Up in Smoke

Extinguishing a fire that has transitioned through flashover at Eastern Kentucky University.

GREGORY GORBETT/EASTERN KENTUCKY UNIVERSITY

Fire researchers have shattered dozens of arson myths in recent years. So why do American courts still lag behind?

by Douglas Starr

On a rainy spring morning in eastern Kentucky, Greg Gorbett prepares to commit arson. His target is a tidy but cheerless one-bedroom apartment with the kind of mauve-colored carpet, couches, tables, and lamps you would find in a cheap motel. Gorbett is not the only one eager to see the place burn. A handful of other fire scientists and grad students from Eastern Kentucky University (EKU) are checking equipment in the test room as well. They have gathered at the EKU fire lab, a concrete structure in an open meadow as close to nowhere as possible, to document in exacting detail the life cycle of a blaze.

Gorbett scans the setup one last time. A foil-covered wire studded with metal probes—a thermocouple array—crosses the ceiling and hangs down the center of the space; it will measure the temperature at one-foot intervals every two seconds. A radiometer shaped like a soup can will detect changes in radiant energy. Bundles of yellow wires will carry the data to a computer-equipped truck sitting out back. There is also a man lying on the floor: James Pharr, a former fire investigator from Charlotte, North Carolina, wearing a fire-resistant suit and oxygen mask, who will record the event with a thermal-imaging camera.

Gorbett lights a pan of flammable heptane under an end table and then quickly exits the room. The fire begins as a glowing ball and then reaches up and curls around the tabletop like a claw. Quickly it moves to the adjacent couch, which bursts into flames. Modern cushions are made of polyurethane foam, and despite their fire-resistant–covering (introduced in the 1970s to protect against smoldering cigarettes), they are basically solidified petroleum. A modern couch can release the heat equivalent of a 3 million watt lightbulb.

The fire doesn't burn the couch so much as melt it, like a marshmallow over a campfire. Flaming liquid drips onto the floor, forming fiery puddles, some of which burn through the carpet. Pharr squiggles out of the room, dragging his camera. Curtains drop burning fragments that in turn start their own flames. The couch across the room catches fire, although no other source of fire has touched it. "Radiant heat," Gorbett explains.

Bill Hicks, monitoring the fire on his computer in the truck, is calling out temperatures over the walkie-talkie. "Five ninety," he says, reading the measurement at the ceiling in degrees Celsius. That translates to almost 1100 degrees Fahrenheit. The room is obscured by a layer of roiling black smoke. A lightbulb pops. The carpet catches fire. The window cracks. "Better get back," Gorbett says, and we retreat from the window. The smoke layer descends like a curtain almost to the floor. "Seven sixty at the ceiling," calls Hicks. Fourteen hundred Fahrenheit. The radiometer spikes.

"Flashover!" yells Hicks.

A furious orange flame explodes out the window and door. The room has gone from being the scene of a fire to being completely *on* fire. Everything has ignited—carpet, furniture, combustible vapors. A few minutes later, a crew of firemen move in to extinguish it.

Afterward Gorbett and his colleagues walk through the rubble, take photos of the burned furniture and walls, measure the depth of charring, tabulate the results, and compare them to other trials in the experiment. They are not alone. At laboratories throughout the United States—some large enough to contain a three-story house—researchers have been lighting rooms and houses on fire and analyzing the results with the kind of scientific scrutiny that has upended several deeply entrenched misconceptions about how fires behave. The upheaval is more than academic. For generations, arson inspectors have used outmoded theories to help indict and incarcerate many suspects. But as new science is brought to bear on old cases, it is becoming clear that over the past several decades, dozens, perhaps hundreds, of people have been convicted of arson based on scant research and misguided beliefs. Many of those people are still in jail, hoping that someone will take up their cause.

"A lot of bad science has been applied to arson investigation," says John Lentini, a renowned fire expert who has given exculpatory testimony in at least 40 arson cases since 2000. His most recent case, now under review, involves a Massachusetts man convicted of arson by Molotov cocktail, even though not a single glass fragment from the supposed bottle bomb was found at the scene.

