

GLENN M. LANGENBURG

6278 Otter Lake Road
St. Paul, Minnesota 55110
(651) 206-3198

glenn@eliteforensicservices.com

TITLE Forensic Scientist, Consultant

EDUCATION University of Lausanne, Switzerland; Ph.D. Forensic Science, 2012
University of Minnesota, M.S. Analytical Chemistry, 1999
Michigan State University, B.S. Forensic Science, 1993

EXPERIENCE

Aug 2012 – present: Elite Forensic Services, LLC
Owner, Primary Consultant, Instructor

Sep 2013 – Oct 2018: Minnesota Bureau of Criminal Apprehension Forensic Science
Laboratory, Drug Chemistry Section Supervisor

Jan 2000 – Sep 2013: Minnesota Bureau of Criminal Apprehension Forensic Science
Laboratory, Latent Print Section

Jan 2003 – Dec 2010: Metropolitan State University, Community Faculty

Sep 2003 – May 2005: Hamline University, Adjunct Faculty

Jun 1995 – Jan 2000: Pace Analytical Inc./3M Environmental Laboratory, Research Chemist

May 1993 – Sept 1993: Dundee Royal Infirmary Dept. of Forensic Medicine, Toxicology
Summer Internship

PROFESSIONAL ORGANIZATIONS

International Association for Identification (IAI)
National and Minnesota Division membership (since 2000)
Pattern Evidence SAC (Scientific Area Committee) (since 2019)
Canadian Identification Society (CIS) (2002-2013)
Midwest Association of Forensic Scientists (MAFS) (since 2003)
Elected member to SWGFAST (Scientific Working Group for Friction
Ridge Analysis, Study, and Technology) (2004-2014)
Fingerprint Society (U.K.), fellow status (2006-2010)
IAI Committee—Standardization II Committee (2008-2010)
NIST-NIJ Committee—Expert Working Group on Human Factors in
Latent Print Analysis (2008-2011)

AWARDS/POSITIONS HELD/CERTIFICATIONS

Status as a certified latent print examiner (IAI) granted May 2003
Status as a certified fellow of criminalistics (ABC) granted (2011-2020)
Editorial review board for Journal of Forensic Identification (since 2006)

Distinguished Member of the IAI Award (2007)
Recipient of Inaugural IFRG “Roland Menzel Award” (2007)
Ethics Committee for MAFS (2006-2010)
MAFS “New Scientist Award” (2002)
Minn. DPS Forensic Science Lab Service Recognition Award (2002)
MAFS Latent Print Section Coordinator (2002-2011)

PUBLISHED WORKS

- Kennedy, K; Heaton, C; Langenburg, G; Francese, S; Pre-validation of a MALDI MS proteomics-based method for the reliable detection of blood and blood provenance. *Scientific Reports*, **2020**; 10:17087. <https://doi.org/10.1038/s41598-020-74253-z>.
- Deininger, L; Francese, S; Clench, M.R; Langenburg, G; Sears, V; Sammon, C. Investigation of infinite focus microscopy for the determination of the association of blood with fingermarks. *Science & Justice*, **2018**; 58:397-404.
- Dror, I; Langenburg, G. “Cannot Decide”: The Fine Line Between Appropriate Inconclusive Determinations Versus Unjustifiably Deciding Not To Decide. *J For Sci*, **2018**; 64(1):10-15.
- Langenburg, G. Addressing potential observer effects in forensic science: a perspective from a forensic scientist who uses linear sequential unmasking techniques. *Australian J of Forensic Sci*, **2017**; online, doi: 10.1080/00450618.2016.1259433.
- Liu, S; Mi, Z; Langenburg, G; Wu, J. Accuracy and reliability of feature selection by Chinese fingerprint examiners, *Forensic Sciences Research* **2017**, 2:4, 203-209, DOI: 10.1080/20961790.2017.1375449
- Patel, E.; Cicatiello, L.; Langenburg, G.; Francese, S.; et al. A proteomic approach for the rapid, multi-informative and reliable identification of blood. *Analyst* **2015**, doi: 10.1039/c5an02016f.
- Langenburg, G.; Hall, C.; Rosemarie, Q. Utilizing AFIS searching tools to reduce errors in fingerprint casework. *For Sci Intl* **2015**, 257, 123-33.
- Neumann, C.; Champod, C.; Yoo, M.; Genessay, T.; Langenburg, G. Quantifying the weight of fingerprint evidence through the spatial relationship, directions and types of minutiae observed on fingermarks. *For Sci Intl* **2015**, 248, 154-171.
- Langenburg, G.; Neumann, C.; Champod, C. A comment on “Experimental results of fingerprint comparison validity and reliability: A review and critical analysis”. *Science & Justice – Letters to the Editor* **2014**, 54, 393-395.
- Langenburg, G.; Bochet, F.; Ford, S. A Report of Statistics from Latent Print Casework. *Forensic Science Policy & Management: An International Journal* **2014**, 5(1-2), 15-37.
- Sheets, H.D.; Torres, A.; Langenburg, G.; Bush, P.J.; Bush, M.A. Distortion in Fingerprints: A Statistical Investigation Using Shape Measurement Tools. *J Forensic Sci* **2014**, 59(4), 1113-1120.
- Sheets, H.D., Gross, S., Langenburg, G., Bush, P.J., and Bush, M.A. Shape measurement tools in footwear analysis: A statistical investigation of accidental characteristics over time. *For Sci Intl*, **2013**, 232 (1-3), 84-91.
- Neumann, C; Champod, C; Yoo, M; Genessay, T; Langenburg, G. Improving the Understanding and the Reliability of the Concept of “Sufficiency” in Friction Ridge Examination. Final Report to U.S. Dept. of Justice-National Institute of Justice, Washington, D.C. July **2013**. Award Grant 2010-DN-BX-K267.
- Langenburg, G; Neumann, C; Meagher, S; Funk, C; Avila, J. Presenting Probabilities in the Courtroom: A Moot Court Exercise. *Journal of Forensic Identification* **2013**, 63(2), 424-488.

