Pseudoscience and Dubious Forensics
A Talk with Chris Fabricant

- Misapplied forensics and wrongful convictions
  - Misapplied forensic methods contributed to a large percentage of wrongful convictions. According to the Innocence Project, 45% of wrongful convictions proven through DNA evidence were a result of misapplied forensic evidence.[1]
  - Forensic science comprises many disciplines and methods. It can offer valuable methods of gathering evidence. However, misapplied forensic methods can have devastating consequences for defendants whose life or liberty is at stake.
  - Misapplied forensics includes:
    - Unreliable forensic testing methods, like bite mark matching.
    - Erroneous expert testimony.
      - Experts may exaggerate the probability or overstate significance of findings that give jurors the impression of certainty. In the most egregious cases, forensic examiners fabricated results.
      - Even if their methods were sound, they may make a mistake in testing.

- Wrongful conviction of Steve Chaney
  - John and Sally Sweek were murdered in their Dallas suburb apartment. They had been stabbed multiple times and their throats cut. A mark resembling a bite mark was found on John's arm. A notebook was found in the apartment that appeared to be drug ledger: Steve Chaney was listed in it among others. Later, a Curtis Hilton called with a tip that he and Chaney had regularly bought cocaine from the Sweeks, had been to their apartment a week before the murders, and that Chaney owed John Sweek money. Among the dozens of fingerprints found in the apartment, one partial fingerprint was matched to Chaney. Chaney was arrested and changed with the Sweeks' murder. After a mistrial was declared at the first trial, Chaney was re-indicted only for John's murder. He was convicted and sentenced to life, and his conviction was upheld on appeal.
  - Problematic forensic evidence used at trial:
    - Shoeprints: bloody shoeprints were found at the apartment. During one of his police interrogations, Chaney was wearing tennis shoes that the investigator believed resembled the bloody shoeprints found at the crime scene. The shoes were presumptively tested and found to have

[1] Innocence Project, Overturning Wrongful Convictions Involving Misapplied Forensics:

non-visible traces of an unknown substance that might have been blood.
    - A forensic serologist testified that presumptive blood tests can return false positives, but that in her experience, it's more likely to be blood if there is a quick positive result, as happened in this case. She also testified that there was too little substance to test to confirm whether it was blood.
    - The defense called a Footlocker manager who testified that the shoeprint pattern found at the crime scene was one of the most widely used sole patterns in sneakers and that 50-80% of all athletic shoes used that sole pattern.
  - Partial print: a partial thumbprint was matched to Chaney on the wall near the kitchen entrance.
  - Bite mark: two forensic odontologists testified that a mark found on John's arm was Chaney's bite mark. Dr. James Hales testified that in his opinion, the marks were inflicted "at or about the time" of death; that the marks were human bite marks; and that the bite marks were made by Chaney, with a "one to a million" chance that someone else made it because it was a "perfect match."
  - All of the State's evidence was circumstantial, and Hales' bite mark testimony was considered damning. A juror indicated later that the bite mark evidence was the most convincing for her.
- In 2015, he filed a petition for a writ of habeas corpus. His conviction was vacated with a recommendation that a writ be granted. Chaney was released from prison.
- His writ was granted in 2018, declaring him innocent, and in 2019, the Texas Court of Criminal Appeals issued the final mandate.[2]
  - The Court agreed with Chaney that the scientific understanding about the reliability of bite mark matching has changed was no longer reliable. Dr. Hales recounted his earlier testimony, indicating that under today's scientific standards, he could not testify with the degree of certainty he had done at Chaney's trial.

- Standards of admissibility of expert testimony
  - Frye standard: *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923)
    - Whether the evidence is obtained from methods that have gained general acceptance in the particular field.
    - Some states still use a modified form of *Frye*.
  - Daubert standard: *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993)

[2] Ex parte Chaney, NO. WR-84,091-01(Tex. Crim. App. Dec. 19, 2018): https://law.justia.com/cases/texas/court-of-criminal-appeals/2018/wr-84-091-01.html

        - Expert testimony must be relevant and foundationally reliable. Nonbinding factors for trial court to consider:
            - Whether the methodology has been or can be tested,
            - Whether the methodology has been peer reviewed and published,
            - The known or potential error rate,
            - Existence and maintenance of standards controlling its operation, and
            - Whether the methodology is generally accepted in the field.
    - Federal Rules of Evidence 702. Testimony by Expert Witnesses
        - Amended in 2000 to codify *Daubert* and progeny cases.
            - *If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise, if (1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliability to the facts of the case*.
    - *Daubert* implemented
        - Empirical evidence supports the view that *Daubert* is more vigorously applied in civil litigation, particularly in cases involving large sums of money. Civil defendants are significantly more successful in *Daubert* challenges to exclude plaintiff's expert testimony than criminal defendants whose life or liberty is on the line.[3] Criminal defendants seeking to exclude prosecutions' evidence via *Daubert* challenges generally lose.

