days. On the twelfth day, the grisly finds ceased.

The final toll was 339 bodies at Tri-State, and immeasurable heartache among the families who knew, or feared, that one of those bodies belonged to a father, a mother, a sibling, a child. About 75 of the 339 bodies were identified within the first two weeks. Most of those were recent, relatively fresh bodies: easy to recognize, hard to look at. But painful as it must have been to identify a loved one among the bodies retrieved from Tri-State, at least those families got swift closure, or the chance to begin seeking it. For hundreds more people, the uncertainty and pain would drag on and on.

Within days after the EPA inspector's discovery of a skull, the lawsuits began—some against Tri-State, others against the funeral homes that had contracted with the crematorium. That's when I started to hear from lawyers.

On February 21, I got an E-mail from William Brown, an attorney from Cleveland, Tennessee, asking me to analyze the cremains that Tri-State had sent back to Chigger Harden's family. Understandably, the family feared that the cremains might not be Chigger's.

Three weeks later, Bill Brown brought me the cremains. Double-bagged in plastic were a few handfuls of dark gray, ashy material. Including the plastic bags, the entire sample weighed 1,650 grams, or 3.6 pounds. That seemed skimpy: the most recent published study on cremation weights gave the average weight of cremains as 2,895 grams for males, 1,840 for females. (Curious about this subject, I began a research study of my own. Several times a week over the next five months, I went to a cooperative crematorium nearby and weighed cremains before they

were sent back to families or funeral homes. After weighing fifty sets of cremains from males and fifty from females, I found the males averaged 3,452 grams, or 7.6 pounds, and the females 2,770 grams, or 6.1 pounds.)

As Brown watched, I carefully emptied the bags onto a clean metal tray, then sifted the material through a 4-millimeter wire screen, which would catch all but the smallest pieces. The bags clearly contained fragments of burned human bones. Even though the pieces were small, I could tell from the smooth, curved surface of some of the fragments that they'd come from the head of a femur (thighbone) or a humerus (upper arm bone). There was also a piece of a bone from the hand, a piece from a foot; and small bits of a metatarsal (foot bone), ribs, a femur, and a tibia (lower leg bone).

Much of what the screen caught, though, was nonhuman material. There was one metal staple—not the kind used for stapling papers together but a big, heavy-duty fastener that might have held together a corrugated cardboard carton, of the sort funeral homes use to ship bodies to crematoriums. (Normally when a body is cremated, it's left in the shipping carton and the entire carton is simply slid into the oven; that makes it easier to handle, and it solves the problem of disposing of the carton as biohazardous waste. Afterward a powerful magnet is used to remove steel objects such as the staples.) The screen had also caught some pieces of what appeared to be burned wood and some fragments of black fabric. The fabric surprised me, since cloth burns at just a few hundred degrees Fahrenheit, while a cremation furnace normally runs far hotter, around 1,600 to 1,800 degrees Fahrenheit. Most puzzling of all, though, were numerous marble-size spheres of a fluffy white substance. *Fuzz balls* was the best term I could come up with to describe them. The fuzz balls weighed practically nothing, but they represented a considerable percentage of the sample's volume. Were they accidental contaminants or deliberately added filler? I'd never seen anything like them, and I told Brown so. I offered to get some laboratory tests made at UT; he agreed that might be a good idea, then he thanked me and left.

I got on the phone and called a textile scientist I knew, who offered to look at the fuzz balls. A professor at UT's Forest Products Center agreed to analyze the fragments that appeared to be wood. I arranged to get samples to them.

These tests would pinpoint the nature of the nonhuman fragments that the 4-millimeter wire screen had sifted out. But that left the bulk of the sample, not quite three pounds of powder and fine particles, which had sifted through the mesh. Visually, the material looked darker than the human cremains I'd seen occasionally over the past forty years, but in a court of law, I knew, I'd have to be more precise than that about what this was—or what it *wasn't*.

