A Simplified Guide To Fingerprint Analysis

Introduction

We touch things every day: a coffee cup, a car door, a computer keyboard. Each time we do, it is likely that we leave behind our unique signature—in our fingerprints.

No two people have exactly the same fingerprints. Even identical twins, with identical DNA, have different fingerprints. This uniqueness allows fingerprints to be used in all sorts of ways, including for background checks, biometric security, mass disaster identification, and of course, in criminal situations.

Fingerprint analysis has been used to identify suspects and solve crimes for more than 100 years, and it remains an extremely valuable tool for law enforcement. One of the most important uses for fingerprints is to help investigators link one crime scene to another involving the same person. Fingerprint identification also helps investigators to track a criminal's record, their previous arrests and convictions, to aid in sentencing, probation, parole and pardoning decisions.

Principles of Fingerprint Analysis

Fingerprints are unique patterns, made by friction ridges (raised) and furrows (recessed), which appear on the pads of the fingers and thumbs. Prints from palms, toes and feet are also unique; however, these are used less often for identification, so this guide focuses on prints from the fingers and thumbs.

The fingerprint pattern, such as the print left when an inked finger is pressed onto paper, is that of the friction ridges on that particular finger. Friction ridge patterns are grouped into three distinct types—loops, whorls, and arches—each with unique variations, depending on the shape and relationship of the ridges:

Loop, whorl & arch pattern examples.

Loops - prints that recurve back on themselves to form a loop shape. Divided into radial loops (pointing toward the radius bone, or thumb) and ulnar loops (pointing toward the ulna bone, or pinky), loops account for approximately 60 percent of pattern types.

Whorls - form circular or spiral patterns, like tiny whirlpools. There are four groups of whorls: plain (concentric circles), central pocket loop (a loop with a whorl at the end), double loop (two loops that create an S-like pattern) and accidental loop (irregular shaped). Whorls make up about 35 percent of pattern types.

Arches - create a wave-like pattern and include plain arches and tented arches. Tented arches rise to a sharper point than plain arches. Arches make up about five percent of all pattern types.

To Each His Own

The two underlying premises of fingerprint identification are uniqueness and persistence (permanence). To date, no two people have ever been found to have the same fingerprints—including identical twins. In addition, no single person has ever been found to have the same fingerprint on multiple fingers.

Persistence, also referred to as permanence, is the principle that a person's fingerprints remain essentially unchanged throughout their lifetime. As new skin cells form, they remain cemented in the existing friction ridge and furrow pattern. In fact, many people have conducted research that confirms this persistency by recording the same fingerprints over decades and observing that the features remain the same. Even attempts to remove or damage one's fingerprints will be thwarted when the new skin grows, unless the damage is extremely deep, in which case, the new arrangement caused by the damage will now persist and is also unique.

The Proof is in the Minutiae

Analysts use the general pattern type (loop, whorl or arch) to make initial comparisons and include or exclude a known fingerprint from further analysis. To match a print, the analyst uses the minutiae, or ridge characteristics, to identify specific points on a suspect fingerprint with the same information in a known fingerprint. For example, an analyst comparing a crime scene print to a print on file would first gather known prints with the same general pattern type, then using a loupe, compare the prints side-by-side to identify specific information within the minutiae that match. If enough details correlate, the fingerprints are determined to be from the same person.

When and how is fingerprint analysis used?

Fingerprints can be used in all sorts of ways:

- Providing biometric security (for example, to control access to secure areas or systems)
- Identifying amnesia victims and unknown deceased (such as victims of major disasters, if their fingerprints are on file)
- Conducting background checks (including applications for government employment, defense security clearance, concealed weapon permits, etc.).

Fingerprints are especially important in the criminal justice realm. Investigators and analysts can compare unknown prints collected from a crime scene to the known prints of victims, witnesses and potential suspects to assist in criminal cases. For example:

- A killer may leave their fingerprints on the suspected murder weapon
- A bank robber's fingerprints may be found on a robbery note
- In an assault case, the perpetrator may have left fingerprints on the victim's skin
- A burglar may leave fingerprints on a broken window pane
- A thief's fingerprints may be found on a safe

In addition, fingerprints can link a perpetrator to other unsolved crimes if investigators have reason to compare them, or if prints from an unsolved crime turn up as a match during a database search. Sometimes these unknown prints linking multiple crimes can help investigators piece together enough information to zero in on the culprit.