"I shudder to think how many wrongful convictions there are," says Richard Roby, president and technical director of Combustion Science and Engineering, a fire-protection engineering firm based in Columbia, Maryland. Roby has testified for several men charged with arson. One, named Michael Ledford, could not have been at the scene when the fire that killed his son was allegedly set, according to Roby's calculations, yet he is now serving a 50-year sentence. "It's amazing to think how long it takes for basic science to be accepted," Roby says. "I lose sleep over this every week."

THE MODERN STUDY OF FIRE IN America was born in the 1970s, when funding was plentiful and consumer protection politically popular. According to a 1973 Nixon administration report called *America Burning,* fires in the United States caused more than $11 billion in annual damage and took an estimated 12,000 lives. The numbers were later found to be exaggerated, but the report galvanized Congress to support the young field of fire research. As part of that support, Congress created a Center for Fire Research at the National Bureau of Standards (NBS), which has since become the National Institute of Standards and Technology (NIST) in Gaithersburg, Maryland. "Until then, there really was no fire safety science," says Vytenis Babrauskas, who in 1976 became the first American to receive a Ph.D. in fire science, from the University of California, Berkeley. With the budget to hire more than 100 bright young engineers, including Babrauskas, NBS began with a fundamental question: How do you quantitatively measure a fire?

Working at NBS in the early 1980s, Babrauskas invented a device that accomplished that purpose. The cone calorimeter resembled a vent hood with a series of ducts attached to the top of a small sealed chamber. When an object, such as a piece of plastic or wood, was burned in the chamber, the device measured a range of variables. It registered the chemical composition of the fumes, the accumulated energy released, and the rate of that release; the temperature, pressure, and opacity of escaping gases; the opacity of the smoke; even the weight of soot compared with the weight of the original substance. It measured so many characteristics that it became known as the Swiss Army Knife of fire research. The first calorimeter could handle small objects a few inches on each side. Later, Babrauskas designed a model big enough to test burning furniture, aptly called the Furniture Calorimeter. "It was basically a big hood with all sorts of instrumentation to capture and measure the gases," he says.

Babrauskas's invention made it possible to investigate fire using classical scientific methodology: setting a fire, measuring the results, reproducing those results, and then repeating the experiment with a new set of variables. Over the next decade, these and other tools shattered long-standing beliefs about fire. The first to go was the assumption that fire always originated in the area of deepest charring, where intense heat creates partial burns marked by a charcoal residue. The idea had seemed to make sense because charring was thought to occur in areas where the fire had burned the longest. Babrauskas and his colleagues found that fire does not progress in a linear way, however. For a time it grows steadily as it consumes fuel and oxygen, but after a while the fire depletes the oxygen and begins to die out. In the absence of air, the energy output, also called the heat-release rate, declines. At this point, if a window breaks or a door opens, air rushes in and the fire shoots in that direction with jetlike intensity, causing the heat-release rate to jump. Researchers now know that the deepest charring sometimes occurs not at the fire's origin or the location of the most fuel but at the source of ventilation—the target of that jet.

The understanding of such ventilation-controlled fires helped explain another phenomenon that turned fire investigation on its ear, says Richard Custer, a former fire researcher who is now a senior fire consultant with Arup, an international engineering firm. That phenomenon, called flashover, occurs when a fire seems to burst out a room's windows and doors. As a fire in an enclosed space progresses, Custer explains, smoke filled with unburned particles and combustible gases accumulates near the ceiling. When the smoke layer descends to almost floor level, a mass of air violently rushes in, igniting the entire flammable mixture. Flames rip across the ceiling, the energy from the fire skyrockets, and the whole compartment becomes engulfed in a blaze. The carbon monoxide the fire pumps out can increase dramatically. Floors burn, and new fires, many of which are also capable of deep charring, spontaneously ignite. Liquid accelerant, the arsonist's tool, is far from the only possible cause. "In the past, investigators had a sense that a certain pattern meant a certain thing," Custer

A typical flashover sequence: A fire starts on a sofa; the fire generates a hot gas layer; the hot gas layer combusts; and finally, everything ignites floor to ceiling (flashover), enveloping the room in a blaze.