When Brown had first contacted me, he'd mentioned that there were indications the cremains from Tri-State might include cement powder, because the authorities' search of the facility turned up numerous bags of cement. Cement looks very similar to the ash that results from incinerating and pulverizing human bones, so it seemed possible that the crematorium might resort to sending families bags of cement powder if they didn't have genuine cremains to send. I searched the scientific literature to find if there was an easy test I could do for the presence of cement.

Cement is mostly powdered limestone, or calcium carbonate. One quick test geologists use to tell if a rock is limestone is to squirt a drop or two of hydrochloric acid on the rock. If the liquid fizzes when it hits the rock, they know it's limestone.

I'd obtained a small quantity of dilute hydrochloric acid, which was sealed in a medicine bottle with an eyedropper. Carefully, I sucked up a few drops into the dropper's rubber bulb and squeezed them onto a small mound of powder I'd put on a metal tray. As soon as the drops hit the powder, they fizzed and bubbled. *It looks like this might be cement*, I thought, *or powdered limestone, anyhow*.

I made one last phone call, to Dr. Al Hazari, a UT chemistry professor I'd known and respected for years. Al agreed to obtain a more detailed chemical analysis of the powdery material; at his direction, I

rescreened the cremains another five times to be sure it was free of larger pieces and to mix it uniformly. Then I scooped out 42 grams—about an ounce and a half—sealed it in a small vial, and took it over to the chemistry department.

With any luck, we'd be able to tell the Harden family more soon.

IT DIDN'T TAKE LONG to hear back from my colleague in the Forest Products Center. The sample I'd taken him was burned plywood, he said. That was neither surprising nor disturbing: The cardboard cartons in which bodies are generally shipped and cremated have a thin plywood floor, so they can support the weight of the corpse when the carton is picked up. Without it, the carton might buckle or tear, especially if fluids have seeped from the body.

My textile expert's report on the fuzz balls told me they were a synthetic material—probably polypropylene, he said. Polypropylene is an incredibly versatile plastic. Molded or cast as a solid material, it's used to make things ranging from dishwasher-safe food-storage containers to automobile bumpers. Spun into fibers, it's made into outdoor carpeting, floating marine ropes, and tearproof FedEx envelopes.

Polypropylene is light, strong, tough, and versatile, but it's not heat-resistant. Its melting point isn't much above 300 degrees Fahrenheit—less than the temperature at which chocolate-chip cookies bake, let alone the fierce heat required to burn a body. Accidentally or intentionally, the fuzz balls had clearly been added after Chigger Harden's body was cremated.

If, that is, Chigger's body *had* been cremated. Clearly the sample contained fragments of burned human bones. But were they Lloyd Harden's bones or someone else's? If DNA could survive the cremation process, we could answer that question definitively. Unfortunately, cremation, if done right, burns all the organic material in bone. In a process called calcining, bone is reduced to its primary mineral building block, calcium. The carbon-based DNA molecules—like the carbon in a card-

board coffin or a cotton shirt—burn up completely. Chemically, all traces of human life and identity go up in smoke. So the bulk of our sample—that 2.9 pounds of ashy material remaining after the rusted staple and charred fabric and fuzz balls were sifted out—couldn't tell us whether this was Chigger Harden. All it could tell us was whether most of it was, or had been, a human being.

On April 30, I received the results of the chemical analysis. My chemist colleague Hazari had hit upon an ingeniously simple test to suggest whether the material was human. The human body has a fairly consistent chemical composition. At some point during our school years, most of us learn that the body is mostly water—roughly 60 percent by weight. The other 40 percent is divided among a host of other elements, mainly calcium and carbon. (If humans had ingredient labels, like prepackaged foods in the grocery store, our list of ingredients might start out as follows: water, calcium, carbon . . .)

One ingredient that's practically last on the body's list is silicon. On average, the human body contains just 18 grams of it, or about two-thirds of an ounce. If you evaporate all the body's water and burn off all its carbon in a cremation furnace, you're likely to end up with 5 or 6 pounds of cremains, of which silicon represents less than 1 percent by weight.