- Langenburg, G. The consideration of fingerprint probabilities in the courtroom. *Australian Journal of Forensic Sciences*, **2013**, doi:10.1080/00450618.2013.784360.
- Langenburg, G; Hall, C. "Friction Ridge Skin: Comparison and Identification" in Wiley Encyclopedia of Forensic Science, eds A. Jamieson and A.A. Moenssens, John Wiley: Chichester. DOI: 10.1002/9780470061589.fsa355.pub2. Published 15th March 2013.
- Praska, N; Langenburg, G. Reactions of latent prints exposed to blood. *Forensic Sci Intl*, **2013**, 224, 51-58.
- Langenburg, G. A Critical Analysis and Study of the ACE-V Process. PhD thesis, Ecole des Sciences Criminelles / Institut de Police Scientifique, Université de Lausanne, Switzerland, **2012**.
- Langenburg, G., Champod, C., Gennessay, T. Informing the Judgments of Fingerprint Analysts Using Quality Metric and Statistical Assessment Tools. *Forensic Sci Intl*, **2012**, 219 (1-3), 183-198; doi:10.1016/j.forsciint.2011.12.017.
- Neumann, C; Langenburg, G, et al. Operational benefits and challenge of the use of fingerprint statistical models: a field study. *Forensic Sci Intl*, **2011**, 212, 32-46.
- Langenburg, G; Champod, C. The GYRO System—A Recommended Approach to More Transparent Documentation. *Journal of Forensic Identification* **2011** 61 (4), 373-384.
- Mnookin, J., Langenburg, G, et al. The Need for a Research Culture in the Forensic Sciences. *UCLA Law Review*, **2011**, 58 (3), 725-779.
- Langenburg, G. Scientific Research Supporting the Foundations of Friction Ridge Examinations”, Chapter 14 in *The Fingerprint Source Book*; Eds.: McRoberts, A; Fitzpatrick, F., U.S. Department of Justice, National Institute of Justice, Washington, D.C., **2011**.
- Langenburg, G., Champod, C., Gennessay, T. Jones, J. Informing the Judgments of Fingerprint Analysts Using Quality Metric and Statistical Assessment Tools, Summary Report to the Midwest Forensics Resource Center. Midwest Forensic Resource Center (MFRC) Research and Development Program Summary, **2010**, November, 42-44.
- Dror, I, Langenburg, G., et al. Cognitive issues in fingerprint analysts: inter- and intra-expert consistency and effect of a ‘target’ comparison. *Forensic Sci Intl*, **2010**, 208, 10-17.
- Langenburg, G. Friction Ridge Skin: Comparison and Identification. In *Wiley Encyclopedia of Forensic Science*, eds. Jamieson, A; Moenssens, A. John Wiley & Sons, Ltd, U.K., 2009.
- Langenburg, G; Champod, C; Wertheim, P. Testing for potential contextual bias effects during the verification stage of the ACE-V methodology when conducting fingerprint comparisons” *J Forensic Sci* **2009**, 54 (3), 583-590.
- Langenburg, G. A performance study of the ACE-V process: A pilot study to measure the accuracy, precision, repeatability, reproducibility, and biasability of conclusion resulting from the ACE-V process, *J Forensic Identification* 2009, 59 (2), 219-257.
- Langenburg, G. Deposition of Bloody Fingermarks” *J Forensic Ident.* 2008 58 (3), 355-389.
- Langenburg, G. Letter to Editor re: Saks and Koehler “The Coming Paradigm Shift in Forensic Science”, *Science*, 3 Feb 2006, vol 311.
- Langenburg, G. A Report of Latent Print Examiner Accuracy During Comparison Training Exercises” *J Forensic Identification* 2006, 56 (1), 55-93.
- Langenburg, G. “Ask the Expert” column for *Scientific American*, 292 (5), May 2005.
- Langenburg, G. Pilot Study: A Statistical Analysis of the ACE-V Methodology—the Analysis Stage,” *J Forensic Identification* 54 (1), 2004, 64-79. Langenburg, G. Defense Against the Dark Arts: Defending Against the Critic’s Curse, *The Chesapeake Examiner* 2003, 41, Spring volume.

TRAINING

In-house Training at the BCA (core training)

Latent Print Training (Jan 2000-Nov 2000)	Approx. 1700 hours
Courtroom Testimony Workshop (Nov 2001)	24 hours
Crime Scene Training (May 2000-present)	Approx. 500 hours

External Courses

Advanced Ridgeology Comparison Techniques (Wertheim, Oct 2000)	40 hours
Forensic Ridgeology (Ashbaugh, Nov 2000)	40 hours
Demystifying Palm Prints (Smith, Sep 2003)	24 hours
Courtroom Testimony Techniques (Smith, Sep 2003)	16 hours
MAFS Bloodspatter Course-- <u>Audited</u> (Epstein and Laber, Apr 2002)	24 hours
MAFS Bloodspatter Course (Epstein and Laber, Apr 2003)	50 hours
ASCLD-LAB-International Assessor Training Course (Jun 2007)	40 hours
Analysis of Distortion in Latent Prints (Maceo, Jun 2008)	16 hours
Current Issues in Drug Chemistry (Astor, et al., Oct 2014)	8 hours

Conferences

IAI Educational Conferences (each **40 hours** of lectures, panels, workshops):

2000, Charlestown, WV, included 3 workshops:

-Digital Imaging	4 hours
-Bloodstain Pattern Reconstruction	4 hours
-Collection and Preservation of Footwear Evidence	4 hours

2001, Miami, FL, included 4 workshops:

-Introduction to Bloodstain Pattern Recognition	4 hours
-Photography	3.5 hours
-Painting with Light (night photography)	3 hours
-Event Reconstruction (BPA)	2 hours

2002, Las Vegas, NV

-Presented "ACE-V: A Statistical Analysis" poster

2003, Ottawa, ON, Canada

-Presented "ACE-V: A Statistical Analysis, Results of Study"

-Presented "Defense Against the Dark Arts: Defending Against the Critic's Curse"

2004, St. Louis, MO

-Conducted a 2-hour on-site research study for ACE-V project

- Presented "ACE-V: A Statistical Analysis, Results of Study"

- Presented "Defense Against the Dark Arts 2: How to Get Rid of That Boggart in Your Closet"

2005, Dallas, TX

- Presented "ACE-V: A Statistical Analysis, Results of Study A+C Stages"

- Presented "Analysis of Factors During the Deposition of Impressions in a Blood Matrix"

- Presented "A Report of Latent Print Examiner Accuracy During Comparison Training Exercises". Co-presented with Kasey Wertheim

- Requested Panel participant “Latent Print Examiner Training Standards”
- 2006, Boston, MA
- Presented “RSW-Lite: Are You Ready for the IAI Certification Exam?” (lecture and two 4-hour workshops). Co-presented with Pat Wertheim
 - Presented “Defense Against the Dark Arts 3: Arithmancy and the Science of Latent Print Comparisons”
- 2007, San Diego, CA
- Presented “Testing for Potential Contextual Bias During the Verification Stage of the ACE-V Methodology in Fingerprint Examinations”
 - Presented “Demystifying Probabilities: An Exercise in Probability Theory for Latent Print Examiners”
 - Co-hosted workshop with Champod, Neumann, and Chamberlain: “From Fingerprint Examination to Fingerprint Statistics”. Two 4-hour workshops, 30 students ea.
- 2008, Louisville, KY
- Presented “Defense Against the Dark Arts 4: The Confundus Errata Charm”
 - Presented “Demystifying Probabilities: An Exercise in Probability Theory for Latent Print Examiners”
 - Co-hosted workshop with Neumann, and Chamberlain: “From Fingerprint Examination to Fingerprint Statistics”. Two 4-hour workshops, 20 students ea.
 - Co-hosted workshop with Josh Bergeron: “RSW-Lite: Are You Ready for the IAI Certification Exam?”(two 4-hour workshops).
- 2009, Tampa Bay, FL
- Co-hosted workshop with Neumann: “From Fingerprint Examination to Fingerprint Statistics”. 4-hour workshops, 28 students.
 - Co-hosted workshop with Amanda Atkins: “RSW-Lite: Are You Ready for the IAI Certification Exam?”(two 4-hour workshops).
 - Co-hosted workshop with Neumann: “Fingerprint Statistics and Probabilities Made Simple” (4-hour workshop, 40 students).
- 2010, Spokane, WA
- Co-hosted workshop with Neumann: “From Fingerprint Examination to Fingerprint Statistics”. 4-hour workshops, 28 students.
 - Co-hosted workshop with Neumann: “Probabilities in the Courtroom”(4-hour workshop, 20 students).
 - Co-hosted workshop with Neumann: “Fingerprint Statistics and Probabilities Made Simple” (4-hour workshop, 36 students).
 - Panels: “Examiner Disagreement and Conflict Resolution” (2.5 hours) and “Standardization 2 Committee Report” (2 hours).
 - Lecture: “Informing the Judgments of Fingerprint Experts Using Quality Metric and Statistical Evaluation Tools” (1 hour).
- 2011, Milwaukee, WI
- Co-hosted workshop with Neumann: “From Fingerprint Examination to Fingerprint Statistics”. 4-hour workshops, 28 students.
 - Co-hosted workshop with Neumann: “Fingerprint Statistics and Probabilities Made Simple” (4-hour workshop, 36 students).
 - “RSW-Lite: Are You Ready for the IAI Certification Exam?”(two 4-hour workshops).
 - Panels: “Moot Court Exercise: Introducing Probabilities in the Courtroom” (4 hours).
 - Lecture: “Defense Against the Dark Arts 5: Muggles, OWLS, and NEWTS” (1 hour).

- 2012, Phoenix, AZ
- Workshop: “Demystifying Error Rates” (two 4-hour workshops, 30 students).
 - Workshop: “Applying and Understand the SWGFAST ACE-V Methodology Standard” (two 2-hour workshops, 30 students).
 - Lecture: “A Critical Analysis and Study of the ACE-V Process” (1 hour).
- 2013, Providence, RI
- Workshop: “Demystifying Error Rates” (two 4-hour workshops, 20 students).
 - Workshop: “Applying and Understanding the SWGFAST ACE-V Methodology Standard” (two 2-hour workshops, 20 students).
 - Lecture: “Exclusions and Sufficiency Decisions” with John Black (1 hr).
 - Lecture: “The Integration of Technology and ACE-V” (1 hour)
- 2014, Minneapolis, MN
- Workshop: “Demystifying Error Rates” (4-hour workshop, 30 students).
 - Workshop: “Applying and Understanding the SWGFAST ACE-V Methodology Standard” (two 2-hour workshops, 35 students total).
 - Workshop: “Understanding and Deconstructing the SWGFAST “Articulation of the Identification Decision” document (two 2-hour workshops, 35 students total).
 - Lecture: “Using Case Specific AFIS to Reduce Errors” with Carey Hall (30 mins).
 - Lecture: “Double Loop Podcast – Live! Panel” (90 mins)
- 2015, Sacramento, CA
- Workshop: “Practical Answers to Court Questions” (4-hour workshop, 30 students)
co-instructor: Carey Hall
 - Workshop: “Applying and Understanding the SWGFAST ACE-V Methodology Standard” (2-hour workshop, 30 students total)
 - Workshop: “Understanding and Deconstructing the SWGFAST “Articulation of the Identification Decision” document (2-hour workshop, 15 students total)
 - Lecture: “Defense Against the Dark Arts 6: The Confundus Charm” (60 mins)
 - Lecture: “Double Loop Podcast – Live! Panel” (90 mins)
 - Lecture: “Exclusion Decision” Discussion Panel hosted by John Black (60 mins)
- 2016, Webinar for European Division of the IAI
- Presentation: “A Critical Review of the ACE-V Process” (2 hours)
- 2017, Atlanta, GA
- Workshop: Making Sense of the PCAST statistics (2 hours)
 - Workshop: An Overview of the ACE-V Process (4 hours)
 - Lecture: Linear Sequential Unmasking (1 hour)
- 2018, San Antonio, TX
- Lecture: Using AFIS Technology to Increase Efficiency and Accuracy (30 mins)
- 2019, Reno, NV
- Lecture: “Activity Level Issues in Fingerprints: Age, Action, Arrangement” (60 min)
 - Workshop: “Practical Answers to Challenging Questions in the Courtroom” 4 hours
 - Workshop: “Making Sense of the Statistics in the PCAST Report” 4 hours
- 2021, Nashville, TN
- Workshop: “Making Sense of the Statistics in the PCAST Report” 4 hours
 - Workshop: “ACE-V 101 – Basic Training in ACE-V”

