Federal Forensic Science Research Initiatives: FBI Laboratory Research

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Overview

- Research at the FBI Laboratory
- Management of research projects
- Research portfolios
- Recent research projects
- Current research and collaboration

Research at the FBI Laboratory

- Primary mechanism for conducting research is through the Counterterrorism and Forensic Science Research Unit (CFSRU)
- CFSRU research is focused on achieving the following three goals:
  - Developing new capabilities
  - Improving existing capabilities
  - Defending current and future capabilities
- CFSRU comprised of research scientists, support staff, and participants in the Visiting Scientist Program (VSP)

Research at the FBI Laboratory

- Visiting Scientist Program (VSP)
  - Managed within CFSRU, administered in cooperation with Department of Energy's Oak Ridge Institute for Science and Education (ORISE)
    - Enhances research & development by providing highly qualified scientists from outside institutions to complement FBI research scientists
    - Builds relationships in the scientific community primarily through educational institutions

Research at the FBI Laboratory

- Visiting Scientist Program (VSP) participants
  - Selected based on project needs and mentored by CFSRU researchers
  - University faculty, post-graduates, Ph.D., M.S., and B.S level students
  - Enhance their professional development by participating in forensic science research initiatives
  - Become well trained, highly skilled, experiences scientists for future employment in forensic science fields
  - Appointments range from three to twelve months, with the potential for renewal for up to five years of participation

Research at the FBI Laboratory

- Forensic Science Research Budget
  - While forensic science research is critical to our operations, the FBI Laboratory receives no funding dedicated to forensic science research
  - Laboratory typically allocates approximately 5% of its annual appropriated budget (~$100 million) to support research and development activities
  - To mitigate the minimal budget, the FBI Laboratory has been extremely successful in partnering with other government agencies to leverage resources and stretch available budgets

Management of research projects

- In 2012, the Laboratory Division (LD) established the Research Review Team (RRT)
  - Comprised of the LD Senior Level Scientists and the Unit Chief of the CFSRU
- Purpose of the RRT is to:
  - Drive the LD research portfolios and monitor performance
  - Evaluate, select and prioritize research projects
  - Provide guidance on research plans
  - Monitor ongoing research projects

Management of research projects

- The RRT utilizes a 7-step process to monitor research
  - Research Idea
  - Proposal
  - Plan
  - Presentation of the plan to the RRT and relevant stakeholders
  - Funding approval
  - Progress reviews
  - Project closeout

Management of research projects

- The RRT conducts an annual call for research projects at the beginning of each calendar year, providing the opportunity for all LD personnel to propose research ideas
- The RRT then selects and prioritizes research projects to be implemented in the next fiscal year
- A semi-annual call for short-term projects (<120 days) is conducted in late summer
- All internal LD research falls within one of the LD Research Portfolios

Management of research projects

- Research program includes both internal research and externally contracted research
  - Internal research conducted by CFSRU staff scientists, case working/operational unit personnel, or a combination of both
  - External research is conducted under the technical direction of CFSRU staff scientists
- CFSRU staff scientists collaborate with academia and other government agencies to successfully research, develop, and deliver new technologies and methodologies that are mutually beneficial

FBI Laboratory Division Research Portfolios

- LD Senior Level Scientists identified research portfolios based on limited topic areas, to help focus the efforts of research personnel
- All internal LD research is captured within one of the research portfolios
- Research needs that fall outside of these portfolios are exploited through external sources

FBI Laboratory Division Research Portfolios

- Current LD research portfolios include:
  - Decision analysis and validation studies for pattern-based disciplines
  - Next Generation Sequencing (NGS)
  - Developing techniques and technologies
  - Emerging issues in forensic science
  - Case working unit specific research, development, testing, and evaluation

Decision Analysis and Validation Study Portfolio

- The Decision Analysis and Validation Study portfolio was developed based on the 2009 National Academy of Sciences report on forensic science, which recommended that more research is needed to address the issues of accuracy, reliability, and validity
- This recommendation was echoed in the 2016 President's Council of Advisors on Science and Technology (PCAST) report
- The PCAST report was very complimentary of the FBI Laboratory's "high-quality scientific studies of latent fingerprint analysis", and urged the FBI to expand these studies

