

Hair microscopy, or microscopic hair analysis, is the practice of comparing hairs under a microscope to determine whether they came from the same person.¹ Examiners look at hair color, chemical treatment, pigment aggregation, shaft form, and other observable characteristics.

Hair analysis is a form of pattern matching.

Pattern matching is sometimes known as **feature comparison**.² Other types of pattern matching include fingerprints, toolmarks, and handwriting. Pattern matching examiners rely on a method called “ACE-V:” **Analyze, Compare, Evaluate, Verify**. ACE-V, however, does not fix reliability problems.³

Pattern matching is unreliable.

Pattern matching is inherently **subjective**. Each examiner decides how to describe the characteristics she sees, how much significance to assign to each observation, and whether she has found a “match.” There are no objective standards.⁴

Pattern matching is based on the unproven assumption of **uniqueness** — here, that hairs from different people will look different. But there is no scientific evidence that hairs are unique or even rarely share characteristics.

Hair analysis, like most pattern matching disciplines, has no known **error rate**: the frequency with which examiners reach the wrong conclusion. Instead, examiners testify “to a reasonable degree of scientific certainty,” a phrase with no real meaning.

Examiners experience **cognitive biases**: subconscious motivations to declare a match.⁵ Bias can come from knowing whether other examiners see a match, whether the police expect the samples to match, or what crime is alleged.

Faulty forensics can snowball into a misguided investigation.

Once investigators have relied on faulty hair analysis, they can develop **tunnel vision**,

reinterpreting or ignoring the other evidence in the case to support their mistaken theory.⁶

Hair analysis leads to wrongful convictions.

A study of more than 320 nationwide exonerations resulting from DNA testing found that **over 70 of those exonerations** involved the improper use of hair evidence.⁷

A Washington, D.C. man was wrongfully imprisoned for over two decades before DNA evidence revealed that one of the hairs the FBI had matched to him was not even a **human** hair; it belonged to a **dog**.⁸

In Massachusetts, **George Perrot** was convicted of burglary and aggravated rape in 1992 on the basis of a hair. The Superior Court granted his Motion for New Trial in 2016, finding that the changes in hair science since his trial constituted newly discovered/available evidence. This marked the first case nationwide in which a new trial was granted based on changes in hair science without exculpatory DNA evidence. Mr. Perrot was fully exonerated in 2017.

IDENTIFYING ERRORS

In 2012, the **Federal Bureau of Investigation** (“FBI”) acknowledged problems with hair microscopy.⁹ The FBI partnered with the Innocence Project and the National Association of Criminal Defense Lawyers to review cases from 1980-2000. They identified **three types of errors** in examiner testimony — testimony unsupported by the science. By 2015, the FBI found that its examiners had made at least one of these testimonial errors in **90% of cases** reviewed.¹⁰ Even in cases without FBI examiners, the FBI trained many state hair examiners from 1980-2000.¹¹

Error Type 1: The examiner claimed that a hair matched a unique person. Hair microscopy “cannot uniquely identify one person” as the source of a hair.¹² When the FBI used DNA to verify matches, they found that 11% of hairs examiners had deemed “similar” in fact came from distinct people.¹³

Error Type 2: The examiner assigned a probability to a source, or gave an opinion about the rareness of the hair's characteristics. "No scientifically accepted statistics exist about the frequency with which particular characteristics of hair are distributed in the population."¹⁴ The FBI has acknowledged that "an examiner report or testimony that applies probabilities to a [. . .] source of a hair of unknown origin cannot be scientifically supported."¹⁵

Error Type 3: The examiner cited the number of times she distinguished hairs in prior analyses in order to bolster her conclusion in this case.