In the absence of DNA, fingerprints are used by the criminal justice system to verify a convicted offender's identity and track their previous arrests and convictions, criminal tendencies, known associates and other useful information. Officers of the court can also use these records to help make decisions regarding a criminal's sentence, probation, parole or pardon.

How It's Done

Where Fingerprints May be Found

Fingerprints can be found on practically any solid surface, including the human body. Analysts classify fingerprints into three categories according to the type of surface on which they are found and whether they are visible or not: Fingerprints on soft surfaces (such as soap, wax, wet paint, fresh caulk, etc.) are likely to be three-dimensional plastic prints; those on hard surfaces are either patent (visible) or latent (invisible) prints. Visible prints are formed when blood, dirt, ink, paint, etc., is transferred from a finger or thumb to a surface. Patent prints can be found on a wide variety of surfaces: smooth or rough, porous (such as paper, cloth or wood) or nonporous (such as metal, glass or plastic).

Latent prints are formed when the body's natural oils and sweat on the skin are deposited onto another surface. Latent prints can be found on a variety of surfaces; however, they are not readily visible and detection often requires the use of fingerprint powders, chemical reagents or alternate light sources. Generally speaking, the smoother and less porous a surface is, the greater the potential that any latent prints present can be found and developed.

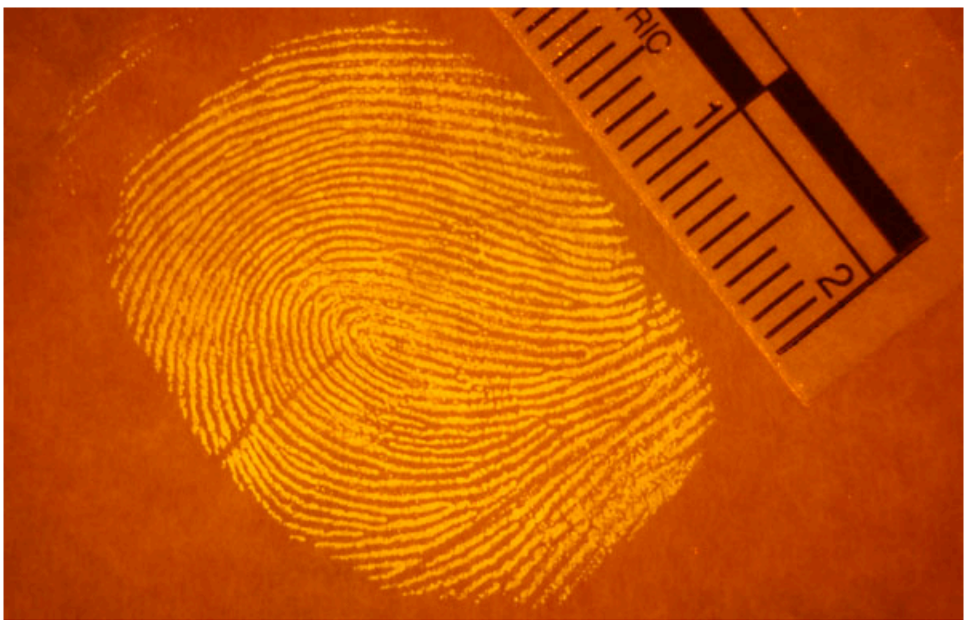
How Fingerprints are Collected

Collecting Patent Prints
Patent prints are collected using a fairly straightforward method: photography. These prints are photographed in high resolution with a forensic measurement scale in the image for reference. Investigators can improve the quality of the images by using low-angle or alternate light sources and/or certain chemicals or dyes during photography, but this is usually not necessary.

Collecting Latent Prints
One of the most common methods for discovering and collecting latent fingerprints is by dusting a smooth or nonporous surface with fingerprint powder (black granular, aluminum flake, black magnetic, etc.). If any prints appear, they are photographed as mentioned above and then lifted from the surface with clear adhesive tape. The lifting tape is then placed on a latent lift card to preserve the print.

However, fingerprint powders can contaminate the evidence and ruin the opportunity to perform other techniques that could turn up a hidden print or additional information. Therefore, investigators may examine the area with an alternate light source or apply cyanoacrylate (super glue) before using powders.

