

U.S.

Casey Anthony CSI: A Triumph of High Tech Forensics?

By Nate Rawlings

Millions of viewers have been transfixed by the parade of forensics experts presented by the prosecution over the past few weeks in the trial of Casey Anthony, a 25-year-old mother who stands accused of killing her 2-year-old daughter Caylee and dumping the body near their Orange County, Florida, home in 2008. The ubiquitous broadcasts of the trial are as compelling as anything that fans of the fictional forensics drama *CSI: Miami* might encounter. But the cutting-edge crime-scene science is far more technical, inexact and contradictory than anything a screenwriter might gin up. And it's just those contradictions that the defense will point out as they take center stage this week.

To find out how Anthony's lawyers might rebut the most damaging evidence presented by the prosecution, TIME asked crime experts to weigh in on the viability of seven aspects of the forensics testimony.

1. Evidence that is "consistent with" a crime does not constitute proof

On TV, forensics scientists usually emerge from the lab with proof of the killer's identity. DNA, fibers, hair samples and a host of other evidence always seem to point fictional cops to the culprit.

But in reality, it's not usually about one hair sample. In the Anthony case, the prosecution has attempted to show that the evidence they've gathered is "consistent with" their theory of how Caylee was killed. Prosecutors allege that Anthony conducted Internet searches for making chloroform, used the homemade chemical to knock her daughter out, put



Joe Burbank / Orlando Sentinel / MCT / Landov

Crime-scene investigator Jennifer Welch holds up duct tape entered as evidence during Day 16 of Casey Anthony's trial at the Orange County Courthouse in Orlando, Fla., on June 11, 2011

duct tape over Caylee's mouth and nose and then dumped the body in the woods. Many of the experts in the case so far have testified that the evidence they've seen is "consistent" with these assertions.

But consistency is not as powerful in court as presenting evidence that points directly to the identity of a killer, explains Adina Schwartz, an expert in evidence law and science and a professor of law and philosophy at the John Jay College of Criminal Justice, City University of New York. "What does 'consistent with' mean? It means 'could be,'" she says. That uncertainty will create room for the defense to make its case.

2. Identifying human hairs isn't an exact science

According to the prosecution's narrative, An-

thony stored the body of her daughter in the trunk of her car after subduing the girl with chloroform.

Investigators discovered hairs in the trunk, which they tested for DNA. This would be the part of the TV plot where we'd learn who owned the hairs. In reality, DNA testing only narrowed the identity. Because the hairs they found contained no roots or tissue, investigators could test only for mitochondrial DNA, which is passed down through female ancestors. This means the hairs could belong to as many as five people: Casey, her mother, grandmother and brother, and finally Caylee.

"They cannot say with scientific certainty that it's Caylee's, although it's suggestive that it's Caylee's," Lawrence Kobilinsky, a DNA expert and head of the forensic sciences department at John Jay College, says of the hairs. (Kobilinsky consulted with Anthony's defense lawyer Jose Baez on the initial part of the case but has since stopped working on it.)

The hairs in the trunk had dark bands near the base, which prosecution experts testified indicate a decomposing body. Kobilinsky says the bands can also be caused by air pockets. "There are people that claim they can tell a difference, and so this may become an issue at trial," he says. "But this calls for subjective determination." In other words, two experts examining the same hair could have two opinions: that the darkening was caused by either decomposition or air pockets.

3. The new science of odor analysis is controversial

One of the most disputed pieces of evidence is the result of a new odor-analysis technique developed by Arpad Vass, a forensics anthropologist at Oak Ridge National Laboratory in Tennessee. He claims that his research on cadavers at the University of Tennessee's "body farm" (an outdoor research lab where donated bodies are allowed to decay to study human decomposition) yielded a database of 400 chemical vapors he calls "decomposition odor analysis." Vass testified that the air in Anthony's trunk contained definitive signs of decomposition.

Vass has published articles in the peer-reviewed *Journal of Forensic Studies*, but Kobilinsky argues that his analysis should not have been admitted given Florida's Frye standard. "It's what the state calls 'state of the art.' It's what I call 'not ready for prime time,'" he says. "It's not junk science, but it never should be brought into a courtroom at this stage."

Prosecutors have also tried to show that the trunk contained unusual levels of chloroform, the chemical they allege Anthony used to kill her daughter. Tests conducted on the air in the trunk by the FBI laboratory and by Vass's odor-analysis

technique long after Caylee's disappearance indicated high levels of chloroform. "Chloroform's quite a volatile liquid, and it wouldn't really stick around for that long," Ruth Smith, a professor of forensic chemistry at Michigan State University, says. "Meaning that if chloroform had been used, it was used at very, very high levels, which would not be common." The defense attacked Vass's odor-analysis technique as unreliable for proving decomposition of a body and blamed the stench on garbage found in the trunk.