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SEVEN MYTHS ABOUT ARSON

Fire investigators have long used certain rules of thumb to identify arson. Many have been proved incorrect.

1. Crazing of windows, in which hundreds of cracks appear in the glass, indicates rapid heating and means an accelerant was used to start the fire. **REALITY:** Crazing is caused by the rapid cooling of window glass, as when water from a fire hose strikes a hot window.

2. Burn marks on the floor indicate that a fire was purposely set, because heat rises and fire only burns upward. It must have been set by pouring a liquid on the ground and lighting it. **REALITY:** When a fire reaches flashover–the point at which an entire room ignites–extreme radiant heat will produce burn marks or even burn holes in the floor.

3. Melted metals, such as doorway thresholds, indicate that a liquid fire starter must have been used in order to reach temperatures that exceed their melting points. **REALITY:** Wood fires, especially those that reach flashover, frequently exceed the melting point of metals.

4. Burn marks under doorway thresholds or under furniture indicate that a liquid accelerant must have been used to start the fire, since the liquid must have been poured and then seeped. **REALITY:** Post-flashover fires commonly cause burning under thresholds and furniture.

5. Spalling, or surface chipping of concrete, indicates that a liquid accelerant must have been poured on the concrete surface and lit. **REALITY:** Many factors can cause this effect, including differential expansion between the heated surface and the interior. Accelerant poured on the concrete actually protects it by providing a cool, evaporative surface.

6. Alligatoring, the appearance of blisters on the surface of burned wood, points to a fire's origin. Small, flat blisters result from a slow burn; large, shiny blisters indicate rapid heating and hence the use of an accelerant. **REALITY:** There is no scientific evidence for any such correlation. Both types of blisters can appear on the same burned wall.

7. Sharply angled V-pattern burn marks on a wall denote a fast-burning fire that must have been started with a liquid accelerant. **REALITY:** Patterns can result from a number of factors, including ventilation, air currents, location of fuel, and the materials burning objects are made of. D. S.

After Cameron Todd Willingham was executed, the **Innocence Project** concluded that **none of the evidence** for arson in the case was scientifically valid.

says. "But post-flashover patterns can have many different sources."

Such insights have helped solve crimes. On New Year's Eve in 1986, a fire broke out in a ballroom at the DuPont Plaza Hotel in San Juan, Puerto Rico. Within minutes it spread to a foyer, then exploded into a second-story casino, killing 98 people. Agents from the FBI and the ATF (Bureau of Alcohol, Tobacco, and Firearms) rushed to the scene and began their investigation old style, interviewing witnesses and sifting through rubble. A couple of days later, two scientists arrived—Harold "Bud" Nelson of the NBS and his boss, James Quintiere, a Ph.D. who had never been to an actual fire scene. At first they were barred from the scene—ATF controlled access tightly—but once they briefed the agents on how their scientific methods could aid the investigation, they were allowed to look around.

"Bud had this little computer with him and began running calculations," recalls Quintiere, who is now John L. Bryan Professor of Fire Protection Engineering at the University of Maryland. Nelson would collect data from the scene, like the room dimensions and the quantity and identity of burned materials. To that data he added known mathematical values for the combustion characteristics of the materials, and he fed all that information into his computer, which simulated the progression of the fire. His mathematical reconstruction worked so accurately that each stage of it matched the recollection of witnesses. Eventually the agents arrested three disgruntled employees who had set fire to furniture in the ballroom. Quintiere and his colleagues were ultimately recruited to train the ATF.