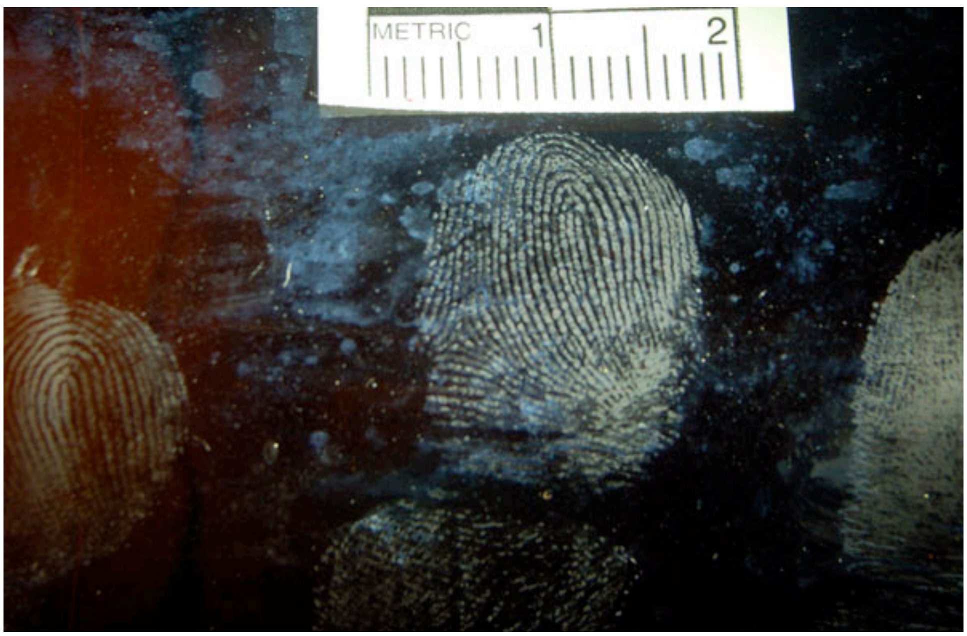
Alternate Light Source (ALS): It is becoming more commonplace for investigators to examine any likely surfaces (doors, doorknobs, windows, railings, etc.) with an alternate light source. These are laser or LED devices that emit a particular wavelength, or spectrum, of light. Some devices have different filters to provide a variety of spectra that can be photographed or further processed with powders or dye stains. For example, investigators may use a blue light with an orange filter to find latent prints on desks, chairs, computer equipment or other objects at the scene of a break-in.



Using a fluorescent dye stain and an orange alternate light source helps this latent print appear clearly so that it can be documented. (Courtesy of Scott Campbell, Ron Smith & Associates)

Cyanoacrylate: Investigators often perform cyanoacrylate (superglue) processing, or fuming, of a surface before applying powders or dye stains. This process, typically performed on non-porous surfaces, involves exposing the object to cyanoacrylate vapors. The vapors (fumes) will adhere to any prints present on the object allowing them to be viewed with oblique ambient light or a white light source.

A chamber specially designed for exposing latent prints to super glue fumes. (Courtesy of Scott Campbell, Ron Smith & Associates)



Super glue fumes adhere to latent fingerprints on the neck of a glass bottle. (Courtesy of Scott Campbell, Ron Smith & Associates)

Chemical Developers: Porous surfaces such as paper are typically processed with chemicals, including ninhydrin and physical developer, to reveal latent fingerprints. These chemicals react with specific components of latent print residue, such as amino acids and inorganic salts. Ninhydrin causes prints to turn a purple color, which makes them easily photographed. DFO (1,2-diazafluoren-9-one) is another chemical used to locate latent fingerprints on porous surfaces; it causes fingerprints to fluoresce, or glow, when they are illuminated by blue-green light.

Paper treated with ninhydrin reagent reveals latent prints after being processed with a household steam iron. (Courtesy of NFSTC)

Other Collection Methods: In addition to the methods identified above, there are special techniques for capturing prints from skin, clothing and other difficult surfaces. Amido Black, a non-specific protein stain that reacts with any protein present, is typically used for developing or enhancing bloody impressions on human skin. To reveal prints on clothing, high-tech methods such as vacuum metal deposition using gold and zinc are showing promise for the investigator. AccuTrans®, a liquid casting compound, can be used to lift powdered latent prints from rough, textured or curved surfaces. AccuTrans® is basically a very thick liquid that fills in the nooks and crannies of rough or textured areas where conventional print lifting tape encounters difficulty.