Hazari had sent my 42-gram sample to a certified commercial lab in Knoxville called Galbraith Laboratories ("Accuracy with Speed—Since 1950"). He could have tested it himself in a chemistry lab at the university, but a certified lab's precision is frequently tested and well documented, and we wanted to be sure the analysis would hold up in court. A Galbraith technician ran the sample through a spectrographic test called "ICP-OES," short for "inductively coupled plasma optical emission spectroscopy." The ICP part of the procedure burns an unknown material in argon gas, glowing brightly at 18,000 degrees Fahrenheit. Then the OES instrument "fingerprints" the sample, essentially, by reading the wavelengths of the light given off as the sample burns. The final step is to compare the sample's optical fingerprint with those of

known elements. It's an analytical chemist's version of the way an FBI fingerprint analyst compares a crime scene print with a database of prints from known criminals.

According to Galbraith Laboratories' analysis, the cremains identified by Tri-State as Chigger's were more than 15 percent silicon. Unless he'd been eating a lot of dirt just before he died, that reading was a lot higher than it should have been. It seemed more likely that the cremains contained filler of some sort—concrete, powdered limestone, or even just plain sand.

Whatever it was, it wasn't right. The cremains that came back from Tri-State should have passed three tests, not unlike the three-part oath every courtroom witness has to swear to: that brass box the Hardens got back should have contained Chigger, the whole Chigger, and nothing but Chigger.

What had really happened to Chigger, and to all those other bodies, down in Georgia? On June 20, 2002, I would get another chance to try to figure it out—by way of a firsthand look.

CHATTANOOGA, Tennessee, lies a hundred miles southwest of Knoxville; about twenty miles southeast of Chattanooga, but a world away culturally, lies the unincorporated Georgia community of Noble. It's a name that now seems mighty ironic.

It doesn't take long for U.S. Highway 27 to make its run through Noble. The four lanes are interrupted by one traffic light, two or three gas stations, and a sprinkling of other establishments offering a few essential goods and services: gas and groceries, hardware and hairdos, several varieties of salvation.

If you weren't looking for it, you'd probably never notice Center Point Road, an unstriped ribbon of asphalt turning off Highway 27 to the east. A sign directs the faithful to Center Point Baptist Church ("Where Jesus Is King"), a few hundred yards down the road on the right. To the left is Roy Marsh Lane, followed by Clara Marsh Lane. Just be-

yond, across the road, is the long, curving driveway leading to Ray Brent Marsh's home and, beyond and slightly downhill, the Tri-State complex.

The house is a small frame structure, maybe a three-bedroom rancher; out front stands an antique Esso gas pump. Just beyond the house is a wooden privacy fence. In this respect, as in many others, it turns out, the Tri-State grounds bear a striking resemblance to the Body Farm. The chief difference is intent: At the Body Farm, we let bodies decompose only because there's no other way to advance this particular frontier of science. It may sound contradictory, but we hold those decomposing bodies in the highest respect for their unique contribution to forensic research and the quest for killers.

Tri-State's fence encloses two large, barnlike buildings, a tiny hut of an office, and a garagelike building with a rusty metal stack jutting up from one end, where the crematorium is located. The larger buildings contain concrete and metal burial vaults; four months before my visit, those vaults had been stuffed with decaying bodies. Now they were empty.

Off to one side of the buildings, at the edge of the woods, I noticed a broken-down hearse resting on flat tires, rusting in the shade. Opening the door, I caught a foul whiff of decomposition; I later learned that a body had been riding in the back for many months, until the property was raided in February. Nearby stood a mobile home, with another junky hearse parked in front; beside the trailer was a commercial-size barbecue grill, which raised some interesting questions—or simply underscored the irony of the crematorium's nonperformance.