Since then, other high-profile disasters attracted extensively trained scientists with their expensive technology, but the average fire did not. The typical local arson investigator, assigned from the police force or the fire department, had never taken college-level chemistry or physics. He learned on the job, by watching other arson investigators, many of whom had learned the trade from their superiors. The misguided notions that older arson investigators subscribed to seemed commonsensical, if you didn't insist on seeing lab work to support them.

AS A ROOKIE ARSON INVESTIGAtor in Marietta, Georgia, John Lentini never questioned his training. He once believed the old saw that the spalling of concrete, in which the surface chipped after a blaze, resulted from the kind of high heat indicating use of a liquid accelerant and arson. Likewise, he thought that only intentional use of a flammable liquid could explain walls with burn marks resembling a sharp-angled V or the charring of a floor.

That was before Lentini was called to work on a case in Jacksonville, Florida. In 1990 prosecutors charged Gerald Wayne Lewis with setting a house fire that killed his pregnant wife, her sister, and her sister's four children. The fire showed all the classic signs of arson, including "pour patterns" on the floor: demarcation lines between burned and unburned areas that suggested a flammable liquid had been poured and ignited. But the suspect, who claimed his innocence, said he had no idea how the fire started.

Given the extensive publicity the case attracted and the fact that the murder charge carried a possible death penalty, prosecutors hired Lentini and John DeHaan, coauthor of a standard fire investigation text, to double-check and rule out other possibilities—including the hypothesis that one of the kids, playing with matches, had started the fire on a couch. As it happened, two doors down from Lewis's house stood a nearly identical structure slated for demolition. Lentini and DeHaan got permission and funds to furnish the house with the same kind of carpeting and furniture as Lewis's and wire the place with sensors. Then they lit the couch and got out.

Within minutes the living room had burst into flames, followed quickly by the entire house. The blaze went up much faster than investigators imagined was possible without an accelerant. Clearly flashover had occurred. After the fire Lentini and DeHaan found the same patterns on the floor that prosecutors had thought indicated arson in Lewis's house. But rather than being produced by a liquid, the markings had been burned into the floor by the radiant heat released during flashover. The experiment, which became known as the Lime Street Fire, stunned everyone, and prosecutors dropped the charges. "That case opened my eyes," Lentini recalls. "I was ready to send Lewis to the electric chair."

The following year Lentini had another conversion experience in a fire that became known as the Oakland Black Hole. A brush fire swept into that California city, killing more than two dozen people and destroying more than 3,000 homes. Eager to study fire in its natural habitat, Lentini and a crew of investigators moved in, examining 50 houses for postfire patterns. They knew the fire had been accidental, yet they found classic signs of arson: large, shiny blisters on wood resembling alligator skin, chipping concrete, and melted metal doorway thresholds, all typically attributed to accelerant and accelerant runoff, resulting in excessively high heat.

Lentini was particularly struck by the presence of tiny cracks, or crazing, in the window glass in a dozen houses around the periphery, where the firemen had been able to reach with their hoses. Crazing was commonly thought to indicate rapid heating and therefore, once again, the use of a fire accelerant. Back at the lab Lentini tested the idea, taking a dozen samples of window glass and heating them to 1400 degrees Fahrenheit in various ways—rapidly, slowly, some in an oven, some in an open flame. None of the samples exhibited crazing, but they all cracked when he sprayed them with cool water. Rapid heating did not cause the crazed pattern, he determined; rapid cooling did. In other words, one of the classic indicators of arson—one that had been used countless times in court to send suspects to prison—was probably caused by firemen spraying water on hot windows.

Lentini became a science convert, but most of his contemporaries did not. Year after year, poorly trained police or fire department officials contributed to faulty convictions. The most notorious such case reached a tragic conclusion in 2004, when the state of Texas executed a man for a fire that almost certainly was accidental. In 1991 Cameron Todd Willingham was accused of setting fire to a house and killing his three daughters. The prosecution relied on all the usual arson indicators: crazed glass, charred wood at the floor level, a melted aluminum threshold, and pour patterns of a flammable liquid. Witnesses had reported flames exploding out the windows—the main indicator of a flashover fire. Scientists and some field investigators, such as Lentini, knew that flashover fires could char wood at the floor level, melt metal, and create burn patterns that might suggest poured flammable liquid. Yet that information had not reached or convinced the state's deputy fire marshal, Manuel Vasquez (who died in 1994). In 1992 Willingham was found guilty of murder and sentenced to death.