Like fingerprint powders, chemical processing can reduce the investigator's ability to perform other techniques that could reveal valuable information. Therefore, any nondestructive investigations are performed before the evidence is treated with chemicals. For example, a ransom or hold-up note will be examined by a questioned documents expert before being treated with ninhydrin, since some formulations of ninhydrin will cause certain inks to run, thus destroying the writing.

Who Conducts the Analysis

In criminal justice cases, computerized systems are used to search various local, state and national fingerprint databases for potential matches. Many of these systems provide a value indicating how close the match is, based on the algorithm used to perform the search. Fingerprint examiners then review the potential matches and make a final determination.

Fingerprint examinations may be conducted by forensic scientists, technicians or police officers; however, the examiner should have the proper training and experience to perform the task. Currently many agencies require new examiners to have a four-year degree in science (biology, chemistry or physics). In addition, agencies may require examiners to become certified by the International Association for Identification (IAI). IAI's website (http://www.theiai.org/) provides certification requirements.

How and Where the Analysis is Performed

Fingerprint analysis is usually performed by law enforcement agencies or crime laboratories; however, casework may be sent to private companies if there is a need, such as to reduce backlogs, verify results, or handle high-profile cases.

Fingerprint examination involves looking at the quality and quantity of information in order to find agreement or disagreement between the unknown print (from the crime scene) and known prints on file. To conduct the examination, fingerprint examiners use a small magnifier called a loupe to view minute details (minutiae) of a print. A pointer called a ridge counter is used to count the friction ridges.

An examiner uses a loupe to view minute details of a fingerprint. (Courtesy of NFSTC)

The Fingerprint Analysis Process

Fingerprint examiners use the ACE-V (analysis, comparison, evaluation and verification) method to reach a determination on each print.

Analysis involves assessing a print to determine if it can be used for a comparison. If the print is not suitable for comparison because of inadequate quality or quantity of features, the examination ends and the print is reported as not suitable. If the print is suitable, the analysis indicates the features to be used in the comparison and their tolerances (the amount of variation that will be accepted). The analysis may also uncover physical features such as recurves, deltas, creases and scars that help indicate where to begin the comparison.

Comparisons are performed by an analyst who views the known and suspect prints side-by-side. The analyst compares minutiae characteristics and locations to determine if they match. Known prints are often collected from persons of interest, victims, others present at the scene or through a search of one or more fingerprint databases such as the FBI's Integrated Automated Fingerprint Identification System (IAFIS). IAFIS is the largest fingerprint database in the world and, as of June 2012, held more than 72 million print records from criminals, military personnel, government employees and other civilian employees.

Evaluation is where the examiner ultimately decides if the prints are from the same source (identification or individualization), different sources (exclusion) or is inconclusive. Inconclusive results may be due to poor quality samples, lack of comparable areas, or insufficient number of corresponding or dissimilar features to be certain.

Verification is when another examiner independently analyzes, compares and evaluates the prints to either support or refute the conclusions of the original examiner. The examiner may also verify the suitability of determinations made in the analysis phase.

FAQs

What kind of results can be expected from fingerprint analysis?

Each fingerprint examination will result in one of the following conclusions:

1. The fingerprint was made by (identified/individualized to) a known source (victim, suspect, etc.)
2. The fingerprint was not made by (excluded to) a known source.

3. The fingerprint cannot be identified or excluded to a known source (inconclusive).
4. The fingerprint is of no value to compare (not suitable for comparison) to a known source.

What are the limitations of fingerprint analysis?

Perhaps the primary limitation of fingerprint analysis is that there must be a known print that can be compared to the collected print. Unless there is a known suspect or the perpetrator's prints are found on file in one of the many databases around the world, the collected prints will likely only be used to exclude individuals from the investigation.

Another limitation is that there is no scientific way to determine the time a latent print was deposited on a surface. An examiner cannot tell how long a print has been on a surface or under what circumstances it was placed there. For example, if a suspect's print is found in the kitchen of a murdered acquaintance, the print may or may not be tied to the murder, especially if the suspect claims to have visited the victim's house fairly recently.