MAFS Educational Conferences:

2001, Minneapolis, MN

-Presented “Latent Prints and Daubert: US v. Mitchell and More...”

2002, Milwaukee, WI

-Presented “ACE-V: A Statistical Analysis” poster

-Co-hosted workshop “Current Daubert Issues” with Larry Olson 8 hours

2014, Minneapolis, MN

-Presented “The Need for Validation Studies”

-Workshop: “Demystifying Error Rates” 4 hours

-Co-hosted Workshop: “Designing, Executing, and Reporting Validation Studies” with Holly Long 4 hours

Additional Forensic Science Conferences:

Minnesota Division IAI (Duluth, MN, Sep 2000) 16 hours

Indiana Division IAI (Fort Wayne, IN, Oct 2004) 18 hours

Presented: “ACE-V: A Statistical Analysis, Results of Study”

American Board of Forensic Document Examiners Symposium 24 hours

Las Vegas, NV, Jul 2002

Presented “Defense Against the Dark Arts: Defending Against the Critic’s Curse”

American Academy of Forensic Sciences 8 hours

Chicago, IL, Feb 2002

Presented “The Daubert Trilogy: Daubert, Joiner, and Kumho”

Toronto Forensic Identification Services Annual Conference 16 hours

Toronto, ON, Canada, Feb 2002

Co-presented “Daubert Issues and Latent Prints” with Kasey Wertheim

Fingerprint Society Annual Educational Conference 20 hours

Brighton, England, United Kingdom, Mar 2005

Presented “Defence Against the Dark Arts: Defending Against the Critic’s Curse”

Canadian Identification Society Educational Conference 24 hours

Calgary, Alberta, Canada, Jul 2005

Presented “A Statistical Analysis of the ACE-V Methodology, A + C”

Human Identification e-Symposium 4 hours

Online symposium hosted in London, England, U.K.

Presented “Fingerprint Detection Errors: A Report of Latent Print Examiner Accuracy”

Fingerprint Society Annual Educational Conference 16 hours

Tulliallan Castle, Fife, Scotland, United Kingdom, Mar 2006

Presented “A Statistical Analysis of the ACE-V Methodology, A + C”

Midwestern States Divisions of the IAI 8 hours

Davenport, IA, Apr 2006

Presented “Defense Against the Dark Arts: Defending Against the Critic’s Curse”

Northwest Pacific Division of the IAI Boise, ID, May 2006 Presented "Defense Against the Dark Arts: 1 & 2"	8 hours
Florida Division of the IAI St. Petersburg, FL, Oct. 2006 Presented "Overview of the ACE-V Methodology" (2 hours) Presented "Errors and Bias: Are We As Good As We Think We Are, Or As Bad As They Say We Are?" (2 hours)	8 hours
American Board of Forensic Document Examiners (ABFDE) Daubert Symposium Las Vegas, NV, Nov. 2006 Presented "Statistical Analysis of ACE-V Methodology: A,C,V Studies" (1 hour) Presented "Error Rates: A Report of Latent Print Examiner Accuracy (1 hour)"	8 hours
International Fingerprint Research Group (IFRG) Canberra, Australia, Mar. 2007 (By invitation, for recognition of research contributions) Presented "Testing for Potential Contextual Bias Effects During the Verification Stage of the ACE-V Methodology" Presented "Analysis of Factors During the Deposition of Impressions in a Blood Matrix"	40 hours
Canadian Identification Society Educational Conference Montreal, Quebec, Canada, Jul 2007 Presented "Testing the ACE-V Methodology" (1.5 hours) Presented "Error Rates: A Report of Latent Print Examiner Accuracy (1.0 hour)"	40 hours
Wisconsin Association for Identification Milwaukee, WI, Mar 2008 Presented "Fingerprints 101-Basic Development Techniques" (2.0 hours) Presented "Current Issues for Fingerprint Examiners" (2.0 hours)	6 hours
Tri-State National Society for Histotechnology Educational Conference Bloomington, MN, Apr 2008 Presented "Top 10 Misconceptions about Crime Scene Investigation" (1.0 hour)	6 hours
Midwest Crime Laboratory Directors' Meeting and MFRC Annual Symposium Bemidji, MN, Apr 2008 Presented "Pilot Studies: Close Non-Match Study and Method Performance Study" (2 hours) Presented "Testing for Potential Contextual Bias Effects During the Verification Stage of the ACE-V Methodology" (30 minutes)	16 hours
The NIJ Conference 2008 Arlington, VA, Jul 2008 Panel: "Whose Print Is It Really? Does Confirmation Bias Affect the Answer?" Panel Members: Itiel Dror, Sargur Srihari, and Glenn Langenburg	1.5 hours

