

Suggested Research Topics

The following research topics were collected from various forensic scientific working groups and their publications, the National Academy of Sciences publication, the National Institute of Justice website, and personal solicitations by the CSDIAI Science and Practices Committee. Funding for research is available through various sources including the National Institute of Justice [<http://www.nij.gov/funding>].

Accuracy & Bias:

1. The effects of contextual bias in forensic examinations, and the quantification of that error. [NAS Publication]
2. Develop studies to measure and understand the influence of bias during the application of the ACE-V method. [SWGFAST]
3. Blind Verification - Determine if or when blind verification is an effective quality assurance measure. [SWGFAST]
4. Determine the accuracy of friction ridge comparison conclusions in adjudicated cases. [SWGFAST]
5. Examiner Consistency - Develop additional or refine existing tools to improve consistency in the interpretation of friction ridge images, feature selection, and decisions in ACE among examiners. Develop tools to assist the examiner measure the quality of friction ridge impressions during the analysis stage. [SWGFAST]
6. Develop additional or refine existing studies to measure the impact of various factors that result in examination errors, and suggest practices to reduce them. [SWGFAST]
7. Further explore the cognitive processes friction ridge examiners use when performing examinations. [SWGFAST]
8. Develop additional or refine existing studies on how aspects in vision science, such as form and color blindness, affect an examiner's ability to conduct friction ridge examinations. [SWGFAST]
9. Research other psychological or physiological conditions that may affect an examiner's ability to conduct friction ridge examinations. [SWGFAST]
10. Assess the effectiveness of various friction ridge examination quality assurance measures (e.g., percentage of casework that is technically reviewed, frequency of proficiency testing, instrument and equipment calibration and maintenance, and frequency of reagent testing). [SWGFAST]
11. Develop additional or refine existing statistical or probability models regarding friction ridge examination. [SWGFAST]
12. Conduct additional studies regarding the objective measure of quality and quantity of friction ridge detail required to conclude whether two or more simultaneous impressions originated from the same source. [SWGFAST]
13. Establish and mandate standards for procedures, terminology or range of conclusions for the collection, examination or testimony of footwear and tire track examiners. [SWGTFREAD]
14. Bloodstain Pattern Analysis:

- a. research in human error and contextual bias
- b. proficiency testing in bloodstain pattern analysis and the establishment of protocols for bloodstain pattern analysis methods and practices
[SWGSTAIN]

Certification & Accreditation:

1. Compare the performance of certified and non-certified friction ridge examiners. This assessment may include quality assurance measures such as accuracy of conclusions, competency and proficiency testing, existence of standard operation procedures, and adherence to those procedures. It may also take into consideration factors such as hiring qualifications for practitioners, training and continuing education, workloads, and compensation.
[SWGFAST]
2. Compare the performance of accredited and non-accredited friction ridge examination service providers. This assessment may include quality assurance measures such as accuracy of conclusions, competency and proficiency testing, existence of standard operation procedures, and adherence to those procedures. It may also take into consideration factors such as hiring qualifications for practitioners, training and continuing education, workloads, and compensation. [SWGFAST]
3. Develop a comprehensive standard training program for latent and tenprint examiners that incorporates SWGFAST documents and can be implemented on a national scale. [SWGFAST]
4. Status of Tenprint Identification Agencies - Assess the status of tenprint operations within identification agencies regarding issues to include hiring standards, training, workloads, and compensation. [SWGFAST]

AFIS:

1. Creation of baseline standards / common interface for AFIS interoperability: baseline standards—to be used with computer algorithms—to map, record, and recognize features in fingerprint images, and a research agenda for the continued improvement, refinement, and characterization of the accuracy of these algorithms (including quantification of error rates). [NAS Publication]
2. Using large AFIS databases, conduct a study that measures the likelihood of finding close non-matches based upon the location within a fingerprint and specificity of these features and their arrangements. Furthermore, assess the ability of the examiner to discriminate these close non-matches. [SWGFAST]
3. Automated Distortion Recognition and Compensation in Automated Fingerprint Identification Systems (AFIS) - Develop additional or refine existing distortion recognition and compensation tools for use in automated fingerprint identification systems that increase reliability and accuracy.
[SWGFAST]
4. A statistical analysis of minutia in specific locations within latent prints,

utilizing the AFIS system. [contact Roy Marzioli]

Chemical Processing & Laboratory Analysis:

1. A comparison processing techniques that are available for bloody prints, and their pros and cons (fixing of LCV, hazards, multiple steps, destruction of surfaces): specifically, comparison testing of LCV to Amido Black. [Contra Costa County Sheriff's Office Forensics Laboratory]
2. A critical analysis of lighting techniques: ALS vs. laser, LED flashlights vs. incandescent bulbs [Contra Costa County Sheriff's Office Forensics Laboratory]
3. Sequential processing of evidence containing bloody fingerprints [Contra Costa County Sheriff's Office Forensics Laboratory]
4. Conduct additional research to determine if there is a reliable and accurate process to measure the age of friction ridge impressions. [SWGFAST]
5. Effects of Chemical, Biological, Radiological, and Nuclear Exposure on Latent Print Residues - Develop additional or refine existing studies regarding the effects of chemical, biological, radiological and nuclear exposure events on latent print residues. [SWGFAST]
6. Develop additional or refine existing method(s) for the detection of latent prints on human skin. [SWGFAST]
7. Develop additional or refine existing research regarding the composition of latent print residue. [SWGFAST]
8. Persistence of Skin and Reproducibility of Level 2 and 3 Level Detail - Further assess and develop additional studies on the reproducibility and persistence of Level 2 and Level 3 detail. Persistence relates to variations in the same friction ridge skin over an extended period of time, considering external impacts (e.g. environmental changes, occupational exposure, aging and chemotherapy or other medical treatment) Reproducibility relates to the extent of variations among multiple impressions of the same friction ridge skin. [SWGFAST]
9. Develop additional or refine existing chemical, physical, or spectral imaging processes to enhance friction ridge detail based on the specific substrate or composition of latent print residue. [SWGFAST]
10. Compare existing chemical, physical or spectral imaging processes to determine which produce the highest quality and quantity of latent prints per substrate, to include the cost per application and ease of use. [SWGFAST]
11. Develop additional quality control standards for use in reagent testing. [SWGFAST]
12. Superimposed Friction Ridge Impressions - Explore means to determine the chronology of the placement of superimposed friction ridge impressions. Develop additional or refine existing tools to separate superimposed friction ridge impressions. [SWGFAST]
13. Assess the discriminating strength of friction ridge skin features such as cuts, lacerations, abrasions, scars, creases, warts and blisters in friction ridge examination. [SWGFAST]

14. Controlled substances:
 - a. More sensitive detection tools to use at crime scenes.
 - b. Improved tools and techniques to identify controlled substances, including emerging “designer drugs,” and evolving manufacturing techniques for existing drugs.
 - c. New, faster and more efficient tools and techniques to analyze controlled substances in the laboratory. [NIJ]
15. Digital evidence
 - a. Mobile and Cellular Device Forensics Tools
 - b. Digital Evidence Investigative Tools
 - c. Digital Evidence Analysis Tools
 - d. Digital Forensic Training
 - e. Digital Forensics Standards and Capacity Building [NIJ]
16. Impression and pattern evidence can help link a suspect or tool to a particular crime scene. New or improved techniques to identify, collect, analyze and preserve impression and pattern evidence would greatly aid the forensic community. NIJ funds the following impression and pattern evidence research:
 - a. Studying the effects of time and environmental factors, such as weather damage, on forms of impression evidence.
 - b. Investigating unique characteristics that may distinguish one type of impression evidence to the exclusion of all others (e.g., what characteristics make a fingerprint unique).
 - c. Developing sophisticated tools to take precise physical measurements of evidence.
 - d. Improving the National Integrated Ballistics Information Network. [NIJ]
17. Questioned Documents
 - a. More efficient, highly sensitive techniques to analyze documents while preserving them.
 - b. Computer-based methods to analyze handwriting and verify signatures.
 - c. Approaches that expand the scientific basis of questioned document examinations. [NIJ]
18. Trace Evidence
 - a. The development of new tools and techniques to detect, collect and preserve evidence from crime scenes.
 - b. Instruments that decrease the time and labor needed for trace evidence

analysis.

- c. New approaches and enhancement of current approaches to interpreting trace evidence data [NIJ]
- 19. Firearms - Determine the degree to which firearms-related toolmarks are unique or even to quantitatively characterize the probability of uniqueness. Assessing uniqueness at, say, a submicroscopic level, though probably technically possible, would be extremely difficult and time consuming compared with less definitive but more practical and generally available methods at the macroscopic level. [SWGUN]
- 20. A survey of sequential processing techniques of different agencies and a quantitative measure of their efficiency. [Contra Costa County Sheriff's Office Forensics Laboratory]¹