It is not possible to determine sex, age or race from a latent print; if sufficient DNA is left behind, then the party's sex can be determined.

How is quality control and quality assurance performed?

To ensure the most accurate analysis of evidence, the management of forensic laboratories puts in place policies and procedures that govern facilities and equipment, methods and procedures, and analyst qualifications and training. Depending on the state in which it operates, a crime laboratory may be required to achieve accreditation to verify that it meets quality standards. There are two internationally recognized accrediting programs focused on forensic laboratories: The American Society of Crime Laboratory Directors Laboratory Accreditation Board (http://www.ascld-lab.org/) and ANSI-ASQ National Accreditation Board / FQS (http://fqsforensics.org/).

In disciplines such as fingerprint examination, where testing requires analysts to compare specific details of two samples, quality control is achieved through technical review and verification of conclusions. This involves an expert or peer who reviews the test data, methodology and results to validate or refute the outcome. The Scientific Working Group on Friction Ridge Analysis, Study and Technology (SWGFAST) (http://www.swgfast.org/Documents.html) publishes quality assurance standards for use by forensic practitioners. These standards indicate that all *identifications* **must** be verified, whereas *exclusions* and *inconclusive* results **should** be verified. This involves having an expert or peer review the test data, methodology and results to validate or refute the outcome.

What information does the report include and how are the results interpreted?

Reports typically will state what evidence was received, what types of examinations were conducted and the results of those examinations. Results should be worded clearly so that the end user has no difficulty in understanding the results (see "What kind of results should I expect?" above).

Once the examiner has completed their analysis and reached a conclusion, there is no interpretation required. Results clearly fall into one of the four categories.

Are there any misconceptions or anything else about fingerprint examination that would be important to the non-scientist?

Just because someone touches a surface does not guarantee that a latent print will be deposited. Here are some reasons a print may not be deposited:

- The person may be wearing gloves.
- The person's hands may be very dry, which means there is little or no sweat or oils coating the ridges. Therefore, the ridge detail won't reliably transfer to the surface.
- Rougher surfaces are less conducive to receiving latent impressions than smooth surfaces.

Even if a print is deposited, it may not become a useful piece of evidence. Here are some reasons why:

- It may not be discovered.
- It may not survive, due to environmental factors. For example, prints deposited outdoors in arid climates may not survive long because latent print residue is approximately 98% water.

- If a particular surface or item is collected/packaged improperly, any latent prints may be destroyed.
- The print may be found but not contain a sufficient amount of information to be useful. For example, it could be a partial print, a smeared print, or from a part of the hand for which a known print is not available.

Common Terms

The Scientific Working Group on Friction Ridge Analysis, Study and Technology (SWGFAST) maintains a list of terms generally used and accepted within the fingerprint analysis community. Additional terms can be found on the SWGFAST website (http://www.swgfast.org/documents/glossary/090508_Glossary_2.0.pdf).

Arch, plain - A type of print pattern in which the friction ridges enter on one side of the print and flow out the other side with a rise or wave in the center.

Arch, tented - A type of print pattern similar to the plain arch but that possesses an angle, upthrust (central rise), or two of the three basic characteristics of the loop.

Cyanoacrylate - The primary (>98%) component of super glue; it is used in a fuming technique to develop latent (invisible) prints on a variety of surfaces so they can be photographed.

Core - A structure in the print that is the center line or lines of the print; it is important for conducting ridge counts,

Delta - A point in loop and whorl prints that lies within an often triangular, three-pronged or funnel-shaped structure; it is the part of a ridge nearest the point where two parallel ridge lines (the "type" lines) diverge to flow around the loop or whorl; loop patterns have one delta, which is the starting point for conducting a ridge count, and whorls have two or more, which are important for determining the whorl type.

Friction ridge - The raised portion of the skin of the print, consisting of one or more connected ridges.

Furrow - A valley or depression between friction ridges.

Loop - A type of print pattern in which one or more friction ridges enter on one side of the print, curve up and around and back down, then flow out on the same side of the print from which it entered; types can be divided into left slant loops and right slant loops or, if the source of the print is known to be a specific hand (the left or right), into radial loops (the pattern flows in the direction of the radius bone of the forearm, toward the thumb) and ulnar loops (the pattern flows in the direction of the ulna bone of the forearm, toward the little finger).