The crematorium building contained virtually nothing but the cremation furnace itself, a massive, industrial-looking oven built mainly of blackened firebrick. At the rear of the furnace, the secondary combustion chamber, which burned any organic material not consumed in the main chamber, looked rusted through in several places, as did the flue above it.

Sliding up the furnace door, I peered inside the main chamber with a flashlight. There wasn't a body inside, I was relieved to see, just walls, a ceiling, and a floor of heat-resistant firebrick and concrete, much of it

cracking and crumbling. The floor at the base of the furnace was blackened, greasy, and littered with dirt, gravel, and at least one small, unburned human vertebra—a child's—missed by the GBI and the D-MORT team in their sweep of the property.

I was not the only one who came to inspect Tri-State on this hot summer day. Today was designated a "discovery day" for all the plaintiffs filing suit against Tri-State, the Marsh family, and various funeral homes. All the lawyers involved, for both the plaintiffs and the various defendants, brought in their expert witnesses to inspect the facility. Several former students of mine came over to say hello. One of them, Tom Bodkin, works for the Chattanooga medical examiner; another, Tony Falsetti, teaches anthropology at the University of Florida. I also spotted Michael Baden, a prominent forensic pathologist from New York City, accompanied by a New York forensic dentist. The concentration of forensic firepower in Noble was remarkable.

My visit was cut short when Tom Bodkin, from Chattanooga, stooped down in the driveway area and began to point out human bones—unburned human bones—lying in the dirt. A local sheriff's deputy, standing watch over all the lawyers and scientists, radioed headquarters for instructions. Seal off the site, the reply came crackling back. He herded us all off the property, and within minutes a caravan of sheriff's cruisers and black GBI sedans arrived, looking appropriately like some forensic funeral procession. I'd already seen enough of Tri-State and its cremation furnace by this point anyway. I could see what kind of shape the equipment was in, and it sure didn't look like it had been regularly serviced by its manufacturer.

THE GENERAL MOTORS of the cremation industry is a Florida company with the particularly uninformative name Industrial Equipment and Engineering Company, or IEE. In the summer of 2001, some nine months before the Noble story first came to light, I visited IEE's factory in Apopka, a small town outside Orlando.

The IEE Power-Pak is the company's workhorse cremation furnace. Unlike a funeral-home coffin, which is mainly about elegance and show, a cremation furnace is clearly a product of heavy industry, not built for public viewing. With its drop-front door open, the Powerpak looks like a triple-deep, heavy-duty version of the oven in which Hansel and Gretel nearly became gingerbread. The floor is flat, the top is arched, and the entire vault, stretching some eight ominous feet from door to back wall, is lined with firebrick or refractory (heat-resistant) concrete.

Bodies generally arrive by hearse; at most crematoriums, the hearse backs up to a garage door, and the body, in its cardboard shipping box, is pulled onto a gurney, which is wheeled up to the furnace door. It's a simple, one-person operation to slide the box from the gurney into the furnace, then close the door and fire up the gas.

The first step is to switch on a powerful fan, which forces a steady draft of air through the oven—the "primary chamber," it's called—and then out through an exhaust stack. Once the fan is running, the operator sets a timer that controls the length of the burn. The timer also controls a gas valve and a sparking ignition device, much like the ones found in residential gas ranges.

The first burner to ignite is called the "afterburner." Located at the rear of the furnace, it's a small burner that does double duty. First it slowly preheats the interior, to minimize heat stress and cracking in the firebrick. During the cremation itself, it burns any uncombusted gases before they go up the stack.

Once the furnace is preheated, a low-intensity burner, the "ignition burner," kicks on in the roof of the furnace, its flame directed downward. The ignition burner's only job is to incinerate the cardboard carton or the body bag containing the corpse. Cardboard catches fire at around 500 degrees Fahrenheit, engulfed by the flame shooting down onto it, the carton catches fire within seconds.

