

## Sandra L. Koch

McCrone Associates  
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### **EDUCATION**

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- Aug 2013-May 2018 Pennsylvania State University  
Degree: PhD Anthropology  
Dissertation: Variation in Human Hair Morphology and Microstructure
- Sept 2009-May 2012 Boston University School of Medicine  
Degree: Masters of Science in Forensic Anthropology  
Thesis: The Detection of Sharp Force, Blunt Force, and Gunshot Trauma on Whole Pigs Recovered from a Fire Environment
- Sept 1995-Sept 1996 George Washington University  
Degree: Masters of Forensic Science
- Sept 1990-Dec 1993 University of Michigan  
Degree: Bachelor of Arts in Anthropology and Political Science

### **ACADEMIC AND PROFESSIONAL POSITIONS**

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*McCrone Associates*

Oct, 2018 – present

Senior Research Microscopist

Scientific analysis and investigative research of materials and contaminants to identify composition using light microscopy, infrared spectroscopy, scanning electron microscopy with energy-dispersive X-ray spectroscopy and other analytical techniques as needed for projects related to industrial processes, legal issues, and archaeological research.

- Active collaborations with academic scholars and government scientists leading to scientific publications.
- Committee work involving scientific experts, academic researchers, human-factors scholars, legal representatives and other stakeholders to develop public programs, write standards, and promote scientific research, accreditation, and certification.
- Instruction/Presentations in webinars, conferences, and short courses to train and advise participants from a range of scientific, legal, and management positions on best practices for the preservation and analysis of a variety of materials.

*Pennsylvania State University*

Aug, 2013-Aug, 2018

Graduate Student/Teaching Assistant/Research Assistant

Research Interests: Anthropology with emphasis on human hair variation, hair microstructure and morphology, bioarchaeology, forensic anthropology, osteology, zooarchaeology, taphonomy, archaeological textiles, microscopy, and transmission electron microscopy. Involved in anthropological collections development for research, collections identifications, multidisciplinary research, and public outreach.

- Conducted collections-based research and interpretation of materials that lead to completion of dissertation, conference presentations, and peer reviewed publications. Analyzed samples and data from museum collection in combination with recently acquired modern samples and provided recommendations for revisions to standards for training and microscopical analysis of human hairs for ancestry determination. Acquired new analytical skills to analyze modern samples with associated genomic data and historic samples from museum collections.
- Collaborated with researchers from academia, cultural institutions, industry, and community-based scholars to analyze samples for research and/or repatriation purposes.

- Actively participated in interdisciplinary committees to develop public programs, training events, conferences, best practices protocols, and strategic planning.
- Developed public program in coordination with Forensic Science Department and American Academy of Forensic Sciences for summer CSI camp and served as co-instructor.
- Created and managed a Human Hair Repository to serve as a collection of hair samples and associated genomic data for current and future research purposes in compliance with US laws, University IRB regulations, and participant consent.

*FBI Laboratory, Trace Evidence Unit, Quantico, VA*

Sept, 1998 – Aug, 2013

Physical Scientist / Forensic Examiner

Forensic analysis of trace evidence collected from items of evidence submitted in criminal cases. Subject matter expert qualified in the morphological and microscopical analysis of mammalian hairs, natural and man-made fibers, textile analysis, cordage, and feather microstructure using stereomicroscopy, transmitted light microscopy, polarized light microscopy, fluorescence microscopy, microspectrophotometry, and Fourier transform infrared spectroscopy.

- Conducted scientific analysis, presented findings in written reports, and testified in legal proceedings.
- Contributed to scientific research projects and technical publications related to the application of analytical techniques and the preservation of evidence, participated in multi-year collaborations with academic and scientific practitioners to develop best practices, presented scientific research and guidance on standards under development in public programs, scientific conferences, to laboratory management and other stakeholders in the forensic community.
- Served on Indian Country Evidence Task Force and worked with contemporary Native/Indigenous communities to facilitate specimen collection and preservation of materials. Collaborated with Native/Indigenous community representatives, forensic scientists, and law enforcement to develop content for conferences and publications. Adapted evidence collection protocols to accommodate Native cultural and religious practices, and recommended broader changes to sexual assault evidence collection protocols to meet the needs of diverse stakeholders.
- Worked to develop and coordinate technical assistance and training programs related to the collection, documentation, preservation, analysis, and disposition of evidential material by outreach to field collection teams and teaching Crime Scene Management short courses.
- Served on interagency Scientific Working Group as a technical expert and helped develop and revise consensus documents for training and analysis protocols, later submitted to a standards development organization.
- Received legal training to understand and comply with laws and regulations related to the handling and preservation of specimens, materials that need to be returned or repatriated, and provided expert testimony in local, state, and federal courts.
- Completed two-year apprenticeship at the National Museum of Natural History in feather identification that included the identification of bird species from feathers and the use of research collections for identification and research purposes. Worked with researchers in interdisciplinary fields to use zoological collections to identify Native American cultural objects to gain information about cultural significance of items and published results of long-term documentation project involving feather identification.
- Served as liaison to National Museum of Natural History Anthropology Division to work forensic anthropology cases together in a multi-year collaboration between the Smithsonian and the FBI Laboratory.
- Participated in and helped develop public programs at the National Museum of Natural History to communicate the applied value of biological species identifications to the general public relating to feathers and mammalian hairs.