4. Even evidence of flesh-eating insects isn't proof of a dead body

To bolster the idea that Anthony's car trunk once contained a decomposing body, forensics entomologist Neal Haskell testified about insects found in garbage in the trunk. Insects are common in murder cases where a body is found outside. "You'll have bugs, various insects, and their larvae will be in [the remains]," says Charles Hitchcock, director of autopsy services at Ohio State University. "In that case, you'll sample those at the crime scene."

But without a body in the trunk, Haskell's testimony focused on insects that commonly swarm decomposing bodies. Haskell explained that the chemical composition of a decomposing body changes, and the insects attracted to the corpse will also change, allowing him to create a possible timeline for how long a body (though he could not prove it was a human body) may have been in the trunk, in this case three to five days.

Defense lawyer Baez challenged the idea that the insects were attracted specifically to a decomposing body, asking whether leftover food could also attract the bugs. Haskell explained that the insects in question would be attracted to "decomposing organic material," which is consistent with the prosecution's theory that Caylee's body was in the trunk. But then again, as we've heard, "consistent with" is not absolute proof.

5. Human remains don't tell the whole story

When investigators found Caylee's remains in December 2008, six months after the girl was last seen, it wasn't a pretty sight. Her body had decomposed in a wooded area 20 ft. (6 m) off the road and less than a mile from her grandparents' home. Although investigators found 350 pieces of evidence at the crime scene, they could collect only a handful of bones.

Unlike most fictional cases, finding Caylee's remains yielded few definitive answers. The duct tape found on her skull contained no DNA. "Duct tape in general is great physical evidence in crimi-

nal cases,” Kobilinsky says. “There is no way anybody can determine if the duct tape had been put on before, during or after death. There’s no way you could do it scientifically or medically.”

Jurors saw pictures from the crime scene and heard graphic details about plants and bugs that had infested Caylee’s remains. “If you have skeletal remains, you’re looking for every bone that you can find, and then try to reconstruct,” Hitchcock of Ohio State University says.

Anthony’s lawyers will likely emphasize that medical examiners were unable to pinpoint the cause of Caylee’s death, but Hitchcock explains that can often be the case. In nearly 10% of medical autopsies, it is impossible to definitively determine the cause of death, a percentage that increases in criminal cases. “It is a giant puzzle,” Hitchcock says. “It’s attention to detail. Every coroner, every medical examiner, every forensic pathologist and dentist and anthropologist is really anal-retentive.”

6. Cyber-evidence is key

To prove their assertion that Anthony searched the Internet for homemade chloroform recipes, prosecutors called on digital forensics experts who recovered searches from Anthony’s laptop, even after they had been erased. This may seem like science fiction, but it’s a common practice for investigators.

“We start out by forensically preserving that evidence at a point in time,” says Cheri Carr, director of the Dallas digital forensics lab for Stroz Friedberg, a digital security firm. The analysts use computer programs to recover data that has been deleted but is stored in unallocated space on the hard drive. It’s tedious, complicated work, but the results are compelling for a jury.

“Computer evidence, in my opinion, is one of the best forms of evidence because it’s somewhat indisputable,” says Erin Nealy Cox, a former federal prosecutor and head of Stroz Friedberg’s Dallas office. “Where you might have problems with eyewitnesses contradicting themselves or not remembering, you don’t have those types of problems with computer evidence.”

While the jurors have seen compelling evidence

that someone searched for chloroform, the prosecution has one glaring limitation. “The one piece that [investigators] can’t do is put the person at the computer, but there’s a lot of circumstantial evidence you can use,” Nealy Cox explains. Prosecutors will emphasize that the damning Internet searches occurred on Anthony’s computer, while defense lawyers will stress that many people other than Anthony had access to the computer.

7. A guilty verdict might not be final

The prosecution has run some risks in building so much of their case on expert testimony that the forensics evidence is “consistent with” their theory of how the crime was committed. No matter how careful investigators and experts have been, the decision of Judge Belvin Perry Jr. to admit analysis using some of the newer and less-tested scientific methods may give Anthony’s lawyers grounds for appeal if she’s convicted. This is because Florida, like New York, Illinois and Pennsylvania, is what is known as a Frye state, where courts must follow strict guidelines for what type of scientific evidence is admissible. In a Frye state, the City University of New York’s Schwartz says, the judge does not “let testimony in where the danger of unfair prejudice vastly outweighs its probative value.” The danger of unfair prejudice, explains Schwartz, is that a jury brought up on *CSI* will assume that “consistent with” testimony equals definitive identification.

“A jury is not the place for judging science when it’s in a debatable, experimental state,” Schwartz says, citing Vass’s odor-analysis technique. “Until the scientific community reaches a consensus, it shouldn’t go to juries.”

For Kobilinsky, who was an early proponent for the use of DNA in the courtroom, his objections underscore the weight jurors give to scientific evidence. “There is no question in my mind that when juries hear about science in the courtroom, the science has an impact,” he says. “And that is another reason it is essential that we show the jury only reliable science. We can’t take a chance, especially in a capital case, of giving them science where the reliability is questioned.”