International Fingerprint Research Group (IFRG) Lausanne, Switzerland, June 2009 Presented "A Method Performance Study of the ACE-V Process" (30 minutes)	40 hours
American Academy of Forensic Sciences (AAFS) 2010 Seattle, WA (presented 2.5 hours) Co-presented with C. Neumann "On the Conclusions of Handwriting Identification" Co-presented with C. Neumann "Moving Towards Using Statistics for Fingerprint Evidence in the Courtroom"	16 hours
Canadian Identification Society Educational Conference Orillia, Ontario, Canada, Sept 2010 Presented "Informing Judgments of Fingerprint Experts..." (2.0 hours) Workshop "Fingerprint Examination Tools To Aid in Documentation and Greater Transparency" (4.0 hours)	6 hours
National Forensic Academy Symposium Nashville, TN, Dec. 2010 Presented "Current Challenges to Forensic Science and Issues of Bias" Short presentation and panel discussion.	4 hours
American Academy of Forensic Sciences (AAFS) Feb 2011 Chicago, IL Co-presented with C. Neumann "Legal and Management Challenges Raised by Current Changes in the Fingerprint Community." (1.5 hours)	16 hours
International Fingerprint Research Group (IFRG) Linkoping, Sweden, June 2011 Presented "Informing the Judgments of Fingerprint Examiners" (30 minutes)	40 hours
New Jersey Academy of Forensic Science (May 2011) Atlantic City, NJ Presented "Research Demonstrating the Reliability of ACE-V" (1.5 hours)	8 hours
NEC Users Fingerprint Educational Conference (Aug 2011) Las Vegas, NV Presented "Demystifying Error Rates" (1.5 hours) Presented "Research Demonstrating the Reliability of ACE-V" (1.5 hours)	6 hours
Canadian Identification Society (Sep 2011) Ottawa, Ontario, Canada Presented "Research Demonstrating Reliability of ACE-V" (2.0 hours)	4 hours
Tri-State IAI Educational Conference (Oct 2011) Tucson, AZ Workshop "Demystifying Error Rates" (4.0 hours) Workshop "Probabilities Made Easy" (4.0 hours) Presented "Research Demonstrating the Reliability of ACE-V" (2.0 hours)	20 hours

Florida Division IAI Educational Conference (Oct 2011) Panama City, FL Workshop “Demystifying Error Rates” (4.0 hours) Workshop “Probabilities Made Easy” (4.0 hours) Presented “Research Demonstrating the Reliability of ACE-V” (2.0 hours)	16 hours
Australian Academy of Forensic Science (Dec 2011) Sydney, Australia Presented “Making Sense of Fingerprint Evidence-Introduction of Probabilities into the Courtroom” (30 min)	16 hours
Australian Federal Police (Dec 2011) Canberra, Australia Presented “Research Demonstrating the Reliability of ACE-V” (3.0 hours)	3 hours
California Division IAI Educational Conference (May 2012) San Diego, CA Workshop “Demystifying Error Rates” (4.0 hours) Workshop “An Overview of the ACE-V Process” (4.0 hours) Presented “Research Demonstrating the Reliability of ACE-V” (2.0 hours)	16 hours
Impression and Pattern Evidence Symposium-NIJ (Aug 2012) “A Critical Analysis and Study of the ACE-V Process” “Effective Report Writing” (part of panel/workshop) “Understanding Sufficiency in Fingerprint Examinations”	3 hours
Colloque International sur la Criminalistique Trois Rivieres, ENPQ, Quebec “Research Demonstrating the Reliability of ACE-V” (1.0 hours) “Presenting Probabilities in the Courtroom” (1.0 hours) Panel: “The Future of Probabilities in Forensic Science”	28 hours
Fingerprint Society Annual Conference (Mar 2014) Glasgow, Scotland, U.K. Presented “The Integration of Technology and ACE-V” (1.0 hours) Presented “Presenting Probabilities in the Courtroom” (30 mins)	16 hours
California Division IAI Educational Conference (May 2014) Riverside, CA Workshop: “Understanding and Deconstructing the SWGFAST “Articulation of the Identification Decision” document (2.0 hours) Presented “Statistics from Latent Print Case Work” (2.0 hours) Panel: “Five Years after the NAS Report – Perspectives” (2.0 hours)	16 hours
European Network of Forensic Science Institutes (ENFSI) Fingerprint Working Group Oslo, Norway Presented: “A Critical Analysis and Study of the ACE-V Process” (1 hour) Co-presented: “Fingerprint Comparison Workshop” with Siobhan Green (4 hours)	20 hrs