Recent FBI Laboratory Decision Analysis Research

- Latent print "Black Box" study
  - Ulery, B.T., Hicklin, R.A., Buscaglia, J., and M.A. Roberts. "Accuracy and reliability of forensic latent fingerprint decisions". *Proceedings of the National Academy of Sciences,* Vol. 108, No. 19 (2011): 7733-7788.
  - Conducted in conjunction with the FBI Criminal Justice Information Service's Biometric Center of Excellence and Noblis
  - Study involved nearly 170 examiners from federal, state, and local law enforcement agencies
  - Nearly 17,000 individual decisions on latent print comparison were made
    - Demonstrated that when examiners made an identification decision within the parameters of the experiment, they were correct 99.8% of the time
    - When examiners made an exclusion decision, they were correct 86.6% of the time

Recent FBI Laboratory Decision Analysis Research

- Latent print follow-on research - resulted in several publications designed to understand the factors that affect examiners' decisions
  - Analyses of fingerprint quality
    - Hicklin, R.A., Buscaglia, J., Roberts, M.A., Meagher, S.B., Fellner, W., Burge, M.J., Monaco, M., Vera, D., Pantzer, L.R., Yeung, C.C., and N. Unnikumaran. "Latent fingerprint quality: a survey of examiners." *Journal of Forensic Identification*. Vol. 61, No. 4 (2011): 385-419.
    - Hicklin, R.A., Buscaglia, J., and M.A. Roberts. "Assessing the clarity of friction ridge impressions." *Forensic Science International*, Vol. 226, No. 1 (2013): 106-17.
  - Determination of value for identification or exclusion
    - Ulery, B.T., Hicklin, R.A., Kiebuzinski, G.I., Roberts, M.A., and J. Buscaglia. "Understanding the sufficiency of information for latent fingerprint value determinations." *Forensic Science International*, Vol. 230, No. 1-3 (2013): 99-106.
  - Sufficiency of information for identifications
    - Ulery, B.T., Hicklin, R.A., and J. Buscaglia. "Repeatability and reproducibility of decisions by latent fingerprint examiners." *PLoS ONE*, (2012).
    - Ulery, B.T., Hicklin, R.A., Roberts, M.A., and J. Buscaglia. "Measuring what latent fingerprint examiners consider sufficient information for individualization determinations." *PLoS ONE*, (2014).
  - How examiners' assessments of a latent print change
    - Ulery, B.T., Hicklin, R.A., Roberts, M.A., and J. Buscaglia. "Changes in latent fingerprint examiners' markup between analysis and comparison." *Forensic Science International*, Vol. 247 (2015): 54-61.

Current FBI Laboratory Research

- Given the recommendations from the NAS report and the PCAST report coupled with the success of the latent fingerprint decision analysis research, the LD is currently moving forward on three additional decision analysis research projects
  - Firearms analysis
  - Shoeprint analysis
  - Questioned Document analysis
- These studies are modeled after the latent print studies
- Given the expansive scope and high cost of these efforts, the LD has prioritized these studies, and expects to conduct further studies in this portfolio in the future

Current FBI Laboratory Research

- Approximately sixty research projects currently active
- Many of these research projects involve close collaboration with external partners, such as
  - National Institute of Standards and Technology
  - Department of Homeland Security
  - Department of Defense
  - United States Geological Survey
  - Smithsonian Institution
  - Department of Energy National Laboratories
  - Numerous Academic Institutions

Other noteworthy collaborative efforts

- TEDAC Improvised Explosives Detection and Synthesis (TIEDS) Center
  - Collaborative project between the Terrorist Explosive Device Analytical Center (TEDAC) and the Department of Homeland Security Science and Technology Directorate
  - Goal is to rapidly and authoritatively assess the safety properties and performance characteristics of home made explosives, improvised explosives, and improvised explosive devices; and the evaluation of civilian explosives detection technologies
  - Core mission
    - Safety risk and performance testing
    - Document test results and disseminate reports to the FBI, Department of Homeland Security, Department of Defense, Law Enforcement, Intelligence Community, and International partners
    - Assess civilian explosives detection technologies
    - Work with explosives detection equipment manufacturers

Conclusions

- Goal of FBI Laboratory Research and Development is to cultivate and deliver new scientific technology and methodologies, in support of the operational requirements of the FBI
- Research is conducted in a wide range of topic areas within defined research portfolios, and designed to support advancement in biological, chemical and physical forensic analyses; operational response; and biometrics

Thank You!