LITIGATING A NEW TRIAL

1. Argue: Modern advances in hair science, and/or the 2012 FBI letter acknowledging error, constitute **newly discovered evidence**. See *Commonwealth v. Perrot*.¹⁶

2. Argue: Defense counsel's failure to present evidence of known flaws in hair analysis constitutes **ineffective assistance of counsel**. Cf. *Hinton v. Alabama*;¹⁷ *State v. Fitzpatrick*.¹⁸

3. Argue: Hair analysis violated the defendant's **due process rights**. If then-known to be flawed, it was **false or misleading**, see *Alcorta v. Texas*,¹⁹ or a *Brady* violation, see *Brady v. Maryland*.²⁰ Or, it violated **fundamental fairness** for lack of "meaningful adversarial testing", *United States v. Cronin*.²¹

4. Argue: Even where hair analysis errors do not fit neatly into a traditional category, **justice may not have been done**.²² See *Commonwealth v. Brescia*;²³ *Commonwealth v. Rosario*.²⁴

FURTHER READING

- **2016 PCAST Report**²⁵
- **2012 FBI Letter**²⁶
- **2009 NAS Report**²⁷

SOURCES CITED

- ¹ [Strengthening Forensic Science in the United States: A Path Forward](#), National Academy of Science (2009) at 156 ("NAS Report").
- ² [Faulty Forensics Explained](#), Jessica Brand, In Justice Today (2017).
- ³ [More than Zero: Accounting for Error in Latent Fingerprint Identification](#), Simon A. Cole, Journal of Criminal Law and Criminology (2005).
- ⁴ [Faulty Forensics Explained](#).
- ⁵ [Bias and the Big Fingerprint Dust-Up](#), Sue Russell, Pacific Standard (2009).
- ⁶ [The Forensic Confirmation Bias: Problems, Perspectives, and Proposed Solutions](#), Saul Kassin, Itiel Dror, & Jeff Kukucka, Journal of Applied Research in Memory and Cognition (2013).
- ⁷ [Microscopic Hair Comparison Review Project](#), National Association of Criminal Defense Lawyers.
- ⁸ [Pseudoscience in the Witness Box](#), Dahlia Lithwick, Slate (2015).
- ⁹ [Microscopic Hair Comparison Analysis](#), Federal Bureau of Investigation (2012) (admitting errors).
- ¹⁰ [FBI Testimony on Microscopic Hair Analysis Contained Errors in at Least 90 Percent of Cases](#), Federal Bureau of Investigation (2015).
- ¹¹ [Review Of FBI Forensics Does Not Extend To Federally Trained State, Local Examiners](#), Spenser Hsu, Washington Post (2012).
- ¹² [NAS Report](#) at 156, 161.
- ¹³ [Convicted Defendants Left Uninformed of Forensic Flaws Found by Justice Dept.](#), Spenser Hsu, Washington Post (2012).
- ¹⁴ [NAS Report](#) at 160.
- ¹⁵ [Innocence Project and NACDL Announce Historic Partnership with the FBI and Department of Justice on Microscopic Hair Analysis Cases](#), Innocence Project (2013).
- ¹⁶ No. 85-5415, 2016 WL 380123, at *37 (Mass. Super. Jan. 26, 2016).
- ¹⁷ 134 S. Ct. 1081, 1088 (2014).
- ¹⁸ 118 So. 3d 737, 755 (Fla. 2013).
- ¹⁹ 355 U.S. 28, 31-32 (1957).
- ²⁰ 373 U.S. 83, 88 (1963) (exculpatory evidence).
- ²¹ 466 U.S. 648, 656 (1984).
- ²² Mass. R. Crim. P. Rule 30(b).
- ²³ 471 Mass. 381, 389-91 (2015) (broad discretion).
- ²⁴ 477 Mass. 69, 78 (2017) (confluence of factors).
- ²⁵ [Forensic Science in Criminal Courts](#), President's Council of Advisors on Science and Technology (2016) (concluding pattern matching often lacks scientific validity and should not be admitted).
- ²⁶ See footnote 9 (also useful in state court, due to FBI having trained state crime labs).
- ²⁷ See footnote 1.