Several minutes later the cardboard has been reduced to ash, and the cremation of the body itself can begin. Now a more powerful burner, the cremation burner, blasts downward onto the body. In most cases the

furnace's temperature stays somewhere between 1,600 and 1,800 degrees Fahrenheit; extremely obese bodies, however, can burn at much higher temperatures, up to 3,000 degrees.

IEE builds its furnaces tough to survive those kinds of conditions. The company also offers annual inspections, cleaning, thermostat calibration, and repairs at the customer's request. Most facilities request at least one inspection and calibration a year. In twenty years, I heard, Tri-State never requested a single inspection or cleaning. Reportedly, the only visit an IEE technician ever made to Tri-State was when the GBI asked the company to come verify or refute Brent Marsh's claim that he'd fallen behind in his work because the furnace was broken. According to the IEE technician, the furnace fired right up.

ON SEPTEMBER 3, 2002, the day after Labor Day, one of Chigger Harden's relatives got a phone call from Greg Ramey, the GBI agent heading the Tri-State investigation. Samples of DNA from the 339 corpses recovered from Tri-State had been analyzed at the Air Force DNA laboratory in Maryland. The lab compared the GBI's samples with known genetic material donated by relatives or obtained from medical offices. Some of Chigger's relatives had given blood samples, but as it turned out, they hadn't have: a tissue sample from Chigger's autopsy remained on file at an area hospital.

Agent Ramey called to say that a DNA match indicated that Chigger's body was one of the 339 corpses found on the grounds of the crematorium back in February. Designated by the GBI as body number 218, he had lain decaying in the Georgia woods for nearly two years. Since February he'd been in a cold-storage facility set up by the GBI near Noble. What, Ramey wanted to know, would the family like done with the body now?

The Hardens still wanted the body cremated, in accordance with Chigger's wishes. First, though, they wanted to be absolutely sure it was Chigger. Bill Brown, their attorney, asked me to examine the body, and



he arranged to have it delivered to a place where the examination and cremation could be done in swift succession.

One crisp October afternoon I arrived at a small, neat building that houses the East Tennessee Cremation Company, located at the edge of an industrial park near the Knoxville airport. A few minutes later Bill Brown arrived, along with his assistant, Lisa Scoggins, and his son, Andy, who would photograph and videotape the body and my examination, so there would be a visual record for their legal case.

The crematorium's manager, Helen Taylor, ushered me into the garage area, which housed two ILE cremation furnaces, both of them spotless. In front of one was a gurney, and on it was a white body bag. Unzipping it, I found that the body was mostly skeletonized, though bits of tissue remained here and there. Beside the skull, though no longer attached, was the hair mat: long, thick brown hair, just like the shoulder-length brown hair depicted in the photo of Chigger that Lisa had brought.

The body was nude; the clothes had been removed by the GBI and put in a separate plastic bag. Leaf litter and pine needles were scattered through the remains and the clothing, suggesting that the body had been lying outdoors for quite some time. The absence of dirt in the nasal passages and ears told me that the body had never been buried. Here and there, I found small bits of rotting cardboard, as well as a handful of dead dermestid beetles, sometimes called hide beetles or carpet beetles, which like to nibble dried flesh off bones.

The skeleton was largely intact; the lower jaw and the bones of the lower right leg and foot were missing, though, probably carried off by scavengers. I studied the skull. It was large and broad, with a heavy brow ridge and an unusually prominent bump at the base of the skull, the external occipital protuberance. Any student in my osteology class would have had no trouble telling this was a male. The teeth were vertical, rather than jutting forward, so the skull was clearly *Caucasoid*, and the cranial sutures showed a degree of fusion typical of a man in his forties. Nothing in the skeletal material contradicted the GBI's identification.

The DNA sample had come from a piece of bone taken from the middle of the left femur. Brown asked me to obtain another bone sample, so an independent DNA lab could cross-check the government's results. I unpacked the Stryker autopsy saw I'd brought from the anthropology department and plugged it in.