Years went by, and Willingham lost one appeal after another. Finally, in 2004, just weeks before Willingham's scheduled execution, Gerald Hurst, an internationally known fire and explosives expert from Texas, was brought in to support a petition for clemency. After reviewing the evidence and videotapes of the fire scene, Hurst wrote a report debunking the Vasquez findings, calling them "invalid in light of current knowledge." Hurst said the blaze was almost certainly accidental, perhaps caused by a faulty space heater or electrical connection. But even that would be difficult to prove, because the house had been shoveled out by investigators. The cause of the fire should have been labeled "undetermined," Hurst said, because there was no evidence a crime had actually been committed.

The Texas Board of Pardons and Paroles disagreed and denied the petition. After Willingham was executed, the Innocence Project, a national nonprofit legal organization focused on overturning wrongful convictions, assembled a team of leading arson investigators, who concluded that none of the evidence for arson in the case was scientifically valid. The project's lawyers later filed an allegation with the newly formed Texas Forensic Science Commission alleging professional misconduct by the fire marshal's office. The case was such an outrageous example of junk science in the courtroom that it was the subject of several newspaper investigations, a major story in *The New Yorker,* and a PBS *Frontline* documentary. Last spring, seven years after his death, a special state commission concluded that the forensic evidence in Willingham's case was deeply flawed but failed to address whether the original fire inspector had been negligent.


BETTMANN/CORBIS

Firemen and engines in front of the National Exchange Bank after the great Baltimore fire of 1904.

TO MANY, THE WILLINGHAM case was a tipping point in the effort to advance the science of arson and bring it into public view. At the fire lab in Kentucky, Gorbett has been examining one piece of the puzzle: how burn patterns might evolve during a flashover fire. For a half-dozen years he and his colleagues have been repeating the same experiment: furnishing a room, setting it on fire, and then recording the blaze with video and electronic sensors until the flashover ends. After each experiment they enter the burned room and scrutinize the furniture, floors, walls, and ceilings. Their investigation has been exhaustive. Instead of just looking at the visible burn patterns on walls, for instance, they photograph them and use a probe to map calcination—the dehydration and subsequent crumbling of wallboard that results from exposure to intense heat. "We're not just looking at patterns, we're measuring them," Gorbett says.

At NIST, engineer Dan Madrzykowski employs a similarly painstaking methodology. For the past 22 years he has been setting fire to bedrooms, office cubicles, and kitchens, all constructed beneath a huge calorimeter. It was during one of these experiments a few years ago that he and his colleagues stumbled upon a mystery. They were inspecting the charred remains of an intentionally torched living room, built with an open doorway and furnished with a couch and polyurethane chairs, when they noticed some V-shaped burn patterns on a wall behind a chair. According to conventional wisdom, the markings indicated the chair as the source of the fire. By then the NIST team knew better, but they were still stumped: The chair had not been placed near a source of ventilation, another possible explanation for the burn marks. So they played with the variables, building and burning the room several times and changing the location of the chair and the door. Eventually they noticed that the V-shaped burn mark would always appear on the wall opposite the open doorway.

It was then that Madrzykowski realized his group had uncovered a new phenomenon in fire behavior. As the fire is burning and smoke descends toward the floor, cool air rushes in through the bottom of the open doorway. It then races across the floor and mixes with unburned gases, causing them to ignite. And so a classic V-pattern appears in a location that had neither fuel nor ventilation.

