# Bullet Evidence

## The Science of Bullet Forensics on Trial

By Dave Brown

*"A lie will go around the world while truth is pulling its boots on."*

*- Charles Haddon Spurgeon, 1855*

I am not a ballistics expert and I don't play one on television. (Except for that one time, but only because I fit the costume.)

As a professional firearms instructor, we don't pretend to know how forensics examiners do their jobs. We know that crime scene investigators don't drive around in Hummers or get DNA results in seconds, complete with name, photo, last known address and list of all accomplices. Unlike television, they can't access any database in the world with a few strokes on a keyboard and they certainly don't solve every crime in 42 minutes to leave time for commercials.

What we do know is that one can match a bullet to a suspect firearm using what is often termed ballistic forensics.

But now that science is being called into question, and some have suggested that it is more correctly termed "junk science."

### Is the science of bullet forensics as 'exact' as what we've been told?

We always knew it was never a perfect science. Microscopic tool marks left behind on a fired bullet as it travels down the barrel were never really seen as "a firearm's DNA" as some have termed it. Bullets fired in non-homogenous substances such as a human body can impact muscle, bone, clothing and internal objects, all of which can deform the bullet, making identification difficult.

Television aside, we knew that not every bullet can be traced to a specific firearm. For example, some rifles such as the RCMP's Patrol Carbine are manufactured with hammer-forged barrels that do not machine the rifling grooves in a barrel in the traditional way. Instead, they use a hardened die inserted into a barrel blank that is pounded by tens of thousands of powerful hydraulic hammer blows to form and shape the barrel to exact dimensions. This process may make it more difficult to come to a conclusive decision about the exact firearm that fired a bullet.

Other firearms manufacturers that use non-traditional rifling may not leave enough marks on the bullet that can be matched to a specific barrel even if recovered fully intact.

Those of us old enough to remember always laughed at the old television gag where the detective would pick up a handgun at a murder scene by sticking a pencil down

the barrel to preserve the fingerprints. “Never do that! It can destroy ballistic evidence,” we would caution our students.

But wait a minute. If ballistic evidence is so exact that one can match a bullet recovered from a crime scene to a suspect firearm with certainty, how can the simple act of sticking a pencil down the barrel or even the suspect cleaning the barrel of a firearm after committing a crime, destroy that same evidence?

Courts and some firearms experts are starting to question how ‘exact’ the science is behind bullet comparisons. In the U.S., the Supreme Court of Maryland recently ruled that ballistics evidence is not supported by science in two separate rulings that may call into question how ballistics are used in court cases across the country. One case was the trial of the two Washington DC murderers John Muhammad and Lee Malvo and the second was the case of Kobina Ebo Abruquah who was found guilty of second-degree murder based almost exclusively on testimony from a forensics firearms examiner that the bullets recovered from the victim’s body were fired from Abruquah’s gun.

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A 2009 report by the National Academies of Science first called into question how exact the science was and noted how there were few if any scientific, double-blind research studies to back up the claims made by examiners in court. The report pointed out that, unlike fingerprints, bullet examination protocols don’t specify how many points of similarity are needed to form a conclusive opinion.

A 2016 report to the U.S. President’s Council of Advisors on Science and Technology (PCAST) concluded that firearms analysis fell short of the criteria for scientific validity, which requires repeatability and reproducibility.

In another widely quoted research paper from 2022 called the Ames II study, 173 firearms examiners were tasked with comparing thousands of fired cartridge cases and bullets. Overall rates of errors and false positives in the study were considered to be under 1%.

Critics of the Ames II study point out that the three categories that examiners used, of “Identified,” “Eliminated” or “Inconclusive,” skewed the result numbers substantially. Being able to answer “inconclusive” and still be scored as perfect, meant error rates of under 1% were perhaps closer to 30% to 40%.

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Critics also pointed out that examiners disagreed on a number of matches made by their own colleagues, and the same examiner even reached different conclusions when given the same test batch twice.

Critics considered that the large number of “inconclusive” results were like answering every multiple-choice question on a test with “I don’t know” and still scoring perfect.

## Science on trial?

So far, courts in Canada have continued to consider firearms identification evidence as scientifically sound. Firearms identification is based on the premise that no two guns will make identical marks on a bullet or cartridge case. The unique marks are said to be the result of a manufacturing process that involves cutting and drilling of the rifling grooves, as well as grinding, filing and polishing of the action parts and the barrel.

What about new methods of manufacturing that may not leave characteristic marks as unique as fingerprints? Some people feel the existing body of research has been insufficient to prove the scientific principles of reproducibility and repeatability. Independent experts examining bullets from an unknown source, provided by researchers with no prior knowledge of the actual matches, must be able to identify and include or exclude

bullets that match the findings of their colleagues, plus match their own findings no matter how many times they examine the same batch of samples.

Even error rates of one percent can result in false negatives where criminals go free, or false positives where innocent people can get convicted. Thankfully, ballistic evidence in Canada is only one contributor to the evidentiary system, but juries in the U.S. have found it hard to discount something purported to be an 'exact science,' which is strange when so many citizens still believe the world is flat or that every crime can be solved in under 42 minutes.

There is no question that further research is needed. Legitimate professional organizations that self-certify and self-govern their membership, should also accept and welcome new research. Few firearms examiners become expert witnesses in a courtroom by joining an organization of fellow firearms examiners and watching the movie, "My Cousin Vinny" the night before a big case.

The role of an expert witness in Canadian courtrooms has been especially well defined. The role is to help the court. They offer an opinion, based on previous training, knowledge and experience, about a case in which they have no personal connection. In my experience, courts in Canada are less likely to recognize expert witnesses who make their living testifying for whatever side pays them the most.

Firearms examiners in Canada are, for the most part, highly professional and reliable.

But that may be changing. Perhaps being accurate more than 99 percent of the time just might not be good enough for courts in the future. The jury is still out.

*Dave Brown is a Winnipeg-based firearms instructor and training specialist. He was subject-matter-expert in the design of Canada's national firearms safety training programs, been recognized in court as an Expert Witness and lectured at the University of Manitoba School of Law. Now retired, Dave was invited by the National Judicial Institute to present at a 2023 judiciary convention hosted by the Court of King's Bench of Alberta on the topic of "The Science Behind Police Firearms Training."*

*He also admits to watching "My Cousin Vinny" in preparation for his first trial.*