MorphoTrak Users Conference (May 2016) Costa Mesa, CA Presented: “The Integration of Technology and ACE-V” (1.0 hours) Workshop: “A Critical Review of the ACE-V Process” (2.0 hours)	8 hours
Australian/New Zealand Forensic Science Society Conference (Sep 2016) Presented: “Addressing potential observer effects in forensic science: a perspective from a forensic scientist who uses linear sequential unmasking techniques.” (1.0 hour)	24 hours
International Fingerprint Research Group (Oct 2017) Beijing, China Presented “Unlocking the Secrets of Bloody Fingermarks” (0.5 hour) Presented “Multi-Informative and Specific Blood Detection” (0.5 hour) Presented “Using Case Specific AFIS to Reduce Errors in Casework” (0.5 hour)	40 hours
International Pattern and Trace Evidence Symposium (IPTES) (Jan 2018) Arlington, VA Co-presented workshop (with Cedric Neumann, Norah Rudin, Keith Inman, and Patrick Buzzini) “Foundations of the Interpretations of Pattern and Trace Evidence” (8 hours)	24 hours
European Academy of Forensic Science (Sep 2018) Co-presented with Christophe Champod “Fingerprint and Probabilities Workshop” (8 hours)	32 hours
European Network of Forensic Science Institutes (Sep 2018) Expert Fingerprint Working Group Co-presented with Christophe Champod “Fingerprint and Probabilities Workshop” (8 hours)	28 hours
California Division IAI Educational Conference (May 2012) Burlingame, CA Workshop “Practical Answers to Challenging Questions in the Courtroom” (4.0 hours) Presented “Using Recent Research in Fingerprints to Improve Practices” (2.0 hours) Both with Brendan Max, Cook County Public Defender	16 hours
IDEMIA Users Conference (May 2019) San Diego, CA Presented: “Let’s Talk About Exclusion Decisions” (1.0 hours) Workshop: “Case AFIS and Cold Case Clinic” (6.0 hours)	8 hours
International Fingerprint Research Group (IFRG) (June 2019) Sheffield, England, United Kingdom Presented: “An End-User Validation of the UNIL PiAnoS-Based Likelihood Ratio Model (30 mins)	40 hours

Pacific Northwest Division of the IAI (Aug 2019) Portland, OR Presented: “Activity Level Issues in Fingerprints: Age, Action, Arrangement” (1 hour) Workshop: “Practical Answers to Challenging Questions in the Courtroom” (4 hours) Workshop: “Making Sense of the Statistics in the PCAST Report” (4 hours)	20 hours
Texas Division of the IAI (Jun 2021) Dallas, TX Presented “The Examination of Bloody Friction Ridge Impressions” (1 hour) Presented “Activity Level Propositions: Activity, Age, and Arrangement” (1 hour)	16 hours
Idemia, Users Conference (Sep 2021) Sarasota, FL Presented “Using and Implementing the OSAC Conclusion Scale” (1 hour) Workshop “Using Case AFIS” (2 hours) Workshop “Integrating Technology into the ACE-V Process” (2 hours) Workshop “Using a Statistical Model to Support Fingerprint Evidence (2 hours)	24 hours
North Carolina Division of the IAI (Sep 2021) Wrightsville, NC Presented “How Case AFIS Can be Used to Solve Cold Cases” (1 hour) Presented “Recent Legal Challenges to Fingerprint Evidence” (1 hour) Presented “Activity Level Propositions: Activity, Age, and Arrangement” (1 hour)	24 hours
Louisiana Division of the IAI (Jun 2022) Baton Rouge, LA Presented “The Examination of Bloody Friction Ridge Impressions” (4 hours) Presented “Recent Legal Challenges to Fingerprint Evidence” (2 hour)	20 hours

Legal Seminars:

DePaul School of Law (Chicago, IL, Apr 2002), attended 8 hours on Daubert issues

Minnesota Bar CLE (Minneapolis, MN, May 2003)

Presented “Latent Prints and Daubert: US v. Mitchell and Plaza...”

Presented “IAFIS-Integrated Automated Fingerprint Identification System”

Minnesota Prosecutors Educational Seminar (Golden Valley, MN, Jul 2003)

Presented “Latent Prints and Daubert: US v. Mitchell and Plaza...”

Hamline School of Law, CLE (Duluth, MN, Jun 2004)

Presented “Fingerprint Science in the Courtroom”

Hamline School of Law and the Innocence Project, CLE (St. Paul, MN, May 2005)

Presented “Fingerprint Science in the Courtroom”, (Forensics 411)

Hamline School of Law and the Innocence Project, CLE (St. Paul, MN, June 2006)

Presented “Latent Print Examinations: Errancy, Entropy, and Epitasis”, (Forensics 411)

Attorney General's Office CLE (St. Paul, MN, Dec. 2006)
Presented "Recent Legal Challenges to Fingerprint Evidence" (20 minutes)

Minnesota Public Defenders Association (Hinckley, MN, Feb. 2007)
Presented "Latent Print Evidence: Scientific and Legal Perspectives" (2 hours)

Minnesota Law Clerks Association (Eagan, MN, May 2007)
Presented "The Most Important Things Attorneys Should Know about Forensic Science" (2 hours)

Minnesota Bar CLE (Minneapolis, MN, June 2007)
Attended: Dynamite Handling of Expert Witnesses (8 hours)

Hamline School of Law and the Innocence Project, CLE (St. Paul, MN, May 2008)
Presented "Latent Print Evidence: Scientific and Legal Perspectives" (1 hour)

Minnesota State-Court Interpreters Conference (Minneapolis, MN, May 2008)
Presented "Overview of the Forensic Sciences for Court Interpreters" (3 hours)

Idaho State-Court Interpreters Conference (Boise, ID, September 2008)
Presented "Overview of the Forensic Sciences for Court Interpreters" (3 hours)

Upper Midwest Translators and Interpreter Assoc. (Minneapolis, MN, Mar 2009)
Presented "Overview of the Forensic Sciences for Court Interpreters" (3 hours)

UCLA School of Law Forensic Science: A Blueprint for the Future (L.A., CA, Feb 2010)
Presented "The Future of Fingerprint Science" and sat on a panel (1.5 hours)

Minnesota CLE: Criminal Justice Institute (St. Paul, MN, Aug 2010)
Presented "Update of Research and Recent Challenges in Fingerprint Science" (1 hour)

Minnesota Chapter of the Innocence Project (St. Paul, MN, Mar 2011)
Presented "Recent challenges to latent print admissibility and the response" (2 hours)

Arizona Forensic Science Academy (Phoenix, AZ, Oct 2011 and Nov 2012)
Presented "Research Demonstrating the Reliability of ACE-V" (3.5 hours)

Actual Innocence & Wrongful Convictions CLE (Plano, TX, 2012)
Presented "Cognitive Bias in Forensic Science" (2 hours)