- Responsible for physically locating and accounting for government property during annual inventory and transferred surplus equipment to better allocate resources within the laboratory.

*FBI Laboratory, Trace Evidence Unit, Washington, DC*  
Physical Science Technician

Mar, 1997 – Sept, 1998

*DC Pretrial Services, Washington, DC*  
Drug Technician

Sept, 1996- Mar, 1997

### ANTHROPOLOGY/ARCHAEOLOGY/MUSEUM EXPERIENCE:

- Field Museum Volunteer –Participated in public programs and guided guests in exhibits related to anthropology, zoology, botany, and paleontology with a focus on Native American culture and history and natural history 2018-2020.
- Teaching Assistant/Instructor for Archaeology and Biological Anthropology courses at Pennsylvania State University (2013-2018).
- Presented in and helped facilitate Smithsonian National Museum of Natural History public program “Forensic Fridays” as a volunteer in the Forensic Anthropology Lab section of the Written in Bone exhibit (2009-2013).
- Research Collaborator with National Museum of Natural History Anthropology Department for forensic anthropology casework (2002-2013) and provided technical analysis of hair attached to objects in museum collection for research and potential repatriation purposes.
- Participated in 2-year apprenticeship/Research Fellowship with National Museum of Natural History Bird Division to learn feather identification (2008-2010).
- Docent at the University of Michigan Natural History Museum from 1991-1993. Co-developed a planetarium program for the University of Michigan Natural History Museum in 1993.
- Archaeological fieldwork involving excavation, mapping, documentation, and use of techniques to preserve and store archaeological specimens for future research and exhibition: Rochester Museum and Science Center field school in Lima, NY Iroquois settlement site (1988), Colonial Williamsburg (1990), Roman mortuary site in Lepti, Tunisia (1991), member of the osteoarchaeology team in the Giza Plateau Mapping Project (2008), and conducted analysis in the Lisbon Archaeology Museum as part of the Portanta Megalitic Osteology Program (2009).

### PUBLICATIONS

- 2020 (online) Koch, S. L., C. Liebowitz, M.D. Shriver, and N. G. Jablonski “Microscopical discrimination of human hairs sharing a mitochondrial haplogroup, *Journal of Forensic Sciences* (expected in print 2021) doi: 10.1111/1556-4029.14560
- 2020 **Koch, S.L.** and Nehse, K. “Fibers” chapter 5 in Handbook of Trace Evidence Analysis, edited by Desiderio, Taylor and Nic Daéid
- 2020 Trejos, Tatiana, **S. Koch**, A. Mehlretter “Scientific foundations and current state of trace evidence – A review” *Forensic Chemistry* doi: 10.1016/j.forc.2020.100223
- 2019 **Koch, S.L.**, S.R. Tridico, B.A. Bernard, M.D. Shriver, and N.G. Jablonski, “The Biology of Hair: A Multidisciplinary Review” *American Journal of Human Biology* (2019). doi: 10.1002/ajhb.23316
- 2018 **Koch, S.L.**, M.D. Shriver, and N.G. Jablonski “Variation in Human Hair Ultrastructure among Three Biogeographic Populations.” *Journal of Structural Biology* (2018). doi: 10.1016/j.jsb.2018.11.008

