

## Suggested Research Topics

### Cognitive Processes, Bias and Statistics

- The effects of cognitive biases in forensic examinations.
- Determine the influence of bias during the application of the ACE-V method.
- Blind Verification - Determine if or when blind verification is an effective quality assurance measure in agencies of varying sizes and workloads.
- Determine the accuracy of friction ridge comparison conclusions in adjudicated cases.
- 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 help the examiner measure the quality of friction ridge impressions during the analysis stage.
- Develop additional or refine existing studies to measure the impact of various factors that result in examination errors, and suggest practices to reduce them.
- Further explore the cognitive processes friction ridge examiners use when performing examinations.
- 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.
- Research psychological or physiological conditions that may affect an examiner's ability to conduct friction ridge examinations.
- 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).
- Develop additional or refine existing statistical or probability models for friction ridge examination.

- Conduct additional studies regarding the analysis of simultaneous impressions.
- Establish and mandate standards for procedures, terminology or range of conclusions for the collection, examination or testimony of footwear and tire track examiners.
- Bloodstain Pattern Analysis:
  - research in human error and contextual bias
  - proficiency testing in bloodstain pattern analysis and the establishment of standards for bloodstain pattern analysis methods and practices

#### Certification & Accreditation

- 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.
- 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.
- Develop a comprehensive standard training program for latent and tenprint examiners that incorporates OSAC/SWGFAST standards and can be implemented on a national scale.
- Assess the status of tenprint operations within identification agencies

regarding issues to include hiring standards, training, workloads, and compensation.

- Hypothesis based alternatives to ACE-V methodology

#### AFIS/ABIS

- 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).
- 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.
- 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.
- A statistical analysis of minutia in specific locations within latent prints, utilizing the AFIS system.

#### Chemical Processing & Laboratory Analysis

- Assess processing techniques that are available for bloody prints, and their pros and cons (fixing of LCV, hazards, multiple steps, destruction of surfaces)
- Compare blood reagents LCV and Amido Black on various surfaces.
- A critical analysis of lighting techniques: ALS vs. laser, LED flashlights vs. incandescent bulbs
- Sequential processing of evidence containing bloody fingerprints and effects on DNA analysis.
- Conduct additional research to determine if there is a reliable and accurate

process to measure the age of friction ridge impressions.

- Develop additional or refine existing studies regarding the effects of chemical, biological, radiological and nuclear exposure events on latent print residues.
- Latent prints from Hawaiian barrier plants: bamboo, yucca etc.
- Develop additional or refine existing method(s) for the detection of latent prints on human skin.
- Comparing fingerprint powders on metal surfaces at different temperatures.
- Explore whether cyanoacrylate fuming inhibits the development of bloody latent prints in sequence with acid yellow 7, Amido black, and/or SPR-W.
- Do adhesive removers inhibit latent print development on the adhesive side of electrical tape? [Pre- and post-blast]
- Develop additional or refine existing research regarding the composition of latent print residue.
- Comparing vinyl static cling film (VSCF) with gel lifters and the electrostatic dust print lifter to lift shoe prints from various surfaces. Develop an optimized processing sequence for post-blast evidence of various substrates.
- 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.
- 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.
- 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).
- Develop quality control standards for use in reagent testing.

- 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.
- Assess the discriminating strength of friction ridge skin features such as cuts, lacerations, abrasions, scars, creases, warts and blisters in friction ridge examination.

#### Controlled substances:

- Develop more sensitive and discriminating detection tools to use at crime scenes.
- Improve on existing tools and techniques to identify controlled substances, including emerging “designer drugs” and evolving manufacturing techniques for existing drugs.
- Develop novel, efficient tools and techniques to analyze controlled substances in the laboratory.

#### Digital evidence

- Develop novel mobile and cellular device forensics tools.
- Determine training needs of the digital forensics community, both for trainees and continuing education and development.
- Develop standards for processing digital evidence.

#### Impression and pattern evidence

- Studying the effects of time and environmental factors, such as weather damage, on various forms of impression evidence, including toolmarks and shoe impressions.
- Investigating unique characteristics of shoe impressions and the persistence of these characteristics in various substrates.
- Explore whether Vinyl Static Cling Film lifts increases in contrast) over time.
- Develop sophisticated tools to take precise physical measurements of

evidence.

- Compare vinyl static cling film (VSCF) with gel lifters and the electrostatic dust print lifter on various surfaces.
- Improve the National Integrated Ballistics Information Network.

### Questioned Documents

- Develop more efficient, sensitive techniques to analyze documents while preserving them for further forensic analysis.
- Explore computer-based methods to analyze handwriting and verify signatures.
- Explore approaches to expand the scientific basis of questioned document examinations.
- The efficacy of ESDA on notebook paper versus bond paper
- Determining the sources of mechanical impressions: dot matrix, inkjet or laser printer?

### Trace Evidence

- The development of new tools and techniques to detect, collect and preserve evidence from crime scenes.
- Instruments that decrease the time and labor needed for trace evidence analysis.
- New approaches and enhancement of current approaches to interpreting trace evidence data
- Determine whether hair products on hairs collected from crime scenes can be chemically identified.
- The condition of the root of the hair is currently utilized to observe growth stages. Can changes in any other parts of the hair, like the medulla or cortex, be observed during its growth?

### Firearms

- Determine the degree to which firearms-related toolmarks are unique.
- Develop striae-based probability models for firearms examiners' conclusions.
- Assess uniqueness at a submicroscopic level.

- Determine whether additional forensic evidence can be gathered with a Scanning Electron Microscope, and the efficiency and cost effectiveness of this tool.