Minnesota CLE: Criminal Justice Institute (St. Paul, MN, Aug 2014)
Co-Presented "Understanding Uncertainty of Measurement" (1 hour) (BCA)

Cook County Public Defender Training (Chicago, IL, May 2015)
Fingerprint clinic "Fingerprint Evidence – Strengths and Limitations" (8 hours)

Cook County Public Defender Annual Conference (Chicago, IL, May 2015), 2 days
Bias in Forensic Science: "Fingerprint Evidence – Strengths and Limitations" (90 min)

National Forensic College (New York City, NY, June 2016) (attended 3 days)
 Research in Fingerprint Evidence – Strengths and Limitations (90 min)

Cook County Public Defender Training (Chicago, IL, July 2016)
 Fingerprint clinic “Fingerprint Evidence 2 – Sufficiency, Distortion, Digital” (8 hours)

Criminal Justice Institute CLE (Minneapolis, MN Aug 2017)
 Implementation of Microcrystal Testing in Drug Chemistry (1 hour)

Cook County Public Defender Annual Conference (Chicago, IL, May 2019), 2 days
 “Activity Level Issues in Fingerprints: Age, Action, Arrangement” (60 min)

NACDL Engage & Exchange Series (Webinar, Jan 2021)
 “Fingerprint Evidence: Litigating and Current Issues” (2 hours)

Minnesota Public Defenders Lunch CLE Series (Webinar, Feb 2021)
 “Fingerprint Evidence: Litigating and Current Issues” (2 hours)

NACDL Engage & Exchange Series (Webinar, Jun 2021)
 “What defense can learn from famous fingerprint errors” (2 hours)

Minnesota Public Defenders Lunch CLE Series (Webinar, May 2021)
 “Drug Chemistry Evidence: Litigating and Current Issues” (1.5 hours)

Boise Public Defenders CLE (Live, May 2021) (with Brendan Max)
 “Fingerprint Evidence: Litigating and Current Issues” (1.5 hours)

Professionally Instructed Training Courses

BCA Basic and Advanced Latent Print Courses (2/yr 2000-2005)	24 hours ea.
BCA Crime Scene Latent Print Recovery lecture (1/yr since 2002-2005)	2 hours ea.
Ridgeology Science Workshop (RSW) (*with Kasey Wertheim)	40 hours ea.
-*Arlington, TX; November 2004 (17 students)	
-*West Palm Beach, FL; February 2005 (27 students)	
-Broomfield, CO; August 2005 (30 students)	
-Hamilton Twshp, NJ; June 2006 (19 students)	
-Seattle, WA; August 2006 (25 students)	
-Las Vegas Metro PD; November 2006 (17 students, 2 audits)	
-Richfield, OH; December 2006 (14 students)	
-Atlanta, GA; June 2009 (10 students)	
Ridgeology Science Workshop (RSW-Plus!) (with Joshua Bergeron)	40 hours
-Worcester, MA; May 2006 (21 students)	
-Fort Collins, CO; April 2007 (36 students)	
-Mesa, AZ; December 2007 (37 students)	

Advanced ACE-V Applications (AAA)

-Lausanne, Switzerland, October 2006	(16 students)	24 hours
-Bern, Switzerland, October 2006	(26 students)	24 hours
-Quantico, VA, August 2007	(25 students)	40 hours
-Lansing, MI, October 2007	(36 students)	40 hours
-West Covina, CA, March 2008	(28 students)	40 hours
-West Palm Beach, FL, May 2008	(31 students)	40 hours
-Los Angeles, CA, June 2008	(27 students)	40 hours
-Downey, CA, July 2008	(20 students)	40 hours
-Portland, OR, August 2008	(18 students)	40 hours
-Culver City, CA, November 2008	(23 students)	40 hours
-Mesa, AZ, December 2008	(33 students)	40 hours
-Los Angeles, CA, February 2009	(19 students)	40 hours
-Largo, FL (NFSTC) March 2009	(19 students)	40 hours
-Clarksburg, WV, June 2009	(28 students)	40 hours
-Lausanne, Switzerland, August 2009	(15 students)	30 hours
-Bern, Switzerland, September 2009	(15 students)	30 hours
-Clarksburg, WV, September 2009	(28 students)	40 hours
-Culver City, CA, October 2009	(15 students)	40 hours
-Livonia, MI (NFSTC) March 2010	(8 students)	40 hours
-Largo, FL (NFSTC) April 2010	(15 students)	40 hours
-Los Angeles, CA, June 2010	(35 students)	40 hours
-New York City, NYPD, October 2010	(25 students)	40 hours
-Brooksville, FL, November 2010	(21 students)	40 hours
-Meridian, MS (USACIL), January 2011	(8 students)	40 hours
-Pittsburg, CA, August 2011	(22 students)	40 hours
-Chantilly, VA, September 2011	(30 students)	40 hours
-Largo, FL (NFSTC) February 2012	(15 students)	40 hours
-Baton Rouge, LA, March 2012	(28 students)	40 hours
-Denver, CO, April 2012	(34 students)	40 hours
-Torrance, CA, August 2012	(18 students)	40 hours
-New York City, NY, October 2012	(30 students)	40 hours
-Largo, FL (NFSTC) October 2012	(15 students)	40 hours
-Fort Lauderdale, FL, December 2012	(40 students)	40 hours
-Los Angeles, CA January 2013	(18 students)	40 hours
-Glendale, CA February 2013	(15 students)	40 hours
-Chula Vista, CA April 2013	(35 students)	40 hours
-Mesa, AZ Oct 2013	(20 students)	40 hours
-Lausanne, Switzerland Nov 2013	(17 students)	40 hours
-Bern, Switzerland Nov 2013	(16 students)	40 hours
-Decatur, GA Dec 2013	(17 students)	40 hours
-Las Vegas, LV, March 2014	(38 students)	40 hours
-Hillsboro, OR, Sep 2014	(16 students)	40 hours
-Taipei, Taiwan, March 2015	(35 students - modified)	32 hours
-Maynard, MA, June 2017	(25 students)	40 hours
-Northfield, MI, Oct 2017	(20 students)	40 hours
-Laguna Hills, CA, Feb 2018	(28 students)	40 hours
-Sanford, FL, Apr 2018	(28 students)	40 hours
-Calgary, AL, Canada Nov 2018	(32 students)	40 hours