Last year Madrzykowski and his colleagues, along with the Chicago Fire Department and representatives from the ATF, replicated those results in condemned town houses near Chicago's O'Hare airport. They fitted the two-story town houses with generic furnishings and lit a fire next to the living-room sofa. By opening and closing different windows on different floors, they were able to manipulate airflow to make it look as if the fire had started at a wide range of spots, even the opposite end of the room from where it actually began. "You've got to get away from this thought that the site of the most damage is where the fire began," Madrzykowski says.

Scientists continue to discover new fire clues. At several labs, investigators are examining the burn patterns resulting after they pour a range of flammable liquids on floor surfaces, including vinyl, wood, carpet, and concrete, and set them ablaze. In some cases, they have found, a flammable liquid actually protects a floor from bursting into flames because the liquid shields it from radiant heat. At Hughes Associates, a Baltimore-based fire science and engineering firm, senior engineer Dan Gottuk was struck by one experiment in which he compared burn patterns left by a liquid-fueled fire to those left by a melting polyurethane couch. "We showed that in many situations you really can't tell the difference," he says.

OTHER INVESTIGATORS ARE studying arcing—a phenomenon that occurs when a fire is hot enough to melt the insulation off the electrical wiring in the walls. At places where the insulation between two wires chars, current can leap from one wire to the next and melt the metal. This in turn can sever the wire or cause a circuit breaker to trip, cutting off electricity. Since unpowered wires cannot arc, mapping these breaks can give a general idea of the fire's progression.

The human body has proved another valuable source of evidence. Richard Roby and colleagues have used toxicology reports from the bodies of fire victims to help determine where a fire originated, what stage it reached, and how long it burned. Not all fire-related deaths are the same. Victims who collapse away from a fire generally die from carbon monoxide, which, pumped out in great volume by flashover fires, can kill in just a few breaths. But victims who die close to the fire perish either from edema (heat-caused swelling of the airways) or heat exposure, in which the organs shut down "like a super heatstroke," Roby says.

Roby has been creating computer models of his findings in the hope they will one day make their way into the courtroom. One case that could benefit involves a woman who died in a trailer fire last year in West Virginia. Neighbors thought they saw her boyfriend, who had recently been released from prison, set a gasoline fire in an outside corner of the trailer. But Roby has another theory. While the autopsy showed low levels of carbon monoxide in the woman's blood, it also revealed extensive thermal injuries in her air passages and lungs. This meant that she must have been close to the fire source. Since the woman was a smoker, Roby speculates that a smoldering cigarette may have set her bed on fire and caused the damage documented in the autopsy report.

Assembling such elements can help investigators understand where a fire began and how it progressed, but even with current technology, determining what started a fire—and whether liquid accelerant was used—remains challenging. One confounding factor is that we live in a petroleum-rich environment: furniture, building materials, carpet, athletic shoes, and toothbrushes all contain petrochemicals. Even a straightforward analysis for gasoline is complicated by the fact that it varies from manufacturer to manufacturer and batch to batch. Investigators must precisely identify the compound and show that—unlike lighter fluid in a convenience store—it would not normally be found at the scene.

Engineer measures a lab fire to see whether he has successfully replicated prior fires used for fire pattern experiments.

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That is where chemist Michael Sigman of the National Center for Forensic Science at the University of Central Florida comes in. With his colleagues, he has been accumulating the data to help investigators identify flammable liquids at fire scenes. As one of the overseers of the Ignitable Liquids Reference Collection Database, he has run more than 600 commercial products through a gas chromatograph and mass spectrometer to record their molecular signatures and uploaded the results to an online database. Investigators who log on can compare chromatographs produced in their labs from fire scene samples with those in a reference collection of flammable liquids. If they find a match, or a near match, Sigman can send them a sample so they can analyze both liquids on their own lab equipment. This provides strong forensic evidence that can form the basis of expert testimony in court. "It's preferable to saying, 'This is how it smells,'" says Sigman.