Loupe - A small, often frame-mounted magnifier used for examining fingerprint detail.

Print - The mark made by a finger or thumb on a surface or in a soft material such as wax or wet paint; can be patent (surface-visible), latent (surface-invisible), or plastic (3-dimensional in soft material).

Ridge counter - A handheld, pointed tool used for counting the number of ridges during fingerprint analysis.

Shoulder - The point of a loop's recurving ridge where it curves back around.

Whorl, accidental - A type of print pattern consisting of the combination of two different types of patterns (excluding the plain arch) with two or more deltas; or a print pattern type that possesses some of the requirements for two or more different types of patterns; or a print pattern type that conforms to none of the definitions of a pattern.

Whorl, central pocket loop - A type of print pattern that has two deltas and at least one friction ridge that makes one complete circuit, which may be spiral, oval, circular, or any variant of a circle; an imaginary line drawn between the two deltas does not touch or cross the "central pocket" (the recurving ridges within the inner pattern area).

Whorl, double loop - A type of print pattern that consists of two separate loop formations with two separate and distinct sets of shoulders and two deltas.

Whorl, plain - A type of print pattern that consists of one or more friction ridges making a complete circuit and two deltas; an imaginary line drawn between the two deltas touches or crosses at least one recurving ridge within the inner pattern area.

Resources & References

Learn more about this topic at the websites and publications listed below.

Resources

International Association for Identification (IAI) Latent Print Certification (http://www.theiai.org/certifications/latent_print/index.php)

International Association for Identification Latent Prints/Fingerprint Identification/AFIS FAQs (http://www.theiai.org/disciplines/latent_prints/faq.php)

International Association for Identification Tenprint Fingerprint Certification (http://www.theiai.org/certifications/tenprint/index.php)

International Association for Identification Tenprint Fingerprint FAQs (http://www.theiai.org/disciplines/tenprint/index.php)

Scientific Working Group on Friction Ridge Analysis, Study and Technology (SWGFAST) (http://www.swgfast.org/)

SWGFAST Documents (http://www.swgfast.org/Documents.html)

Fingerprint Patterns (http://e-ditionsbyfry.com/Olive/ODE/FNS/Default.aspx?href=FNS/2012/06/01&pageno=01&view=document), **FORENSIC MAGAZINE**, June 2012

THE FINGERPRINT SOURCEBOOK (http://www.nij.gov/pubs-sum/225320.htm), SWGFAST, August 2011

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Cherry, M., and Imwinkelried, E. "A Cautionary Note About Fingerprint Analysis and Reliance on Digital Technology (https://www.ncjrs.gov/app/publications/Abstract.aspx?id=236592)", **JUDICATURE** Volume 89, Number 6 May–June 2006. (accessed 3/6/2012).

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Scientific Working Group on Friction Ridge Analysis, Study and Technology (SWGFAST), *Standard Terminology of Friction Ridge Examination, ver. 3*, February 11, 2011.

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THE FINGERPRINT SOURCEBOOK, Scientific Working Group on Friction Ridge Analysis, Study and Technology (SWGFAST), et al. August 2011.

THE SCIENCE OF FINGERPRINTS, U.S. Department of Justice, Federal Bureau of Investigation, 1990.

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Forensic Evidence Admissibility and Expert Witnesses

How or why some scientific evidence or expert witnesses are allowed to be presented in court and some are not can be confusing to the casual observer or a layperson reading about a case in the media. However, there is significant precedent that guides the way these decisions are made. Our discussion here will briefly outline the three major sources that currently guide evidence and testimony admissibility.

The *Frye* Standard – Scientific Evidence and the Principle of General Acceptance

In 1923, in *Frye v. United States*[1], the District of Columbia Court rejected the scientific validity of the lie detector (polygraph) because the technology did not have significant general acceptance at that time. The court gave a guideline for determining the admissibility of scientific examinations:

Just when a scientific principle or discovery crosses the line between the experimental and demonstrable stages is difficult to define. Somewhere in this twilight zone the evidential force of the principle must be recognized, and while the courts will go a long way in admitting experimental testimony deduced from a well-recognized scientific principle or discovery, the thing from which the deduction is made must be **sufficiently established to have gained general acceptance** *in the particular field in which it belongs.*

Essentially, to apply the "*Frye* Standard" a court had to decide if the procedure, technique or principles in question were generally accepted by a meaningful proportion of the relevant scientific community. This standard prevailed in the federal courts and some states for many years.