A Stryker saw is an ingenious tool. It can chew through a femur in a matter of seconds but can also buzz against a child's forearm without even breaking the skin. The secret is that its fine teeth, about the size of those on a hacksaw blade, oscillate back and forth in tiny strokes, just a sixteenth of an inch long. Bearing down on rigid material, such as a corpse's bones or a child's plaster cast, the teeth take rapid little bites. Pressing lightly on the skin, though, the teeth merely wiggle the skin back and forth, maybe producing a tickle and a giggle.

I cut into the femur right beside the notch left by the GBI's Stryker saw; it took less than a minute to notch out a quarter-cylinder about two inches long and an inch wide. I gave this to Brown for shipment to the independent DNA lab. As one final precaution, I bagged and gave him a finger bone, too, in case a third test should someday seem necessary.

Next I opened the plastic bag of clothes tucked down at the foot of the body bag. The body itself wasn't too smelly, but the clothes reeked of decomp and ammonia. Despite their rotting and stained fabric, a pair of blue jeans was easily recognizable. The shirt was also crumbling, but it looked to be red and green plaid. According to Lisa, the Harden family had asked the funeral home to dress Chigger in his favorite outfit, jeans and a plaid shirt.

If we were lucky, we would find one final piece of identifying material accompanying Chigger's body: the bullet his brother had fired into his chest more than twenty-five years earlier. It would be difficult and time consuming to search the remains for it now; I decided my chances of finding it might be better after the cremation, when I could sift through the ashes.

As the sun sank low over the red- and gold-leafed Tennessee hills outside, I folded the white body bag back over the moldy skeleton; with

a quick push, the bag slid deep into the furnace. Helen Taylor slid the door upward, latched it in place, and switched on the fan. Seconds later I heard a soft *whump* as the gas ignited.

The next morning dawned foggy and cold. Back inside the garage at the East Tennessee Cremation once more, I felt the heat still radiating from the furnace's masonry. The cremation had taken only a couple of hours, but the body had remained overnight in the furnace so I could examine the burned bones in situ. Sliding the furnace door open, I peered inside the long, dark chamber with a flashlight. The bones inside still clearly outlined a human skeleton. The long bones of the arms and legs were fractured but intact, as was the pelvic structure; the crumbling remnants of a rib cage still sketched the framework of a chest. Most recognizably human of all was the skull. As soon as I touched it, it broke into small pieces.

Using a long-handled broom and a large dustpan, Helen Taylor scooped up the bone fragments and ashes, then spread them on a worktable beneath a vented exhaust hood so I could sift through them. Lurking amid the bone shards and the soft, ashy material were dozens of rusty steel staples; two years before, they had held together the cardboard container in which the body had arrived at Tri-State. Helen handed me a large, heavy magnet and showed me how to drag it through the cremains, trolling for staples.

The weight of the magnet was enough to crush all but the largest pieces of bone; in their lightness and fragility the fragments resembled the airy and brittle meiningue cookies made by baking beaten, sweetened egg whites. Tiny blobs of an amorphous, glasslike material were scattered throughout the cremains, possibly left by melted buttons or other artifacts from the clothing that was burned along with the body. As I continued to sift and stir the material, sorting out pieces that were obviously not human cremains, I strained for a glimpse of a bullet or, more precisely, a melted blob of lead, something that might once have been a bullet. I saw nothing that looked even close.

The final stage in the cremation process was to pulverize the re-

maining pieces of bone. Some of the Tri-State cremains I'd analyzed had contained large bone fragments; news reports had indicated that the Marshes had used a wood chipper or simply a large board to break up large fragments. So I'd done an experiment in cremains processing myself, on another set of cremains I'd received from Bill Brown. I'd put some of the burned bones down in Carol's blender, an old Hamilton Beach model, and switched it on. A terrible clatter and chatter ensued, some of it from the blender, some of it from Carol. (You'd think I'd have learned, after buying two new stoves for Ann, not to use my household appliances for research. Needless to say, the kitchen counter soon acquired a new blender, and the contaminated one was banished to the garage.)