- 2018 Nehse, K and **S.L. Koch** “New Fibre Developments” chapter in Forensic Examination of Fibres 3<sup>rd</sup> edition, edited by Robertson, Roux, and Wiggins
- 2017 **Koch, S.L.** and Joanna Lambert “Detection of Sharp Force, Blunt Force, and Gunshot Trauma on Whole Pigs Recovered from a Fire Environment” *Journal of Anthropology Rep* 2.113 (2017):2.
- 2014 Tridico, S. R., **Koch, S.L.**, Michaud, A., Thomson, G., Kirkbride, K. P., & Bunce, M. “Interpreting biological degradative processes acting on mammalian hair in the living and the dead: which ones are taphonomic?” *Proceedings of the Royal Society B: Biological Sciences*, 281.1796 (2014): 20141755.
- 2013 **Koch, S.L.**, A. Michaud and C. Mikell “Taphonomy of Hairs: A study of postmortem root banding of hairs” *Journal of Forensic Sciences*, Vol. 58, No. S1
- 2010 Dove, C and **Koch, S.L.** “Microscopy of Feathers: A Practical Guide for Forensic Feather Identification” *Journal of the American Society of Trace Evidence Examiners* Vol. 1, Issue 1. Reprinted in the *Microscope* V 59 (2) 2011
- 2007 **Koch, S.L.** and Deaver, K.L. “The Effects of Weathering and Scavenging on Fabric Damage” Proceedings of the 2007 Trace Evidence Symposium
- 2007 **Koch, S.L.** “Beyond Cotton, Nylon and Polyester; the emergence of new fibers” *Global Forensics Today* Vol. 1, January 2007
- 2004 Deedrick, D. W. and **Koch, S. L.** Microscopy of Hair Part II: A Practical Guide and Manual for Animal Hairs *Forensic Science Communications* (July 2004)  
[https://www.fbi.gov/about-us/lab/forensic-science-communications/fsc/july2004/research/2004\\_03\\_research02.htm](https://www.fbi.gov/about-us/lab/forensic-science-communications/fsc/july2004/research/2004_03_research02.htm)
- 2004 Deedrick, D. W. and **Koch, S. L.** Microscopy of Hair Part I: A Practical Guide and Manual for Human Hairs *Forensic Science Communications* (January 2004)  
[https://www.fbi.gov/about-us/lab/forensic-science-communications/fsc/jan2004/research/2004\\_01\\_research01b.htm](https://www.fbi.gov/about-us/lab/forensic-science-communications/fsc/jan2004/research/2004_01_research01b.htm)

### **TEACHING EXPERIENCE**

- 2015-present Forensic Hair Analysis (Hooke College of Applied Sciences) - Adjunct Instructor
- 2018 Introduction to Biological Anthropology (Penn State) online instructor
- 2015 Humans as Primates (Penn State online course) – Graduate Teaching Assistant
- 2014 Introduction to Biological Anthropology (Penn State) – Graduate TA/lab instructor
- 2013, 2014 Introduction to Archaeology (Penn State) – Graduate Teaching Assistant/lab instructor
- 2010-2012 Mapping of Skeletal Remains course (FBI) – Presenter
- 2000-2010 Indian Country Evidence Task Force Crime Scene Management Schools (18) – Instructor
- 2000-2006 Hair and Fiber school (FBI Academy) – Instructor

### **PUBLIC PROGRAMS:**

- 2018-2020 Volunteer at Field Museum – Highlights tour leader
- 2015 Helped to develop Pennsylvania State University and American Academy of Forensic Sciences summer camp program to introduce students to the forensic sciences
- 2009-2013 Volunteer in Forensic Anthropology Lab in Written in Bone exhibit and Forensic Fridays at National Museum of Natural History

**WORKSHOPS:**

- 2014, 2015, 2016 Natural Dye workshop presenter – multiple conferences  
 2014 American Academy of Forensic Sciences and Pennsylvania State University summer Crime Scene Investigation camp instructor  
 2013, 2014 Post-Mortem Root Banding workshop presenter – American Society of Trace Evidence Examiners, MidAtlantic Association of Forensic Sciences  
 2009 Fabric Damage workshop presenter – Trace Evidence Symposium  
 2009 Feather Workshop presenter – Trace Evidence Symposium

**MENTORING:**

- 2015-2017 Undergraduate research at Penn State University – microscopical hair analysis (2 students)  
 2016 AAPA poster “Quantifying Phenotypic Differences in Human Scalp Hair Morphology Associated with Ancestry and Sex” Emily Bramel (presenter), Sandra Koch, Nina Jablonski, Mark D. Shriver  
 2000-2013 Responsible for or assisted in training new technicians and examiners in Trace Evidence Unit (FBI Laboratory), and provided continued technical guidance to state/local students from FBI hair and fiber short course