Federal Rules of Evidence, Rule 702

In 1975, more than a half-century after *Frye* was decided, the Federal Rules of Evidence were adopted for litigation in federal courts. They included rules on expert testimony. Their alternative to the *Frye* Standard came to be used more broadly because it did not strictly require general acceptance and was seen to be more flexible.

[1] 293 Fed. 1013 (1923)

The first version of Federal Rule of Evidence 702 provided that a witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if:

a. the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue;
b. the testimony is based on sufficient facts or data;
c. the testimony is the product of reliable principles and methods; and
d. the expert has reliably applied the principles and methods to the facts of the case.

While the states are allowed to adopt their own rules, most have adopted or modified the Federal rules, including those covering expert testimony.

In a 1993 case, *Daubert v. Merrell Dow Pharmaceuticals, Inc.,* the United States Supreme Court held that the Federal Rules of Evidence, and in particular Fed. R. Evid. 702, superseded *Frye's* "general acceptance" test.

The *Daubert* Standard – Court Acceptance of Expert Testimony

In *Daubert* and later cases[2], the Court explained that the federal standard includes general acceptance, but also looks at the science and its application. Trial judges are the final arbiter or "gatekeeper" on admissibility of evidence and acceptance of a witness as an expert within their own courtrooms.

In deciding if the science and the expert in question should be permitted, the judge should consider:

- What is the basic theory and has it been tested?
- Are there standards controlling the technique?
- Has the theory or technique been subjected to peer review and publication?
- What is the known or potential error rate?
- Is there general acceptance of the theory?
- Has the expert adequately accounted for alternative explanations?
- Has the expert unjustifiably extrapolated from an accepted premise to an unfounded conclusion?

The *Daubert* Court also observed that concerns over shaky evidence could be handled through vigorous cross-examination, presentation of contrary evidence and careful instruction on the burden of proof.

[2] The "Daubert Trilogy" of cases is: **DAUBERT V. MERRELL DOW PHARMACEUTICALS**, **GENERAL ELECTRIC CO. V. JOINER** and **KUMHO TIRE CO. V. CARMICHAEL**.

In many states, scientific expert testimony is now subject to this *Daubert* standard. But some states still use a modification of the *Frye* standard.

Who can serve as an expert forensic science witness at court?

Over the years, evidence presented at trial has grown increasingly difficult for the average juror to understand. By calling on an expert witness who can discuss complex evidence or testing in an easy-to-understand manner, trial lawyers can better present their cases and jurors can be better equipped to weigh the evidence. But this brings up additional difficult questions. How does the court define whether a person is an expert? What qualifications must they meet to provide their opinion in a court of law?

These questions, too, are addressed in **Fed. R. Evid. 702**. It only allows experts "qualified … by knowledge, skill, experience, training, or education." To be considered a true expert in any field generally requires a significant level of training and experience. The various forensic disciplines follow different training plans, but most include in-house training, assessments and practical exams, and continuing education. Oral presentation practice, including moot court experience (simulated courtroom proceeding), is very helpful in preparing examiners for questioning in a trial.

Normally, the individual that issued the laboratory report would serve as the expert at court. By issuing a report, that individual takes responsibility for the analysis. This person could be a supervisor or technical leader, but doesn't necessarily need to be the one who did the analysis. The opposition may also call in experts to refute this testimony, and both witnesses are subject to the standard in use by that court (*Frye, Daubert*, Fed. R. Evid 702) regarding their expertise.

Each court can accept any person as an expert, and there have been instances where individuals who lack proper training and background have been declared experts. When necessary, the opponent can question potential witnesses in an attempt to show that they do not have applicable expertise and are not qualified to testify on the topic. The admissibility decision is left to the judge.

Additional Resources

Publications:

Saferstein, Richard. **CRIMINALISTICS: AN INTRODUCTION TO FORENSIC SCIENCE**, Pearson Education, Inc., Upper Saddle River, NJ (2007).

McClure, David. Report: Focus Group on Scientific and Forensic Evidence in the Courtroom (online), 2007, https://www.ncjrs.gov/pdffiles1/nij/grants/220692.pdf (accessed July 19, 2012)

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