Types of forensics more commonly misapplied

- Bite mark analysis and matching
    - Bite mark analysis involves identifying whether an injury on skin is a human bite mark, whether made by an adult or child, the position of the victim at time of injury, etc. Bite mark matching involves comparing the bite mark to a suspect's dentition (teeth development and arrangement in mouth).
    - Dr. Mary Bush and Peter Bush, forensic dentistry experts, conducted a series of tests to determine scientific underpinnings of bite mark comparison,

[3] Craig M. Cooley, & Gabriel S. Oberfield, *Increasing Forensic Evidence's Reliability and Minimizing Wrongful Convictions: Applying Daubert Isn't the Only Problem*, 43 Tulsa L. Rev. 285, 291 (2013) (citing D. Michael Risinger, *Navigating Expert Reliability: Are Criminal Standards of Certainty Being Left on the Dock?* 64 Alb. L. Rev.99, 108-11 (2000)).
https://digitalcommons.law.utulsa.edu/cgi/viewcontent.cgi?article=2612&context=tlr

whether dentitions are unique[4], and whether bite marks on skin can be reliability matched to specific dentitions.[5] Their series of studies found unreliability in various bite mark comparison methods and that matching is highly subjective process.

- Cadaver dogs
  - Cadaver dogs are dogs that are trained to alert to the presence of a decomposing body. Cadaver dogs are trained to distinguish between human scents and animal scents, not between individual humans. Various experiments have shown that that scent dogs are affected by their handler's subtle cues, beliefs, and reactions.
  - There is no one national standard for cadaver dog training. Courts throughout the country have also been inconsistent in their standards for admissibility of cadaver dog evidence.
  - D'Andre Lane's trial and appeal[6]
    - 2-year-old Bianca Lane went missing in 2011. Her father D'Andre Lane claimed he was carjacked with Bianca in the backseat. Cadaver dogs were used as part of the search for Bianca. The dogs detected the presence of decomposition in Lane's car and on Bianca's car seat and blanket. Lane was charged with murder and child abuse. Lane moved to exclude the cadaver dog evidence. At the hearing, FBI Canine Program manager Rex Stockham stated that there are no instruments that can detect human remains and that he assumes the cadaver dog is correct if the dog has routinely passed testing before and after the incident. Dog handler Martine Grime submitted the cadaver dogs' training reports showing over 95% accuracy on tests into evidence. Lane's motion to exclude was denied. The jury was instructed not to convict solely on the basis of the cadaver dog evidence. Lane was convicted of felony murder and child abuse and sentenced to life.
    - On appeal, the Michigan Court of Appeals affirmed the admissibility of the cadaver dog evidence.
- Hair microscopy
  - The first reported use of hair comparison evidence was in 1855 at the trial of John and Gaston Browning for the murder of John Neal. [7] Hair found at the

[4] Bush, M.A., Bush, P.J. & Sheets, *H.D. Similarity and match rates of the human dentition in three dimensions: relevance to bitemark analysis*, Int J Legal Med (2011) 125: 779. https://www.ncbi.nlm.nih.gov/pubmed/20814692

[5]Bush MA, Thorsrud K, Miller RG, Dorion RB, Bush PJ, *The response of skin to applied stress: investigation of bitemark distortion in a cadaver mode*l, J Forensic Sci. 2010 Jan;55(1):71-6: https://www.ncbi.nlm.nih.gov/pubmed/20002269

[6] People v. Lane, 862 N.W.2d 446 (Mich. Ct. App. 2014)

[7] Fabricant, M. Chris and Carrington, William Tucker, The Shifted Paradigm: Forensic Sciences's Overdue Evolution from Magic to Law (March 2, 2015). 4 Va. J. Crim. L. 1, 64 (2016): https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2572480&download=yes

defendants' residence was visually matched in length and color to the victim's. The Mississippi Supreme Court found the hair evidence and other evidence sufficient to sustain a guilty verdict, but affirmed the lower court's reversal of the guilty verdict and a new trial granted on other grounds. One dissenter found testimony insufficient to uphold a guilty verdict. *See* Browning v. State, 33 Miss. 47 (1857).

- Microscopic hair matching involves comparing hairs based on characteristics like pigment, tip shape, shaft diameter. Some of these characteristics are subjective. Different examiners may use different words for the same characteristic. Another problem is that there are no population-based databases of hair characteristics that indicate the proportion of the population that have the same hair characteristics or the probability of matching on certain characteristics.
- FBI use of hair microscopy[8]
  - In 2015, the FBI completed its review of its use of hair microscopy in criminal cases before 2000.
  - It concluded that in at least 90% of the criminal trials it reviewed, the examiner's testimony contained erroneous statements. Examiners made statements that gave more weight to the evidence than was scientifically warranted.
  - Since 2000, the FBI has been using mitochondrial DNA where available.

- Blood spatter
  - Blood spatter/bloodstain pattern analysis involves looking at bloodstains, its size, shape, pattern, direction, etc., to determine information about where and how a victim was injured or killed.
  - Blood spatter analysis is extremely complicated and involves multiple disciplines, including physics, biology, and pathology.
- Shoe treads
  - Shoe treads/shoeprint is a type of pattern matching evidence. It involves comparing tread/sole size and patterns.
  - Ways in which shoeprint evidence can be degraded or misapplied:
    - At any point between collection and analyses, the evidence can degrade or be corrupted.
    - Comparisons and identifications can be highly subjective.

[8] FBI Press Release, "FBI Testimony on Microscopic Hair Analysis Contained Errors in at Least 90 Percent of Cases in Ongoing Review," April 20, 2015: https://www.fbi.gov/news/pressrel/press-releases/fbi-testimony-on-microscopic-hair-analysis-contained-errors-in-at-least-90-percent-of-cases-in-ongoing-review