East Tennessee Cremation Services had a much more sophisticated way of pulverizing burned bones: an IEEF processor, which looked a lot like a soup kettle grafted on top of a garbage disposal, but cost a whopping \$4,000. Helen put the cremains in the kettle and covered the top with a heavy lid, then flipped a switch. The fragments were gone in sixty seconds, reduced to a grainy powder. Then she poured the processed cremains into a plastic bag positioned inside a rectangular plastic case—they fit, but just barely—sealed the bag tightly with a plastic cable tie, and handed the box to me. I now held in my hands what the Harden family believed they had received more than two years before. I placed the container in the backseat of my truck and headed home.

The initial, bogus cremains of Chigger Harden had weighed in at 3.6 pounds, less than half what my measurements of one hundred sets of cremains had shown to be the average weight of cremains from males. The cremains I had with me now, on the other hand, were a testament to a burly farmer's frame: including the weight of the bag (but not the plastic box), they tipped the scales at 8.1 pounds, probably pretty close to what he'd weighed back when he first came into this world. After weighing the cremains, I opened the bag and filled a clean plastic film canister with a sample, then resealed the bag. I sent this sample, like the others, to Galbraith Laboratories.

When the results came back, I was surprised: the cremains contained 5 percent silicon, roughly ten times what I'd expected. Perhaps all that silicon came from soil clinging to the body or the clothing, or perhaps some of it was bits of the furnace's concrete lining flaking off. Another cremains sample, which Galbraith analyzed at the same time, contained just 0.5 percent silicon, which was much closer to the human body's normal ratio. As usual, a piece of research had raised as many questions as it had answered. But the fundamental question had been answered pretty conclusively by now: We had a positive DNA identification from the GBI and the Air Force; we had an anthropological examination of the skeletal remains, which were consistent with Chigger's age, race, sex, and hair length and color; we had clothing that matched; and we had independent corroboration from the commercial DNA lab that tested the piece of bone I'd cut from the femur with the Stryker saw.

There was one loose end that still nagged at me, one unanswered question that still kept me from laying this case to rest. I climbed into my truck and headed for UT. Displaying my TBI badge conspicuously on the dashboard, I parked in an illegal spot (the only kind I could find) and walked into the radiology department in the basement of UT's student clinic. Over the years the technicians and physicians there have been unfailingly gracious and accommodating about my occasional requests to have odd things x-rayed. They seem to find it interesting; they also seem to appreciate the fact that I don't bring them decomposing bodies to x-ray. I get those scanned with a portable machine on the loading dock at UT Medical Center.

From a cardboard box I was carrying, I took out two flat plastic bags, roughly a foot square, into which I had divided Chigger's cremains. Spread to a uniform thickness, the cremains formed a square layer about an inch thick in each bag.

The radiology technician stepped behind her lead shield and opened the shutter. The first negative she brought me was almost clear, indicating that it was badly underexposed; apparently she'd overcompensated for the thinness of the sample. Her second exposure was right on the

money. The ground-up bone fragments appeared in many shades of gray; dozens of tiny white toothlike objects dotted the image—metal teeth from the zipper of the bag in which the body had arrived from Georgia and been cremated.

The negative showed one other radiographically opaque object. It was an almost perfect disk, about the size of a penny and twice as thick. I fished it out. The disk was heavy—heavy as lead. I hadn't been able to see it or feel it in the cremains, but it had been there all along. I had found Chigger's bullet.

The Harden family's long period in limbo was over. The finding of the bullet wasn't exactly good news, but they were grateful for it all the same. I've encountered that response time and time again in dealing with the families of the missing and the dead. Uncertainty and dread are almost always harder to bear than the finality of certain loss.

I can't give people back their loved ones. I can't restore their happiness or innocence, can't give back their lives the way they were. But I can give them the truth. Then they will be free to grieve for the dead, and then free to start living again. Truth like that can be a humbling and sacred gift for a scientist to give.