Chair Prozanski, Vice Chair Thatcher, Members of the Committee:

My name is Alicia Carriquiry. I am Distinguished Professor of Liberal Arts and Sciences, and Dr. Patricia S. Conn Professor of Statistics at Iowa State University in Ames. I am testifying in support of Senate Bill 1515.

I have worked on forensic science problems since about 1998. In fact, my first research project was on comparative bullet lead analysis in collaboration with the FBI. Since 2015 I have been the director of the Center for Statistics and Applications in Forensic Evidence (CSAFE), which until 2024 was a Center of Excellence of the National Institute of Standards and Technology. CSAFE researchers collaborate with forensic scientists and legal professionals, and its mission is three-fold: we develop statistical methods for the evaluation of forensic evidence, we construct the tools (such as software) that forensic practitioners need to implement those methods, and we train forensic and legal professionals in the use of modern technology to examine and interpret evidence.

Many forensic methods were developed by forensic practitioners or law enforcement in crime labs, and never had the benefit of undergoing serious testing and validation.

In the last two decades, however, several of these methods have undergone increased scrutiny in part because they were used to convict persons that were later exonerated thanks to DNA analyses. Three methods in particular have been thoroughly reviewed by the broader scientific community and those are bitemark analysis, hair microscopy and comparative bullet lead analysis.

I now briefly explain why those methods should not be used in source attribution and why they have been abandoned by most law enforcement agencies including the FBI.

In comparative bullet lead analysis, practitioners compare the concentration of several trace elements in the lead alloy from which bullets are manufactured. The question is whether a bullet from a crime scene can be tied to a defendant's box of unused ammunition, for example. This technology was abandoned about 20 years ago because it was shown that bullets could

be chemically indistinguishable even if they were manufactured years apart. Further, and depending on caliber, one batch of molten lead may result in 200,000 to 400,000 bullets, so the chances of finding matching bullets from different boxes in a certain geographic area depended on things such as commercial distribution, size of the market and such.

Forensic bite mark analysis has been discredited because it has no scientific foundation. First, when someone who is alive is bitten by another person or by an animal, the instinct is to quickly pull away from the biter. Therefore, the shape of the injury is distorted by this reaction. Second, injuries begin to heal instantly, so after a short time, the injury looks very different from what it looked like when the biting occurred. Finally, there is no reliable information about the uniqueness of dentition across persons. So even if it were possible to match a dentition to a bitemark injury, we would still not know whether the defendant or someone else was the biter. About 15 years ago, two board certified forensic odontologists carried out a study, where they showed 90 or so images of abrasion injuries to about 40 of their colleagues. They asked colleagues to classify each as either a human bitemark, a bitemark made by an animal, or unknown. The degree of disagreement among board-certified forensic odontologists was very large, even though they were all looking at the same photos. In 2023, NIST in collaboration with CSAFE, assembled a group of about 50 stakeholders that included forensic odontologists, statisticians, legal professionals, crime lab directors and others, to review the literature on forensic bitemark analysis. The consensus was that bitemark analysis is not a reliable science and should not be used for source attribution.

Like bitemarks and the trace element composition of bullet lead, microscopic hair attributes cannot reliably tie a crime scene hair to a person. Again, there are several reasons for this, including the fact that the physical hair attributes that examiners look at under the microscope can vary even within the same person's hair. In addition, there is no agreement regarding how many attributes should agree before two hairs are declared a match, and the measurement processes used by examiners have not been standardized or evaluated for accuracy and reliability. Finally, there is no information about the distribution of the attributes in the population so even if it were possible to reliably establish a match between two hairs, one would still not know

whether there might be another 5 or another 5 million persons who would also match the crime scene hair. About 10 years ago, the FBI determined that microscopic hair analysis should not be used for source attribution and that testimony should not suggest any probabilistic or quantitative weight of the evidence.

To finish I'll note that forensic testimony carries enormous weight with juries, especially when framed as scientific or probabilistic.

Allowing courts to revisit convictions substantially based on discredited science is consistent with how science progresses. When new information becomes available, scientists correct past errors and move forward.

My testimony does not undermine forensic science as a whole, only methods that have been shown, through research, to lack reliability