**PROFESSIONAL AFFILIATIONS / COMMITTEES**

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- 2020 American Board of Criminalistics – Board of Directors (At-Large Member)  
 2016-2018 Microscopy Society of American member  
 2014-present Materials (Trace) subcommittee member within the NIST Organization of Scientific Area Committees (OSAC) in the Chemistry/Instrumental Analysis Group –Hair task group (chair), fiber task group, strategic planning/outreach task group  
 2009-present American Society of Trace Evidence Examiners (ASTEE) – founding member, secretary (2011-2013), education committee (2009-present), President-2020  
 2007-present American Board of Criminalistics (ABC) – certified in Hairs and Fibers (Fellow-ABC), Hair and Fiber proficiency testing review committee since 2012  
 2000-2013 Scientific Working Group for Material Analysis (SWGMA) – Fiber subgroup member 2000-2013, Fiber subgroup chair 2007 – 2013  
 1998-present American Academy of Forensic Sciences – Member since 2008, Fellow since 2011  
 2002-2013 Smithsonian Institution National Museum of Natural History (NMNH) Research Collaborator - Anthropology Department  
 2006-2013 Trace Evidence Symposium steering committee - co-sponsor representative  
 2010-2011 Sexual Assault Response Team (SART) National Conference planning committee  
 2009 Tribal Sexual Assault Medical Forensic Examination Protocol Development Working Group  
 2008 Evidence Response Team Field Reference Guide Working Group – Subject Matter Expert  
 2008 National Institute of Justice (NIJ) Trace Evidence Panel – Subject Matter Expert

**SELECTED CONFERENCE PRESENTATIONS**

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- 2018, 2019 “Microscopical Discrimination of Human Head Hairs Among Persons Sharing Mitochondrial Haplogroups” presentation at American Academy of Forensic Sciences in Seattle, WA and at European Textile and Hair Group meeting in Dublin Ireland  
 2018 “Reanalysis of the Trotter Collection: A Study of Variation in Human Hair Form and Microstructure” presentation at American Association of Physical Anthropologists in Austin, TX  
 2018 “Untangling the Relationship between Hair Microstructure and Ancestry” at the National Institute of Justice Impression Pattern and Trace Evidence Symposium  
 2017 “Reanalysis of Trotter Collection” presentation at Inter/Micro conference

- 2016 “Hair analysis: Historical overview and current research collections” and “Analyst and Management Survey Results about Trace Evidence” at National Institute of Standards and Technology Trace Data Workshop
- 2016 “Exploring the ultrastructure of human hair: Preliminary results from transmission electron microscopy and fluorescence microscopy” presentation at Inter/Micro
- 2016 “Exploring the ultrastructure of human hair: Preliminary results and prospects for correlation with genetic variation” poster at American Association of Physical Anthropologists meeting in Atlanta, GA
- 2016 “Hair Analysis: Learning from the Past and Moving toward the Future” presentation at American Academy of Forensic Sciences meeting in Las Vegas, NV
- 2015 “Contributions of Physical Evidence in Human Identifications” invited presentation at American Academy of Forensic Sciences meeting in Orlando, FL
- 2013 “The Importance of Knowing What Cited Sources You Used” presentation in Young Forensic Scientists Forum at American Academy of Forensic Sciences meeting in DC  
\*invited presentation
- 2011 “Postmortem Root Banding of Hairs” presentation at European Hair Group meeting in Riga, Latvia
- 2011 “He Said/They Said ... and the Evidence Said” presentation at the 6<sup>th</sup> National Sexual Assault Response Team Conference in Austin, TX \*invited presentation
- 2009 Fabric Damage workshop, Feather workshop and “Results from the Assessment of Trace Evidence Questionnaire” presentation at the Trace Evidence Symposium
- 2008 “Postmortem Root Banding of Hairs” presentation at American Academy of Forensic Sciences meeting in DC and Scientific Working Group for Materials Analysis meeting in VA
- 2007 “The Effects of Weathering and Scavenging on Fabric Damage” Poster presentation at the Trace Evidence Symposium in Clearwater Beach, FL
- 2006 “Beyond Polyester, Nylon and Cotton; the Emergence of New Fibers” Poster presentation American Academy of Forensic Sciences Meeting in Seattle, WA