-Taipei, Taiwan, Dec 2018	(35 students - modified)	40 hours
-Hackensack, NJ, Apr 2019	(18 students)	40 hours
-Bern, Switzerland May 2019	(19 students-German)	40 hours
-Bern, Switzerland May 2019	(18 students-French)	40 hours
-Maynard, MA, Jun 2019	(34 students)	40 hours
-Dulles, VA, Jul 2019	(24 students)	40 hours
-Dublin, CA, Oct 2019	(19 students)	40 hours
-Copenhagen, Denmark Dec 2019	(20 students)	40 hours
-Derbyshire, U.K. Feb 2020	(25 students)	40 hours
-Derbyshire, U.K. Mar 2020	(28 students)	40 hours
-Bergen County, NJ Mar 2021	(18 students)	40 hours
-Hillsboro County, OR Apr 2021	(16 students)	40 hours
-USACIL, Forest Park, GA Jul 2021	(24 students)	40 hours
-Indianapolis, IN, Nov 2021	(19 students)	40 hours
-Calgary, Alberta, Canada Dec 2021	(34 students)	40 hours
-Osceola County, FL Mar 2022	(18 students)	40 hours
-Barnstable County, MA May 2022	(23 students)	40 hours
-Irvine, CA Jun 2022	(24 students)	40 hours

Statistics Applied to Ridgeology and the ACE-V Methodology (with Cedric Neumann)

-Las Vegas, NV, April 2008	(13 students)	40 hours
-St. Paul, MN, August 2008	(17 students)	40 hours
-St. Paul, MN, May 2009	(30 students)	24 hours
-Portland, OR, March 2010	(27 students)	40 hours
-Clarksburg, WV, June 2010	(39 students)	40 hours
-Mesa, AZ, May 2011	(25 students)	40 hours
-Kissimmee, FL, December 2011	(16 students)	24 hours
-Albany, NY, March 2012	(28 students)	40 hours
-Boise, ID, November 2012	(23 students)	40 hours
-Denver, CO, March 2013	(18 students)	40 hours
-Alameda Co, CA, May 2013	(20 students)	40 hours
-San Diego, CA, August 2013	(18 students)	40 hours

Understanding Exclusion and Sufficiency Decisions (with John Black)

-Tucson AZ, April 2014	(24 students)	32 hours
-Ft. Lauderdale, FL, Aug. 2014	(36 students)	32 hours
-Clackamas, OR, Oct. 2014	(40 students)	32 hours
-Olathe, KS, Dec. 2014	(26 students)	32 hours
-Denver, CO, April 2015	(31 students)	32 hours
-Los Angeles, CA, May 2015	(34 students)	36 hours
-Milwaukee, WI, June 2015	(25 students)	36 hours
-Pennsylvania, PA, July 2015	(28 students)	36 hours
-Carlsbad, CA, Sep. 2015	(32 students)	36 hours
-Northville, MI, Oct. 2015	(25 students)	32 hours
-Las Vegas, NV, Nov. 2015	(19 students)	36 hours
-Dublin, CA, Mar. 2016	(30 students)	36 hours
-Edmonton, AB, Canada, Apr. 2016	(43 students)	36 hours
-Maynard, MA, June 2016	(32 students)	36 hours
-New York, NY, Oct 2016	(25 students)	36 hours

-Sanford, FL, Mar 2017	(28 students)	36 hours
-Torrance, CA, Apr 2017	(29 students)	36 hours
-Honolulu, HI, Jun 2018 (solo)	(15 students)	36 hours
-Baton Rouge, LA, Apr 2019	(28 students)	32 hours
-Bowling Green, OH, Jun 2019	(19 students)	32 hours
-Dulles, VA, Sep 2020	(9 students)	36 hours
-Houston, TX, Jul 2021	(19 students)	36 hours
-Osceola County, FL Apr 2022	(28 students)	36 hours
Incorporating Technology into the ACE-V Process (with Carey Hall)		
-Anaheim, CA, Jan 2019	(32 students)	24 hours
-Escondido, CA Jun 2019	(25 students)	24 hours
Daubert Workshop for Latent Print Evidence		
-Denver, CO, Dec 2018	(5 students)	16 hours
Advanced Latent Print Examiner Training Topics		
-Washington, D.C. (U.S. Secret Service), Mar 2019 (14 students)		32 hours
-Huntsville, AL, FBI TEDAC, Jul 2019 (13 students)		24 hours
-Quantico, VA, FBI Laboratory, Jul 2019 (45 students)		24 hours
Practical Answers to Challenging Questions in the Courtroom (with Brendan Max and Carey Hall)		
-Golden, CO, Sep 2019	(46 students)	24 hours
-San Diego, CA (webinar) Jun 2020	(24 students)	24 hours
-Boise, ID May 2022	(33 students)	24 hours
Short Webinars (through Evolve Forensics www.evolveforensics.com)		
Beyond Discriminating Power of Friction Ridge Arrangements		4 hours
Implementing the Expanded OSAC Conclusion Scale		4 hours
Resolving Conflict in Friction Ridge Examinations		3 hours
Examination of Bloody Friction Ridge Impressions		4 hours
How to Prepare for a Latent Print Daubert Hearing		4 hours
Managing Cognitive Bias in Friction Ridge Examinations		3 hours