Despite the surge in fire science, pseudoscience remains entrenched in arson investigation. Most states have no legal requirements for a person to become a fire investigator, although they prefer him or her to take in-person or online training courses and pass rudimentary tests. In some states, including Indiana, a private investigator's license is enough to give you legal authority to investigate a fire and testify about its origins. In other words, someone who makes his living spying on his clients' spouses in hotel rooms can become an expert in fire analysis after an optional training period of just a couple of weeks. "It's still the Wild West out there," says Justin McShane, a Harrisburg, Pennsylvania, attorney who has defended many arson cases. "You've still got people talking about crazed glass or using the most damage as an indicator of the source. One can only hope that in ten to twenty years we get trained scientists doing these investigations."

A few states are pushing for higher standards. In New Hampshire, anyone who wants to become a fire investigator for the state fire marshal's office must earn a two-year associate's degree in fire science or a related field, take an intensive training course, and continue supervised on-the-job training sessions for at least a year. Yet the problem is not limited to investigators. Despite legal precedents that courts should evaluate forensic data as a provable, quantifiable, peer-reviewed science, many judges remain unconvinced. One scientifically trained investigator, who asked not to be identified, testified last winter at the appeal hearing of a man who had been convicted of murder and arson based on a pour pattern on the floor, with no confirmatory laboratory results. Preparing for the case, the investigator replicated the man's floor using the same kind of rug and horsehair carpet pad. He then reproduced the same pattern in his tests without using a flammable liquid. The judge denied the convict's appeal anyway. "I don't want to see arsonists go free," said the investigator, "but I certainly don't want to see innocent people going to jail."

REVERSING AN ARSON CASE IS notoriously difficult, much more so than, say, a rape or murder case that involves DNA. Analyzing DNA with modern techniques can produce definitive proof of the suspect's innocence. In contrast, scientists can testify that an arson investigation was done poorly, but rarely can they definitely rule out arson as the source of the blaze, which is often required to win an appeal. Although it has used Willingham's story to press for changes in policy, even the Innocence Project does not take on arson convictions in court since they cannot be overturned with DNA.

Some other investigative groups are trying to pick up the slack. Local innocence projects in Massachusetts, Pennsylvania, Indiana, Nebraska, California, and several other states are pursuing arson appeals.

Three years ago, a few faculty members at the John Jay College of Criminal Justice in New York set up a national clearinghouse for arson appeals and began collecting dossiers from prisoners around the country. Once they completed their review, they planned to submit the files to attorneys to take to court. "We had about 20 cases that met our criteria for deficiency in science," says Peter Diaczuk, a forensic scientist at the college. But the philanthropy that supported the project, the JEHT Foundation, had invested its money with Bernard Madoff. The foundation went bankrupt, and last summer the project collapsed. "I think we were on the brink of making an important contribution" to freeing potentially innocent prisoners, says Diaczuk. "Unfortunately for some of them, now it's as if we never existed."

> In Indiana, someone who earns a living spying on **cheating spouses** can be certified to testify in arson cases after a **couple of weeks**.

Despite some setbacks, Gorbett and other fire scientists remain optimistic that the results of their research are beginning to take hold. For almost a decade, scientists working with the National Fire Protection Association, a professional group of fire fighters and safety engineers, have been publishing a set of standards and procedures that many courts recognize as a gold standard in arson prosecutions. Law enforcement agencies in some states seem to be taking a more nuanced approach to arson analysis.

In Massachusetts, the percentage of building fires determined to be arson has dropped from more than 15 percent in the early 1990s to less than 2 percent in 2009. In Texas the proportion of fires labeled incendiary has declined by more than half in the last decade. Nationwide, according to the National Fire Prevention Association, the number of intentional structure fires declined by about 51 percent between 1990 and 2007, the most recent year for which statistics are available—from 111,900 incidents to 54,700.

Some of that decline resulted from a change in accounting procedures, but the trend indicates that better science is beginning to produce better justice. "Investigators will have to be willing to make the effort," Gorbett says. "We're all going to have to work harder to get better data to make a change." ◗

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