### **CONTINUING EDUCATION**

- 2019 Wood Identification Workshop – Southern Association of Forensic Sciences combined meeting with American Society of Trace Evidence Examiners, Asheville, NC – 2 days
- 2018-2019 Industrial Microscopist Specialization Training - Coursework in FTIR, PLM, and SEM at Hooke College of Applied Sciences
- 2017 Image Processing and Measurement workshop – 2 days at InterMicro
- 2015-2016 Certificate of Advanced Studies: Statistics and the Evaluation of Forensic Evidence University of Lausanne (online program)
- 2012 Forensic Examination of rope workshop and factory tours, Augusta Maine – 3 days
- 2011 Dyes, Fibers and Recent Advances in Textile Chemistry at Trace Evidence Symposium in Kansas City – 1 day
- 2011 Animal Hair Workshop at American Academy of Forensic Sciences meeting in Chicago, IL - 2 days
- 2010, 2011 Cranial and Post-Cranial Juvenile Osteology courses at the University of Dundee
- 2010 Mapping of Skeletal Remains Evidence Response Team class at the Boston University Forensic Anthropology Outdoor Research Facility - 3 days
- 2010 Analysis of Bone Trauma and Pseudo-Trauma in Suspected Violent Deaths short course at Mercyhurst College – 1 week
- 2010 The Forensic Investigation of Human Remains from Armed Conflicts and Catastrophes workshop at American Academy of Forensic Sciences meeting in Seattle, WA – 1 day
- 2010 Taphonomy of Bone Destruction: Information Lost, Information Gained workshop at American Academy of Forensic Sciences meeting in Seattle, WA – 1 day

- 2008-2010 Feather training at Smithsonian Institution
- 2009 Crime Laboratory Management Symposium in Madison, WI
- 2008 Armed Forces Institute of Pathology's Forensic Anthropology course at the National Transportation Safety Board Training Center – 1 week
- 2008 Measurements, Statistics, Terminology, and Quantitative Methods: Uses and Interpretations in Physical/Forensic Anthropology workshop at American Academy of Forensic Sciences meeting – 1 day
- 2007 Feather Identification Workshop – Trace Evidence Symposium - ½ day
- 2007 Statistics 1 & 2 - USDA Graduate classes
- 2007 Clandestine Graves Workshop – Chesapeake Bay Division of IAI Conference – 1 day
- 2006 Instructor Development course at the FBI Academy Training Division - 1 week
- 2005 Fordisc 3.0 Forensic Anthropology statistics program training in Chattanooga, TN – 1 day
- 2005 Human Remains Recovery School at the University of Tennessee Forensic Anthropology Center – 1 week
- 2004 Crime Laboratory Development Symposium at Carlson School of Management, University of Minnesota – 1 week
- 2003 Infrared Spectroscopy course at Bowdoin University – 1 week
- 2001 Color Measurement Course – Clemson University – 1 week
- 2000 Detection and Recovery of Human Remains Course – Federal Bureau of Investigation (Quantico, VA) – 1 week
- 1999 Textile Fundamentals Course – North Carolina State University (Raleigh, NC) – 1 week
- 1999 Forensic Hair Examination Course – Royal Canadian Mounted Police at Carleton University Ottawa, Canada – 1 week
- 1999 Evidence Response Team Training Course – Federal Bureau of Investigation (Quantico, VA) – 1 week
- 1997,1998 Hair and Fiber Course – Federal Bureau of Investigation (Quantico, VA) – 2 weeks 4/97 fiber week and 3/98 hair week
- 1997 Infrared Spectrometry for Trace Analysis course – Federal Bureau of Investigation (Quantico, VA) – 1 week
- 1994 Forensic Anthropology summer course at University of London and Cambridge University

**GRANTS AND AWARDS**

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- 2018 William T. Sanders Graduate Award in Anthropology
- 2017 American Society of Trace Evidence Examiners (ASTEE) travel award for Inter/Micro meeting (\$500)
- 2016 ASTEE research grant (\$500)
- 2016 Hill Fellowship – Penn State University Department of Anthropology (\$3,500)
- 2016 American Association of Physical Anthropologists Student Travel award (\$500)
- 2015, 2016 Pennsylvania State University Conference Travel award (\$400)
- 2015 National Science Foundation grant (award 1453571) – Nina Jablonski PI, Mark Shriver and Sandra Koch Co-PI's "Variation in human hair morphology within and among human populations" (\$82,400)
- 2014 Hill and Baker Fellowship – Penn State University Department of Anthropology (\$4,525)
- 2014 Beta Chapter Fellowship – Gamma Phi Beta Foundation (\$1000)
- 2011 FBI Certificate of Achievement – Postmortem root banding study
- 2008 FBI Certificate of Achievement – Trace Evidence Symposium
- 2004 FBI Certificate of Achievement – Indian Country Evidence Task Force
- 1999 FBI Certificate of Achievement – casework